3.4 Noise and Vibration

3.4.1 Introduction

Section 3.4, Noise and Vibration, of the Burbank to Los Angeles Project Section (project section) Environmental Impact Report/Environmental Impact Statement (EIR/EIS) analyzes the potential impacts and benefits of the No Project Alternative and the High-Speed Rail (HSR) Build Alternative, and describes impact avoidance and minimization features (IAMF) that would avoid, minimize, or reduce the impacts. Where applicable, mitigation measures are proposed to further reduce, compensate for, or offset impacts of the HSR Build Alternative. Section 3.4 also defines the noise and vibration resources within the region and describes the affected environment in the resource study areas (RSA).

> ***Noise and Vibration***
>
> Noise and vibration assessments are key elements of the environmental impact analysis process for rail projects. Noise is one of the principal environmental impacts associated with rail projects and has been identified as a public concern throughout the public involvement process. The purpose of this analysis is to examine the potential environmental noise and vibration impacts of the project.

The *Burbank to Los Angeles Project Section Noise and Vibration Technical Report* (California High-Speed Rail Authority [Authority] 2019) provides additional technical details on noise and vibration resources, and noise and vibration mitigation guidelines are provided in Appendix 3.4-A. Additional details on noise and vibration resources are provided in the following appendix in Volume 2 of this EIR/EIS:

- Appendix 3.1-B, Regional and Local Policy Inventory

Nine other resource sections in this Draft EIR/EIS provide additional information related to noise and vibration:

- **Section 3.2, Transportation**—Construction and operations impacts and regional benefits of the HSR Build Alternative on automobile, pedestrian, and bicycle traffic.
- **Section 3.7, Biological and Aquatic Resources**—Construction and operations noise impacts and benefits of the HSR Build Alternative on fauna in the biological and aquatic resources RSAs.
- **Section 3.9, Geology, Soils, Seismicity, and Paleontological Resources**—Construction and operations impacts and benefits of the HSR Build Alternative on soil erosion and stability that could affect hazardous materials and wastes sites, as well as natural phenomena such as earthquakes.
- **Section 3.11, Safety and Security**—Construction and operations impacts and benefits of the HSR Build Alternative on emergency response preparedness in the event of leaks, spills, or accidents involving hazardous materials and wastes.
- **Section 3.12, Socioeconomics and Communities**—Construction and operations impacts and benefits of the HSR Build Alternative on socioeconomics and communities.
- **Section 3.13, Station Planning, Land Use, and Development**—Construction and operations impacts and benefits of the HSR Build Alternative on land use compatibility and development.
- **Section 3.15, Parks, Recreation, and Open Space**—Construction and operations impacts and benefits of the HSR Build Alternative on public areas such as parks, open space, and areas of recreation.
- **Section 3.17, Cultural Resources**—Construction and operations impacts and benefits of the HSR Build Alternative on cultural resources and historical land use in the project section.
- **Section 3.19, Cumulative Impacts**—Construction and operations impacts and benefits of the HSR Build Alternative and other past, present, and reasonably foreseeable future projects.

3.4.1.1 *Definition of Resources*

The following are definitions for the noise and vibration resources analyzed in this Draft EIR/EIS:

- **Noise** is generally defined as a loud, unpleasant, unexpected, or undesired sound that is typically associated with human activity and that interferes with or disrupts normal activities. Airborne sound is a rapid fluctuation of air pressure above and below atmospheric pressure. Noise can interrupt ongoing activities and can result in community annoyance, especially in residential areas.
- **Vibration** is an oscillatory motion that can be described in terms of the displacement, velocity, or acceleration of an object. Ground-borne vibration generated by rail systems can be a serious concern for occupants of nearby buildings, causing feelable movement of building floors, rattling of windows, or shaking of items on shelves or hanging on walls. Ground-borne vibration can also cause rumbling sounds inside buildings, referred to as ground-borne noise. Although vibration can cause damage to buildings in extreme cases, building damage is not a factor for normal transportation projects, with the occasional exception of blasting and pile driving during construction.

3.4.2 Laws, Regulations, and Orders

Federal, state, and local laws, regulations, and orders relevant to noise and vibration affected by the project are presented below. The National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA) requirements for assessment and disclosure of environmental impacts are described in Section 3.1, Introduction, and are therefore not restated in this resource section.

3.4.2.1 *Federal*

The following federal regulations and procedures are also applicable to this Noise and Vibration section.

Federal Railroad Administration, Procedures for Considering Environmental Impacts (64 Fed. Reg. 28545)

On May 26, 1999, the Federal Railroad Administration (FRA) released Procedures for Considering Environmental Impacts (FRA 1999). These FRA procedures supplement the Council on Environmental Quality Regulations (Code of Federal Regulations [C.F.R.] Title 40, Part 1500 et seq.) and describe the FRA's process for assessing the environmental impacts of actions and legislation proposed by the agency and for the preparation of associated documents (U.S. Code Title 42, Section 4321 et seq.). The FRA Procedures for Considering Environmental Impacts states that "the EIS should identify any significant changes likely to occur in the natural landscape and in the developed environment. The EIS should also discuss the consideration given to design quality, art, and architecture in project planning and development as required by U.S. Department of Transportation Order 5610.4." These FRA procedures state that an EIS should consider possible impacts on noise and vibration.

Noise Control Act of 1972 (42 U.S. Code § 4910)

The Noise Control Act of 1972 was the first comprehensive statement of national noise policy. It declared, "it is the policy of the U.S. to promote an environment for all Americans free from noise that jeopardizes their health or welfare." Although the act, as a funded program, was ultimately abandoned at the federal level, it served as the catalyst for comprehensive noise studies and the generation of noise assessment and mitigation policies, regulations, ordinances, standards, and guidance for many states, counties, and even municipal governments. For example, the "noise elements" of community general plan documents and local noise ordinances studied as part of this EIS were largely created in response to passage of the Noise Control Act.

As discussed below, the U.S. Environmental Protection Agency (USEPA) and the FRA have issued regulations under the Noise Control Act establishing noise emissions standards for interstate rail carriers, including emissions standards for locomotives.

Federal Railroad Administration Guidelines for Noise and Vibration Analysis

The FRA guidelines in the *High-Speed Ground Transportation Noise and Vibration Impact Assessment* (FRA 2012) for assessing noise impacts from HSR, with the exception of noise effects on livestock and wildlife, are based on the Federal Transit Administration (FTA) *Transit Noise and Vibration Impact Assessment Manual. FTA Report No. 0123* (FTA 2018) for rail projects and their associated stationary facilities. A description of the FTA guidelines and more detailed information used for the technical noise and vibration analysis (including noise assessment criteria from animals) are provided below.

Federal Transit Administration Guidelines for Noise and Vibration Analysis

The FTA guidelines provide the noise impact criteria for rail operations, as well as the associated stationary facilities, such as storage and maintenance yards, passenger stations and terminals, parking facilities, and substations for all rail projects. The impact criteria are for human annoyance; the comparison of the existing outdoor noise level and the future noise levels from the proposed HSR project is used to determine the level of impact (i.e., no impact, moderate impact, and severe impact). A proposed project is considered to have no impact if, on average, the introduction of the project would result in an insignificant increase in the number of people highly annoyed by the new noise. A moderate impact indicates the introduction of the project would be noticeable to most people, but it may not be sufficient to cause strong reactions from the community. A severe impact indicates that a significant percentage of people would be highly annoyed by the introduction of the project. Section 3.4.4, Methods for Evaluating Impacts, provides more specific information regarding the criteria used to establish where severe, moderate, and no impacts would occur.

Occupational Safety and Health Administration Occupational Noise Exposure (29 C.F.R. Part 1910.95)

The Occupational Safety and Health Administration has regulated worker noise exposure to a time-weighted average of 90 A-weighted decibels (dBA) over an 8-hour work shift. Areas where levels exceed 85 dBA must be designated and labeled as high-noise-level areas where hearing protection is required. This noise exposure criterion would apply to construction activities associated with the HSR project. Noise from the HSR project might also elevate noise levels at nearby construction sites to levels that exceed 85 dBA and thus trigger the need for administrative/engineering controls and hearing conservation programs as detailed by the Occupational Safety and Health Administration. This regulation would apply to construction worker activities associated with the HSR Build Alternative rather than an environmental impact, but it is included here for informational purposes.

U.S. Environmental Protection Agency Railroad Noise Emission Standards (40 C.F.R. Part 201)

The USEPA has issued noise emission standards (40 C.F.R. Part 201), which set maximum measured noise levels for locomotives manufactured after 1979, as follows:

- One hundred feet from the geometric center of a stationary locomotive, connected to a load cell and operating at any throttle setting except idle: 87 dBA (at idle setting, 70 dBA)
- One hundred feet from the geometric center of a mobile locomotive: 90 dBA
- One hundred feet from the geometric center of mobile railcars, at speeds up to 45 miles per hour (mph): 88 dBA (at speeds greater than 45 mph, 93 dBA)

Federal regulations exist, issued in the early 1980s by the USEPA, that generally limit the strength or loudness of noise a locomotive or railcar may generate (40 C.F.R. Part 201.12/13). Whether or not this regulation applies to high-speed trainsets, the analysis in this EIR/EIS does not assume that Authority trainsets will comply with the noise generation standard of this regulation because the Authority is not aware of any high-speed trainsets manufactured in the world today that meet this standard at all speeds. A noise generation standard specific to high-speed trains does exist in Europe (European Technical Specification for Interoperability Standard), and a trainset manufactured to those standards complies with the USEPA standard (if applicable) generally at speeds below 190 to 200 mph. Above that speed, airflow over the trainset and its pantograph and related apparatus is the main source of noise, which presently known technology cannot resolve to comply with the USEPA standard (if applicable). The analysis in this EIR/EIS—both prior to and after mitigation—assumes a trainset generating noise in compliance with the European Technical Specification for Interoperability Standard, because trainsets currently in manufacture and operation in Europe can meet this standard; the analysis does not assume a trainset that meets the USEPA standard.

Federal Railroad Administration Railroad Noise Emission Compliance Regulations (49 C.F.R. Part 210)

The FRA's Railroad Noise Emission Compliance Regulations (49 C.F.R. Part 210) adopt and enforce the USEPA's railroad noise emission standards (40 C.F.R. Part 201).

Federal Highway Administration Procedures for Abatement of Highway Traffic Noise and Construction Noise (23 C.F.R. Part 772)

The Federal Highway Administration (FHWA) stipulates procedures and criteria for noise assessment studies of highway projects (23 C.F.R. Part 772). It requires that noise abatement measures be considered for all major transportation projects if the project would cause a substantial increase in noise levels, or if projected noise levels approach or exceed the Noise Abatement Criteria (NAC) level for activities occurring on adjacent lands. The specific NAC information is described in Table 3.4-1. These FHWA regulations apply to projects funded or approved by the FHWA and thus would not apply to this project (since FHWA funds are not expected to be used). However, the criteria in these regulations have been considered in assessing noise impacts associated with motor vehicles.

Table 3.4-1 Federal Highway Administration Noise Abatement Criteria in A-Weighted Decibels

Activity Category	Activity Criteria[1] $L_{eq}(h)$	Evaluation Location	Activity Description
A	57	Exterior	Lands on which serenity and quiet are of extraordinary significance and serve an important public need, and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose
B[2]	67	Exterior	Residential
C[2]	67	Exterior	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, daycare centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings
D	52	Interior	Auditoriums, daycare centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios
E[2]	72	Exterior	Hotels, motels, offices, restaurants/bars, and other developed lands, properties, or activities not included in activity categories A through D or F.
F	--	--	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, shipyards, utilities (water resources, water treatment, and electrical), and warehousing
G	--	--	Undeveloped lands that are not permitted

Source: Federal Highway Administration, 2011
[1] The $L_{eq}(h)$ Activity Criteria values are for effect determination only and are not design standards for noise abatement measures.
[2] Includes undeveloped lands permitted for this activity category.
dBA = A-weighted decibels
$L_{eq}(h)$ = equivalent sound level for a 1-hour period, dBA

3.4.2.2 State

California Noise Control Act (California Health and Safety Code, § 46010 et seq.)

At the state level, the California Noise Control Act of 1973 (California Health and Safety Code § 46010 et seq.) provides for the Office of Noise Control in the Department of Health Services to assist communities in developing local noise control programs and to work with the Office of Planning and Research to provide guidance for the preparation of the required noise elements in city and county General Plans, pursuant to California Government Code, Section 65302(f). In preparing the noise element, a city or county must identify local noise sources and analyze and quantify, to the extent practicable, current and projected noise levels for various sources, including highways and freeways; passenger and freight railroad operations; ground rapid transit systems; commercial, general, and military aviation and airport operations; and other ground stationary noise sources (these would include HSR alignments).

Title 24, Part 2, California Code of Regulations

The California Noise Insulation Standard (California Code of Regulations Title 24, Part 2, Chapter 35, Section 3501) limits interior noise exposure levels within multifamily (not single-family detached houses) residential developments to 45 dBA Community Noise Equivalent Level (CNEL) or 45 dBA day-night sound level (L_{dn}).

The standard is often adopted by city and county agencies for land use planning purposes. The California Department of Health Land Use Compatibility Criteria feature guidelines for acoustical compatibility based on existing ambient noise levels in the community. For example, commercial land uses are considered appropriate where existing noise levels might be considered too high for residential development.

3.4.2.3 Regional and Local

Table 3.4-2 lists county and city general plan goals, policies, and ordinances relevant to the HSR Build Alternative.

Table 3.4-2 Regional and Local Plans and Policies

Title	Summary
Los Angeles County	
Los Angeles County 2035 General Plan (2015)	▪ Goal N 1: The reduction of excessive noise impacts. ▪ Policy N 1.1: Utilize land uses to buffer noise-sensitive uses from sources of adverse noise impacts. ▪ Policy N 1.2: Reduce exposure to noise impacts by promoting land use compatibility. ▪ Policy N 1.3: Minimize impacts to noise-sensitive land uses by ensuring adequate site design, acoustical construction, and use of barriers, berms, or additional engineering controls through Best Available Technologies (BAT). ▪ Policy N 1.4: Enhance and promote noise abatement programs in an effort to maintain acceptable levels of noise as defined by the Los Angeles County Exterior Noise Standards and other applicable noise standards. ▪ Policy N 1.5: Ensure compliance with the jurisdictions of State Noise Insulation Standards (Title 24, California Code of Regulations and Chapter 35 of the Uniform Building Code), such as noise insulation of new multifamily dwellings constructed within the 60 dB (CNEL or L_{dn}) noise exposure contours. ▪ Policy N 1.6: Ensure cumulative impacts related to noise do not exceed health-based safety margins. ▪ Policy N 1.7: Utilize traffic management and noise suppression techniques to minimize noise from traffic and transportation systems. ▪ Policy N 1.8: Minimize noise impacts to pedestrians and transit-riders in the design of transportation facilities and mobility networks. ▪ Policy N 1.9: Require construction of suitable noise attenuation barriers on noise-sensitive uses that would be exposed to exterior noise levels of 65 dBA CNEL and above, when unavoidable impacts are identified. ▪ Policy N 1.10: Orient residential units away from major noise sources (in conjunction with applicable building codes). ▪ Policy N 1.11: Maximize buffer distances and design and orient sensitive receptor structures (hospitals, residential, etc.) to prevent noise and vibration transfer from commercial/light industrial uses. ▪ Policy N 1.12: Decisions on land adjacent to transportation facilities, such as the airports, freeways and other major highways, must consider both existing and future noise levels of these transportation facilities to assure the compatibility of proposed uses.
Los Angeles County Airport Land Use Commission Comprehensive Land Use Plan (2004)	▪ Policy N-1: Use community Noise Equivalent Level (CNEL) method for measuring noise impacts near airports in determining suitability for various types of lands uses. ▪ Policy N-3: Utilize the Table Listing Land Use Compatibility for Airport Noise Environments in evaluating projects within the planning boundaries.

<table>
<tr><th>Title</th><th>Summary</th></tr>
<tr><td>Los Angeles County Code of Ordinances (1978)</td><td>

- Section 12.08.010 of the County Code aims “to control unnecessary, excessive, and annoying noise and vibration.…” It declares that the purpose of the County policy is to “…maintain quiet in those areas which exhibit low noise levels and to implement programs aimed at reducing noise in those areas within the county where noise levels are above acceptable values.”
- Table 11.2 of the Noise General Element overviews Los Angeles County Community Noise Criteria and additional information on noise barrier strategies can be found in Appendix G.
- Section 12.08.350, states, “operating or permitting the operation of any device that creates vibration that is above the vibration perception threshold of any individual at or beyond the property boundary of the source if on private property, or at 150 feet (46 meters) from the source if on a public space or public right-of-way is prohibited. The perception threshold shall be a motion velocity of 0.01 in/sec [inch per second] over the range of 1 to 100 Hertz.”
- Section 12.08.390: Establishes exterior noise standards.
- Section 12.08.400: Establishes interior noise standards for multifamily residential land uses from non-transportation noise sources based on time restrictions within a one-hour period.
- Section 12.08.440: Limits construction at the exterior of residential structures (versus the property line for nonconstruction noise activities) to between the hours of 7:00 a.m. and 7:00 p.m. on weekdays. It prohibits construction on Sundays and holidays.
- Section 12.08.4440: Delineates construction activity from mobile and stationary construction equipment. The construction noise level limitations from mobile construction equipment are defined as “maximum noise levels for nonscheduled, intermittent, short-term operation (less than 10 days),” and the construction noise level limitations from stationary construction equipment are defined as “maximum noise levels for repetitively scheduled and relatively long-term operation (periods of 10 days or more).

</td></tr>
<tr><td colspan="2">City of Burbank</td></tr>
<tr><td>City of Burbank General Plan, Noise Element (2013)</td><td>

- Goal 1 Noise Compatible Land Uses: Burbank’s diverse land use pattern is compatible with current and future noise levels.
- Policy 1.1. Ensure the noise compatibility of land uses when making land use planning decisions.
- Policy 1.2. Provide spatial buffers in new development projects to separate excessive noise-generating uses from noise-sensitive uses.
- Policy 1.3. Incorporate design and construction features into residential and mixed-use projects that shield residents from excessive noise.
- Policy 1.4. Maintain acceptable noise levels at existing noise-sensitive land uses.
- Policy 1.5. Reduce noise from activity centers located near residential areas, in cases where noise standards are exceeded.
- Policy 1.6. Consult with movie studios and residences that experience noise from filming activities to maintain a livable environment.
- Goal 4 Train Noise: Burbank’s train service network reduces noise levels affecting residential areas and noise-sensitive land uses.
- Policy 4.1. Support noise-compatible land uses along rail corridors.
- Policy 4.2. Require noise-reducing design features as part of transit-oriented, mixed-use development near rail corridors.
- Policy 4.3. Promote the use of design features, such as directional warning horns or strobe lights, at railroad crossings that reduce noise from train warnings.

</td></tr>
<tr><td colspan="2">City of Glendale</td></tr>
</table>

Title	Summary
City of Glendale General Plan, Noise Element (2007)	▪ Goal 1: Reduce noise impacts from transportation noise sources. ▪ Policy 1.1 Coordinate with the California Department of Transportation (Caltrans) and the Metropolitan Transportation Authority (MTA) to reduce noise impacts from existing or proposed freeway projects with respect to existing noise-sensitive land uses. ▪ Program 1.1 Investigate the opportunity for Caltrans or the MTA to construct barriers to mitigate existing sound emissions where necessary and where feasible. ▪ Program 1.2 Actively pursue with Caltrans or the MTA the potential for noise barriers for the apartments west of Paula Avenue and the residential areas along the Ventura Freeway near Isabel Street. ▪ Program 1.3 Include noise mitigation measures in the design or improvement of freeways and arterial roadways consistent with funding capability and support efforts by Caltrans, the MTA, and the City to provide for acoustical protection for existing noise-sensitive land uses affected by these projects. ▪ Goal 3: Continue incorporating noise considerations into land use planning decisions. ▪ Policy 3.1 Ensure that land uses comply with adopted standards. ▪ Program 3.1 Use the criteria in Table 1 and standards in Table 2 to assess the compatibility of proposed land uses with the noise environment. New land uses, as described in the Land Uses column of Table 2, in a 60 CNEL or higher noise contour, as shown on the map of the 2030 Noise Contours, Exhibit 2, may be subject to potentially significant environmental impacts that must be addressed by a noise study. The study, prepared by a qualified consultant (to the satisfaction of the City), shall address the noise environment and propose appropriate conditions of approval or mitigation measures to comply with the interior and exterior noise standards as shown in Table 2. Interior tenant improvements, signs, and exterior remodeling will not normally be subject to review under this Program. ▪ Policy 3.2 Encourage acoustical mitigation design in new construction when necessary. ▪ Program 3.2 Continue to enforce the State of California Building Code that specifies that the indoor noise levels for residential living spaces not exceed 45 dB CNEL due to the combined effect of all noise sources. ▪ Goal 4: Enhance measures to control construction noise impacts. ▪ Policy 4.1 Amend the Noise Ordinance to address construction noise problems. ▪ Program 4.1 Change the permitted hours of construction to Monday through Friday, 7:00 a.m. to 7:00 p.m. and on Saturday from 9:00 a.m. to 5:00 p.m.; maintain the ban on construction on Sundays and Holidays. Continue to allow emergency repair work, and work to correct safety hazards, at any time.
City of Los Angeles	
City of Los Angeles General Plan, Noise Element (1999)	▪ Objective 2 (Nonairport): Reduce or eliminate nonairport related intrusive noise, especially relative to noise-sensitive uses. ▪ Policy 2.2: Enforce and/or implement applicable city, state and federal regulations intended to mitigate proposed noise producing activities, reduce intrusive noise and alleviate noise that is deemed a public nuisance. ▪ Objective 3 (Land Use Development): Reduce or eliminate noise impacts associated with proposed development of land and changes in land use. ▪ Policy 3.1 Develop land use policies and programs that will reduce or eliminate potential and existing noise impacts.
City of Los Angeles Central City North Community Plan (December 2000)	▪ Policy 6-1.4: Proximity to noise sources should be avoided whenever possible. ▪ Program: Implement appropriate provisions of the City's Noise Element. ▪ Program: Incorporate noise mitigation measures to reduce adverse environmental impacts in order you comply with CEQA.

