3.4 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. This section summarizes detailed information contained in the technical report prepared for the HSR project per California High-Speed Rail Authority (Authority) and Federal Railroad Administration (FRA) guidance. For information on how to access and review technical reports, please refer to the Authority's website at www.hsr.ca.gov.

Summary of Impacts

Construction Impacts

Noise and vibration impacts from the construction of the California High-Speed Rail (HSR) Project rail corridor have the potential to be significant under the California Environmental Quality Act (CEQA) and an impact would occur under the National Environmental Policy Act (NEPA). However, the implementation of mitigation measures would reduce the various noise and vibration impacts to a less than significant impact under CEQA.

Noise impacts from construction of the HSR stationary facilities would be significant under CEQA and an impact under NEPA, while vibration impacts from the construction of the HSR stationary facilities and electric power utility improvements would be less than significant under CEQA. Implementation of mitigation measures would reduce noise impacts to less than significant under CEQA.

Operations Impacts

The operation of the Bakersfield to Palmdale Project Section (B-P) of the HSR project would result in both moderate and severe noise impacts on sensitive uses, as well as noise impacts classified as "no impact." The analysis is presented in two sub-sections, from the F Street Bakersfield Station to Oswell Street followed by Oswell Street to the Palmdale Station. In addition to the four B-P Build Alternatives in the Oswell Street to Palmdale Station subsection, the César E. Chávez National Monument Design Option (CCNM Design Option) and the Refined CCNM Design Option are also analyzed. The impacts associated with the CCNM Design Option and the Refined CCNM Design Option would only affect the Nuestra Señora Reina de La Paz/César E. Chávez National Monument CCNM (La Paz) and are otherwise the same as the impacts associated with Alternatives 1, 2, 3, and 5. Therefore, additional tables and columns for the CCNM Design Option and the Refined CCNM Design Option are not necessary throughout the section. Where appropriate, specific discussion of impacts on La Paz and the effects of the noise barrier, which is a part of the project design, are included. Table 3.4-1 summarizes the results of the severe impacts.

Table 3.4-1 Summary of Severe Noise Operations Impacts

Section/Alternative		Category 1[1]	Category 2[1]	Category 3[1]
Bakersfield Station—F Street (Locally Generated Alternative) Alignment from the intersection of 34th Street and L Street to Oswell Street		2-Recording Studios	1,582-Residential 1-Hospital 8-Other[2]	3-Schools 7-Churches 4-Parks 7-Other[2]
Bakersfield to Palmdale Station—Oswell Street to Palmdale Station	Alternative 1	1-La Paz	1,967-Residential 7-Other[2]	1-Schools 2-Churches 2-Other[2]
	Alternative 2	1-La Paz	1,922-Residential 7-Other[2]	1-Schools 2-Churches 2-Other[2]

Section/Alternative		Category 1[1]	Category 2[1]	Category 3[1]
	Alternative 3	1-La Paz	1,965-Residential 7-Other[2]	1-Schools 2-Churches 2-Other[2]
	Alternative 5	1-La Paz	2,065-Residential 4-Other[2]	1-Schools 3-Churches 2-Other[2]
	CCNM Design Option	None[3]	None	None
	Refined CCNM Design Option	None	None	None

Source: California High-Speed Rail Authority, 2017

[1] The Federal Transit Administration has identified specific land uses by category. For a complete description of the uses under each category, see Table 3-2 of the *Bakersfield to Palmdale Project Section Noise and Vibration Technical Report* (Authority 2018).

[2] Other Category 3 land uses include one cemetery, one club, one development service, one disability service, three driving schools, one library, six meeting halls, four mortuaries, four museums, and two theaters.

[3] Under the CCNM Design Option and Refined CCNM Design Option, with the incorporation of the noise barrier as a project design feature, La Paz is not an impacted receptor.

CCNM Design Option = César E. Chávez National Monument Design Option

La Paz = Nuestra Señora Reina de La Paz/César E. Chávez National Monument

In order to reduce long-term operational noise impacts, a total of 20 noise barriers were considered throughout the Bakersfield to Palmdale Project Section. All 20 noise barriers were determined to be feasible[1] (a minimum noise level reduction of 5 A-weighted decibels [dBA]) at the maximum height of 14 feet, whereas only 15 noise barriers were determined to be reasonable and cost-effective. The remaining five noise barriers were determined to be cost-effective. However, if noise barriers are not implemented, secondary abatement measures, including property insulation, could be provided to reduce noise exposure.

As presented in Table 3.4-1, La Paz, at 29700 Woodford-Tehachapi Road in Keene, is listed in the National Register of Historic Places and is designated as a National Historic Landmark. As part of the Section 106 consultation for the Bakersfield to Palmdale Project Section, potential alignment refinements were considered and their respective noise impacts were analyzed. As part of that consultation, a noise reduction measure in the form of a track-side barrier was analyzed at a height of 12 feet for both the CCNM Design Option and the Refined CCNM Design Option, resulting in a no impact determination at La Paz. For the other B-P Build Alternatives without the CCNM Design Option or the Refined CCNM Design Option, La Paz would be severely impacted from operations associated with the HSR project. In order to reduce noise impacts on La Paz, a sound barrier along the edge of track would be implemented as part of the CCNM Design Option or the Refined CCNM Design Option to reduce noise levels to a no-impact classification. The necessary height to meet the desired reduction is 12 feet. Because this barrier was incorporated to minimize impacts on a historic property, it is not required to meet the minimum selection criteria for a sound barrier as presented in N&V-MM#3.

For the segment of the alignment between the F Street Station and Oswell Street, the results show that 14 residential units, 2 hotel/motel uses, and 2 shelters would be impacted from vibrations associated with HSR operations. No vibration impacts would result from long-term operation of the HSR stationary facilities or electric power utility improvements. With the implementation of F-B LGA N&V-MM#5, the vibration impacts would be reduced to less than significant under CEQA and no effect under NEPA.

Implementation of the HSR system would increase traffic on some roadways near HSR stations, thereby increasing traffic-related noise. The increase in traffic noise levels would be less than

[1] The term “feasible” here and throughout the document is not being used as a CEQA term. For purposes of CEQA, “feasible” means “capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social, and technological factors” (Public Resources Code Section 21061.1). For the purposes of this document, “feasible” refers to a barrier being capable of reducing noise by a minimum of 5 dBA.

3 dBA except for one segment each in the Cities of Lancaster and Palmdale and Los Angeles County. Typically, an increase between 1 and 3 dBA is considered barely perceptible. The segments identified would either have the future 60 dBA community noise equivalent level (CNEL) noise contour associated with future traffic noise levels remain within the roadway right-of-way or create an increase of noise less than 3 dBA, resulting in a less than significant impact under CEQA and no effect under NEPA. In addition to project-related traffic increases in the noise and vibration resource study area, roadway modification projects, which include road closures, overcrossings, or undercrossings, would be required to accommodate the HSR system. A total of 11 modifications would change the horizontal or vertical alignment of the current roadway configuration throughout the noise and vibration resource study area. Therefore, a more in-depth preliminary analysis has been completed to assess the potential impacts of these changes. The preliminary analyses show that the receptors immediately west of Sierra Highway and south of Avenue I in the City of Lancaster would potentially experience noise levels that would approach or exceed the Noise Abatement Criteria (NAC).

Depending on the location and individual component, noise impacts from long-term operations of the HSR stationary facilities (maintenance-of-way facility [MOWF] and traction power substation [TPSS]) and electric power utility improvements have the potential to create a significant impact under CEQA and an impact under NEPA. With the implementation of appropriate mitigation, impacts would be reduced to less than significant under CEQA and to no effect under NEPA.

3.4.1 Introduction

This section describes the regulatory setting, affected environment, impacts, and mitigation measures for noise and vibration resulting from the Bakersfield to Palmdale Project Section of the California HSR Project. This section provides a summary analysis of the *Bakersfield to Palmdale Project Section Noise and Vibration Technical Report* (Authority 2018), which includes additional technical information and all references used.

There are correlations among various sections of the Bakersfield to Palmdale Project Section Environmental Impact Report/Environmental Impact Statement (EIR/EIS) and the Noise and Vibration Impact Analysis. These include:

- Section 3.2: Transportation
- Section 3.7: Biological and Aquatic Resources
- Section 3.13: Station Planning, Land Use, and Development
- Section 3.16: Aesthetics and Visual Quality
- Chapter 5: Environmental Justice
- The supportive/associated technical documents prepared for the above sections

This section will discuss noise and vibration impacts, based on a conservative analysis, and mitigation measures for each B-P Build Alternative (Alternatives 1, 2, 3, and 5) along with the CCNM Design Option, the Refined CCNM Design Option, and the No Project Alternative during the year 2040 time horizon.

Noise and vibration impacts associated with the proposed Bakersfield to Palmdale Project Section can be categorized into the following categories:

- Short-term construction impacts
- Long-term HSR corridor operations
- Long-term stationary-source operations at stations, the MOWF, and the TPSS
- Long-term project-related traffic impacts

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. NEPA and 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 Federal Register 28545)

These FRA procedures for implementing NEPA state that an EIS should consider possible noise and vibration impacts.

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 act.

As discussed below, the Environmental Protection Agency (USEPA) and 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 *High-Speed Ground Transportation Noise and Vibration Impact Assessment* (FRA 2012 guidance manual) (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 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 (no impact, moderate impact, and severe impact). A proposed project is considered to have no impact if, on average, the introduction of the project will 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 will occur.