Title	Summary
City of Los Angeles Municipal Code (2016)	▪ Chapter XI Section 111.02, Sound Level Measurement Procedure and Criteria sets forth how to measure sound. ▪ Section 112.03, Construction Noise: Noise due to construction or repair work shall be regulated as provided by Chapter IV, Article 1, Section 41.40 of the Los Angeles Municipal Code. ▪ Section 112.05, Maximum Noise Level of Powered Equipment or Powered Hand Tools: Requires that between the hours of 7:00 a.m. and 10:00 p.m., in any residential zone of the city or within 500 feet thereof, no person shall operate or cause to be operated any powered equipment or powered hand tool that produces a maximum noise level exceeding noise limits in sections (a), (b), or (c). ▪ Section 41.40. Noise Due To Construction, Excavation Work – When Prohibited: The noise limitations in Section 112.05 would not apply where compliance is deemed to be technically infeasible, which means that said noise limitations cannot be complied with despite the use of mufflers, shields, sound barriers, and/or other noise reduction devices or techniques during the operation of the equipment. The aforementioned limitations apply only to uses in residential zones or within 500 feet thereof. ▪ Section 91.1207.11.2: requires that interior noise levels attributable to exterior sources shall not exceed 45 dB in any habitable room. The Los Angeles Municipal Code further states that the noise metric to be used with regard to this standard shall be either the L_{dn} or the CNEL. ▪ Chapter XI Article 2 covers special noise sources including construction noise, power equipment intended for repetitive use in residential areas, other machinery, equipment and devices, and maximum noise level of powered equipment or power hand tools. ▪ Chapter IV, Public Welfare, Section 41.40, Noise due to Construction, Excavation Work – When Prohibits, stipulates prohibitions and restrictions for construction noise in Los Angeles.

Sources: City of Burbank, 2013; City of Glendale, 2007; City of Los Angeles, 1999, 2019; Los Angeles County, 1978, 2015; Los Angeles County Airport Land Use Commission, 2004

BAT = Best Available Technologies
Caltrans = California Department of Transportation
CNEL =Community Noise Equivalent Level
dB = decibel
dBA = A-weighted decibel
L_{dn} =day-night sound level
MTA = Metropolitan Transportation Authority

3.4.3 Consistency with Plans and Laws

As indicated in Section 3.1, Introduction, CEQA and NEPA regulations[1] require a discussion of inconsistencies or conflicts between a proposed undertaking and federal, state, regional, or local plans and laws.

Several federal and state laws, listed in Section 3.4.2.1, Federal, and Section 3.4.2.2, State, pertain to noise and vibration. The Authority, as the federal lead agency (the Authority is the lead federal agency pursuant to 23 U.S.C. 327 and the terms of the Memorandum of Understanding between FRA and the State of California effective July 23, 2019) and state lead agency proposing to construct and operate the HSR system, is required to comply with all federal and state laws and regulations and to secure all applicable federal and state permits prior to initiating construction of the project. Therefore, there would be no inconsistencies between the HSR Build Alternative and these federal and state laws and regulations.[2]

The Authority is a state agency and therefore is not required to comply with local land use and zoning regulations; however, it has endeavored to design and construct the HSR project so that it is consistent with land use and zoning regulations. A total of nine plans and policies were reviewed. The HSR Build Alternative would be inconsistent with certain provisions of the regional

[1] NEPA regulations refer to the regulations issued by the Council for Environmental Quality located at 40 C.F.R. Part 1500.

[2] Due to anticipated operating speeds in the Burbank to Los Angeles Project Section, it is anticipated that selected trainsets would meet USEPA noise emissions standards.

and local policies and plans that include local noise standards and limits, as described in Table 3.4-3.

Table 3.4-3 Regional and Local Plans and Policies Inconsistencies

Policy/Goal/Objective	Inconsistency
Los Angeles County General Plan, Noise Element	May not be possible to meet standards
Los Angeles County Noise Ordinance	May not be possible to meet standards
Los Angeles County Airport Land Use Plan	May not be possible to meet standards
City of Burbank General Plan, Noise Element	May not be possible to meet standards
City of Burbank Municipal Code	May not be possible to meet standards
City of Glendale General Plan, Noise Element	May not be possible to meet standards
City of Glendale Municipal Code	May not be possible to meet standards
City of Los Angeles General Plan, Noise Element	May not be possible to meet standards
City of Los Angeles Municipal Code	May not be possible to meet standards

Sources: City of Burbank, 1987, 2013; City of Glendale, 1991, 2007; City of Los Angeles, 1999, 2019; Los Angeles County, 1978, 2015; Los Angeles County Airport Land Use Commission, 2004

Despite the inconsistencies, the project is still "consistent" overall. Although it may not be possible to meet local noise standards, the IAMFs and mitigation measures would minimize the impacts and ultimately meet the overall objectives of the local policies to limit noise in the context of a developed rail corridor.

Refer to Volume 2, Appendix 3.1-B, for a complete consistency analysis of local plans and policies, including the inconsistencies noted above in Table 3.4-3.

3.4.4 Methods for Evaluating Impacts

The following sections summarize the RSAs and the methods used to analyze noise and vibration impacts. As summarized in Section 3.4.1, Introduction, nine other sections also provide additional information related to noise and vibration resources: Section 3.2, Transportation; Section 3.7, Biological and Aquatic Resources ; Section 3.9, Geology, Soils, Seismicity, and Paleontological Resources; Section 3.11, Safety and Security; Section 3.12, Socioeconomics and Communities; Section 3.13, Station Planning, Land Use, and Development; Section 3.15, Parks, Recreation, and Open Space; Section 3.17, Cultural Resources; and Section 3.19, Cumulative Impacts.

Evaluation of noise and vibration effects is a requirement of the Noise Emission Compliance Regulation adopted by the USEPA, the California Noise Control Act of 1973 (California Health and Safety Code, § 46010 et seq.), CEQA, NEPA, and the following procedures:

- The methods and criteria for evaluating high-speed ground transportation noise and vibration impacts are found in the FRA's *High-Speed Ground Transportation Noise and Vibration Impact Assessment* (FRA 2012).
- The methods and criteria for evaluating nonhigh-speed transit noise and vibration impacts (e.g., ancillary facilities, stations, and construction) are found in the FTA's *Transit Noise and Vibration Impact Assessment Manual. FTA Report No. 0123* (FTA 2018).
- The criteria for roadway noise impacts (relevant to the extent HSR causes changes in traffic patterns) are included in the FHWA's *Procedures for Abatement of Highway Traffic Noise and Construction Noise* (23 C.F.R. Part 772). The FHWA procedures are implemented as defined by the California Department of Transportation (Caltrans) *Traffic Noise Analysis Protocol* (2011). The FHWA requires each state to write its own noise policy, based on the FHWA's *Highway Traffic Noise: Analysis and Abatement Guidance* (2011). The state policy must address the issues of (1) required noise reduction needed for a wall to be reasonable, (2) cost of a reasonable wall, and (3) noise level reduction required for a receiver to be

considered benefited. The Caltrans *Traffic Noise Analysis Protocol* addresses these issues. The Caltrans *Technical Noise Supplement* (2013) gives guidance on how Caltrans requires noise measurements, modeling, and barrier analyses to be done. Caltrans' Standard Environmental Reference Volume 1: Guide for Compliance gives an outline for the noise report.

Noise and vibration measurements collected within the RSA were used to characterize existing conditions at noise- and vibration-sensitive receiver locations for the purpose of applying FRA and FTA criteria. Project section information was used in noise and vibration models.

The *Burbank to Los Angeles Project Section Noise and Vibration Technical Report* (Authority and FRA 2019) contains specific procedures used to assess effects from construction and operation of the HSR Build Alternative.

For effects analysis, the following thresholds, discussed in Section 3.4.4.3, Methods for NEPA and CEQA Impact Analysis, were used in assessing locations with effects:

- FRA noise impact criteria for HSR operations and construction
- FRA detailed analysis vibration impact criteria for HSR operations
- FHWA noise abatement criteria for traffic (on roadways affected by the project)
- FTA noise impact criteria for ancillary and non-HSR noise sources

The following sections summarize the RSAs and the methods used to analyze impacts resulting from noise and vibration.

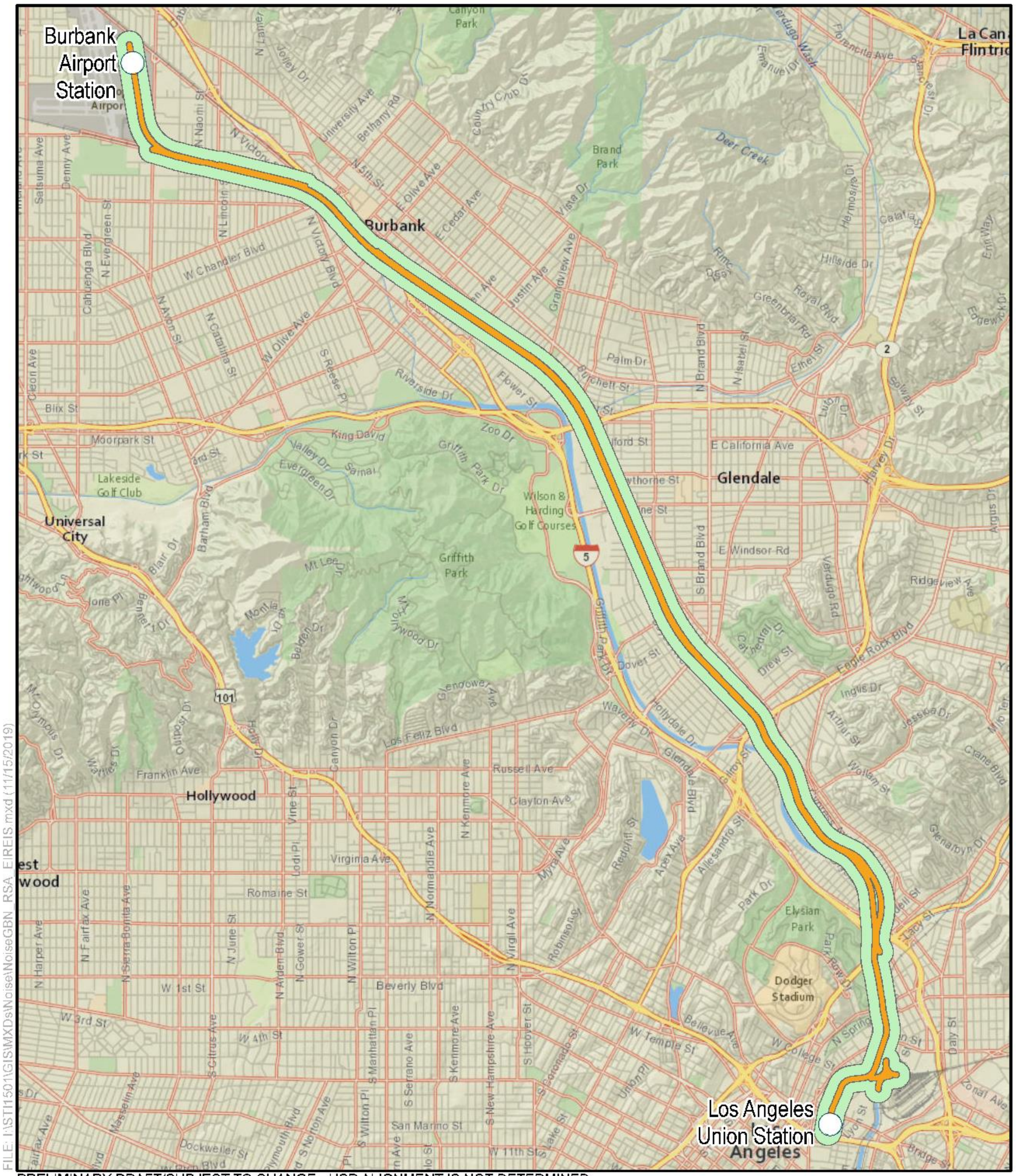
3.4.4.1 Definition of Resource Study Areas

As defined in Section 3.1, Introduction, RSAs are the geographic boundaries in which the Authority conducted environmental investigations specific to each resource topic. The RSAs for noise and vibration impacts define the areas in which all environmental investigations specific to noise and vibration are conducted in order to determine the resource characteristics and potential effects of the HSR Build Alternative. The boundaries of the RSA extend beyond the project footprint, as the effects analysis focuses on effects of source noise and vibration on sensitive receivers, which are assessed at the receiver. The same RSAs apply to both direct and indirect impacts. Direct impacts consist of increases in noise and vibration as a result of construction activities or HSR operation, while indirect impacts for noise include the HSR Build Alternative's impact on traffic patterns, which indirectly affect noise levels. The RSAs used for this analysis are presented in Table 3.4-4 and illustrated on Figure 3.4-1.

Table 3.4-4 Definition of Resource Study Areas

General Definition	Resource Study Area Boundary and Definition
Noise	
Construction and Operations	For direct and indirect noise effects on sensitive receivers, the FRA defines the screening distance as 700 feet from the centerline of the rail corridor for steel-wheeled vehicles operating on new or existing track at any speed and frequency in a suburban or nonsuburban setting with an unobstructed view (FRA 2012). This is used as the RSA for the noise analysis for rail operation, as elevated track sections may result in an unobstructed view of trains for receivers at this distance from the track. This RSA has been determined based on typical screening distances as defined by the FRA and project-specific factors of the project section.
Vibration	
Construction and Operations	▪ Station RSA: 150 feet from the station boundary, which corresponds to light rail transit sources for residential (Category 2) land use (FTA 2018) ▪ Alignment RSA, including existing railroads: up to 275 feet from the edge of the right-of-way, which corresponds to the maximum screening distance for more than 70 passbys per day in a residential area (FRA 2012)

FRA = Federal Railroad Administration
FTA = Federal Transit Administration
RSA = resource study area



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HSR ALIGNMENT IS NOT DETERMINED
SOURCE: National Geographic (2018; CHSRA (11/2019)

N

0 0.75 1.5
Miles

0 1.25 2.5
Kilometers

Noise Resource Study Area (Centerline + 700 ft)
Vibration Resource Study Area (Centerline + 150 ft)
HSR Stations

Figure 3.4-1 Noise and Vibration Resource Study Areas

To identify areas that could be affected by noise from the HSR Build Alternative, the locations of noise-sensitive areas were determined by segmenting the corridor into areas between major road crossings that include clusters of noise-sensitive receivers. Analysts conducted ambient noise measurements at 43 sites throughout the noise RSA along the proposed HSR alignment. They collected long-term (24-hour) measurements at 26 sites and short-term (20-minute) measurements at 17 sites. They then used the measurement results at these locations to characterize the existing noise conditions at sensitive receptors in the area, as noted in Section 5 of the *Burbank to Los Angeles Project Section Noise and Vibration Technical Report* (Authority 2019b).

To identify areas that could be affected by vibration from the HSR Build Alternative, the locations of vibration-sensitive areas were determined. Analysts identified 25 vibration-sensitive areas and conducted vibration propagation measurements at eight sites throughout the vibration RSA along the project section to determine the spread of noise from its source. Propagation measurements are used to determine the movement of sound. Analysts then used the measurement results at these locations to characterize the ground vibration propagation conditions at particular vibration-sensitive areas. Vibration test results are presented in the *Burbank to Los Angeles Project Section Noise and Vibration Technical Report* (Authority 2019b).

3.4.4.2 Impact Avoidance and Minimization Features

The HSR Build Alternative incorporates standardized HSR features to avoid and minimize impacts. These features are referred to as IAMFs. The Authority would implement IAMFs during project design and construction and, as such, the analysis of impacts of the HSR Build Alternative in this section factors in all applicable IAMFs. Appendix 2-B, Impact Avoidance and Minimization Features, provides a detailed description of IAMFs that are included as part of the HSR Build Alternative design. IAMFs applicable to noise and vibration include:

- **NV-IAMF#1: Noise and Vibration**—Contractor to prepare and submit to the Authority a noise and vibration technical memorandum documenting how the FTA and FRA guidelines for minimizing construction noise and vibration impacts will be employed.

3.4.4.3 Methods for NEPA and CEQA Impact Analysis

This section describes the sources and methods the Authority used to analyze potential noise and vibration impacts from implementing the HSR Build Alternative. These methods apply to both NEPA and CEQA unless otherwise indicated. Refer to Section 3.1.5.4, Methods for Evaluating Impacts, for a description of the general framework for evaluating impacts under NEPA and CEQA. Refer to the *Burbank to Los Angeles Project Section Noise and Vibration Technical Report* (Authority 2019b) for information regarding the methods and data sources used in this analysis. Laws, regulations, and orders (Section 3.4.2, Laws, Regulations, and Orders) that regulate noise and vibration resources were also considered in the evaluation of impacts on noise and vibration resources.

For the purposes of analysis in this document, FRA and FTA guidelines were used to conduct a detailed assessment for noise and vibration effects at sensitive receivers. Exceedance of recommended limits in the FRA and FTA guidance was assessed to determine effects under NEPA and CEQA.

Depending on the magnitude of the proposed project's noise increase, the FTA and the FRA categorize impacts as: (1) no impact, (2) moderate impact, or (3) severe impact. A severe impact is defined as the level at which a large percentage of people would be highly annoyed by the project's noise. A moderate impact is defined as the point at which the change in the cumulative noise level would be noticeable to most people but may not be sufficient to generate strong, adverse reactions.

For HSR Build Alternative construction and operation actions that would result in severe noise impacts or vibration impacts, feasible mitigation measures are identified to avoid or minimize effects or to compensate for effects. Only after consideration of mitigation measures would NEPA effects be determined.

Analysts used the methods below to evaluate potential noise and vibration impacts from construction and operations.

Construction Noise

Construction noise effects are assessed using a combination of the methods and construction source data contained in the FRA manual (FRA 2012) and the FHWA Roadway Construction Noise Model (FHWA 2006). The prediction of construction noise is based on the noise emissions from equipment expected to be used for each phase of construction. To be conservative, the noise estimates did not assume any shielding because of topography or ground effects.

While the FTA and the FRA do not specify standardized criteria for construction noise limits, the FTA and FRA guidance manuals provide guidelines for impact assessment, which are intended to minimize or avoid adverse community reaction. This guidance is used in the analysis, as this is a project undertaken by the FRA.

Table 3.4-5 shows the FRA noise assessment thresholds for construction. The last column applies to construction activities that extend over 30 days near any given receiver. L_{dn} is used to assess effects in residential areas and 24-hour equivalent sound level (L_{eq}) is used in commercial and industrial areas. The 8-hour L_{eq} and the 30-day average L_{dn} noise exposure from construction noise calculations use the noise emission levels of the construction equipment, their locations, and operating hours.[3]

Table 3.4-5 Federal Railroad Administration Construction Noise Assessment Criteria

Land Use	8-hour L_{eq} (dBA)		L_{dn} (dBA)
	Day	Night	30-Day Average
Residential	80	70	75
Commercial	85	85	80[1]
Industrial	90	90	85[1]

Source: Federal Railroad Administration, 2012
[1] 24-hour L_{eq}, not L_{dn}
dBA = A-weighted decibels
L_{dn} = day-night sound level
L_{eq} = equivalent sound level

Operational Noise

Table 3.4-6 summarizes the operational parameters used to model future with project noise levels, which were provided by the Authority. These data include the type of HSR car to be modeled, the number of cars per train, the length of the train, the number of operations expected throughout the day, and the basic track geometries for the project alignment. The number of daily trains, including those during the peak period and nighttime hours, was calculated from the tables provided in the Authority's *Statewide Operations and Service Plan* (2017a). Note that any change in the number of operations, particularly during nighttime hours, would result in a change in predicted noise levels. The reference noise data used to model the HSR Build Alternative's operations were taken from the high-speed electric-multiple-unit systems for the propulsion and wheel rail sources and the very-high-speed electric systems for the aerodynamic source. A specific speed profile for the entire proposed project alignment was used to analyze the receivers in the RSA more accurately. Any changes to the speeds of the modeled operations would result in a change in the corresponding noise impacts.

[3] Refer to the *Burbank to Los Angeles Project Section Noise and Vibration Technical Report* (Authority 2019b) for a discussion of noise descriptors.

Table 3.4-6 High-Speed Rail Build Alternative Operational and Geometric Assumptions

Parameter	Value
Number of Cars per Train	8
Number of Powered Cars per Train	8
Car Length	82.5 feet
Train Length	660 feet
Number of Daytime Operations	174
Number of Nighttime Operations	22
Number of Peak-Hour Trains	15
Range of Speed	20–125 mph
Track Geometry	Two-track, 16.5 feet on center
Geometric Cross-Sections	At-grade
Near Track to Sound barrier – At-Grade	21.5 feet

Source: California High Speed Rail Authority, 2017
mph = miles per hour

Federal Railroad Administration Guidelines

The FRA criteria for assessing noise impacts from high-speed train operations (FRA 2012) are identical to those contained in the FTA guidelines for rail projects (FTA 2018). These criteria are discussed in the section below.

Noise impacts on wildlife and livestock are not found in the FTA guidance document but are addressed in the FRA guidelines. Similarly, the FRA provides guidelines for identifying noise-sensitive locations where increased annoyance can occur because of the sudden increase in noise (the startle effect) from the rapid approach of high-speed trains. Criteria for these effects are presented in the *Burbank to Los Angeles Project Section Noise and Vibration Technical Report* (Authority 2019b).

Federal Transit Administration Guidelines

The noise impact criteria for rail projects and their associated fixed facilities, such as storage and maintenance yards, passenger stations and terminals, parking facilities, and substations, depend on the category of land use. Land use categories defined by the FRA are shown in Table 3.4-7. These land use categories are separated into three categories with varying metrics for transit noise impact criteria:

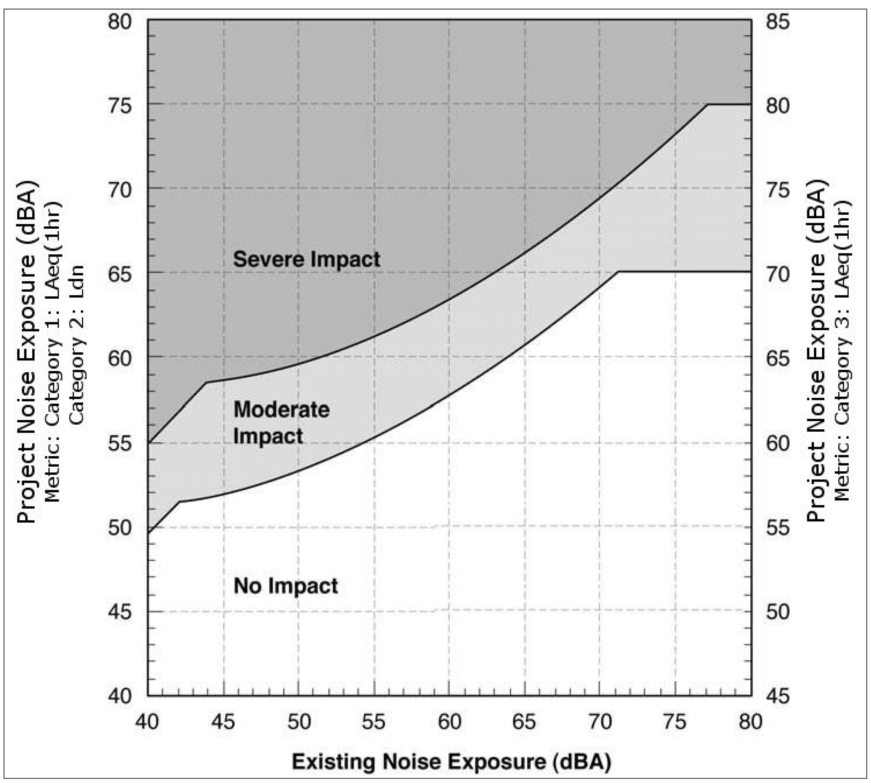
1. Tracts of land where quiet is an essential element in their intended purpose
2. Residences and buildings where people normally sleep, where nighttime sensitivity is assumed to be of utmost importance
3. Institutional land uses with primarily daytime and evening use, where it is important to avoid interference with activities such as speech, meditation, and concentration.

The noise criteria for land use categories are shown graphically on Figure 3.4-2.

Table 3.4-7 Land Use Categories and Metrics for Transit Noise Impact Criteria

Land Use Category	Noise Metric (dBA)	Land Use Category
1	Outdoor $L_{eq}(h)$[1]	Tracts of land where quiet is an essential element in their intended purpose. This category includes lands set aside for serenity and quiet, such land uses as outdoor amphitheaters and concert pavilions, and National Historic Landmarks with substantial outdoor use.
2	Outdoor L_{dn}	Residences and buildings where people normally sleep. This category includes homes, hospitals, and hotels, where nighttime sensitivity to noise is assumed to be of utmost importance.
3	Outdoor $L_{eq}(h)$[1]	Institutional land uses with primarily daytime and evening use. This category includes schools, libraries, and churches, where it is important to avoid interference with such activities as speech, meditation, and concentration. Buildings with interior spaces where quiet is important, such as medical offices, conference rooms, recording studios, and concert halls, fall into this category, as well as places for meditation or study associated with cemeteries, monuments, and museums. Certain historical sites, parks, and recreational facilities are also included.

Source: Federal Transit Administration, 2018
[1] L_{eq} for the noisiest hour of transit-related activity during hours of noise sensitivity.
dBA = A-weighted decibels
L_{dn} = day-night sound level
L_{eq} = equivalent sound level
$L_{eq}(h)$ = equivalent sound level for a 1-hour period, dBA



Sources: Federal Transit Administration, 2018; Federal Railroad Administration, 2012

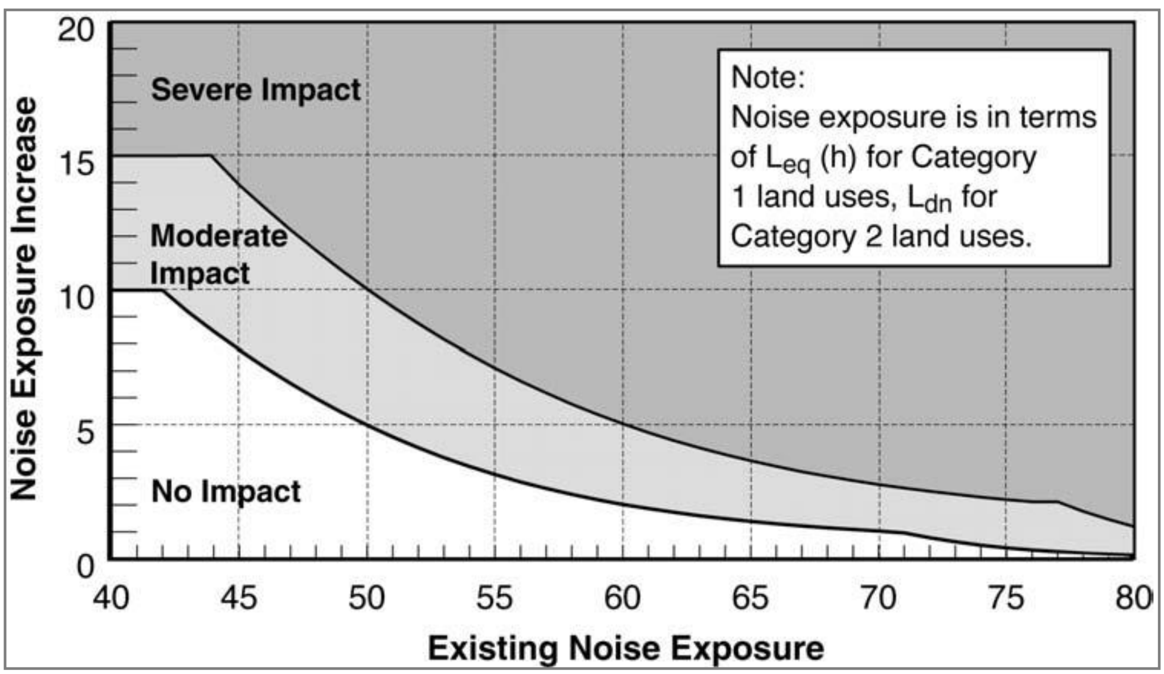
Figure 3.4-2 Noise Impact Criteria for Transit and High-Speed Rail Projects

For noise exposures below the lower of the two curves on Figure 3.4-2, a proposed project is considered to have no noise impact because, on average, the introduction of the project would result in an insignificant increase in the number of people highly annoyed by the new noise. The curve defining the onset of noise effects stops increasing at 65 dBA for Category 1 and Category 2 land uses, a standard limit for an acceptable living environment defined by a number of federal, state, and local agencies. Project noise above the upper curve is considered to cause a severe impact because a substantial percentage of people would be highly annoyed by the new noise.

The upper curve on Figure 3.4-2 flattens out at 75 dBA for Category 1 and Category 2 land uses, a level associated with an unacceptable living environment. As indicated by the right-hand scale on Figure 3.4-2, the project noise criteria are 5 decibels (dB) higher for Category 3 land uses because these types of land uses are considered to be slightly less sensitive to noise than the types of land uses in Categories 1 and 2.

Between the two curves, a project is judged to have a moderate effect. The change in the cumulative noise level is noticeable to most people, but it may not be sufficient to cause strong, adverse reactions from the community. In this transitional area, other project-specific factors must be considered to determine the magnitude of the effect and the need for mitigation, such as the existing noise level, the predicted level of increase over existing noise levels, and the types and numbers of noise-sensitive land uses affected.

Although the curves on Figure 3.4-2 are defined in terms of the project noise exposure and the existing noise exposure, the increase in the cumulative noise—when project-generated noise is added to existing noise levels—is the basis for the criteria. To illustrate this point, Figure 3.4-3 shows the noise impact criteria for Category 1 and Category 2 land uses in terms of the allowable increase in the cumulative noise exposure. Because L_{dn} and L_{eq} are measures of total acoustic energy, any new noise source in a community will cause an increase, even if the new source level is lower than the existing level. On Figure 3.4-3, the criterion for a moderate effect allows a noise exposure increase of 10 dBA if the existing noise exposure is 42 dBA or less, but only a 1 dBA increase when the existing noise exposure is 70 dBA.



Sources: Federal Transit Administration, 2018; Federal Railroad Administration, 2012

Figure 3.4-3 Allowable Increase in Cumulative Noise Levels (Categories 1 and 2)

As the existing level of ambient noise increases, the allowable level of transit noise increases, but the total amount that community noise exposure is allowed to increase is reduced. This accounts for the unexpected result that a project noise exposure that is lower than the existing noise exposure can still cause an effect. This is clearer from the examples given in Table 3.4-8, which indicate the level of transit noise allowed for different existing levels of exposure.

Table 3.4-8 Noise Impact Criteria: Effect on Cumulative Noise Exposure

L_{dn} or L_{eq} in dBA (rounded to nearest whole decibel)			
Existing Noise Exposure	Allowable Project Noise Exposure	Allowable Combined Total Noise Exposure	Allowable Noise Exposure Increase
45	51	52	7
50	53	55	5
55	55	58	3
60	57	62	2
65	60	66	1
70	64	71	1
75	65	75	0

Source: Federal Transit Administration, 2018
dBA = A-weighted decibels
L_{dn} = day-night sound level
L_{eq} = equivalent sound level

With respect to construction noise, no standard criteria apply at the federal level. However, Section 12.1.3 of the FTA guidelines does offer suggested threshold values for two levels of analysis (general and detailed) that can help identify potential noise impacts from construction equipment (FTA 2018).

Federal Highway Administration Procedures for Abatement of Highway Traffic Noise and Construction Noise (23 Code of Federal Regulations Part 772)

The FHWA stipulates procedures and criteria for noise assessment studies of highway projects funded or approved by the FHWA (23 C.F.R. Part 772). For projects subject to those regulations, the FHWA requires that noise abatement measures be considered on federal-aid highway projects if the project would cause a substantial increase in noise levels, or if projected noise levels approach or exceed the NAC level for activities occurring on adjacent lands.

Highway traffic noise generally becomes an important consideration where there is a new roadway project, a roadway is designed to increase capacity, or a significant horizontal or vertical alteration would occur in an existing roadway. While the HSR Build Alternative would result in roadway modifications, the *Burbank to Los Angeles Project Section Noise and Vibration Technical Report* (Authority 2019b) determined that these modifications would result in a noise increase of less than 3 dB (which would generally not be perceptible) or a likely decrease in noise relative to existing levels. Therefore, effects from traffic noise are not anticipated for the project and are not considered further in the analysis.

Construction Vibration

Construction vibration effects are assessed using the methods and construction source data contained in the FRA manual (FRA 2012) based on the equipment expected to be used during construction. The FRA provides construction vibration criteria designed primarily to prevent building damage and to assess whether vibration might interfere with vibration-sensitive building activities or temporarily annoy building occupants during the construction period. The FRA criteria include two ways to express vibration levels: (1) root-mean-square vibration velocity decibels

(VdB) for annoyance and activity interference, and (2) peak particle velocity (PPV), which is the maximum instantaneous peak of a vibration signal used for assessments of building damage potential.

To avoid temporary annoyance to building occupants during construction or construction interference with vibration-sensitive equipment inside special-use buildings, such as a magnetic resonance imaging machine, the FRA recommends using the long-term vibration criteria provided below under Operation Vibration.

Table 3.4-9 shows the FRA building damage criteria for construction activity. The table lists PPV limits for four building categories. These limits are used to estimate potential problems that should be addressed during final design.

Table 3.4-9 Federal Railroad Administration Construction Vibration Damage Criteria

Building Category	PPV (inch per second)	Approximate Lv[1]
I. Reinforced concrete, steel, or timber (no plaster)	0.5	102
II. Engineered concrete and masonry (no plaster)	0.3	98
III. Non-engineered timber and masonry buildings	0.2	94
IV. Buildings extremely susceptible to vibration damage	0.12	90

Source: Federal Railroad Administration, 2012
[1] Root-mean-square vibration velocity level in vibration velocity decibels relative to 1 micro-inch per second.
Lv = velocity level in decibels
PPV = peak particle velocity

Operation Vibration

Vibratory motion of the ground at a specific location caused by HSR operations may result in two forms of human annoyance. Ground-borne vibration is tactile movement of the ground or structures, whereas ground-borne noise is the radiation of acoustical energy from ground and structural surfaces excited by ground-borne vibration. Broadly speaking, vibration impact criteria levels are influenced by land use category and vibration event frequency (i.e., how often a train passes within a given time period).

As with train passage events, construction activity can also be considered on the basis of vibration occurrence frequency, so the same vibration criteria (in the absence of standardized construction vibration compliance criteria) may be used to help determine vibration effects during project construction.

Federal Railroad Administration Guidelines

The FRA guidelines (FRA 2012), which acknowledge the FTA guidance document (FTA 2006) as their basis, provide ground-borne vibration and noise criteria for a general assessment, as shown in Table 3.4-10. In addition, the guidelines provide criteria for special buildings that are very sensitive to ground-borne noise and vibration. The impact criteria for these special buildings are shown in Table 3.4-11. Ground-borne vibration and noise criteria are also assigned based on categories of land use, which are defined in Table 3.4-10. These levels represent the maximum root-mean-square level of an event.

Both Table 3.4-10 and Table 3.4-11 differentiate the vibration impact threshold depending on the number of vibration events per day, with fewer than 30 vibration events per day considered “infrequent,” between 30 and 70 vibration events considered “occasional,” and more than 70 events considered “frequent” for Table 3.4-10. For Table 3.4-11, fewer than 70 vibration events per day are considered “occasional or infrequent” and more than 70 events are considered “frequent.” This dividing line was originally selected so that most commuter rail or intercity rail projects would fall into the “infrequent” category and most urban transit projects (subway and light-rail transit) would more typically be in the “frequent” category.

Table 3.4-10 Ground-Borne Vibration and Noise Impact Criteria

Land Use Category	Ground-Borne Vibration Impact Levels (VdB re 1 micro-inch per second)			Ground-Borne Noise Impact Levels (dBA re 20 microPascals)		
	Frequent Events[1]	Occasional Events[2]	Infrequent Events[3]	Frequent Events[1]	Occasional Events[2]	Infrequent Events[3]
Category 1: Buildings where vibration would interfere with interior operations	65 VdB[4]	65 VdB[4]	65 VdB[4]	N/A[5]	N/A[5]	N/A[5]
Category 2: Residences and buildings where people normally sleep	72 VdB	75 VdB	80 VdB	35 dBA	38 dBA	43 dBA
Category 3: Institutional land uses with primarily daytime use	75 VdB	78 VdB	83 VdB	40 dBA	43 dBA	48 dBA

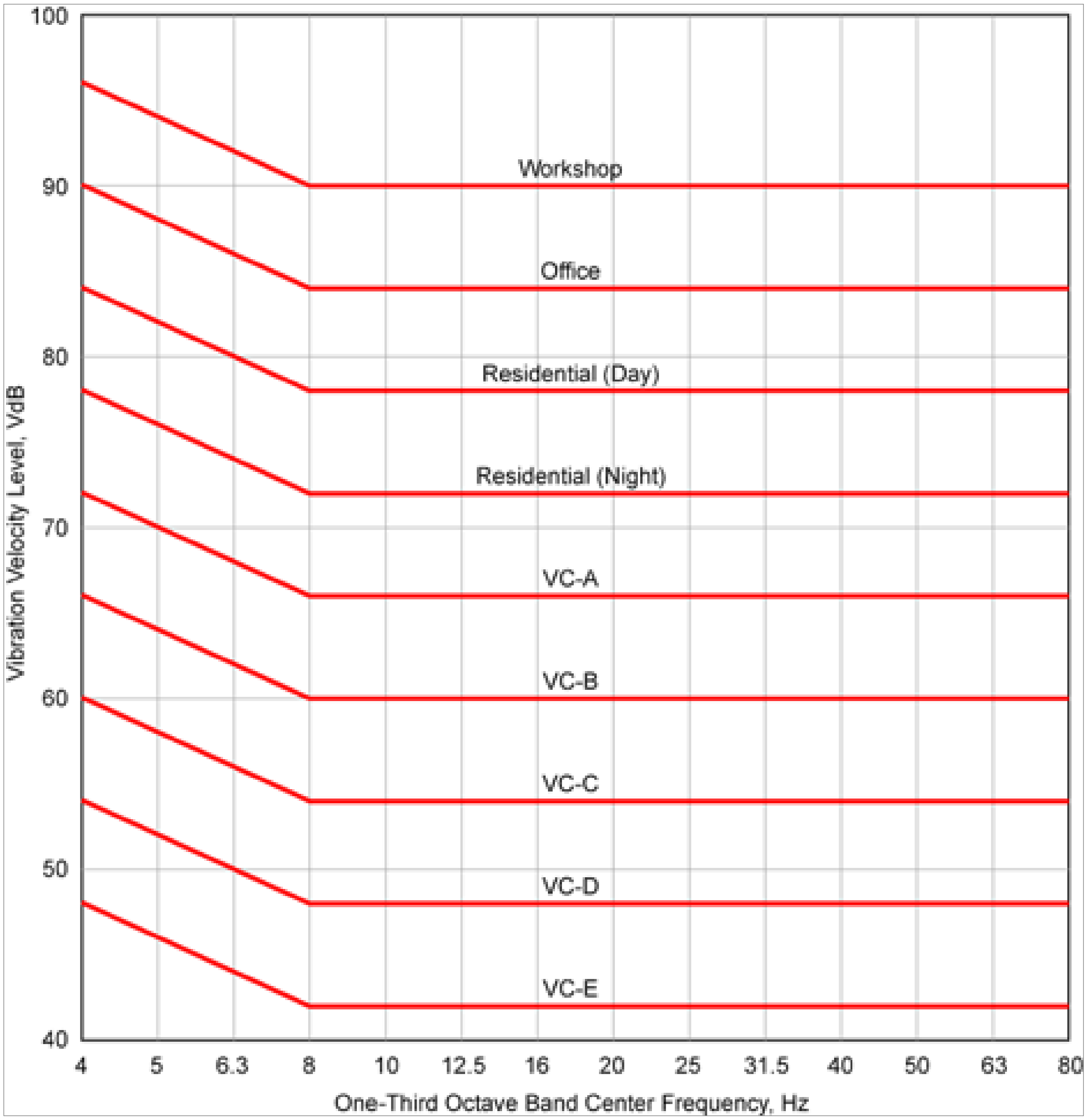
Source: Federal Railroad Administration, 2012
[1] Frequent events are defined as more than 70 vibration events of the same kind per day.
[2] Occasional events are defined as between 30 and 70 vibration events of the same kind per day.
[3] Infrequent events are defined as fewer than 30 vibration events of the same kind per day.
[4] This criterion limit is based on levels that are acceptable for most moderately sensitive equipment, such as optical microscopes. For vibration-sensitive manufacturing or research equipment, a detailed vibration analysis must be performed.
[5] Vibration-sensitive equipment is generally not sensitive to ground-borne noise.
dBA = A-weighted decibels
N/A = not applicable
VdB = vibration velocity decibels

Table 3.4-11 Ground-Borne Vibration and Noise Impact Criteria for Special Buildings

Type of Building or Room	Ground-Borne Vibration Impact Levels (VdB re 1 micro-inch per second)		Ground-Borne Noise Impact Levels (dBA re 20 microPascals)	
	Frequent Events[1]	Occasional or Infrequent Events[2]	Frequent Events[1]	Occasional or Infrequent Events[2]
Concert Halls	65 VdB	65 VdB	25 dBA	25 dBA
Television Studios	65 VdB	65 VdB	25 dBA	25 dBA
Recording Studios	65 VdB	65 VdB	25 dBA	25 dBA
Auditoriums	72 VdB	80 VdB	30 dBA	38 dBA
Theaters	72 VdB	80 VdB	35 dBA	43 dBA

Source: Federal Railroad Administration, 2012
[1] Frequent events are defined as more than 70 vibration events per day.
[2] Occasional or infrequent events are defined as fewer than 70 vibration events per day.
dBA = A-weighted decibels
N/A = not applicable
VdB = vibration velocity decibels

For a detailed vibration analysis, more refined impact criteria are required than for a general assessment. Therefore, the criteria for a detailed vibration assessment are expressed in terms of one-third octave band frequency spectra, based on international and industry standards. The FRA criteria for a detailed vibration assessment are shown on Figure 3.4-4 and descriptions of the curves are shown in Table 3.4-12. The impact criteria curves are applied to the projected vibration spectrum for the project section. If the vibration level at any frequency exceeds the criteria, an impact would occur. Conversely, if the entire proposed vibration spectrum of the project section were below the curve, there would be no impact.