Occupational Safety and Health Administration Occupational Noise Exposure (29 Code of Federal Regulations Part 1910.95)

The Occupational Safety and Health Administration has regulated worker noise exposure to a time-weighted average of 90 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.

United States Environmental Protection Agency Railroad Noise Emission Standards (40 Code of Federal Regulations Part 201)

The USEPA has issued noise emission standards (Code of Federal Regulations [C.F.R.] Title 40, 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 Code of Federal Regulations Part 210)

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 Code of Federal Regulations 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 will cause a substantial increase in noise levels, or if projected noise levels approach or exceed the NAC level for activities occurring on adjacent lands. The specific NAC information is described in further detail in the Methodology section below. These FHWA regulations apply to projects funded or approved by 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.

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).

CEQA Noise and Vibration Criteria

Under CEQA, the specific impact, significance measures, and thresholds are left to local jurisdictions to set. Environmental concerns (e.g., clean air and noise) and thresholds of significance (e.g., parts per million of particulate matter or decibel level of noise) are not legislated under CEQA at the state level but are left to the local jurisdiction to determine. For example, if one considers pedestrian safety to be an environmentally significant concern, then that issue can be added to the list of significance measures evaluated in the environmental review practice as long as it establishes a meaningful measure and threshold of significance, and substantial evidence of the environmental concern can be developed and cataloged.

Title 21, Chapter 2.5, Subchapter 6, California Code of Regulations

The California Department of Transportation (Caltrans) Division of Aeronautics defines a 65 dBA CNEL noise criterion as part of its "Noise Standards" with respect to aviation traffic, as measured at potentially impacted residences near an airport. Quarterly reports of measured noise levels near an airport (prepared and submitted to determine where these requirements are satisfied) can offer insight about the surrounding ambient acoustical environment that may help describe and/or model current existing noise levels as part of the noise impact assessment for the proposed project.

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 residential developments (not single-family detached houses) to 45 dBA CNEL or 45 dBA day-night average 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 features 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.

California Department of Transportation Traffic Noise Analysis Protocol

The Caltrans Traffic Noise Analysis Protocol (Caltrans 2011) provides California policies and procedures for complying with 23 C.F.R. 772. 23 C.F.R. 772 applies to all federal or federal-aid highway projects that are categorized as Type I, Type II, and Type III projects. Noise abatement measures are considered when the following criteria are met.

1. The predicted noise level in the design year approaches or exceeds the NAC specified in 23 C.F.R. 772 or a predicted noise level substantially exceeds the existing noise level. In California, a noise level is considered to approach the NAC for a given activity category if it is within 1 dBA of the NAC. In addition, in California, 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.
2. A feasible noise barrier must provide a minimum noise reduction of 5 dBA at an impacted receptor.
3. A reasonable noise barrier must achieve the noise reduction goal, consider costs, and evaluate the viewpoints of benefited receptors. The noise reduction goal requires all noise abatement to provide at least 7 dBA of noise reduction at one or more benefited receptors. The cost consideration for determining reasonableness is evaluated by comparing reasonableness allowances and projected abatement costs. The viewpoints of the benefited

receptors are evaluated by determining whether property owners and nonowner-occupants who benefit from noise abatement are in favor of or in opposition to the noise abatement.

3.4.2.3 Regional and Local

Counties and cities in California prepare general plans with noise policies and ordinances (outlined above in the discussion of state regulations). These noise elements often incorporate specific allowable noise levels to achieve a quality environment. Where airports exist, the general plans often include a section on airport land use compatibility with respect to noise so that new, noise-sensitive uses are not located near and do not encroach on areas surrounding airports. General plans usually do not address ground-borne vibration. The HSR project is not subject to local general plan policies and ordinances related to noise limits on construction or to locally based criteria for determining the significance of a noise increase from a project. Table 3.4-2 provides a list of the plans, policies, and ordinances adopted by the cities and counties in the Bakersfield to Palmdale Project Section. These local general plan objectives, policies, and goals and municipal code ordinances were identified and considered in the preparation of this analysis.

Table 3.4-2 Regional and Local Plans, Policies, and Ordinances

Policy Title	Summary
Kern County	
Kern County General Plan	Section 3.2 of the Noise Element provides policies and implementation measures regarding exterior and interior noise level limits, as well as compliance with Title 24 and the Uniform Building Code.
Kern County Municipal Code	Section 8.36.020, Prohibited Sounds, (H) provides specific requirement in regards to allowable construction times.
Los Angeles County	
Los Angeles County General Plan	The Los Angeles Country General Plan refers to the Municipal Code for direction on and definition of specific noise criteria.
Los Angeles County Municipal Code	Sections 12.08.390 and 12.08.400 provide exterior and interior noise standards at a variety of uses based on the time of day and the duration of the operation in question, respectively. Section 12.08.440 provides specific requirements with regard to allowable construction times and exterior noise level limits, depending on the receiving land use classification and duration of the construction activities.
City of Bakersfield	
Metropolitan Bakersfield General Plan	The Noise Element provides policies and implementation measures regarding exterior and interior noise level limits as well as compliance with Title 24 and the Uniform Building Code. Table VII-2, Noise Level Performance Standards, provides exterior noise standards at a variety of uses based on the time of day and the duration of the operation in question, respectively.
Bakersfield Municipal Code	Section 9.22.050, Noise During Construction, provides specific requirements with regard to allowable construction times.
City of Tehachapi	
City of Tehachapi General Plan Safety Element and Greater Tehachapi Area Specific and Community Plan	Both the General Plan Safety Element and the Greater Tehachapi Area Specific and Community Plan provide standards and policies to limit both exterior and interior noise impacts from transportation and other operational sources.

Policy Title	Summary
City of Tehachapi Municipal Code	The City of Tehachapi Municipal Code does not define construction noise standards or construction hour limits. Jay Schlosser, City Engineer for the City of Tehachapi, was contacted on October 22, 2012. He indicated that construction noise is typically limited to between the hours of 7:00 a.m. and 5:00 p.m. on weekdays. Construction noise is prohibited on Saturdays and Sundays.
Community of Rosamond	
Community of Rosamond Specific Plan	The Specific Plan Noise Element provides standards and policies to limit both exterior and interior noise impacts from transportation and other operational sources.
Community of Rosamond Municipal Code	The community of Rosamond does not define construction noise standards or construction hour limits in the Rosamond Specific Plan Noise Element. Therefore, the County of Kern's construction noise hour limits apply.
City of Lancaster	
City of Lancaster General Plan	Objective 4.3 of the Noise Element provides policies and implementation measures regarding exterior and interior noise level limits as well as compliance with Title 24 and the Uniform Building Code.
City of Lancaster Municipal Code	Section 8.24.040 provides specific requirements with regards to allowable construction times.
City of Palmdale	
City of Palmdale General Plan	Section B of the Noise Element provides policies and implementation measures regarding exterior and interior noise level limits as well as compliance with Title 24 and the Uniform Building Code.
City of Palmdale Municipal Code	Section 8.28.030 provides specific requirements with regard to allowable construction times.

3.4.3 Regional and Local Policy Analysis

CEQA and NEPA regulations require a discussion of inconsistencies or conflicts between a proposed undertaking and federal, state, regional, or local plans and laws. As such, this EIR/EIS describes inconsistencies of the proposed alternatives with federal, state, regional, and local plans and laws to provide planning context.

Noise and vibration impacts associated with the proposed Bakersfield to Palmdale Project Section are categorized into the following subsections:

- Short-term construction impacts
- Long-term HSR corridor operations
- Long-term stationary-source operations at stations, the MOWF, the light maintenance facility (LMF) and the TPSS
- Long-term project-related traffic impacts

There are a number of federal and state laws and implementing regulations, listed in Section 3.4.2.1, Federal, and Section 3.4.2.2, State, that govern compliance with noise emission limits for construction projects and transportation facilities. As noise and vibration assessment is highly technical, there are several published federal and state guidance documents that can be used to assess potential impacts. The federal and state requirements considered in this analysis included:

- FHWA and FRA guidelines for emissions of noise from transportation sources and for the abatement of excessive noise emissions

- Occupational Safety and Health Administration regulations that provide permissible construction worker noise exposure limits
- FHWA and Occupational Safety and Health Administration guidelines regarding modeling and mitigating noise from construction sources for both construction workers and sensitive receptors near to construction
- The Caltrans *Traffic Noise Analysis Protocol* (Caltrans 2011), which provides a methodology for evaluating construction and traffic noise and for evaluating the effectiveness and feasibility of different sound abatement methods

The Authority, as the lead state and federal 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 on the selected alternative. Therefore, there would be no inconsistencies among the proposed B-P Build Alternatives and these federal and state laws and regulations.

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. For example, the proposed B-P Build Alternatives would incorporate an impact avoidance and minimization feature (IAMF) that requires the contractor to prepare a plan demonstrating how construction noise levels would be maintained below applicable standards. The Authority has also adopted statewide policies that seek to reduce noise impacts associated with new sources of transportation noise (Appendix 3.4-B).

A total of 14 plans and policies were reviewed. The B-P Build Alternatives would be inconsistent with certain provisions of the regional and local policies and plans, as described in Table 3.4-3.