Source: Federal Railroad Administration, 2012

Figure 3.4-4 Federal Railroad Administration Detailed Ground-Borne Vibration Impact Criteria

Table 3.4-12 Interpretation of Vibration Criteria for Detailed Analysis

Criterion Curve (Figure 3.4-4)	Max Lv (VdB)[1]	Description of Use
Workshop	90	Distinctly feelable vibration. Appropriate for workshops and nonsensitive areas.
Office	84	Feelable vibration. Appropriate for offices and nonsensitive areas.
Residential Day	78	Barely feelable vibration. Adequate for computer equipment and low-power optical microscopes (up to 20X).
Residential Night, Operating Rooms	72	Vibration not feelable, but ground-borne noise may be audible inside quiet rooms. Suitable for medium-power optical microscopes (100X) and other equipment of low sensitivity.
VC-A	66	Adequate for medium- to high-power optical microscopes (400X), microbalances, optical balances, and similar specialized equipment.
VC-B	60	Adequate for high-power optical microscopes (1000X) and inspection and lithography equipment to 3-micron line widths.
VC-C	54	Appropriate for most lithography and inspection equipment to 1-micron detail size.
VC-D	48	Suitable in most instances for the most demanding equipment, including electron microscopes operating to the limits of their capability.
VC-E	42	The most demanding criterion for extremely vibration-sensitive equipment.

Source: Federal Railroad Administration, 2012
[1] As measured in 1/3-octave bands of frequency over the frequency range of 8 to 80 Hertz.
Lv = velocity level in decibels
VdB = vibration velocity decibels

Existing Vibration Conditions

One factor not incorporated in the criteria is how to account for existing vibration. In most cases, except near railroad tracks, the existing environment does not include a substantial number of perceptible ground-borne vibration or noise events. However, HSR projects commonly use parts of existing rail routes. The criteria given in Table 3.4-10 and Table 3.4-11 do not indicate how to account for existing vibration, a common situation for HSR projects using existing rail rights-of-way. Methods of handling representative scenarios include the following:

- **Infrequently Used Rail Route**—Use the vibration criteria from Table 3.4-10 and Table 3.4-11 when the existing rail traffic consists of four or fewer trains per day.
- **Moderately Used Rail Route**—If the existing rail traffic consists of 5 to 12 trains per day with vibration that substantially exceeds the impact criteria, there would be no effect as long as the project vibration levels estimated using the procedures outlined in either Chapter 8 or 9 of the FRA guidelines are at least 5 VdB less than the existing vibration. Vibration from existing trains could be estimated using the general assessment procedures in Chapter 8 of the FRA guidelines; however, measuring vibration from existing train traffic is usually preferable.
- **Heavily Used Rail Route**—If the existing traffic exceeds 12 trains per day, and if the project would not substantially increase the number of vibration events (less than a doubling of the number of trains is usually considered not substantial), there would be no additional effect unless the project vibration (estimated using the procedures in Chapter 8 or Chapter 9 of the FRA guidelines) would be higher than the existing vibration. In locations where the new trains would be operating at much higher speeds than the existing rail traffic, the high-speed trains would likely generate substantially higher levels of ground-borne vibration. When the project would cause vibration more than 5 VdB greater than the existing source, the existing source can be ignored and the vibration criteria in Table 3.4-10 and Table 3.4-11 can be applied to the project.

- **Moving Existing Tracks**—Another scenario where existing vibration can be substantial is a new HSR line within an existing rail right-of-way that requires shifting the location of existing tracks. Where the track relocation would cause higher vibration levels at sensitive receptors, the projected vibration levels from both rail systems must be compared to the appropriate impact criterion to determine if there would be a new effect. If an effect were judged to have existed prior to moving the tracks, new effects would be assessed only if the relocation would result in more than a 3 VdB increase in vibration level. Although the impact thresholds given in Table 3.4-10 and Table 3.4-11 are based on experience with vibration from rail transit systems, the thresholds can be applied to freight train vibrations as well. However, locomotive and railcar vibration should be considered separately. Because locomotive vibration only lasts for a few seconds, the infrequent-event limit is appropriate. However, for a typical line-haul freight train where the railcar vibration lasts for several minutes, the frequent-event limits should be applied to the railcar vibration. Some judgment must be exercised to ensure that the approach is reasonable. For example, some spur rail lines carry very little rail traffic (sometimes only one train per week) or have short trains, in which case the infrequent-event limits are appropriate.

Federal Transit Administration Guidelines

The FTA guidelines (FTA 2018) form the basis of the FRA guidelines (FRA 2012) and use the same criteria for ground-borne vibration and noise as described above for the FRA guidelines.

3.4.4.4 Method for Determining Significance under CEQA

CEQA requires that an EIR identify the significant environmental impacts of a project (State CEQA Guidelines § 15126). One of the primary differences between NEPA and CEQA is that CEQA requires a significance determination for each impact using a threshold-based analysis (see Section 3.1.5.4 for further information). By contrast, under NEPA, significance is used to determine whether an EIS will be required; NEPA requires that an EIS be prepared when the proposed federal action (project) as a whole has the potential to “significantly affect the quality of the human environment.” Accordingly, Section 3.4.9, CEQA Significance Conclusions, summarizes the significance of the environmental impacts on noise and vibration for the HSR Build Alternative. The Authority is using the following thresholds to determine if a significant impact on noise and vibration would occur as a result of the HSR Build Alternative. A significant impact is one that would:

- Generate temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of FRA/FTA and FHWA standards for severe noise impacts.
- Generate temporary or permanent ground-borne vibration or ground-borne noise levels exceeding FRA/FTA standards.
- Be located within an airport land use plan area or where such a plan has not been adopted, within 2 miles of a private airstrip, public airport, or public use airport and expose people residing or working in the project area to excessive noise levels.

Of these guidelines, the first two items are applicable to the project and were considered in the analysis presented in this EIR/EIS. The last guideline is included because Hollywood Burbank Airport is within the RSA. However, because the HSR would be in a tunnel near this small general aviation airport, there would be no increase in noise where the airport generates noise (i.e., at the end of the runway).

As discussed in Section 3.4.4.4, the analysis relies on noise and vibration standards developed by FTA and FRA to determine whether the project would result in significant noise or vibration impacts. These standards are derived primarily from the FRA guidelines in *High-Speed Ground Transportation Noise and Vibration Impact Assessment* (FRA 2012), which is based on the FTA *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018). The noise impact criteria established in these documents is based on the level of human annoyance and were developed to apply to a wide variety of surface transportation modes and to respond to the varying sensitivities of communities to projects under different background noise conditions. The vibration standards address both human reaction to vibration as well as the potential for physical damage. The FRA standards were developed specifically for assessing noise and vibration impacts caused by high-speed rail projects, and the FTA standards were developed for rail projects and their associated stationary facilities. Accordingly, these standards serve as appropriate thresholds for determining whether the project would result in significant noise or vibration impacts.

For determining the significance of impacts related to traffic noise, the analysis relies in part on criteria that are included in the FHWA's *Procedures for Abatement of Highway Traffic Noise and Construction Noise* (23 C.F.R. Part 772), which are implemented by Caltrans through its *Traffic Noise Analysis Protocol* (Caltrans 2011). These criteria are based on the level of human perception or annoyance and consider various types of land uses. Although the FHWA regulations only apply to projects funded or approved by FHWA, the criteria in these regulations are regularly considered in assessing noise impacts associated with motor vehicles. Moreover, the Caltrans *Traffic Noise Analysis Protocol* provides policy guidance for assessing traffic noise impacts as well as noise abatement criteria. Therefore, the criteria provided in these documents serve as appropriate thresholds for determining whether traffic noise would result in a significant impact.

3.4.5 Affected Environment

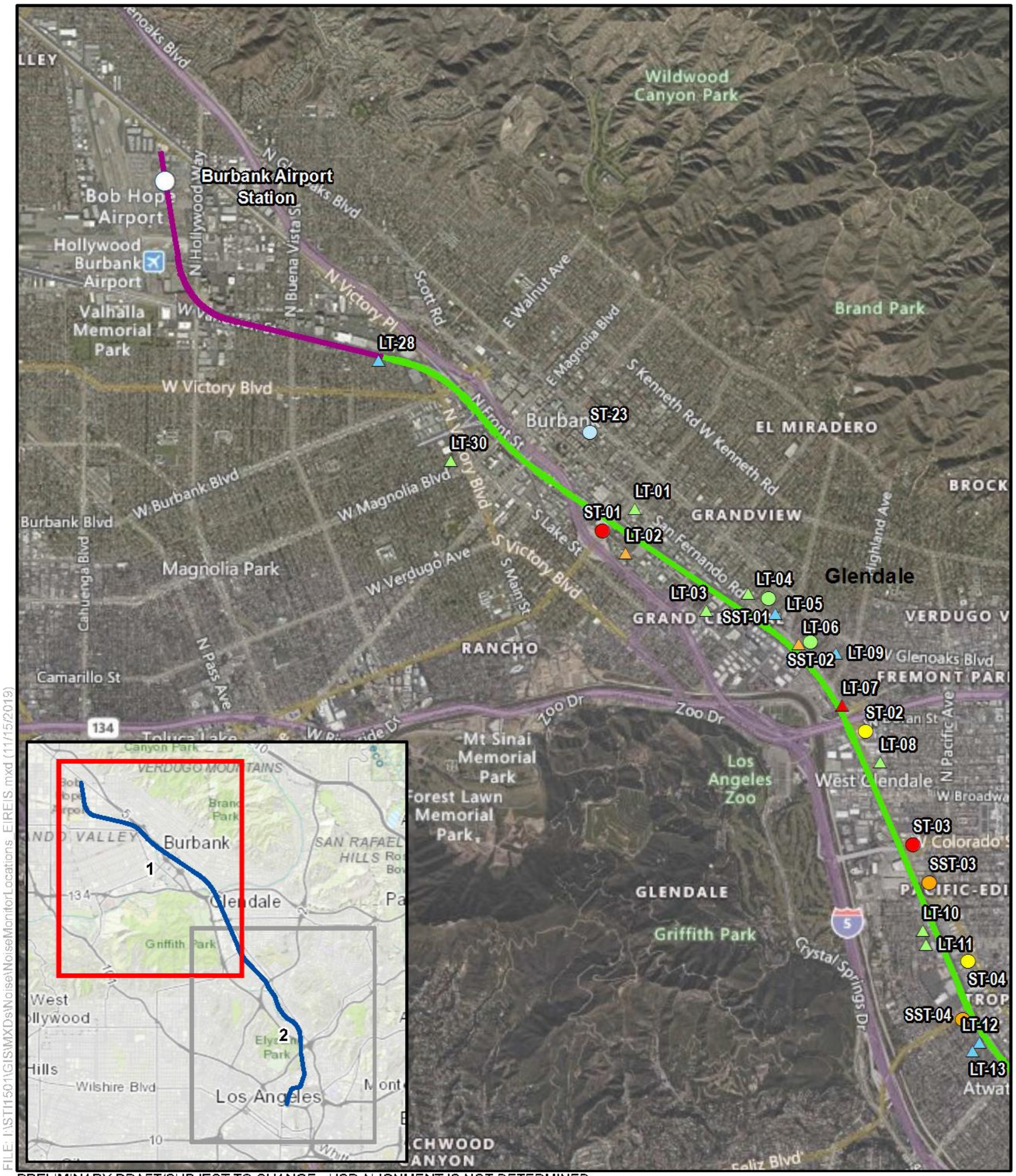
This section describes the affected environment for noise and vibration in the Burbank to Los Angeles RSA. This information provides the context for the environmental analysis and evaluation of impacts.

A summary of stakeholder issues and concerns from public outreach efforts can be found in Chapter 9, Public and Agency Involvement.

3.4.5.1 Noise and Vibration Measurements

The site of the proposed HSR project is a busy existing railroad corridor where commuter rail, Amtrak, and freight rail currently operate. Ambient noise level measurements were conducted at representative noise-sensitive receiver locations within the RSA to document the existing noise environment for project noise effect assessment. A combination of 28 long-term (24 hours in duration) and 18 short-term (30 minutes in duration) noise level measurements were conducted to represent the noise-sensitive uses within the RSA. The discussion below describes existing noise conditions broken into segments based on varying HSR operation speeds. The noise level measurement locations are shown on Figure 3.4-5 (Sheets 1 and 2), and the results are summarized below. Section 5 of the *Burbank to Los Angeles Project Section Noise and Vibration Technical Report* (Authority 2019b) provides the detailed noise level results.

- Between the Burbank Airport Station and Alameda Avenue, the HSR Build Alternative is within the city of Burbank. Land uses in this area are primarily residential and industrial. In addition to residences, other sensitive receivers include recording studios, places of worship, and schools. HSR speeds in this segment would range up to 125 mph. The measured ambient noise levels ranged from 58 to 61 dBA L_{dn}. These noise levels are primarily attributed to traffic on local streets and Interstate (I) 5, and train operations within the existing railroad corridor. The measurement locations in this area are labeled as PB-LT-28, PB-LT-30, and PB-ST-23.
- Between Alameda Avenue and Los Feliz Boulevard, the HSR Build Alternative is within the cities of Burbank, Glendale, and Los Angeles. Land uses in this area are primarily residential, commercial, and industrial. In addition to residences, other sensitive receivers include theaters, churches, parks, and recording studios. HSR speeds in this segment would range up to 125 mph. The measured ambient noise levels gathered at LT-1 through LT-11 range from 59.5 to 73.5 dBA L_{dn}, while the short-term measurements ST-1 through ST-4, and SST-1 through SST-3 were used to estimate existing peak noise hours that ranged from 55.9 to 73.4 dBA L_{eq}. These noise levels are primarily attributed to traffic on local streets and I-5, and train operations within the existing railroad corridor.



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HSR ALIGNMENT IS NOT DETERMINED
SOURCE: Bing (2018); CHSRA (11/2019)

HSR Alignment Under Consideration
- Surface
- Below-grade
- HSR Stations

Long-Term Measurement Locations
- Between 50 and 59.9 dBA L_{dn}
- Between 60 and 64.9 dBA L_{dn}
- Between 65 and 69.9 dBA L_{dn}
- Between 70 and 73.5 dBA L_{dn}

Short-Term Measurement Locations
- Between 50 and 54.9 dBA L_{eq}
- Between 55 and 59.9 dBA L_{eq}
- Between 60 and 64.9 dBA L_{eq}
- Between 65 and 69.9 dBA L_{eq}
- Between 70 and 78.0 dBA L_{eq}

N

0 0.5 1
Miles

0 0.75 1.5
Kilometers

Figure 3.4-5 Existing Noise Measurement Locations

(Sheet 1 of 2)