Table 3.4-3 Regional and Local Plans and Policies Inconsistencies

Policy/Goal/Objective	Inconsistency
Kern County General Plan	May not be possible to meet standards
Kern County Municipal Code	May not be possible to meet standards
Los Angeles County General Plan	May not be possible to meet standards
Los Angeles County Municipal Code	May not be possible to meet standards
Metropolitan Bakersfield General Plan	May not be possible to meet standards
Bakersfield Municipal Code	May not be possible to meet standards
City of Tehachapi General Plan Safety Element and Greater Tehachapi Area Specific and Community Plan	May not be possible to meet standards
City of Tehachapi Municipal Code	May not be possible to meet standards
Community of Rosamond Specific Plan	May not be possible to meet standards
Community of Rosamond Municipal Code	May not be possible to meet standards
City of Lancaster General Plan	May not be possible to meet standards
City of Lancaster Municipal Code	May not be possible to meet standards
City of Palmdale General Plan	May not be possible to meet standards
City of Palmdale Municipal Code	May not be possible to meet standards

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.

Refer to Volume 2, Appendix 2-H, for a complete consistency analysis of local plans and policies.

3.4.4 Methods for Evaluating Impacts

Evaluation of impacts from noise and vibration is performed in accordance with the following procedures:

- The methods and criteria for evaluating high-speed ground transportation noise and vibration impacts are found in the FRA 2012 guidance manual (FRA 2012).
- The methods and criteria for evaluating construction and stationary-source noise and vibration impacts are found in FTA's *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018).
- The criteria for highway 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 Caltrans *Traffic Noise Analysis Protocol* (Caltrans 2011). The FHWA requires each state to write its own noise policy based on the FHWA's *Highway Traffic Noise: Analysis and Abatement Guidance* (FHWA 2011 noise guidance) (FHWA 2011). The state policy must address the issues of (1) the required noise reduction needed for a wall to be reasonable, (2) the cost of a reasonable wall, and (3) the 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* (Caltrans 2013) gives guidance on how Caltrans requires noise measurements, modeling, and barrier analyses to be conducted. The Caltrans *Standard Environmental Reference*, Volume 1 section on noise gives an outline for the noise report.
- The analysis of the potential for increased roadway noise during HSR operations (Impact N&V #6) is based on the high ridership forecast (56.8 million) in 2040.

The following analysis is divided into two major sections:

- The first is the segment from the Bakersfield Station (Locally Generated Alternative) to Oswell Street.
- The second is the segment from Oswell Street to the Palmdale Station for each of the four B-P Build Alternatives:
  - Alternative 1
  - Alternative 2
  - Alternative 3
  - Alternative 5

In addition to the four B-P Build Alternatives in the Oswell Street to Palmdale Station section, the CCNM Design Option and Refined CCNM Design Option are also analyzed.

3.4.4.1 Definition of Resources

The following are definitions for noise analyzed in this EIR/EIS:

- **Noise**—Noise is expressed in terms of a "source-path-receptor" framework, as follows:
  - **Source**: The source generates noise levels that depend on the type of source (e.g., a high-speed train) and its operating characteristics (e.g., speed).
  - **Path:** Between the source and the receptor is the path, where the noise is reduced by distance, intervening buildings or other features, and topography.
  - **Receptor:** The receptor is the noise-sensitive land use (e.g., residence, hospital, or school, referred to as sensitive receptors) exposed to noise from the source.

  Environmental noise impacts are assessed at the receptor. Noise criteria are established for the various types of receptors individually because not all receptors have the same noise sensitivity.

Analysts use three primary noise measurement descriptors to assess noise impacts from traffic and transit projects: equivalent sound level (L_{eq}), L_{dn}, and sound exposure level.

- **Vibration**—Vibration is also expressed in terms of a "source-path-receptor" framework, as follows:
  - **Source:** The source generates energy that causes vibration, such as the operation of construction equipment (e.g., an auger) that could cause ground vibrations that spread through the ground and diminish in strength with distance from the source.
  - **Path**: Once the vibration gets into the ground, it propagates through the various soil and rock strata to the foundations of nearby buildings (i.e., the receptors). Ground-borne vibrations generally decline with distance, depending on the local geological conditions.
  - **Receptor:** A receptor is a vibration-sensitive building (e.g., residence, hospital, or school), where the vibrations may cause perceptible shaking of the floors, walls, and ceilings, and a rumbling sound inside rooms. Not all receptors have the same vibration sensitivity. Consequently, criteria are established for the various types of receptors.

  Vibration above certain levels can damage buildings, can disrupt sensitive operations, and can annoy people within buildings. The range of interest is approximately 50 to 100 vibration velocity level (VdB) (i.e., from an imperceptible background vibration to the threshold of damage). Although the threshold of human perception to vibration is approximately 65 VdB, annoyance does not usually occur unless the vibration exceeds 70 VdB.

For full details regarding noise and vibration descriptors, see the *Bakersfield to Palmdale Project Section Noise and Vibration Technical Report* (Authority 2018).

3.4.4.2 Resource Study Area for Analysis

Noise Resource Study Area

The boundaries of the resource study area (RSA) for noise and vibration extend beyond the project footprint. The noise and vibration impact analysis focuses on the effects of source noise on sensitive receivers, which is assessed at the receiver. Sensitive receivers include, but are not limited to: residential dwellings; schools; churches; hospitals; parks; amphitheaters; auditoriums; campgrounds; cemeteries; daycare centers; hospitals; libraries; parks; picnic areas; playgrounds; public meeting rooms; public or nonprofit institutional structures; radio, television, and recording studios; recreation areas, and in some cases, trails; and historic properties.

The noise resource study area (Noise RSA) for the project includes sensitive receivers within 2,500 feet of the proposed HSR track. The Noise RSA is consistent with that identified in the previously completed sections and has been determined based on typical screening distances (Table 3.4-4) defined by FRA and project-specific conditions. Screening distances indicate whether any noise-sensitive receivers are near enough to the proposed alignment for a noise impact to be possible under typical conditions. If receivers are farther away than these screening distances, the FRA guidance has determined that impacts would be unlikely. Table 3.4-4, which groups screening distances by the type of corridor the project would occupy, takes into account whether the HSR alignment follows along an existing rail line or highway, or along a new transportation corridor.

Table 3.4-4 Noise Screening Distances for Noise Assessments

Corridor Type	Existing Noise Environment	Screening Distance in Feet for HSR[1]	
		Steel-Wheeled	
		90 to 170 mph	170 mph or more
Railroad	Urban/noisy suburban—unobstructed	300 feet	700 feet
	Urban/noisy suburban—obstructed[2]	200 feet	300 feet
	Quiet suburban/rural	500 feet	1,200 feet

Corridor Type	Existing Noise Environment	Screening Distance in Feet for HSR[1]	
		Steel-Wheeled	
		90 to 170 mph	170 mph or more
Highway	Urban/noisy suburban—unobstructed	250 feet	600 feet
	Urban/noisy suburban—obstructed[2]	200 feet	350 feet
	Quiet suburban/rural	400 feet	1,100 feet
New	Urban/noisy suburban—unobstructed	350 feet	700 feet
	Urban/noisy suburban—obstructed[2]	250 feet	350 feet
	Quiet suburban/rural	600 feet	1,300 feet

Source: Federal Railroad Administration, 2012
[1] Measured from the centerline of the alignment. Minimum distance is assumed to be 50 feet.
[2] Rows of buildings are assumed to be at 200, 400, 600, 800, and 1,000 feet away, parallel to the alignment.
HSR = high-speed rail
mph = miles per hour

The FRA noise impact screening distances for noise-sensitive receivers depend on the existing noise environment and speeds of the trains. For noise impact screening distance purposes, existing noise environments are defined by the existence of rail corridors; the type of existing noise environment based on the nearby population density (urban, suburban, and rural); and whether the noise-sensitive receiver is obstructed or unobstructed from view of the alternative alignments. Screening distances change based on the speeds of the trains. Trains moving up to 100 miles per hour (mph) have a shorter screening distance than trains moving up to 200 mph. Because train speeds are planned for 220 mph, the highest speed range category (Regime III—170 mph or greater) was used to define the screening distance. These screening distances are based on general assumptions associated with typical projects, such as the number of train operations, train speeds, and existing noise conditions. The maximum screening distance of 1,300 feet was replaced by a screening distance of 2,500 feet because the FRA screening distance assumes 50 trains per day, whereas the proposed project would operate at 225 trains per day. Therefore, specific factors of the HSR project were considered when the potential impact was assessed for all noise-sensitive receivers within approximately 2,500 feet.

Vibration Resource Study Area

The vibration resource study area (Vibration RSA) for the proposed project is as follows:

- HSR stations—150 feet from the station boundary
- HSR alignment, including existing railroads—up to 275 feet from the edge of the right-of-way
- Highways—50 feet from the roadway centerline

The vibration impact assessment uses the FRA screening procedure. Screening distances indicate the potential for vibration impact on vibration-sensitive receivers. The FRA 2012 guidance manual has determined that receivers located beyond the screening distances are not likely to be affected by the HSR project. Table 3.4-5 presents the screening distances for vibration assessment.