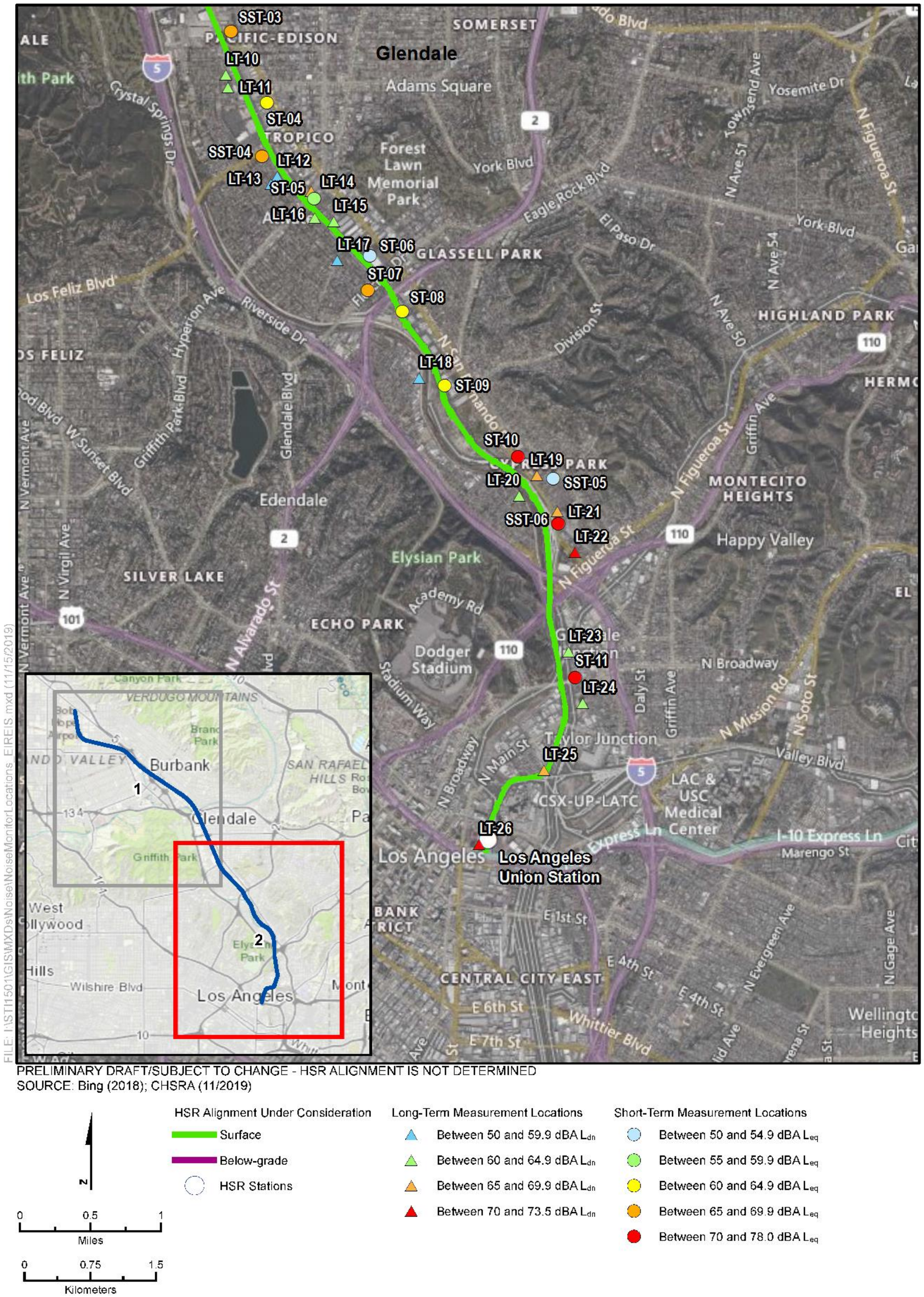


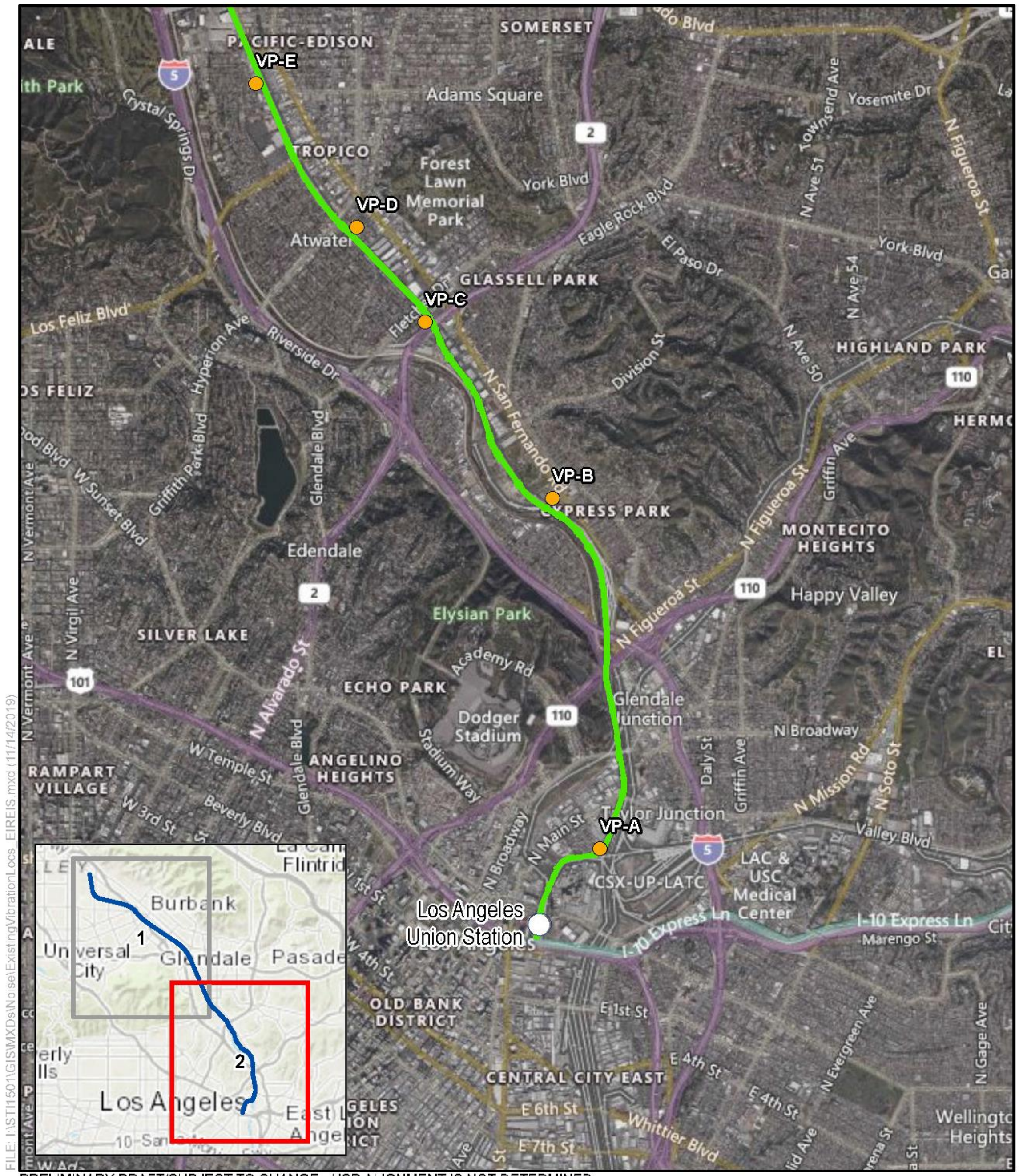
Figure 3.4-5 Existing Noise Measurement Locations

(Sheet 2 of 2)

- Between Los Feliz Boulevard and State Route (SR) 2, the HSR Build Alternative is within the cities of Glendale and Los Angeles. Land uses in this area are primarily residential, commercial, and industrial. In addition to residences, other sensitive receivers include churches, retirement homes, and recording studios. HSR speeds in this segment would approach 125 mph. The measured ambient noise levels gathered at LT-12 through LT-17 range from 57.7 to 68 dBA L_{dn}, while the short-term measurements ST-5 through ST-7, and SST-4 were used to estimate existing peak noise hours that ranged from 53.6 to 69.9 dBA L_{eq}. These noise levels are primarily attributed to traffic on local streets, I-5, and SR 2, and train operations within the existing railroad corridor.
- Between SR 2 and Arvia Street, the HSR Build Alternative is within the city of Los Angeles. Land uses in this area are primarily residential, commercial, and industrial. In addition to residences, other sensitive receivers include schools. HSR speeds in this segment would range up to 50 mph. The measured ambient noise levels gathered at LT-18 resulted in a noise level of 57.7 dBA L_{dn}, while the short-term measurements ST-8 and ST-9 were used to estimate existing peak noise hours that ranged from 62.1 to 64.2 dBA L_{eq}. These noise levels are primarily attributed to traffic on local streets, I-5, and SR 2, and train operations within the existing railroad corridor.
- Between Arvia Street and SR 110, the HSR Build Alternative is within the city of Los Angeles. Land uses in this area are primarily residential, commercial, and industrial. In addition to residences, other sensitive receivers include a church, a studio, and a park. HSR speeds in this segment would range up to 50 mph. The measured ambient noise levels gathered at LT-19 through LT-22 range from 61.8 to 70.1 dBA L_{dn}, while the short-term measurements ST-10, and SST-5 and SST-6 were used to estimate existing peak noise hours that ranged from 53.1 to 78 dBA L_{eq}. These noise levels are primarily attributed to traffic on local streets, I-5, and SR 110, and train operations within the existing railroad corridor.
- Between SR 110 and Los Angeles Union Station, the HSR Build Alternative is within the city of Los Angeles. Land uses in this area are primarily residential, commercial, and industrial. In addition to residences, other sensitive receivers include a church, a park, and a courthouse. HSR speeds in this segment would range up to 55 mph. The measured ambient noise levels gathered at LT-23 through LT-26 range from 62.5 to 73.1 dBA L_{dn}, while the short-term measurement ST-11 was used to estimate the existing peak noise hour of 70.3 dBA L_{eq}. These noise levels are primarily attributed to traffic on local streets, I-5, and SR 110, and train operations within the existing railroad corridor.

In addition, vibration propagation measurements were conducted at eight sites shown on Figure 3.4-6 (Sheets 1 and 2) throughout the vibration RSA along the proposed Alternative 3 alignment as described in the *Burbank to Los Angeles Project Section Noise and Vibration Technical Report* (Authority 2019b). The measurement results at these locations were used to characterize the ground vibration propagation conditions at particular vibration-sensitive areas.

Figure 3.4-6 Existing Vibration Measurement Locations
(Sheet 1 of 2)



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HSR ALIGNMENT IS NOT DETERMINED
SOURCE: National Geographic (2018); CHSRA (11/2019)

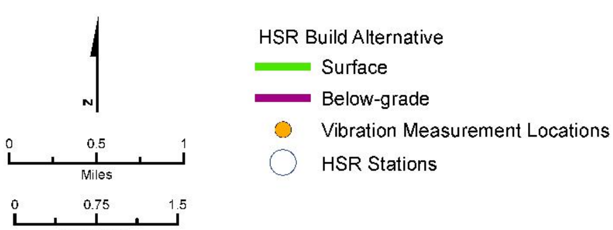


Figure 3.4-6 Existing Vibration Measurement Locations
(Sheet 2 of 2)

3.4.6 Environmental Consequences

3.4.6.1 Overview

This section evaluates how the No Project Alternative and the HSR Build Alternative could affect noise and vibration resources. The impacts of the HSR Build Alternative are described and organized as follows:

Construction Impacts

- Impact N&V #1: Temporary Exposure of Sensitive Receivers to Construction Noise
- Impact N&V #2: Temporary Exposure of Sensitive Receivers to Vibration from Construction
- Impact N&V #3: Temporary Traffic-Generated Noise from Rerouting Traffic during Construction

Operations Impacts

- Impact N&V #4: Permanent Exposure of Sensitive Receivers to Noise from Project Operation
- Impact N&V #5 Permanent Exposure of Sensitive Receivers and Buildings to Vibrations from Project Operation
- Impact N&V #6: Effects on Wildlife and Domestic Animals
- Impact N&V #7: Traffic Noise
- Impact N&V #8: Noise from High-Speed Rail Stationary Facilities

3.4.6.2 No Project Alternative

Under the No Project Alternative, the HSR Build Alternative would not be constructed, and there would be no temporary or permanent increases in project-related noise or vibration. However, the population in the RSA would continue to grow, and changes in noise and vibration sources from development projects and infrastructure improvements along with additional rail and road traffic from other planned projects within the existing rail alignment could cause localized noise and vibration impacts.

Within the Burbank to Los Angeles Project Section, noise and vibration effects would occur from other planned and committed projects to be constructed by 2040. Growth in the RSA would add additional residential and commercial developments and associated infrastructure that could affect traffic noise levels in the RSA. The No Project Alternative would include the future development reported in the general plans of the cities and counties within the project section, including both suburban expansion and development in existing urban areas. This future development would include additional rail traffic from other planned projects within the existing rail alignment that may result in a perceptible increase in noise levels at adjacent receivers. Future planned and committed projects that may influence the future noise and vibration environment with the RSA are described in Section 3.19, Cumulative Impacts.

Planned development and transportation projects that would occur as part of the No Project Alternative would likely include project design features and mitigation to reduce impacts on noise and vibration. Future roadway projects under the No Project Alternative would require individual environmental review, including an analysis of traffic noise and vibration impacts on sensitive receptors, in accordance with state and federal highway noise criteria. Any increases in noise and vibration from development projects would be regulated by local general plans and noise and vibration ordinances. It will be the responsibility of the affected jurisdiction to ensure that consistency with local regulations and ordinances aimed at avoiding or reducing permanent increases in noise and vibration levels is achieved.

3.4.6.3 High-Speed Rail Build Alternative

Construction Impacts

Construction and operation of the HSR Build Alternative could result in temporary and permanent impacts related to noise and vibration on sensitive receptors in the RSA.

Impact N&V #1: Temporary Exposure of Sensitive Receivers to Construction Noise

Three types of short-term noise impacts would occur during the rail corridor construction. Noise impacts would result from construction traffic activities and heavy-equipment operations during rail corridor construction and during roadway modifications in the project footprint.

Construction Traffic

The first type of short-term noise impact would be from construction crew commutes. In addition, the transport of construction equipment and materials to the project site as part of HSR Build Alternative construction would incrementally raise noise levels on local roads leading to the site. The pieces of construction equipment would be moved on-site, where they would remain for the duration of each construction phase, and would not add to the daily traffic volumes in the RSA. The projected construction traffic volume would be minimal when compared to existing traffic volumes on affected local streets and, therefore, would not result in an audible change in noise.

Rail Corridor Construction

The second type of short-term noise impact is related to noise generated during rail corridor construction. Construction of the HSR Build Alternative comprises 11 construction phases. These include land clearing, earthmoving, roadway construction, structure demolition, elevated structures, track at-grade, materials handling, tunnel construction, systems facilities construction, and Metrolink Central Maintenance Facility upgrades. Each phase has a unique set of construction equipment that would be used. Appendix C of the *Burbank to Los Angeles Project Section Noise and Vibration Technical Report* (Authority 2019b) provides a complete list of the construction equipment and the associated reference noise levels that would be used for each phase of construction. In addition to the construction equipment list, pile driving may be used for road and canal overcrossing and track construction.

Table 3.4-13 summarizes the distance to construction noise impact thresholds for daytime and nighttime work for each phase of construction when a small set of construction equipment was assumed to operate simultaneously as a worst-case scenario. As shown in Table 3.4-13, residences and schools within 113 to 199 feet of the construction boundary would be exposed to noise levels greater than the detailed FRA construction noise criterion of 80 dBA L_{eq} during daytime hours. Residences within 356 to 629 feet of the construction boundary would be exposed to noise levels greater than the detailed FRA construction noise criterion of 70 dBA L_{eq} during nighttime hours. Schools would not be impacted during nighttime hours because they would not be in operation.

Table 3.4-13 Noise Criteria Exceedance Screening Distances for High-Speed Rail Construction Activities in Residential Areas

Construction Activity	Daytime 80 dBA L_{eq} (feet)	Nighttime 70 dBA L_{eq} (feet)
Land Clearing	131–134	416–423
Earthmoving	148	467
Roadway Construction	176	555
Structure Demolition	117	370
Building Demolition	113	356
Elevated Structures	139-182	440–576
Track At-Grade	175	553
Materials Handling	160	507

Construction Activity	Daytime 80 dBA L_{eq} (feet)	Nighttime 70 dBA L_{eq} (feet)
Tunnel Construction	199	629
Systems Facilities	163	516
Maintenance Facility Upgrades	167	527

dBA = A-weighted decibels L_{eq} = equivalent sound level

Roadway Construction

The third aspect of construction noise impacts would occur because the HSR Build Alternative would improve a number of local roadways in the RSA. Some roadway improvements are considered minor, whereas others, such as grade separations, are more extensive. Chapter 2, Alternatives, provides more detail regarding the proposed grade separation locations.

Construction crew commutes and the transport of construction equipment and materials to each roadway improvement site would incrementally raise noise levels on local roads leading to the site. The pieces of construction equipment would be moved on-site, where they would remain for the duration of the construction phase, and would not add to the daily traffic volumes in the RSA. Projected construction traffic volumes would be minimal when compared to existing traffic volumes on affected local streets.

Roadway construction activity noise levels would be similar to typical noise levels from construction activities for public works projects, as described in Table 3.4-14. Construction activities would generate noise levels up to 88 dBA L_{eq} at a distance of 50 feet. Residences within 125 feet of the construction boundary would be exposed to noise levels greater than 80 dBA L_{eq} during daytime hours. Residences within 396 feet of the construction boundary would be exposed to noise levels greater than 70 dBA L_{eq} during nighttime hours. Residences within these distances would be affected by noise generated from construction activities that is greater than the recommended FRA construction noise criteria.

Table 3.4-14 Typical Noise Levels from Construction Activities for Public Works Projects

Construction Activity	Average Sound Level at 50 feet (dBA L_{eq})	Standard Deviation (dBA)
Ground Clearing	84	7
Excavation	89	6
Foundations	78	3
Erection	87	6
Finishing	89	7

Source: U.S. Environmental Protection Agency, 1971
dBA = A-weighted decibel(s) L_{eq} = equivalent sound level

If pile driving is required for the grade separation projects, and if it is conducted simultaneously with the operation of other pieces of construction equipment, noise levels would reach up to 96 dBA L_{eq} at a distance of 50 feet. Residences within 308 feet of the construction boundary would be exposed to noise levels greater than 80 dBA L_{eq} during daytime hours. Residences within 973 feet of the construction boundary would be exposed to noise levels greater than 70 dBA L_{eq} during nighttime hours. Residences within these distances would be affected by noise generated from construction activities that is greater than the recommended FRA construction noise criteria.

The transformation and distribution of electricity throughout the HSR system would take place in three types of stations: traction power substations, switching stations, and paralleling stations. No traction power substations are proposed in the RSA; however, noise effects related to noise and vibration associated with paralleling stations or switching stations may occur.

Electric power utilities within the proposed HSR Build Alternative right-of-way would be relocated to outside the right-of-way. The relocation of utilities would be limited to areas in direct conflict with HSR Build Alternative construction and right-of-way but may require complete abandonment or removal and the reconstruction of a utility facility. Modification of existing high-voltage lines and towers within their existing rights-of-way and easements may require temporary high-voltage-line bypasses outside their rights-of-way or easements to construct the relocations.

Assuming a bulldozer, a drill rig, a flatbed truck, a crane, and a concrete mixer truck would be used to perform electric power utility improvements and would operate simultaneously as a worst-case scenario, the worst-case composite noise level during this phase of construction would be 87 dBA L_{eq} at a distance of 50 feet from the construction boundary. Residences and schools within a distance of 108 feet from the construction boundary would be exposed to noise levels greater than 80 dBA L_{eq} during daytime hours. Residences within a distance of 342 feet from the construction boundary would be exposed to noise levels greater than 70 dBA L_{eq} during nighttime hours. Schools would not be affected during nighttime hours because they would not be in session. Residences and schools within these distances from the construction boundary would be affected by noise generated from construction-related activities that is greater than the recommended FRA construction noise criteria.

Early action projects are components of the HSR Build Alternative. An early action project is a regionally significant connectivity project that provides early benefits to transit riders and local communities and lays solid foundation for the HSR system. Early action projects include grade separations and improvements at regional passenger rail stations. For a full list and detailed description of each early action project, see Chapter 2, Alternatives. When noise-sensitive receptors are within the distances for the applicable phases as presented in Table 3.4-13, temporary noise impacts have the potential to occur.

The design characteristics of the project include measures to comply with FRA guidelines and minimize noise impacts. NV-IAMF#1 would require the contractor to document how federal guidelines for minimizing noise and vibration would be employed when construction is occurring near sensitive receivers (such as hospitals, residential neighborhoods, and schools). In addition, the Authority would implement mitigation measures to minimize the impacts on sensitive receivers from construction noise. Mitigation measure N&V-MM#1 would require the contractor to provide noise control measures as necessary to meet the noise limits and to monitor construction noise to verify compliance with the limits.

CEQA Conclusion

Construction noise impacts under CEQA would be significant because of the FRA noise criteria exceedances for sensitive receptors within the screening distances shown in Table 3.4-13. The impact would be significant even with the inclusion of NV-IAMF#1, which requires the contractor to provide the Authority with a technical memorandum documenting how federal guidelines for minimizing noise and vibration would be employed. Therefore, CEQA requires mitigation. However, in any given location along the HSR alignment, construction noise would be temporary and intermittent, and would cease once work is complete. Impacts would be greatly reduced by implementing mitigation measure N&V-MM#1, which requires the contractor to provide noise control measures as necessary to meet the FRA construction noise limits and to monitor construction noise to verify compliance with the limits. By implementing mitigation measure N&V-MM#1, the impact under CEQA is expected to be less than significant after mitigation.

Impact N&V #2: Temporary Exposure of Sensitive Receivers to Vibration from Construction

During construction of the HSR Build Alternative, construction equipment has the potential to increase ground-borne vibration levels near sensitive receivers. For construction-related vibration, the FRA 2012 guidance manual provides some vibration source level guidelines for various pieces of construction equipment, which are listed in Table 3.4-15. This table shows the PPV in inches per second and the corresponding root-mean-square velocity level in VdB at a distance of 25 feet for each type of construction equipment.

Table 3.4-15 Vibration Source Levels for Construction Equipment

Equipment		PPV at 25 feet (in/sec)	Approximate Lv[1] at 25 feet)
Pile driver (impact)	Upper range	1.518	112
	Typical	0.644	104
Pile driver (vibratory)	Upper range	0.734	105
	Typical	0.170	93
Clam shovel drop (slurry wall)		0.202	94
Hydromill (slurry wall)	In soil	0.008	66
	In rock	0.017	75
Vibratory roller		0.210	94
Hoe ram		0.089	87
Large bulldozer		0.089	87
Caisson drilling		0.089	87
Loaded trucks		0.076	86
Jackhammer		0.035	79
Small bulldozer		0.003	58

Source: Federal Railroad Administration, 2012
[1] RMS VdB re 1 micro in/sec.
in/sec = inch(es) per second PPV = peak particle velocity VdB = vibration velocity decibels
Lv = RMS velocity level RMS = root-mean-square

The distances within which annoyance or interference would occur with vibration-sensitive activities were calculated for each of the three land use categories defined in Table 3.4-7 and are shown in Table 3.4-16. In addition, the distances within which the damage criterion of 0.12 PPV (inches/second) for buildings that are extremely susceptible to vibration damage and the damage criterion of 0.20 PPV (inches/second) for buildings constructed of non-engineered timber and masonry were calculated are shown in Table 3.4-17. Fragile or historic structures are extremely susceptible to vibration damage. Wood-frame structures are buildings constructed of non-engineered timber and masonry, such as residential structures.