Table 3.4-5 FRA Screening Distances for Vibration Assessment

Land Use	Train Frequency[1]	Screening Distance (feet)	
		Train Speed of 100 to 200 mph	Train Speed of 200 to 300 mph
Residential	Frequent	220	275
	Infrequent	100	140
Institutional	Frequent	160	220
	Infrequent	70	100

Source: Federal Railroad Administration, 2012
[1] Frequent = greater than 70 pass-bys per day
Infrequent = less than 70 pass-bys per day
mph = miles per hour

3.4.4.3 Impact Avoidance and Minimization Features

The Authority has pledged to integrate programmatic IAMFs consistent with (1) the 2005 Statewide Program EIR/EIS, (2) the 2008 Bay Area to Central Valley Program EIR/EIS, and (3) the 2012 Partially Revised Final Program EIR into the HSR project. The Authority will implement these features during project design and construction, as relevant to the project section, to avoid or reduce impacts.

IAMFs are incorporated into the project design and construction that will avoid or minimize the environmental or community impacts. The IAMF relevant to noise and vibration is described below.

NV-IAMF#1: Noise and Vibration

Prior to construction, the contractor shall 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 when work is being conducted within 1,000 feet of sensitive receivers. Typical construction practices contained in the FTA and FRA guidelines for minimizing construction noise and vibration impacts include the following:

- Construct noise barriers, such as temporary walls or piles on excavated material, between noisy activities and noise-sensitive resources.
- Route truck traffic away from residential streets when possible.
- Construct walled enclosures around especially noisy activities or around clusters of noise equipment.
- Combine noisy operations so that they occur in the same period.
- Phase demolition, earthmoving, and ground-impacting operations so as not to occur in the same time period.
- Avoid impact pile driving where possible in vibration-sensitive areas.

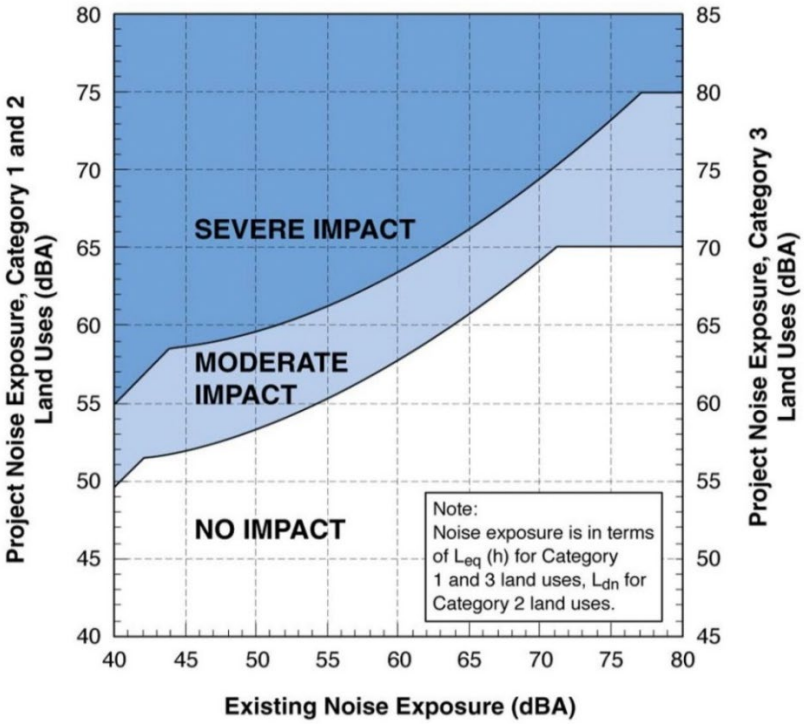
It is expected that the implementation of the IAMF would provide a significant amount of reduction in noise and vibration effects; however, effects may still occur as a result of construction noise and vibration activities. In order to further reduce potential effects, additional mitigation measures are provided in Section 3.4.7.

3.4.4.4 Methods for NEPA and CEQA Impact Analysis

This section describes the sources and methods the Authority used to analyze potential impacts from implementing the B-P Build Alternatives on noise and vibration. These methods apply to both NEPA and CEQA unless otherwise indicated. Refer to Section 3.1.3.3, Methods for Evaluating Impacts, for a description of the general framework for evaluating impacts under NEPA and CEQA. Laws,

regulations, and orders (Section 3.4.2, Laws, Regulations, and Orders) that regulate noise and vibration were also considered in the evaluation of impacts on sensitive receivers.

The noise impact criteria used by FRA and FTA are ambient-based; the increase in future noise (future noise levels with the project compared to existing noise levels) is assessed rather than the noise caused by each passing train. The criteria specify a comparison of future project noise with existing levels because comparison with an existing condition is more accurate (FRA 2012). Figure 3.4-1 shows the FRA noise impact criteria for human annoyance. Depending on the magnitude of the cumulative noise increases, FTA and FRA categorize impacts as (1) no impact, (2) moderate impact, or (3) severe impact. A severe impact is where a significant percentage of people would be highly annoyed by the project's noise. A moderate impact is where the change in cumulative noise level would be noticeable to most people, but may not be sufficient to generate strong adverse reactions.



Source: Federal Railroad Administration, 2012

Figure 3.4-1 Noise Impact Criteria for High-Speed Rail Projects

Train Operation Noise and Vibration Methodology

HSR operation noise and vibration levels are projected using current HSR system operation plans and the prediction models provided in the FRA 2012 guidance manual. Potential noise and vibration impacts are also evaluated in accordance with the FRA 2012 guidance manual.

Assumptions for train operation are as follows:

- Noise modeling projections assume atmospheric absorption of sound based on the International Organization for Standardization's ISO 9613-2.
- The noise analysis uses source reference levels for the very-high-speed electric vehicle type listed in Table 5-2 of the FRA 2012 guidance manual. These adjustments assumed that trainsets would be distributed-power, electric-multiple-unit vehicles with eight cars and a maximum speed of 220 mph.

- The noise sources include the wheel/rail interface (at 1 foot above top-of-rail), the propulsion noise (at 2 feet above top-of-rail), the aerodynamic noises from the train nose (at 10 feet above top-of-rail), the wheel region (at 5 feet above top-of-rail), and the pantograph (at 15 feet above top-of-rail).
- The HSR track was assumed to be a combination of ballast and slab track with continuous welded rail, consistent with the assumptions in the FRA 2012 guidance manual. Slab construction would be used for elevated structures exceeding 1,000 feet in length, where operating speeds are planned for 220 mph.
- Modeling used the full-system schedule of train operations as updated by the Rail Delivery Partner and provided in the *Service Planning Methodology: 2016 Business Plan* (Authority 2016b). Times of day of train runs will be specified in the operating schedule.
- Top-of-rail elevations were based on preliminary design, as specified in the Authority's *Technical Memorandum 15% Design Scope Guidelines TM 0.1*.
- All aerial structure sections of the corridor were assumed to be as described in *Technical Memorandum TM 1.1.21 Typical Cross Section 15% R0 090404 TM Excerpt*.
- Buildings assumed to be full acquisitions were not to be included in the impact assessment because they are assumed to be acquired and removed as part of the B-P Build Alternatives' footprints.
- The B-P Build Alternatives would replace existing railroad at-grade crossings with grade separations and/or roadway closures. Because this change would eliminate railroad horn warnings to oncoming vehicular and pedestrian traffic, the modeling for the HSR trains did not include the horn warnings. However, noise modeling in some cases was not done to analyze the effects of changes to the at-grade crossings on the existing noise levels from the existing freight and passenger trains. Therefore, there are no changes to the noise levels from the freight trains at locations where they presently blow their horns.
- No adjustments were made to projected noise levels to account for increases in localized noise due to special trackwork, such as crossovers and turnouts, because the project would use special trackwork that would not have gaps associated with crossovers.

Table 3.4-6 summarizes the operational parameters used to model future with project noise levels, which were provided by the Authority. This data includes 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 *Operations and Service Plan* (Authority 2017b). 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 B-P Build Alternatives' 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 Noise RSA more accurately. Any changes to the speeds of the modeled operations would result in a change in the corresponding noise impacts.

The projected B-P Build Alternatives' noise levels were calculated at each noise measurement location in the Noise RSA using the operational assumptions listed above. The calculated noise levels were then compared to the measured noise levels at each location, and the moderate impact and severe impact distances were determined. The results of the analysis are presented for each subsection. Noise modeling projections do not include the effects of atmospheric absorption; however, using atmospheric absorption of sound based on the International Organization for Standardization's ISO 9613-2 would result in a 1 dBA drop in noise level per 1,000 feet from the proposed alignment.

Table 3.4-6 Bakersfield to Palmdale Project Section 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 Noise Barrier—At-Grade	21.5 feet

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

A detailed noise impact analysis was conducted for the project using the FRA methodology. Noise impacts using the FRA methodology are determined by the increase in noise exposure levels attributed to the project based on the existing noise environment. Figure 3-1 of the FRA 2012 guidance manual shows FRA's noise impact criteria for the project. As shown on Figure 3-1, the noise criteria and noise descriptor depend on the land use. In addition, noise impacts are classified as (1) no impact, (2) moderate impact, or (3) severe impact.

Station Noise Methodology

The FTA *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018) establishes screening distances for stations. One new HSR station location is proposed in the City of Bakersfield and one HSR station location is proposed in the City of Palmdale. A general noise assessment was conducted utilizing the screening distances and criteria provided in the FTA manual to determine if there are sensitive receivers at the stations. Specific analyses were not conducted because the operations at the stations have not been defined at this time. Some of the major noise sources at the stations would include signal horns, a public-address system, locomotives idling, and other site-specific activities.

Construction Noise Methodology

There are no standardized construction noise criteria from FTA or FRA for assessing noise impacts at sensitive receivers due to construction. The FTA and the FRA guidance manuals do outline general assessment and detailed assessment criteria if local ordinances and standards are not adequate. Local ordinances and standards will always have precedence over the "reasonable guidelines" established by FRA. Section 3.4.2.3 provides local ordinances and standards. The "reasonable guidelines" established by the FRA are deliberately conservative in order to avoid adverse community reaction.

The purpose of the general assessment for construction noise is to identify land uses/sensitive receivers that would experience construction noise within the Noise RSA where construction would occur. The land uses are categorized by residential, commercial, and industrial land uses. The general assessment recommends combining the noise levels from the two noisiest pieces of construction equipment, assuming they operate at the same time. According to the general assessment, noise levels should not exceed the criteria found in Table 3.4-7. The general assessment criteria for construction noise prescribe different levels for daytime and nighttime construction. Daytime is defined as 7:00 a.m. to 10:00 p.m., and nighttime is defined as 10:00 p.m. to 7:00 a.m. A detailed assessment for construction will predict noise levels in terms of an 8-hour L_{eq} and a 30-day averaged L_{dn}. According to the detailed assessment criteria for construction noise, the noise levels found in Table 3.4-7 should not be exceeded.

Table 3.4-7 Detailed Assessment Criteria for Construction Noise

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_{eq} = equivalent continuous sound level, dBA
L_{dn} = day-night average sound level, dBA

The following equation calculates the L_{eq} noise level at a sensitive receiver for an individual piece of construction equipment. This formula was used to estimate the noise contours for all construction activities.

$$L_{eq}(equip) = E.L. + 10\log(U.F.) - 20\log\left(\frac{D}{50}\right) - 10G\log\left(\frac{D}{50}\right)$$

where:

$L_{eq}(equip)$	=	L_{eq} at a receiver resulting from the operation of a single piece of equipment over a specified time period
$E.L.$	=	noise emission level of the particular piece of equipment at a reference distance of 50 feet
G	=	constant that accounts for topography and ground effects
D	=	distance from the receiver to the piece of equipment
$U.F.$	=	usage factor that accounts for the fraction of time that the equipment is in use over the specified period of time

Construction Vibration Methodology

FTA has established vibration damage criteria. Table 3.4-8 lists FTA's vibration damage criteria for four building categories. These limits are viewed as criteria that should be used to identify problem locations that must be addressed during final design.

Table 3.4-8 Construction Vibration Damage Criteria

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

Source: Federal Transit Administration, 2006
[1] RMS velocity in VdB re 1 micro-inch per second.
L_V = root-mean-square vibration level RMS = root-mean-square
PPV = peak particle velocity VdB = vibration velocity decibels

The following equation was used to determine if there would be vibration impacts at sensitive receivers as a result of construction activities.

$$PPV_{equip} = PPV_{ref} \times \left(\frac{25}{D}\right)^{1.5}$$

where: PPV_{equip} = the peak particle velocity (PPV), in inches per second, of the equipment, adjusted for distance

PPV_{ref} = the reference vibration level in inches per second at 25 feet

D = the distance from the equipment to the receiver in feet

Vibration due to construction activities can also cause annoyance or interference with vibration-sensitive activities at sensitive receiver locations. The ground-borne vibration impact criteria for different land use categories can be found in Table 3.4-18 (provided later in this section).

This analysis focuses on the direct impacts of the B-P Build Alternatives on noise and vibration resources. Additional supporting information is provided in Section 4, Methodology for Effects Analysis, of the *Bakersfield to Palmdale Project Section Noise and Vibration Technical Report* (Authority 2018).

3.4.4.5 Method for Determining Significance under CEQA

CEQA requires that an EIR identify the significant environmental impacts of a project (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 3.1.3.3, Methods for Evaluating Impacts, for further information). By contrast, under NEPA, significance is used to determine whether an EIS would 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 resources for the B-P Build Alternatives. The Authority uses the following thresholds to determine if a significant impact on from noise and vibration would occur as a result of the B-P Build Alternatives. A significant impact is one that would:

- Expose persons to or generate noise levels in excess of severe impact standards for a severe impact established by FRA for high-speed ground transportation and by FTA for transit projects. These standards cover both permanent and temporary/periodic increases in ambient noise levels in the project vicinity above levels existing without the project.
- Expose persons to or generate excessive ground-borne vibration or ground-borne noise levels.

- Permanently substantially increase ambient noise levels in the project vicinity above levels existing without the project.
- Temporarily or periodically substantially increase ambient noise levels in the project vicinity above levels existing without the project.

3.4.5 Affected Environment

The Bakersfield to Palmdale Project Section is approximately 80 miles in length and traverses valley, mountain, and high desert terrain, as well as urban, rural, and agricultural lands. From the north, this project section begins at the Bakersfield Station[2] and travels south and southeast through the Tehachapi Mountains, then descends into the Antelope Valley, where it terminates at the Palmdale Station in the south. The project section from the north, beginning at the Bakersfield Station, includes the portion of the Fresno to Bakersfield Locally Generated Alternative (F-B LGA) alignment from the intersection of 34th Street and L Street to Oswell Street. This project section includes a potential LMF and an MOWF in the Lancaster area.

The affected environment for the northern portion is included in Section 3.4.4 of the *Fresno to Bakersfield Section Final Supplemental EIR* (Authority 2018), respectively. The affected environment discussions included in Sections 3.4.5.1 and 3.4.5.2 below also reflect the portion of the F-B LGA alignment from the intersection of 34th Street and L Street to Oswell Street.

3.4.5.1 Noise-Sensitive Receivers

Noise-sensitive receivers near the proposed alignment would experience potential noise impacts related to the proposed project. The FRA screening distances were used to identify noise-sensitive receivers based on the existing land uses and the speeds at which future railroad operations are expected to function. The FRA screening distances are shown in Table 3.4-5. As shown in Table 3.4-5, the proposed project would have a maximum screening distance of 1,300 feet. However, this screening distance was replaced with a screening distance of 2,500 feet to account for areas with relatively low existing noise conditions and to adequately identify noise impacts within the project vicinity. Noise-sensitive land uses include residences, schools, parks, libraries, and hospitals.

Measured Noise Levels

Long-term and short-term noise level measurements were conducted to establish the existing noise levels within the project vicinity. The L_{dn} noise levels were estimated by comparing the short-term measured values to the corresponding L_{eq} values at a nearby long-term measurement location subjected to a similar characteristic noise environment according to the following method:

A. Note the L_{eq} value for the short-term measurement.

B. Compare the monitored short-term (ST) L_{eq} value from Step A to the monitored L_{eq} value for the nearby long-term (LT) measurement location for the same measurement period used for the short-term (ST) L_{eq} value.

Then:

$$L_{eq}\ (ST) - L_{eq}\ (\text{simultaneous})\ (LT) = \text{delta}$$

and

$$L_{dn}\ (ST) = L_{dn}\ (LT) + \text{delta}$$

[2] "Bakersfield Station" refers to the station at the northern terminus of the Bakersfield to Palmdale Project Section. The station was analyzed within the Fresno to Bakersfield Final Supplemental EIR [Authority 2018]).

Bakersfield Station—Fresno to Bakersfield (Locally Generated Alternative) Alignment from the Intersection of 34th Street and L Street to Oswell Street

Ambient long-term (24-hour) and short-term (20-minute) noise level measurements were conducted at representative noise-sensitive receiver locations within 2,500 feet of the proposed rail line to document the existing noise environment for project noise impact assessment. Short-term noise level measurements were selected in areas not covered by long-term noise level measurement locations. The nearest representative long-term noise level measurement was used to estimate the L_{dn} noise level at each short-term noise level measurement location.

The existing noise environment in the project vicinity is dominated by traffic on local streets and nearby freeways, and train operations along the Union Pacific Railroad (UPRR). Noise levels were measured at the noise-sensitive land uses throughout the area, and the measured noise levels ranged from 49.6 to 80.9 dBA L_{dn}. These noise levels are typical for urban settings dominated by vehicular traffic and railroad operations. The noise level measurements details are provided in the *Fresno to Bakersfield Section Final Supplemental EIR* (Authority 2018).

Bakersfield to Palmdale Station Alignment

Ambient noise level measurements were conducted at representative noise-sensitive receiver locations within 2,500 feet of the proposed rail line to document the existing noise environment for project noise impact assessment. A combination of 44 long-term (24 hours in duration) and 115 short-term (20 minutes in duration) noise level measurements were conducted to represent the project section. Short-term noise level measurements were selected in areas not covered by the long-term noise level measurement in order to estimate the L_{dn}. The long-term and short-term noise level measurement locations are shown on Figure 3.4-B-1 (Figures 3.4-B-1 through 3.4-B-13 are provided in Appendix 3.4-A). Tables 5-2 and 5-3 in the *Bakersfield to Palmdale Project Section Noise and Vibration Technical Report* (Authority 2018) provide a summary of the long-term and short-term noise level measurement results, respectively.