Table 3.4-16 Distances to Construction Vibration Annoyance Criteria

Land Use Category	Vibration Criterion Level (VdB)	Approximate Vibration Effect Distance (feet)
Category 1: Buildings where vibration would interfere with interior operations	5	230
Category 2: Residences and buildings where people normally sleep	72	135
Category 3: Institutional land uses with primarily daytime use	75	105

Source: California High Speed Rail Authority, 2017
VdB = vibration velocity decibels

Table 3.4-17 Distances to Construction Vibration Damage Criteria

Source	Vibration Source Level PPV at 25 feet (in/sec)	Approximate Vibration Impact Distance to 0.12 PPV (feet)[1]	Approximate Vibration Impact Distance to 0.2 PPV (feet)[2]
Pile Driver (impact)	0.644	77	55
Caisson Drilling	0.089	20	15
Large Bulldozer	0.089	20	15

[1] Vibration damage threshold for buildings that are extremely susceptible to vibration damage, such as fragile or historic structures.
[2] Vibration damage threshold for buildings that are constructed of non-engineered timber and masonry, such as residential structures.
In/sec = inch(es) per second PPV = peak particle velocity

During construction, some activities may cause ground-borne vibration, most notably excavation for trenching and vibro-compaction for ground improvements. Construction equipment associated with these activities can produce vibration levels at 25 feet that range from 87 VdB to 94 VdB. Although it is unlikely that such equipment would be used close enough to sensitive structures to have any substantial damage impacts, there could be some potential for vibration annoyance or interference with the use of sensitive equipment. Table 3.4-17 provides the approximate distances within which receivers could experience an annoyance due to construction vibration.

CEQA Conclusion
The construction vibration impact under CEQA would be significant should construction activities occur within the distances shown in Table 3.4-16 and Table 3.4-17 relative to sensitive uses because construction would generate vibration exceeding federal criteria for annoyance and building damage, respectively. The impact would be significant even with the inclusion of NV-IAMF#1, which requires the contractor to provide the Authority with a vibration technical memorandum documenting how federal guidelines for minimizing noise and vibration would be employed prior to the start of construction. Therefore, CEQA requires mitigation. However, in any given location along the HSR alignment, construction vibration would be temporary and intermittent and would cease once work is complete. Impacts would be greatly reduced by implementing mitigation measure N&V-MM#2, which requires the contractor to utilize vibration reduction methods to meet the FRA standards for construction vibration. By implementing mitigation measure N&V-MM#2, the impact under CEQA is expected to be less than significant after mitigation.

Impact N&V #3: Temporary Traffic-Generated Noise from Rerouting Traffic during Construction

This analysis addresses any possible additional traffic noise as a result of traffic being rerouted because of local road closures during construction of the HSR Build Alternative. Construction of the HSR Build Alternative would result in temporary or permanent closure of five local roads in the RSA, which would require rerouting traffic and other roadway modifications. Rerouted traffic could affect existing noise levels in the noise RSA, as would the construction of any needed roadway modifications. Any changes in traffic that expose sensitive receptors to noise levels exceeding FHWA and Caltrans NAC would be considered noise impacts.

Based on the projected increases in peak-hour traffic volumes on the anticipated detour routes during construction, it is estimated that traffic noise levels along these routes would increase by at most 5 dBA; the actual increases may be lower if the added traffic results in lower vehicle speeds along the routes. According to the FHWA and the Caltrans NAC, a substantial noise increase is considered to occur when the project's predicted worst-hour design-year noise level exceeds the existing worst-hour noise level by 12 dBA or more. Because the estimated increases in traffic noise are less than 5 dBA, there would be no substantial noise effects related to rerouted traffic.

CEQA Conclusion
Noise impacts due to temporary traffic-generated noise from rerouting traffic during construction would be less than significant under CEQA because the projected increases in traffic noise do not

exceed the FHWA and Caltrans NAC as presented in Table 3.4-1; therefore, CEQA does not require mitigation.

Operations Impacts

Impact N&V #4: Permanent Exposure of Sensitive Receivers to Noise from Project Operation

A noise analysis was conducted for the long-term and short-term measurement locations to show potential noise impacts in the RSA. The measured existing noise level and project noise levels were used to determine the total noise level and the project-related noise level increase at each measurement location. Table 6-8 in the *Burbank to Los Angeles Project Section Noise and Vibration Technical Report* (Authority 2019b) shows the results of the analysis for the long-term and short-term measurement locations under the HSR Build Alternative, along with the various parameters used to determine the noise effects. These parameters include the track elevation, the receiver base elevation, land use, land use category, existing noise level, unmitigated project noise levels, total noise level (existing plus project) unmitigated noise level increase, and FRA impact. The noise levels shown in Table 6-8 in the Noise and Vibration Technical Report are described in terms of L_{dn} or L_{eq}, depending on the land use category. For land use Categories 1 and 3, the noise descriptor is L_{eq}, whereas the noise descriptor for land use Category 2 is L_{dn}.[4] The existing noise level, project noise level (unmitigated), and total (existing plus project) noise level (unmitigated) were rounded to the nearest whole number. Table 6-8 in the Noise and Vibration Technical Report also provides the calculated distances to the severe and moderate impacts for each measurement location for generalization purposes.

Table 3.4-18 summarizes the results of the noise analysis by reporting the number of total affected noise-sensitive receivers under the HSR Build Alternative based on their land use category and noise impact classification (either moderate or severe impact). Figure 3.4-7 (Sheets 1 and 2) shows land use Category 2 noise-sensitive receivers under the HSR Build Alternative that would experience either moderate or severe impacts as a result of operations under the HSR Build Alternative. Figure 3.4-8 (Sheets 1 and 2) shows land use Category 1 and Category 3 noise-sensitive receivers that would experience either moderate or severe impacts as a result of operations under the HSR Build Alternative. An inventory of all severely impacted receivers is provided in Table D-1 of the *Burbank to Los Angeles Project Section Noise and Vibration Technical Report* (Authority 2019b).

Table 3.4-18 Noise Impact Summary Without Mitigation

Category	Moderate Impacts	Severe Impacts
1	1 recording studios	2 theaters
2	1 nursing home 712 residences	210 residences
3	1 church 3 schools	None

Source: California High Speed Rail Authority, 2019
This table provides a summary of all sensitive noise receivers.

[4] Category 1 receptors include television stations, theaters, and recording studios. Category 2 receptors include residential uses and nursing homes. Category 3 receptors include churches, courthouses, parks, and schools.

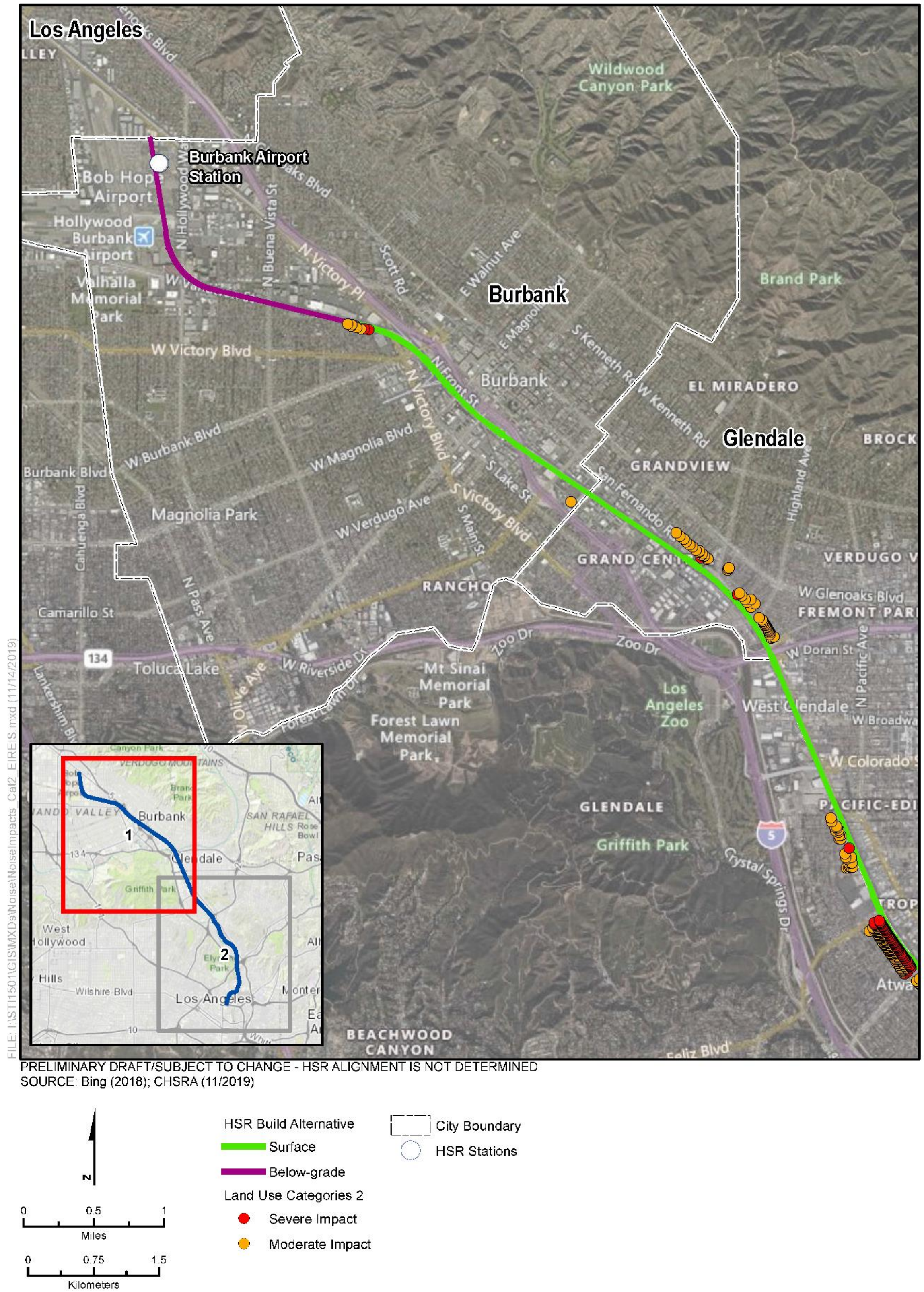


Figure 3.4-7 Land Use Category 2 Noise Impacts—High-Speed Rail Build Alternative
(Sheet 1 of 2)

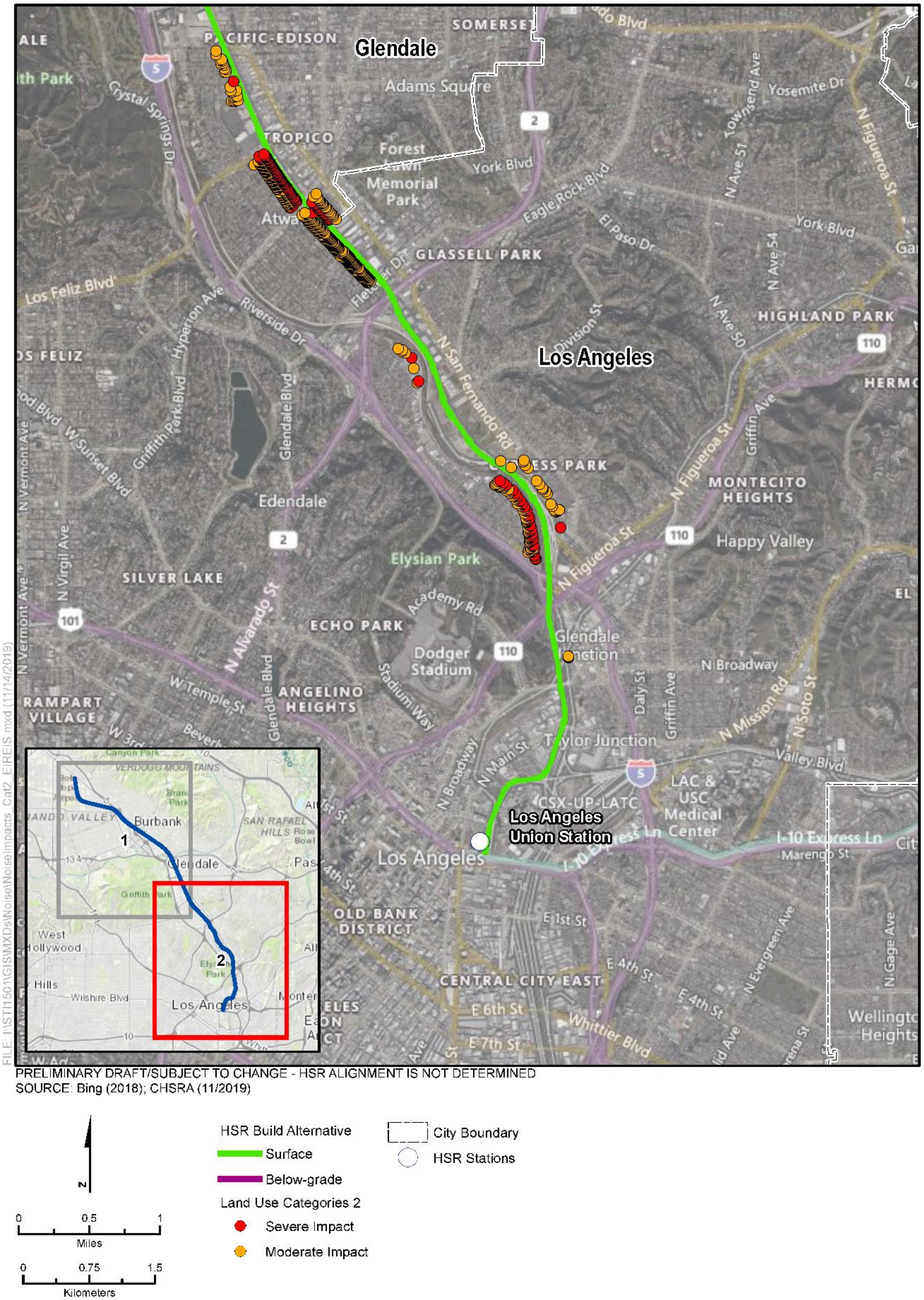


Figure 3.4-7 Land Use Category 2 Noise Impacts—High-Speed Rail Build Alternative

(Sheet 2 of 2)

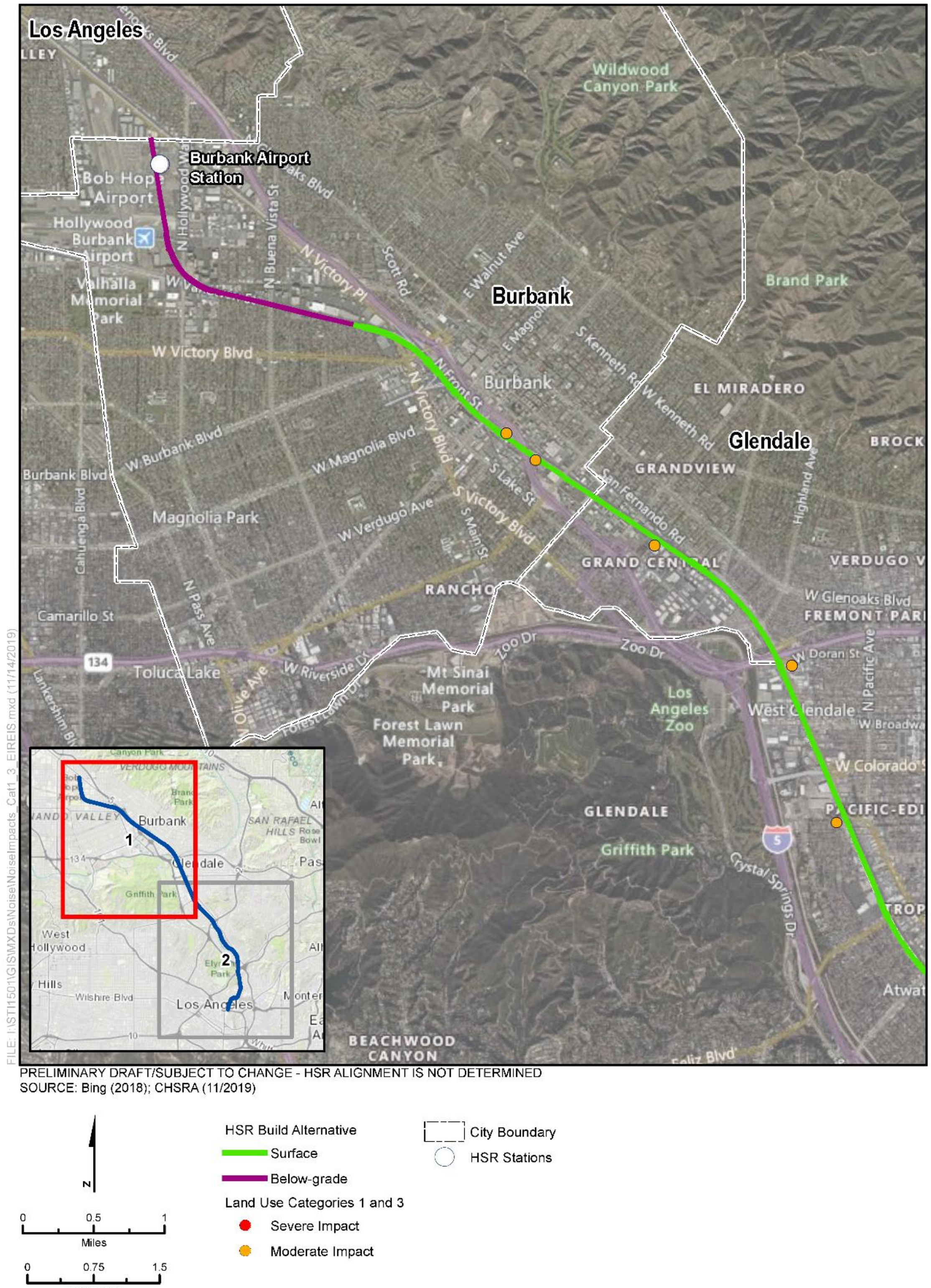


Figure 3.4-8 Land Use Categories 1 and 3 Noise Impacts—High-Speed Rail Build Alternative

(Sheet 1 of 2)

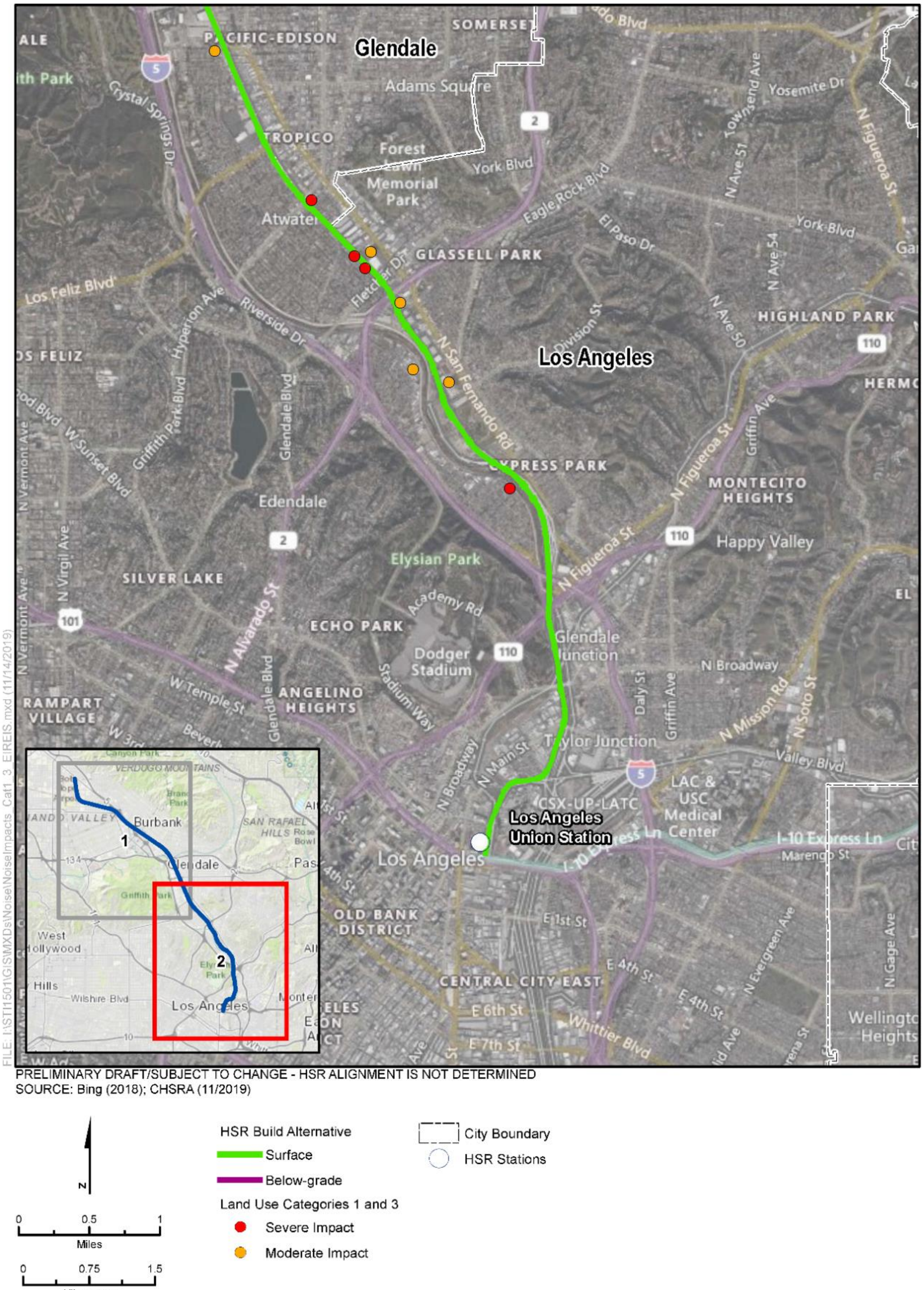


Figure 3.4-8 Land Use Categories 1 and 3 Noise Impacts—High-Speed Rail Build Alternative

(Sheet 2 of 2)

Throughout the Burbank to Los Angeles Project Section, impacts are projected at both residential and institutional noise receivers. Severe noise impacts are projected at 209 single-family residences due to the proximity of the receivers to the proposed track and the speed of the train. The results also indicate severe noise impacts to the ATX Arts and Innovation Complex, a theater at 3191 Casitas Avenue in the city of Los Angeles, and Atwater Village Theatre, a theater at 3265 Casitas Avenue in the city of Los Angeles. Mitigation measures N&V-MM#3 through N&V-MM#5 would be needed and are described in more detail in Section 3.4.7. These measures include the construction of sound barriers, noise insulation considerations, and vehicle specifications and special trackwork that would reduce noise impacts. Although the implementation of mitigation measures N&V-MM#3 through N&V-MM#5 would reduce the operational noise impacts of the HSR Build Alternative, noise impacts as a result of the HSR Build Alternative would still remain. The sound barrier analysis in Table 3.4-21 (provided later in this section) shows that even with the implementation of mitigation measure N&V-MM-#3, severe residual impacts would remain.