Existing Noise Conditions

Bakersfield Station—Fresno to Bakersfield (Locally Generated Alternative) Alignment from the Intersection of 34th Street and L Street to Oswell Street

The existing noise environment within the project vicinity was obtained from the *Fresno to Bakersfield Section Final Supplemental EIR* (Authority 2018). Noise levels in this area are dominated by traffic on the local streets, nearby freeways, and train operations along the UPRR line. Noise levels were measured at the noise-sensitive land uses are provided, below. These noise levels shown below are typical for urban settings dominated by vehicular traffic and railroad operations.

- From the F-B LGA to Chester Avenue in the City of Bakersfield, land uses are primarily residential, commercial, and industrial. The measured ambient noise levels ranged from 58.0 to 68.3 dBA L_{dn}. These noise levels are dominated by traffic on local streets, State Route (SR) 204/Golden State Avenue, and train operations along the UPRR line.
- From Chester Avenue to Beale Avenue in the City of Bakersfield, land uses are primarily residential, commercial, and industrial. The measured ambient noise levels ranged from 49.6 to 66.3 dBA L_{dn}. These noise levels are dominated by traffic on local streets, SR 204/Golden State Avenue, SR 178, and by train operations along the UPRR line.
- From Beale Avenue to Oswell Street in the City of Bakersfield and Kern County, land uses are primarily residential. The measured ambient noise levels ranged from 51.3 to 80.9 dBA L_{dn}. These noise levels are dominated by traffic on local streets and train operations along the UPRR line.

Bakersfield to Palmdale Station Alignment

- From Oswell Street to Morning Drive in the City of Bakersfield and Kern County, land uses in this area are primarily residential, commercial, and industrial. The measured ambient noise levels ranged from 49.5 to 80.7 dBA L_{dn}. These noise levels are dominated by traffic on local streets, Edison Highway, and train operations along the UPRR line.
- From Morning Drive to SR 58 in Kern County, land uses in this area are primarily residential, agriculture, and vacant land. The measured ambient noise levels ranged from 41.0 to 75.3 dBA L_{dn}. These noise levels are dominated by traffic on local streets, SR 58, Edison Highway, and train operations along the UPRR line.
- From SR 58 to Cameron Road in Kern County and the City of Tehachapi, land uses in this area are primarily residential and vacant land. The measured ambient noise levels ranged from 51.1 to 69.7 dBA L_{dn}. These noise levels are dominated by traffic on local streets.
- From Cameron Road to the Kern/Los Angeles County line in Kern County and the community of Rosamond. Land uses in this area are primarily residential and vacant land. The measured ambient noise levels ranged from 43.2 to 81.1 dBA L_{dn}. These noise levels are dominated by traffic on local streets.
- From the Kern/Los Angeles County line to Avenue E in Kern County and the community of Rosamond, land uses in this area are primarily residential and vacant land. The measured ambient noise levels ranged from 43.3 to 63.5 dBA L_{dn}. These noise levels are dominated by traffic on local streets.
- From Avenue E to Avenue O-8 in the cities of Lancaster and Palmdale, land uses in this area are primarily residential, commercial, industrial, and vacant land. The measured ambient noise levels ranged from 46.8 to 79.5 dBA L_{dn}. These noise levels are dominated by traffic on local streets, Sierra Highway, and train operations along the UPRR line.
- From Avenue O-8 to the Palmdale Station in the City of Palmdale, land uses in this area are primarily residential, commercial, industrial, and vacant land. The measured ambient noise levels ranged from 63.0 to 65.0 dBA L_{dn}. These noise levels are dominated by traffic on local streets, Sierra Highway, aircraft operations, and train operations along the UPRR line.

3.4.5.2 Vibration-Sensitive Receivers

The vibration-sensitive receivers would be similar to the noise-sensitive receivers described above, except they would be limited to those with sensitive structures within an appropriate screening distance shown in Table 3.4-9.

Table 3.4-9 Vibration Impact Screening Distances

Land Use	Screening Distance for HSR (in feet from centerline)		
	Up to 100 mph	Up to 200 mph	Up to 300 mph
Residential	120 feet	220 feet	275 feet
Institutional	100 feet	160 feet	220 feet

Source: Federal Railroad Administration, 2012
HSR = high-speed rail mph = miles per hour

In general, the noise-sensitive receiver locations with structures that are within the limited vibration screening distance would be a small subset of the list of noise-sensitive receiver locations.

Unlike the FTA/FRA noise impact assessment method, train-related vibration impact thresholds are not dependent on existing ground vibration levels, so the empirical documentation of existing ground vibration levels is not as critical as for noise levels. However, ground propagation characteristics are inherently variable from one location to another, so it is helpful to collect train-induced ground vibration level data, where available, to assess whether established general train-related ground vibration prediction methods, such as those provided by the FRA, are sufficiently conservative.

Measured Vibration Levels

Bakersfield Station—Fresno to Bakersfield (Locally Generated Alternative) Alignment from the Intersection of 34th Street and L Street to Oswell Street

Vibration measurements were conducted at four locations (V-5 through V-8). These measurements were representative of actual potentially impacted areas within 220 feet of the F-B LGA and within approximately 260 feet of an existing active rail line. The field vibration data were processed in accordance with the established FTA/FRA impact criteria (i.e., maximum event vibration level) and then compared to the value generated by the FTA general vibration assessment procedure (using the generalized ground surface vibration curve for "locomotive-powered passenger or freight"). The vibration measurements were approximately 70 VdB, with the highest measured vibration level being 84.1 VdB and the lowest measured vibration level being 69.7 VdB. The details of the vibration level measurements are provided in *Fresno to Bakersfield Section Final Supplemental EIR* (Authority 2018).

Bakersfield to Palmdale Station Alignment

Vibration propagation measurements were conducted at 10 locations. Project vibration levels would range between 45.5 and 71.1 VdB at the nearest vibration-sensitive receiver. These vibration levels are below the FRA impact criteria of 72 VdB for residential land uses and 75 VdB for institutional land uses. Based on the project vibration levels calculated from the transfer of mobility measurements, no residential or institutional land uses adjacent to the HSR tracks would experience a vibration impact. The details of the vibration analysis from the vibration propagation test are provided in Section 6.9.3 of the *Bakersfield to Palmdale Project Section Noise and Vibration Technical Report* (Authority 2018), and the transfer of mobility tests are provided in Appendix E of the *Bakersfield to Palmdale Project Section Noise and Vibration Technical Report* (Authority 2018).

3.4.6 Environmental Consequences

3.4.6.1 Overview

The Bakersfield to Palmdale Project Section is in both Kern and Los Angeles Counties and crosses some urban and rural environments. The project section from the north, beginning at the Bakersfield Station, includes the portion of the F-B LGA alignment from the intersection of 34th Street and L Street to Oswell Street.

This section describes the impact analysis relating to noise and vibration for the Bakersfield to Palmdale Project Section, which also reflects the portion of the F-B LGA alignment from the intersection of 34th Street and L Street to Oswell Street. The impact analysis relating to noise and vibration for this portion is included in Section 3.4.4 of the *Fresno to Bakersfield Section Final Supplemental EIR* (Authority 2018). Potential noise and vibration impacts that would result from both construction and operations were evaluated within the Noise RSA and the Vibration RSA.

The impacts of the proposed project are described and organized in Section 3.4.6.3 as follows:

- **Construction Impacts**
  - Impact N&V #1: Construction Noise
  - Impact N&V #2: Construction Vibration
- **Operations Impacts**
  - Impact N&V #3: Moderate and Severe Noise Impacts from Project Operation to Sensitive Receivers
  - Impact N&V #4: Noise Effects on Wildlife and Domestic Animals
  - Impact N&V #5: Impacts from Project Vibration

- Impact N&V #6: Traffic Noise
- Impact N&V #7: Noise from High-Speed Rail Stationary Facilities

3.4.6.2 No Project Alternative

Under the No Project Alternative, the proposed project would not be built. The No Project Alternative represents the condition of the Bakersfield to Palmdale Project Section without the project at the year 2040-time horizon identified for the environmental analysis. In assessing future conditions, it was assumed that all currently known, programmed, and funded improvements to the intercity transportation system (highway, rail, and transit) and reasonably foreseeable local development projects (with funding sources already identified) would be developed as planned by 2040. The No Project Alternative is based on a review of all city and county general plans, regional transportation plans for all modes of travel, and agency-provided lists of pending and approved projects in the following jurisdictions: Kern County, Los Angeles County, and the cities of Bakersfield, Tehachapi, Lancaster, and Palmdale.

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 that would be conducted according to 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 Bakersfield to Palmdale Project Section Build Alternatives

Construction and operation of the proposed project could result in temporary and permanent impacts related to noise and vibration at the year 2040-time horizon identified for the environmental analysis.

Construction Impacts

Construction of the proposed project would involve demolition of existing structures, clearing, and grubbing; reduction of permeable (concrete and paved) surface area; handling, storing, hauling, excavating, and placing fill; possible pile driving; and construction of aerial structures, bridges, road modifications, utility upgrades and relocations, HSR electrical systems, and railbeds. Table 2-24 in Chapter 2, Alternatives, further describes construction activities.