Schools

Table 3.4-19 provides more detailed operations impact information on schools within the RSA. As shown in this table, of the five schools within the RSA, three schools would experience a moderate noise impact and one school would have no impact.

Table 3.4-19 Operations Impact on Schools

School Name	Existing Noise Exposure (dBA L_{eq})	Total Noise Level Unmitigated (dBA L_{eq})	FRA Manual Impact Rating (No Mitigation)
Monterey High School	58.0	58.0	None
Hollywood Piano Company	58.0	66.0	Moderate
Glendale Fire Training Center	66.8	67.7	None
Los Feliz Charter School for the Arts	64.2	69.0	Moderate
Renaissance Arts Academy	64.2	65.2	None
Sotomayor Learning Academies	62.1	66.2	Moderate

Source: California High Speed Rail Authority, 2019
dBA = A-weighted decibel(s)
L_{eq} = equivalent sound level
FRA = Federal Railroad Administration

In addition to the impacts associated with the construction and operation of the HSR Build Alternative, there would be a benefit associated with the five new grade separations at Sonora Avenue, Grandview Avenue, Flower Street, Goodwin Avenue/Chevy Chase Avenue, and Main Street. Currently, the rail corridor within the RSA is at-grade with existing roadways, which requires horns to be sounded when passenger and freight trains approach the crossings. Because the HSR Build Alternative would grade-separate the rail corridor from these roadways, horn sounding would no longer be necessary. This would lower noise levels experienced by those receptors near these current at-grade crossings, providing a more desirable noise environment.

Annoyance and Startle Effects from Rapid Onset of High-Speed Rail Pass-bys

As discussed in the *Burbank to Los Angeles Project Section Noise and Vibration Technical Report* (Authority 2019b), an onset rate of 15 dB per second at a distance of 90 feet would result in annoyance, and an onset rate of 30 dB per second at a distance of 45 feet would result in startle effects. The term startle effect has been previously defined as "*a transient disruption of interruption of human task, performance, or activity in man or animals cause by any abrupt or unexpected physical stimulus or event"* (Applied System Technologies, Inc. 1994). Noise-sensitive receivers within 90 feet of the HSR alignment would experience annoyance from onset rates caused by the HSR Build Alternative. In addition, noise-sensitive receivers within 45 feet of the proposed alignment would experience a startle effect from onset rates caused by the HSR Build Alternative. Because there are a number of unresolved issues regarding the application of the U.S. Air Force research (Stusnick and Bradley 1992) to determine the startle effects of the

HSR Build Alternative, the annoyance and startle effects should only be considered as additional information for this assessment rather than a specific assessment of of noise exposure.

Tunnel Portal Noise

Based on the current tunnel design described in Chapter 2, it is anticipated that roughly half of the sound generated in the tunnel would pass out through the exit portal, and the other half would propagate into the interior. The effect would be a rapid rise in sound level as the train leaves the tunnel and portal, forewarned by a propagating wave ahead of the train. Depending on the shape of the portal, shape of the train nose, and blockage ratio, the rate of pressure rise may be substantial. The pressure wave front rate of rise is reduced by friction between the moving air column and tunnel wall, so that the pressure wave does not easily develop into a shock wave. This portal noise effect has been studied theoretically and experimentally and is well understood. Attenuation of the portal noise for this project section, where necessary, would be achieved with the incorporation of noise mitigation hoods which may be up to 150 feet long and will be inclined at least 45 degrees from the vertical. Typically, these features are only necessary when train speeds are 150 mph or more, whereas the peak speed in the Burbank to Los Angeles Project Section is no more than 140 mph. Additionally, in-tunnel cross-passages and vents can reduce pressure magnitudes and rates of rise, though passage of these vents may generate additional propagating and steepening wave fronts. These tunnel portal design features will be used to attenuate any additional noise associated with the train entering or exiting a tunnel.

CEQA Conclusion

Noise impacts from operation of the HSR Build Alternative to sensitive receivers under CEQA would be significant due to the exceedance of FRA standards established on Figure 3.4-2. Therefore, CEQA requires mitigation. Mitigation measures N&V-MM#3 through N&V-MM#5 would be needed and are described in more detail in Section 3.4.7. These measures include the construction of sound barriers, noise insulation considerations, ~~design~~, and vehicle specifications and special trackwork that reduce noise impacts. Although the implementation of mitigation measures N&V-MM#3 through N&V-MM#5 would reduce the HSR Build Alternative operational noise impacts, noise impacts as a result of the HSR Build Alternative would still remain significant under CEQA at some locations. The sound barrier analysis in Table 3.4-21 (provided later in this section) shows that even with the implementation of mitigation measures N&V-MM-#3 through N&V-MM-#5, severe residual impacts would remain at some locations, and these impacts would be considered significant and unavoidable.

Impact N&V #5: Permanent Exposure of Sensitive Receivers and Buildings to Vibrations from Project Operation

The assessment of ground-borne vibration and noise impacts from the HSR Build Alternative's operation are summarized in Table 3.4-20, based on the criteria presented in Section 3.4.4.3. These results indicate that ground-borne vibration levels would exceed the FRA impact criteria at vibration-sensitive residences nearest to the track.

Table 3.4-20 Vibration and Ground-Borne Noise Impacts

	Residential	Hotel/Motel	Hospital	Shelter	Schools	Churches	Parks	Studios	Theaters
HSR Build Alternative Vibration Impacts	1	0	0	0	0	0	0	2	2
HSR Build Alternative Ground-Borne Noise Impacts	4	0	0	0	0	0	0	2	3

HSR = high-speed rail

Based on the vibration assessment conducted, the HSR Build Alternative would result in a ground-borne vibration impact at one residence and ground-borne noise impacts at four residences in proximity to the trench alignment between the Burbank Airport Station and Burbank Boulevard. In addition, both ground-borne vibration and ground-borne noise impacts are projected at the Six01 Studio on the southbound side of the alignment between W Olive Avenue and Alameda Avenue, the DisneyToon Studios on the southbound side of the proposed alignment between Western Avenue and Grandview Avenue, and at the Independent Shakespeare Company and Swing House on the southbound side of the proposed alignment between Tyburn Street and SR 2. Ground-borne noise impact is also projected at The Echo Theater Company on the southbound side of the proposed alignment between Tyburn Street and SR 2.

The locations of noise and vibration impacts caused by operation of the HSR Build Alternative are shown on Figure 3.4-9 (Sheets 1 and 2). These impacts would be permanent. To reduce impacts on sensitive receivers from operational vibration, the Authority would implement mitigation measures N&V-MM#4, N&V-MM#5, and N&V-MM#6, which would require measures such as vehicle suspension enhancements, special track support systems, and building modifications. It is expected that the impacts would result in a permanent effect.

CEQA Conclusion

Operation vibration would exceed the impact criteria established in Section 3.4.4.3. The locations of ground-borne noise and vibration impacts caused by operation of the HSR Build Alternative are shown on Figure 3.4-9. These impacts would be permanent. The impact would therefore be significant and CEQA requires mitigation. To reduce impacts on sensitive receivers from operational vibration and ground-borne noise, the Authority would implement mitigation measures N&V-MM#4 and N&V-MM#5 based on information taken from Section 9.4 of the FTA's *Transit Noise and Vibration Impact Assessment Manual, FTA Report No. 0123* (FTA 2018), which include vehicle suspension enhancements, special track support systems, building modifications, etc. In particular, special track support systems such as resiliently supported ties, ballast mats, high-resilience fasteners, and floating track slabs are standard techniques used in the railroad industry to reduce vibration effects and have been used successfully in many railroad and transit system projects worldwide. These measures provide vibration reduction that would be applied as needed to reduce the vibration impacts to the FRA threshold criteria. Therefore, with implementation of mitigation measures N&V-MM#4 and N&V-MM#5, impacts on sensitive receivers from operational vibration would be less than significant after mitigation.

Figure 3.4-9 Locations of Ground-Borne Noise and Vibration Impacts Resulting from Operation, Burbank to Los Angeles Project Section

(Sheet 1 of 2)

Figure 3.4-9 Locations of Ground-Borne Noise and Vibration Impacts Resulting from Operation, Burbank to Los Angeles Project Section

(Sheet 2 of 2)

Impact N&V #6: Noise Effects on Wildlife and Domestic Animals

As discussed in the *Burbank to Los Angeles Project Section Noise and Vibration Technical Report* (Authority 2019b), all domestic and wild birds and mammals near the RSA may be affected by train pass-bys if they are subjected to sound exposure level values of 100 dBA or higher. Assuming a maximum speed of 125 mph, when these species are within 30 feet of the HSR Build Alternative centerline, they may be affected. However, the HSR Build Alternative would be fenced, and these animal species would be more than 30 feet from the HSR track. Furthermore, due to the intermittent nature of the train operations, it is expected that the noise environment would only be affected for short periods of time and would not affect animal species communications.

CEQA Conclusion
The impact under CEQA would be less than significant due to the distance of potential animals from the HSR track. Therefore, CEQA does not require any mitigation.

Impact N&V #7: Traffic Noise

The HSR Build Alternative would increase traffic noise in the RSA as well as in areas surrounding each station. Traffic noise in the cities of Burbank, Glendale, and Los Angeles was evaluated using the existing and future volumes obtained from the *Burbank to Los Angeles Project Section Transportation Technical Report* (Authority 2019b), based on a high ridership forecast scenario. Traffic noise in the cities within the RSA is characterized by vehicular traffic in the surrounding area. Tables 6-4 and 6-5 in the *Burbank to Los Angeles Project Section Noise and Vibration Technical Report* (Authority 2019b) show the HSR Build Alternative-related change in traffic noise levels in each of the cities under the existing and future with and without HSR Build Alternative scenarios. The change in traffic noise levels is described in both CNEL (when average daily traffic volumes were used to determine the change in daily noise levels) and peak-hour L_{eq} (when a comparison of the peak-hour traffic volumes was performed).

Traffic in the City of Burbank
In the city of Burbank, the HSR Build Alternative has the potential to increase traffic noise within the RSA. These traffic noise level increases would be less than 3 dBA (a noise level increase slightly perceptible to the human ear in an outdoor environment) for both daily and peak-hour conditions.

Traffic in the City of Glendale
In the city of Glendale, HSR Build Alternative-related traffic noise increases would be less than 3 dBA (a noise level increase slightly perceptible to the human ear in an outdoor environment) for both daily and peak-hour conditions.

Traffic in the City of Los Angeles
In the city of Los Angeles, the HSR Build Alternative has the potential to increase traffic noise within the RSA. These traffic noise level increases would be less than 3 dBA (a noise level increase slightly perceptible to the human ear in an outdoor environment) for both daily and peak-hour conditions, except for San Fernando Road Minor between Vineland Avenue and Sunland Boulevard, and San Fernando Road Minor between Sunland Boulevard and Clyburn Avenue. No sensitive receptors are immediately adjacent to these segments. Increases in traffic noise levels would be minimal along these segments and the 65 dBA CNEL impact zone would remain within the roadway right-of-way.

Traffic Noise from Roadway Improvements
As presented above in Section 3.4.4.1, FHWA and Caltrans noise regulations only apply at locations with a significant change in the horizontal or vertical alignment or location of an existing highway or roadway, or where traffic volumes are anticipated to increase by a substantial amount (a doubling of volume) under the HSR Build Alternative. There were no locations in the project corridor near noise-sensitive locations where either of these conditions were met; therefore, no detailed analyses associated with roadway improvements are necessary.

CEQA Conclusion
Noise impacts related to traffic noise would be less than significant under CEQA due to an increase of less than 12 dBA L_{eq} during the peak noise hour conditions. An increase in 12 dBA is considered the threshold at which a significant noise impact would occur; therefore, CEQA does not require any mitigation.

Impact N&V #8: Noise from High-Speed Rail Stationary Facilities

Noise generated by stationary facilities related to operation of the HSR Build Alternative includes public address systems, signal horns, power tools, human activity, and vehicle activity. No stationary sources are proposed outside of the stationary facilities.

No sensitive receivers are within the FRA- and FTA-established screening distance of 250 feet from the proposed Burbank Airport Station or Los Angeles Union Station; therefore, no operational noise impacts related to the stations are anticipated.

Long-term operational noise effects from the proposed electric power utility improvements have the potential to generate corona noise. However, since all power lines would be rated at 230 kilovolts or less, noise impacts would not be audible at low voltages. Therefore, no noise effects would occur from the operation of the proposed electric power utility improvements, and no mitigation measures are required.

CEQA Conclusion
Noise impacts associated with station operations would be less than significant because no sensitive receivers are within the FRA and FTA-established screening distance of 250 feet from the proposed Burbank Airport Station or Los Angeles Union Station. Therefore, CEQA does not require any mitigation.

3.4.7 Mitigation Measures

The Authority has identified the following mitigation measures for impacts under NEPA and significant impacts under CEQA that cannot be avoided or minimized adequately by IAMFs.

N&V-MM#1: Construction Noise Mitigation Measures

Prior to construction (any ground disturbing activities), the contractor shall prepare a noise-monitoring program for Authority approval. The noise-monitoring program shall describe how during construction the contractor will monitor construction noise to verify compliance with the noise limits (An 8-hour L_{eq}, dBA of 80 during the day and 70 at night for residential land use, 85 for both day and night for commercial land use, and 90 for both day and night for industrial land use). The contractor would be given the flexibility to meet the FRA construction noise limits in the most efficient and cost-effective manner. This can be done by either prohibiting certain noise-generating activities during nighttime hours or providing additional noise control measures to meet the noise limits. In addition, the noise-monitoring program will describe the actions required of the contractor to meet required noise limits. These actions will include the following nighttime and daytime noise control mitigation measures, as necessary:

- Install a temporary construction site sound barrier near a noise source.
- Avoid nighttime construction in residential neighborhoods.
- Locate stationary construction equipment as far as possible from noise-sensitive sites.
- Re-route construction truck traffic along roadways that will cause the least disturbance to residents.
- During nighttime work, use smart back-up alarms, which automatically adjust the alarm level based on the background noise level, or switch off back-up alarms and replace with spotters.
- Use low-noise-emission equipment.
- Implement noise-deadening measures for truck loading and operations.
- Monitor and maintain equipment to meet noise limits.

- Line or cover storage bins, conveyors, and chutes with sound-deadening material.
- Use acoustic enclosures, shields, or shrouds for equipment and facilities.
- Use high-grade engine exhaust silencers and engine-casing sound insulation.
- Prohibit aboveground jackhammering and impact pile driving during nighttime hours.
- Minimize the use of generators to power equipment.
- Limit use of public address systems.
- Grade surface irregularities on construction sites.
- Use moveable sound barriers at the source of the construction activity.
- Limit or avoid certain noisy activities during nighttime hours.
- To mitigate noise related to pile driving, the use of an auger to install the piles instead of a pile driver would reduce noise levels substantially. If pile driving is necessary, limit the time of day that the activity can occur.
- The Authority will establish and maintain in operation until completion of construction a toll-free “hotline” regarding the HSR Build Alternative construction activities. The Authority shall arrange for all incoming messages to be logged (with summaries of the contents of each message) and for a designated Authority representative to respond to hotline messages within 24 hours (excluding weekends and holidays). The Authority shall make a reasonable good-faith effort to address all concerns and answer all questions, and shall include on the log its responses to all callers. The Authority shall make the log of the incoming messages and the Authority’s responsive actions publicly available on its website.

The contractor shall provide the Authority with an annual report by January 31 of the following year documenting how it implemented the noise-monitoring program.

Impacts from Implementing Mitigation Measure N&V-MM#1

Implementation of the recommendations above would reduce construction-related noise levels from the construction of the HSR Build Alternative. Measures to reduce construction-related noise levels would not expand the construction area, and the increase in noise would be minimal in comparison to the scope of the project. Therefore, the impacts of mitigation would be less than significant under CEQA.

N&V-MM#2: Construction Vibration Mitigation Measures

Prior to construction involving impact pile driving within 80 feet of any building, the contractor shall provide the Authority with a vibration technical memorandum documenting how project pile driving criteria will be met. Upon approval of the technical memorandum by the Authority, and where a noise-sensitive receiver is present, the contractor shall comply with the vibration reduction methods described in that memorandum. Potential construction vibration building damage is only anticipated from impact pile driving at very close distances from buildings. If pile driving occurs more than 25 to 50 feet from buildings, or if alternative methods such as push piling or auger piling are used, damage from construction vibration is not expected to occur. When a construction scenario has been established, pre-construction surveys will be conducted by the contractor at locations within 50 feet of pile driving to document the existing condition of buildings in case damage is reported during or after construction. The contractor will arrange for the repair of damaged buildings or will pay compensation to the property owner.

Impacts from Implementing Mitigation Measure N&V-MM#2

Implementation of the recommendations above would reduce construction-related vibration levels or construction-related vibration impacts. Although pre-construction surveys and repair of damaged buildings would likely be conducted outside of the construction boundary, increases in vibration levels would be minimal to negligible in comparison to the scope of the project. Therefore, the impacts of mitigation would be less than significant under CEQA.

N&V-MM#3: Implement Proposed California High-Speed Rail Project Noise Mitigation Guidelines

The Authority has developed Noise Mitigation Guidelines for the statewide HSR system that sets forth three categories of mitigation measures to reduce or offset severe noise impacts from HSR operations: sound barriers, sound insulation, and noise easements. The Guidelines also set forth an implementation approach that considers multiple factors for determining the reasonableness of sound barriers as mitigation for severe noise impacts, including structural and seismic safety, cost, number of affected receptors, and effectiveness. Sound barrier mitigation would be designed to reduce the noise level from HSR operations from severe to moderate according to the provisions of the FRA (FRA 2012).

Sound Barriers

Prior to operation of the HSR Project, the Authority will install sound barriers where they can achieve between 5 and 15 decibels (dB) of noise reduction, depending on their height and location relative to the tracks. The primary requirements for an effective sound barrier are that the barrier must: (1) be high enough and long enough to break the line of sight between the sound source and the receiver; (2) be of an impervious material with a minimum surface density of 4 pounds per square foot; and (3) not have any gaps or holes between the panels or at the bottom. Because many materials meet these requirements, aesthetics, durability, cost, and maintenance considerations usually determine the selection of materials for sound barriers. Depending on the situation, sound barriers can become visually intrusive. Typically, the sound barrier's style is selected with input from the local jurisdiction to reduce the visual effect of barriers on adjacent lands uses (refer to Aesthetic Options for Non-Station Structures [Authority 2017b]). For example, sound barriers could be solid or transparent, and made of various colors, materials, and surface treatments.