Impact N&V #1: Construction Noise

Rail Corridor Construction

Bakersfield Station—Fresno to Bakersfield (Locally Generated Alternative) Alignment from the Intersection of 34th Street and L Street to Oswell Street

Table 3.4-10 summarizes the distance to construction noise impact for daytime and nighttime work for each phase of rail corridor construction. Details of the rail corridor construction noise analysis are provided in the *Fresno to Bakersfield Section Final Supplemental EIR* (Authority 2018). Residences and schools within these distances from the construction boundary would be affected by noise generated from rail corridor construction activities that is greater than the recommended FRA construction noise criteria.

Table 3.4-10 Distances to Federal Railroad Administration Noise Impact Contours from Construction Activities for the High-Speed Rail Corridor

Construction Activity	Daytime 80 dBA L_{eq} (feet)	Nighttime 70 dBA L_{eq} (feet)
Mobilization	80	253
Demolition	63	199
Land Clearing	156	493
Earthmoving	141	447
Road and Canal Overcrossing	143	454
Road and Canal Overcrossing (with pile driving)	316	998
Track Construction		
At-Grade Track	50	158
Elevated Track	113	357
Elevated Structure	134	424
Track Construction (with pile driving)		
At-Grade Track	286	903
Elevated Track	303	958
Elevated Structure	311	985
Demobilization	113	357

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

Bakersfield to Palmdale Station Alignment

The detailed FRA construction noise criteria were used to evaluate potential noise impacts from the construction of the proposed project. These impacts would be applicable to all alternatives. As discussed in Section 3.4.2.1, the detailed FRA construction noise criteria are the same as the detailed FTA construction noise criteria. Two types of short-term noise impacts would occur during the rail corridor construction. The first type would be from construction crew commutes. In addition, the transport of construction equipment and materials to the project site as part of the rail corridor 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 project vicinity. 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.

The second type of short-term noise impact is related to noise generated during rail corridor construction. Construction of the HSR corridor consists of seven construction phases that make up the construction schedule: mobilization, demolition, land clearing, earthmoving, road and canal overcrossing, track construction, and demobilization. Each phase has a unique set of construction equipment that will be utilized. Appendix C of the *Bakersfield to Palmdale Project Section Noise and Vibration Technical Report* (Authority 2018) provides a complete list of the construction equipment that will 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 3.4-11 lists typical maximum construction equipment noise levels (L_{max}) recommended for use in noise impact assessments based on a distance of 50 feet between the equipment and a noise receiver.

Table 3.4-11 Typical Construction Equipment Noise Levels

Equipment Description	Spec 721.560[1] L_{max} at 50 feet	Actual Measured[2] L_{max} at 50 feet
All Other Equipment > 5 HP	85	85
Auger Drill Rig	85	84
Backhoe	80	78
Crane	85	81
Dozer	85	82
Drill Rig Truck	84	79
Dump Truck	84	76
Excavator	85	81
Flat-Bed Truck	84	74
Front-End Loader	80	79
Grader	85	85
Impact Pile Driver	95	101
Jackhammer	85	89
Man Lift	85	75
Mounted Impact Hammer (hoe ram)	90	90
Paver	85	77
Pickup Truck	55	75
Pneumatic Tools	85	85
Pumps	77	81
Rock Drill	85	81
Roller	85	80
Sand Blasting (single nozzle)	85	96
Scraper	85	84
Shears (on backhoe)	85	96
Slurry Plant	78	78
Slurry Trenching Machine	82	80
Tractor	84	84
Vacuum Excavator (vac-truck)	85	85
Vacuum Street Sweeper	80	82
Impact Pile Driver	95	101

Sources: Federal Transit Administration, 2018; Federal Highway Administration, 2006
[1] Maximum noise levels were developed based on Spec. 721.560 from the Central Artery/Tunnel program to be consistent with the City of Boston's Noise Code for the "Big Dig" project.
[2] The maximum noise level was developed based on the average noise level measured for each piece of equipment during the Central Artery/Tunnel program in Boston, Massachusetts.
Note: The noise levels reported in this table are rounded to the nearest whole number.
HP = horsepower L_{max} = maximum instantaneous noise level Spec = specification

Table 3.4-12 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 reasonable worst-case scenario. As shown in Table 3.4-12, residences and schools within 190 to 317 feet of the construction boundary (without pile driving) would be exposed to noise levels greater than the detailed FRA construction noise criterion of 80 dBA L_{eq} during daytime hours. Residences within 601 to 1,004 feet from 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. Standard daytime classes and activities would not be impacted by nighttime construction activity. If pile driving is required and is conducted simultaneously with other construction, residences and schools within 580 to 603 feet from 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 1,835 to 1,906 feet from 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. All schools within the project vicinity are located beyond 603 feet from the proposed HSR track, except for the University of Antelope Valley (Assessor's Parcel Number 3132-013-005).

Roadway Construction

The proposed Bakersfield to Palmdale Project Section would improve a number of local roadways in the project vicinity. Some roadway improvements are considered minor, while others are considered more extensive, such as grade separations. Below is a list of roadways that would be improved along with the roadway construction noise analysis.

Bakersfield Station—Fresno to Bakersfield (Locally Generated Alternative) Alignment from the Intersection of 34th Street and L Street to Oswell Street

Proposed roadway construction as part of the HSR project would include the interchange at SR 204/F Street. Projected construction traffic volumes would be minimal when compared to existing traffic volumes on affected local streets, and therefore would not result in an audible change in noise.

Roadway construction activity noise levels would be similar to typical noise levels from construction activities for public works projects described in *Fresno to Bakersfield Section Final Supplemental EIR* (Authority 2018). Construction activities would generate noise levels up to 89 dBA L_{eq} at a distance of 50 feet. Residences and schools within 141 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 447 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. Standard daytime classes and activities would not be impacted by nighttime construction activity. Residences and schools within these distances would be impacted by noise generated from construction activities that is greater than the recommended FRA construction noise criteria.

If pile driving is required and if it is conducted simultaneously with operation of other pieces of construction equipment, noise levels would reach up to 96 dBA L_{eq} at a distance of 50 feet. Residences and schools within 316 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 995 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. Residences and schools within these distances would be impacted by noise generated from construction activities that is greater than the recommended FRA construction noise criteria. Details of the roadway construction noise impact analysis are provided in Section 6.4 of the *Fresno to Bakersfield Section Noise and Vibration Technical Report* (Authority 2017a).

Table 3.4-12 Distances to Federal Railroad Administration Noise Impact from Construction Activities for the High-Speed Rail Corridor[1]

Construction Activity	Daytime 80 dBA L_{eq} (feet)				Nighttime 70 dBA L_{eq} (feet)			
	Alternative 1	Alternative 2	Alternative 3	Alternative 5	Alternative 1	Alternative 2	Alternative 3	Alternative 5
Road Crossing Demolition	190–317	190–317	190–317	190–317	601–1,004	601–1,004	601–1,004	601–1,004
Elevated Structure (without pile driving)	148–221	148–221	143–221	143–221	467–698	467–698	454–698	454–698
Elevated Structure (with pile driving)	580–603	580–603	580–603	580–603	1,835–1,906	1,835–1,906	1,835–1,906	1,835–1,906
Structure Demolition	76–132	76	76	76	240–418	240	240	240
Land Clearing	119–128	105–128	105–128	105–128	376–404	332–404	332–404	332–404
Earthmoving	110	265	265	265	348	838	838	838
Tunnels (without blasting)	137	137	137	137	433	433	433	433
Tunnels (with blasting)	286	286	286	286	903	903	903	903
Track At-Grade	92	92	92	92	292	292	292	292
Materials Handling	99	99	99	99	314	314	314	314
Mobilization	176	176	176	176	555	555	555	555
Cut-and-Cover Structures	138	138	138	138	436	436	436	436
Retaining Walls	123	123	123	123	388	388	388	388
Railway Systems	110	110	110	110	348	348	348	348
Demobilization	177	177	177	177	555	555	555	555

Source: California High-Speed Rail Authority, 2017

[1] The numbers presented above are the same for each B-P Build Alternative both with and without the CCNM Design Option or the Refined CCNM Design Option.

dBA = A-weighted decibels

L_{eq} = equivalent continuous sound level

Bakersfield to Palmdale Station Alignment
Below is a list of proposed roadway construction projects as part of the HSR project.

- SR 58 realignment
- Sierra Highway realignment
- Grade separations in Lancaster and Palmdale
- Intersection modifications in Tehachapi, Lancaster, and Palmdale

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 project vicinity. Projected construction traffic volumes would be minimal when compared to existing traffic volumes on affected local streets and therefore would not result in an audible change in noise.

Roadway construction activity would be similar to typical noise levels from construction activities for public works projects, as described Table 3.4-13. As shown in Table 3.4-13, construction activities would generate noise levels up to 89 dBA L_{eq} at a distance of 50 feet. Residences and schools within 141 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 446 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. Standard daytime classes and activities would not be impacted by nighttime construction activity.

Table 3.4-13 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 decibels L_{eq} = equivalent continuous sound level

If pile driving is required for the grade separation projects, and if it is conducted simultaneously with operation of other pieces of construction equipment, noise levels would reach up to 96 dBA L_{eq} at a distance of 50 feet. Residences and schools within 315 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 995 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. Residences and schools within these distances would be exposed to noise generated from construction activities that is greater than the recommended FRA construction noise criteria.