Recommended sound barriers must meet the following criteria:

- Achieve a minimum of 5 decibels (dB) of noise reduction.
- The minimum number of affected sites should be at least 10.
- The length should be at least 800 feet.
- Must be cost-effective, defined as mitigation not exceeding $95,000 per benefited receptor.

The maximum sound barrier height would be 14 feet for at-grade sections; however, all sound barriers would be designed to be as low as possible to achieve a substantial noise reduction. Berm and berm/wall combinations are the preferred types of sound barriers where space and other environmental constraints permit. On aerial structures, the maximum sound barrier height would also be 14 feet, but barrier material would be limited by engineering weight restrictions for barriers on the structure. Sound barriers on the aerial structure will still be designed to be as low as possible to achieve a substantial noise reduction. Sound barriers on both aerial structures and at-grade structures could consist of solid, semitransparent, or transparent materials as defined in the Aesthetic Options for Non-Station Structures (Authority 2017b).

Table 3.4-21 shows the reasonableness of each feasible sound barrier along with its height, approximate length, number of benefited receivers, total construction cost, number of unmitigated severe impacts, and number of residual impacts (with mitigation). Consistent with Caltrans guidelines, sound barriers were determined to be feasible because the barrier is capable of providing a noise level reduction of 5 dBA or more, and sound barriers were determined to be reasonable because the cost to construct the barrier would not exceed the cost allowance per benefited receiver approved by the Authority. Figure 3.4-10 shows the sound barrier locations. Table 3.4-22 shows the residual severe impacts based on each land use in each category that were not evaluated with a sound barrier because they are in areas that do not meet the minimum number of 10 severely impacted receivers and the minimum barrier length of 800 feet.

Table 3.4-21 Noise Barrier Analysis—High-Speed Rail Build Alternative

Barrier	Track	Location	Track Type	Total Length (feet)	Height (feet)	Area (square feet)	Total Cost	Benefited Receivers	Cost per Benefited Receiver	Cost Exceeds $95,000?	Is Barrier Reasonable?	5 dBA Reduction?	Unmitigated Severe Impacts	Severe Residual Impacts (with Mitigation)
1	Southbound Track	Fernando Ct to south of Glendale Blvd	At-Grade	3,200	10	32,000	$2,240,000	48	$46,667	No	Yes	Yes	52	25
					12	38,400	$2,688,000	273	$9,846	No	Yes	Yes		0
					14	44,800	$3,136,000	273	$11,487	No	Yes	Yes		0
2	Northbound Track	Glendale Blvd to Tyburn Ave	At-Grade	2,000	10	20,000	$1,400,000	0	--	--	No	No	19	19
					12	24,000	$1,680,000	208	$8,077	No	Yes	Yes		0
					14	28,000	$1,960,000	208	$9,423	No	Yes	Yes		0
3	Southbound Track	Arvia Ct to I-5 Overpass	At-Grade	4,900	10	49,000	$3,430,000	0	--	--	No	No	11	4
					12	58,800	$4,116,000	211	$19,507	No	Yes	Yes		0
					14	68,600	$4,802,000	211	$22,758	No	Yes	Yes		0

[1] Height above the top of the rail.
dBA = A-weighted decibel(s)
I = Interstate

Table 3.4-22 High-Speed Rail Build Alternative—Severe Residual Impacts: Mitigation Not Considered

Category 1			Category 2		Category 3			
Recording Studio	Concert Hall	Theater	Residential	Nursing Home	School	Church	Park	Court
0	0	2	68	0	0	0	0	0

Source: California High Speed Rail Authority, 2017
[1] The receivers that do not meet the eligibility requirements for a sound barrier specified in mitigation measure N&V-MM #3.

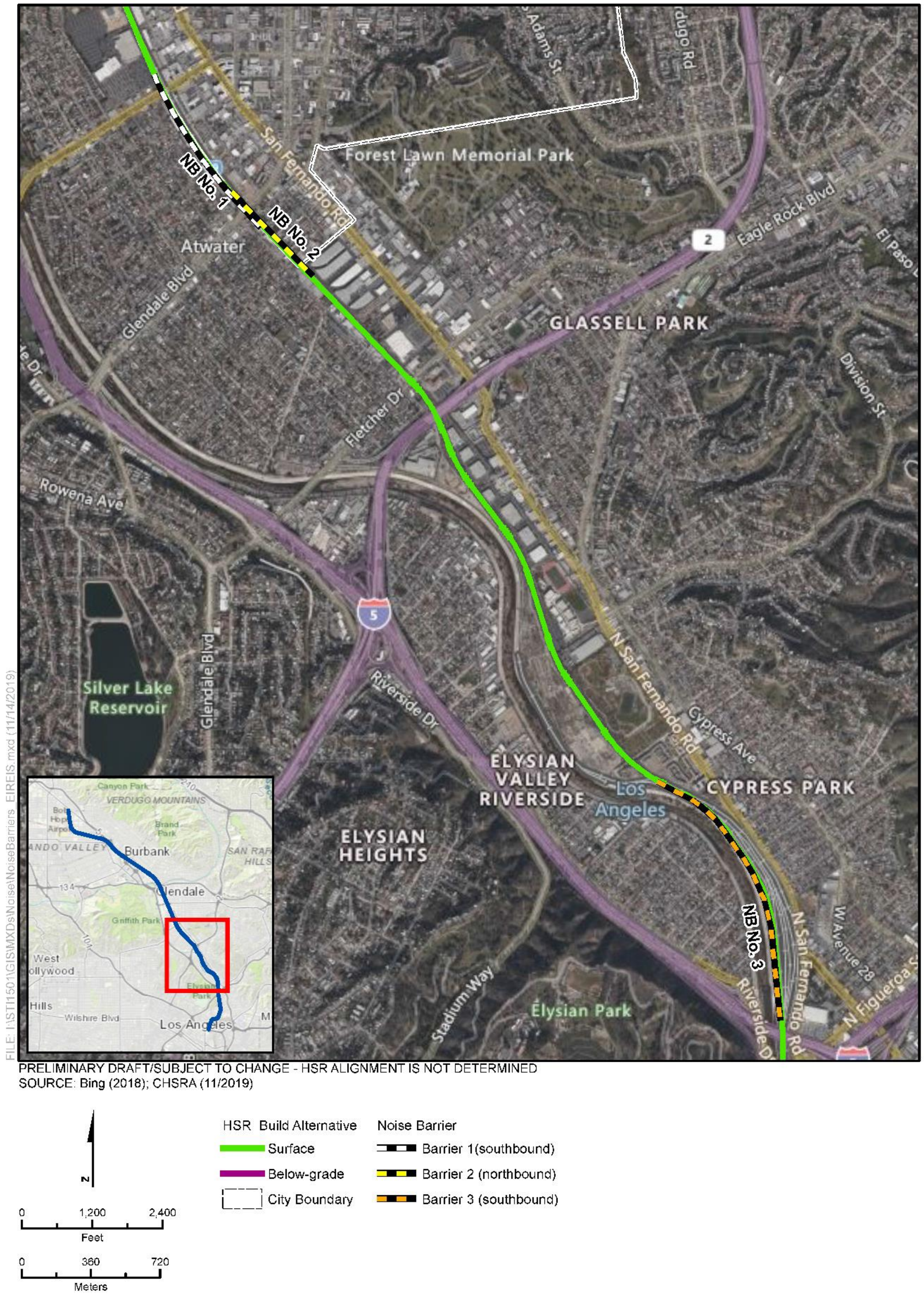


Figure 3.4-10 Sound Barrier Locations

Building Sound Insulation

If sound barriers are not proposed for receptors with severe impacts, or if proposed sound barriers do not reduce sound levels to below a severe impact level, the Authority will consider building sound insulation as a potential additional mitigation measure on a case-by-case basis. Sound insulation of residences and institutional buildings to improve the outdoor-to-indoor noise reduction is a mitigation measure that can be provided when the use of sound barriers is not feasible in providing a reasonable level (5 to 7 dB) of noise reduction. Although this approach has no effect on noise in exterior areas, it may be the best choice for sites where sound barriers are not feasible or desirable and for buildings where indoor sensitivity is of most concern. Substantial improvements in building sound insulation (on the order of 5 to 10 dB) can often be achieved by adding an extra layer of glazing to windows, by sealing holes in exterior surfaces that act as sound leaks, and by providing forced ventilation and air conditioning so that windows do not need to be opened. The considered sound insulation would also be required to provide a reduction of at least 5 dBA.

Noise Easements

If a substantial noise reduction cannot be achieved through installation of sound barriers or building sound insulation, the Authority will consider acquiring a noise easement on properties with a severe impact on a case-by-case basis. This approach is usually taken only in isolated cases where other mitigation options are infeasible, impractical, or too costly. If all mitigation efforts are found to be not effective or reasonable and feasible, property acquisitions may occur.

Impacts from Implementing Mitigation Measure N&V-MM#3

Implementation of the recommendations above would reduce operation-related noise from the HSR Build Alternative. The installation of sound barriers along the HSR alignment would remain within the construction boundary and would not be additional obstacles to wildlife movement because they would be installed within the HSR right-of-way. Section 3.7, Biological and Aquatic Resources and Wetlands, addresses impacts specific to wildlife. However, the installation of sound barriers has the potential to affect visual and aesthetic qualities. Section 3.16, Aesthetics and Visual Resources, addresses potential impacts to visual and aesthetic resources in the visual RSA. Although providing property insulation would occur beyond the construction boundary, increases in noise would be minimal to negligible in comparison to the scope of the project. Therefore, the impacts of mitigation would be less than significant under CEQA.

N&V-MM#4: Vehicle Noise Specification

In the procurement of an HST vehicle technology, the Authority will request bidders to provide information regarding technology development, if any, that might allow trainsets to be procured that would be more quiet than the European Technical Specification for Interoperability Standard.

The analysis in this EIR/EIS does not assume for its quantitative calculations of post-mitigation impacts that trainsets will be able to comply with the US EPA standard (40 CFR Part 201.12/13), if applicable, cited earlier in this chapter, due to lack of currently-available compliant technology.

Impacts from Implementing Mitigation Measure N&V-MM#4

Implementation of the recommendations above would require the construction of HSR locomotives to meet federal regulations (40 C.F.R. Part 201.12/13). This measure would not increase noise and vibration levels within the RSA. Therefore, the impacts of mitigation would be less than significant under CEQA.

N&V-MM#5: Special Trackwork

Prior to construction, the contractor shall provide the Authority with an HSR operation noise technical report for review and approval. The report shall address the minimization/elimination of rail gaps at turnouts. Because the impacts of HSR wheels over rail gaps at turnouts increases HSR noise by approximately 6 dB over typical operations, turnouts can be a major source of noise impact. If the turnouts cannot be moved from sensitive areas, the noise technical report will recommend the use special types of track work that eliminate the gap. The Authority will require the project design to follow the recommendations in the approved noise impact report.

Impacts from Implementing Mitigation Measure N&V-MM#5

Implementation of the recommendations above would require special types of trackwork to eliminate gaps, which create noise impacts, to reduce noise levels generated from rail turnouts. This measure would be conducted within the HSR rail right-of-way and staging areas. The increase in noise and vibration would be minimal to negligible in comparison to the scope of the project. Therefore, the impacts of mitigation would be less than significant under CEQA.

N&V-MM#6: Additional Noise and Vibration Analysis Following Final Design

Prior to construction, the contactor shall provide the Authority with an HSR operation noise technical report for review and approval. If final design or final vehicle specifications result in changes to the assumptions underlying the noise technical report, the Authority shall prepare necessary environmental documentation, as required by the California Environmental Quality Act and National Environmental Policy Act, to reassess noise impacts and mitigation.

Table 3.4-23 shows potential vibration mitigation procedures.

Table 3.4-23 Potential Vibration Mitigation Procedures and Descriptions

Mitigation Procedure	Location of Mitigation	Description
Maintenance	Source	Rail condition monitoring systems with rail grinding on a regular basis. Wheel truing to re-contour the wheel, provide a smooth running surface, and remove wheel flats. Reconditioning vehicles. Installing wheel condition monitoring systems.
Location and Design of Special Trackwork	Source	Careful review of crossover and turnout locations during the preliminary engineering stage. When feasible, relocate special trackwork to a less vibration-sensitive area. Installation of spring frogs eliminates gaps at crossovers and helps reduce vibration levels. Additionally, the use of insulated joints can provide the same benefit for noise and vibration.
Vehicle Suspension	Source	Rail vehicles should have a low unsprung weight, soft primary suspension, minimum metal-on-metal contact between the moving parts of the truck, and smooth wheels that are perfectly round.
Special Track Support Systems	Source	Floating slabs, resiliently supported ties, high-resilience fasteners, resilient subroadbed materials, and ballast mats all help reduce vibration levels from the track support system.
Building Modifications	Receiver	For existing buildings, if vibration-sensitive equipment is affected by train vibration, the floor upon which the vibration-sensitive equipment is located might be stiffened and isolated from the remainder of the building. For new buildings, the building foundation should be supported by elastomer pads that are similar to bridge bearing pads.
Operational Changes	Source	Reduce vehicle speed. Adjust nighttime schedules to minimize train movements during sensitive hours. Operating restrictions require continuous monitoring and may not be practical or achieve the purpose and need for the project.
Buffer Zones	Receiver	Negotiate a vibration easement from the affected property owners or expand the rail right-of-way.

Impacts from Implementing Mitigation Measure N&V-MM#6

Implementation of the recommendations above would require a reassessment of noise and vibration impacts and recommendations for mitigation if there are changes in assumptions during final design of the locomotive. Additional mitigation measures that may result from changes to the assumptions for the HSR Build Alternative would be minimal in comparison to the scope of the project. Therefore, the impacts of mitigation would be less than significant under CEQA.

3.4.7.1 Early Action Projects

As described in Chapter 2 section 2.5.2.9, early action projects would be completed in collaboration with local and regional agencies, and they include grade separations and improvements at regional passenger rail stations. These early action projects are analyzed in further detail to allow the agencies to adopt the findings and mitigation measures as needed to construct the projects. The following noise and vibration mitigation measures, listed in Table 3.4-24, would be required for the early action projects.

Table 3.4-24 Mitigation Measures Required for Early Action Projects

Early Action Project	Impacts	Mitigation Measure
Downtown Burbank Metrolink Station	Impact N&V #1 ▪ Significant impact of noise contributions in exceedance of noise standards or ambient noise levels	N&V-MM#1
	Impact N&V #2 ▪ Significant impact of vibration contributions in exceedance of ground-borne vibration standards during construction	N&V-MM#2
Sonora Avenue Grade Separation	Impact N&V #1 ▪ Significant impact of noise contributions in exceedance of noise standards or ambient noise levels	N&V-MM#1
	Impact N&V #2 ▪ Significant impact of vibration contributions in exceedance of ground-borne vibration standards during construction	N&V-MM#2
Grandview Avenue Grade Separation	Impact N&V #1 ▪ Significant impact of noise contributions in exceedance of noise standards or ambient noise levels	N&V-MM#1
	Impact N&V #2 ▪ Significant impact of vibration contributions in exceedance of ground-borne vibration standards during construction	N&V-MM#2
Flower Street Grade Separation	Impact N&V #1 ▪ Significant impact of noise contributions in exceedance of noise standards or ambient noise levels	N&V-MM#1
	Impact N&V #2 ▪ Significant impact of vibration contributions in exceedance of ground-borne vibration standards during construction	N&V-MM#2
Goodwin Avenue/ Chevy Chase Drive Grade Separation	Impact N&V #1 ▪ Significant impact of noise contributions in exceedance of noise standards or ambient noise levels	N&V-MM#1
	Impact N&V #2 ▪ Significant impact of vibration contributions in exceedance of ground-borne vibration standards during construction	N&V-MM#2

Early Action Project	Impacts	Mitigation Measure
Main Street Grade Separation	Impact N&V #1 ▪ Significant impact of noise contributions in exceedance of noise standards or ambient noise levels	N&V-MM#1
	Impact N&V #2 ▪ Significant impact of vibration contributions in exceedance of ground-borne vibration standards during construction	N&V-MM#2

3.4.8 NEPA Impacts Summary

This section summarizes the impacts of the HSR Build Alternative and compares them to the anticipated impacts of the No Project Alternative.

The No Project Alternative would include future development, including both suburban expansion and development in existing urban areas. This future development would include additional rail traffic from other planned projects within the existing rail alignment that may result in a perceptible increase in noise levels at adjacent receivers. Planned projects in the area would potentially increase noise from traffic sources; however, increases in noise from traffic sources are expected to not be perceptible relative to existing conditions. Vibration is generally a localized effect and would not be perceptible at sensitive uses except those directly adjacent to the construction activity; however, vibration from other planned projects may intermittently result in perceptible vibration at sensitive receiver locations.

Construction of the HSR Build Alternative would result in temporary increases in noise and vibration levels at sensitive receivers in the vicinity of construction areas. Noise-sensitive receivers within 311 feet of a construction zone may be exposed to noise levels exceeding the FRA criteria for daytime hours (between 7:00 a.m. to 10:00 p.m.) for one or more phases of construction. Noise-sensitive receivers within 973 feet of a construction zone may be exposed to noise levels exceeding the FRA criteria for nighttime hours (10:00 p.m. to 7:00 a.m.) for one or more phases of construction. This increase in noise levels is considered to result in a temporary impact.

One construction activity with substantial potential for damaging effects would be pile driving, which could affect structures at distances of up to 30 feet for the least sensitive buildings, and at distances of up to 75 feet for the most sensitive buildings. Human annoyance or interference from construction vibration would be expected within a distance of up to 500 feet, depending on the type of land use and type of equipment used. This increase in vibration levels is considered to result in a temporary impact. With implementation of mitigation measures N&V-MM#1 and N&V-MM#2, the impact from increased noise and vibration levels would be reduced, resulting in no effect after mitigation.

The HSR Build Alternative would have no operational effects related to noise effects associated with stationary facilities and traffic noise or on wildlife and domestic animal noise.

Under NEPA, operation of the HSR Build Alternative would result in noise impacts to sensitive receivers. Although the implementation of mitigation measures N&V-MM#3 through N&V-MM#5 would reduce HSR Build Alternative noise impacts, severe residual noise impacts would still remain at 48 locations. Ground-borne vibration and ground-borne noise impacts would occur at 12 locations.

In addition to the impacts associated with construction and operation of the HSR Build Alternative, there would be a benefit associated with the five new grade separations at Sonora Avenue, Grandview Avenue, Flower Street, Goodwin Avenue/Chevy Chase Avenue, and Main Street. Currently, the rail corridor within the RSA is at-grade with existing roadways, which requires horns to be sounded when passenger and freight trains approach the crossings. Because the HSR Build Alternative would grade-separate the rail corridor from the roadways, horn sounding would no longer be necessary. This would lower noise levels experienced by those receptors near current at-grade crossings, providing a more desirable noise environment.

3.4.9 CEQA Significance Conclusions

Table 3.4-25 provides a summary of the CEQA determination of significance for all construction and operations impacts discussed in Section 3.4.6.3.

Table 3.4-25 Summary of CEQA Significance Conclusions and Mitigation Measures for Noise and Vibration

Impact	Level of Significance before Mitigation	Mitigation Measure	Level of Significance after Mitigation
N&V #1: Temporary Exposure of Sensitive Receivers to Construction Noise	Significant	N&V-MM #1	Less than Significant
N&V #2: Temporary Exposure of Sensitive Receivers to Construction Vibration	Significant	N&V-MM #2	Less than Significant
N&V #3: Temporary Traffic-Generated Nosie From Re-routing Traffic During Construction	Less than Significant	No mitigation measures are required	Not Applicable
N&V #4: Project Noise Impacts ▪ 212 Severe Impacts ▪ 718 Moderate Impacts	Significant	N&V-MM #3 N&V-MM #4 N&V-MM #5 N&V-MM #6	Significant and Unavoidable in Some Locations Residual Severe Impacts: ▪ 68 Residences ▪ 2 Theaters
N&V #5: Vibration Impacts from Project Operation	Significant	N&V-MM #4 N&V-MM #5 N&V-MM #6	Less than Significant
N&V #6: Noise Effects on Wildlife & Domestic Animals	Less than Significant	No mitigation measures are required	Not Applicable
N&V #7: Project-Related Traffic Noise Impacts	Less than Significant	No mitigation measures are required	Not Applicable
Impact N&V #8: Noise from High-Speed Rail Stationary Facilities	Less than Significant	No mitigation measures are required	Not Applicable