As discussed in Section 3.4.4.2, IAMFs are incorporated as part of the proposed project design to help avoid and minimize impacts. NV-IAMF#1 would provide a significant reduction in noise and vibration impacts. NV-IAMF#1 requires that the contractor 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 when work is conducted within 1,000 feet of sensitive receivers. However, impacts may still occur as a result of construction noise and vibration activities. To further reduce potential impacts, additional mitigation measures may be needed. These mitigation measures are described in Section 3.4.7.

Stations

Bakersfield Station—Fresno to Bakersfield (Locally Generated Alternative) Alignment from the Intersection of 34th Street and L Street to Oswell Street

Construction of the F-B LGA is anticipated to take approximately 35 months to complete. The list of construction equipment for the Bakersfield Station is provided in Appendix C of the *Bakersfield to Palmdale Project Section Noise and Vibration Technical Report* (Authority 2018). Construction crew commutes and the transport of construction equipment and materials to the project 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 each construction phase, and would not add to the daily traffic volumes in the project vicinity. However, the projected construction traffic volume would be minimal when compared to existing traffic volumes on affected local streets and the change in noise would not be audible.

Assuming a small set of construction equipment that would operate simultaneously as a reasonable worst-case scenario, the reasonable 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 112 feet from 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 a distance of 353 feet from 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. Standard daytime classes and activities would not be impacted by nighttime construction activity. Schools within these distances from the construction boundary would be impacted by noise generated from construction-related activities that is greater than the recommended detailed FRA construction noise criteria.

Palmdale Station

Construction crew commutes and the transport of construction equipment and materials to the project site would be similar to the F-B LGA, as discussed above, and 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 project vicinity. However, the projected construction traffic volume would be minimal when compared to existing traffic volumes on affected local streets, and the change in noise would not be audible.

Assuming a small set of construction equipment that would operate simultaneously as a reasonable worst-case scenario, the reasonable worst-case composite noise level during this phase of construction would be 88 dBA L_{eq} at a distance of 50 feet from the construction boundary. Residences and schools within a distance of 119 feet from 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 a distance of 376 feet from 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. Standard daytime classes and activities would not be impacted by nighttime construction activity. Residences and schools within these distances from the construction boundary would be impacted by noise generated from construction-related activities that is greater than the recommended detailed FRA construction noise criteria.

Maintenance-of-Way Facilities

Lancaster North A and North B Sites

The list of construction equipment for the co-located LMF/MOWF is provided in Table C-9 in Appendix C of the *Bakersfield to Palmdale Project Section Noise and Vibration Technical Report* (Authority 2018). Construction crew commutes and the transport of construction equipment and materials to the project 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 each construction phase and would not add to the daily traffic volumes in the project vicinity. However, 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.

Assuming a small set of construction equipment that would operate simultaneously as a reasonable worst-case scenario, the reasonable worst-case composite noise level during this phase of construction would be 88 dBA L_{eq} at a distance of 50 feet from the construction boundary. Residences and schools within a distance of 114 feet from 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 a distance of 360 feet from 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. Standard daytime classes and activities would not be impacted by nighttime construction activity. Residences and schools within these distances from the construction boundary would be impacted by noise generated from construction-related activities that is greater than the recommended detailed FRA construction noise criteria. There are two existing residences within 360 feet of the proposed co-located LMF/MOWF. However, these two existing residences would be fully acquired as part of the proposed project under all Build Alternatives. No noise impacts from short-term construction of the co-located LMF/MOWF would occur, and no mitigation measures are required.

Avenue M

The list of construction equipment for the LMF is provided in Table C-9 in Appendix C of the *Bakersfield to Palmdale Project Section Noise and Vibration Technical Report* (Authority 2018). Construction crew commutes and the transport of construction equipment and materials to the project 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 each construction phase, and would not add to the daily traffic volumes in the project vicinity. However, 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.

Assuming a small set of construction equipment that would operate simultaneously as a reasonable worst-case scenario, the reasonable 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 114 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 360 feet from the construction boundary would be exposed to noise levels greater than 70 dBA L_{eq} during nighttime hours. Standard daytime classes and activities would not be impacted by nighttime construction activity. There are 10 noise-sensitive receivers within 360 feet from the proposed LMF. However, these 10 existing noise-sensitive receivers would be fully acquired as part of the proposed project under all B-P Build Alternatives. No noise impacts from short-term construction of the LMF would occur under all B-P Build Alternatives, and no mitigation measures are required.

Traction Power Substations

Bakersfield Station—Fresno to Bakersfield (Locally Generated Alternative) Alignment from the Intersection of 34th Street and L Street to Oswell Street

Information about the TPSS is provided in the *Fresno to Bakersfield Section Noise and Vibration Technical Report* (Authority 2017a). The list of construction equipment for the TPSS is provided in Table C-10 in Appendix C of the *Bakersfield to Palmdale Project Section Noise and Vibration Technical Report* (Authority 2018) 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.

Assuming a small set of construction equipment that would operate simultaneously as a reasonable worst-case scenario, the reasonable worst-case composite noise level during this phase of construction would be 90 dBA L_{eq} at a distance of 50 feet from the construction boundary. Residences and schools within a distance of 154 feet from 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 a distance of 486 feet from 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. Standard daytime classes and activities would not be impacted by nighttime construction activity. Residences and schools within these distances

from the construction boundary would be impacted by noise generated from construction-related activities that is greater than the recommended FRA construction noise criteria.

Bakersfield to Palmdale (between Station Areas) Alignment

The list of construction equipment for the TPSS is provided in Appendix C of the *Bakersfield to Palmdale Project Section Noise and Vibration Technical Report* (Authority 2018). Construction crew commutes and the transport of construction equipment and materials to the project 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 each construction phase, and would not add to the daily traffic volumes in the project vicinity. However, 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.

Assuming a small set of construction equipment that would operate simultaneously as a reasonable worst-case scenario, the reasonable worst-case composite noise level during this phase of construction would be 90 dBA L_{eq} at a distance of 50 feet from the construction boundary. Residences and schools within a distance of 133 feet from 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 a distance of 421 feet from 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. Standard daytime classes and activities would not be impacted by nighttime construction activity. Residences and schools within these distances from the construction boundary would be impacted by noise generated from construction-related activities that is greater than the recommended detailed FRA construction noise criteria.

Palmdale Station Alignment

The construction of the TPSS would be similar to the Bakersfield to Palmdale Project Section (Between Station Areas) alignment.

Electric Power Utility Improvements

Construction crew commutes and the transport of construction equipment and materials to the project 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 each construction phase, and would not add to the daily traffic volumes in the project vicinity. However, 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.

Assuming a dozer, drill rig, flatbed truck, crane, and concrete mixer truck would be used to perform electric power utility improvements and would operate simultaneously as a reasonable worst-case scenario, the reasonable 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 the detailed FRA construction noise criterion of 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 the detailed FRA construction noise criterion of 70 dBA L_{eq} during nighttime hours. Standard daytime classes and activities would not be impacted by nighttime construction activity. Residences and schools within these distances from the construction boundary would be impacted by noise generated from construction-related activities that is greater than the recommended detailed FRA construction noise criteria.

Construction Impact Summary

The FRA noise criteria are 80 dBA for daytime noise levels for the 8-hour L_{eq}, and 70 dBA for nighttime noise levels. Noise levels from construction of each B-P Build Alternative (including the CCNM Design Option and Refined CCNM Design Option) would exceed these criteria for both daytime and nighttime activities for some sensitive receptors. As shown in Table 3.4-14, depending on the construction phase and the B-P Build Alternative selected, construction would temporarily affect between 1,551 and 1,629 sensitive receptors during daytime hours and between 8,047 and 8,229 sensitive receptors during nighttime hours.

Table 3.4-14 Construction Noise Impact Summary[1,2]

Level of Impact	Alternative 1			Alternative 2			Alternative 3			Alternative 5		
	Cat. 1	Cat. 2	Cat. 3	Cat. 1	Cat. 2	Cat. 3	Cat. 1	Cat. 2	Cat. 3	Cat. 1	Cat. 2	Cat. 3
Daytime												
General Construction	1	665	32	1	654	32	1	666	32	1	737	32
Pile Driving	2	834	23	2	839	23	2	834	23	2	834	23
Roadway Crossing Demolition	–	–	–	–	–	–	–	–	–	–	–	–
Nighttime												
General Construction	2	2,736	76	2	2,718	76	2	2,736	76	2	2,917	76
Pile Driving	3	5,133	98	3	5,176	99	3	5,132	98	3	5,133	98
Roadway Crossing Demolition	–	7	1	–	–	–	–	–	–	–	–	–

Source: California High-Speed Rail Authority, 2019

[1] Combines the receptors from Locally Generated Alternative and Hybrid Alternative along with the Oswell Street to Palmdale Station Alternatives.

[2] The numbers presented above are the same for each B-P Build Alternative both with and without the CCNM Design Option or the Refined CCNM Design Option.

Cat. = Category

CEQA Conclusion

Even with implementation of the above-stated IAMF during construction of the proposed project, the construction-related impacts under CEQA would be potentially significant due to the resulting noise levels exceeding the FRA construction noise levels of 80 dBA L_{eq} during daytime hours and 70 dBA L_{eq} during nighttime hours. Therefore, CEQA requires mitigation. Mitigation Measure F-B LGA N&V-MM#1 and N&V-MM#1 would be needed and is described in more detail in Section 3.4.7. With the implementation of F-B LGA N&V-MM#1 and N&V-MM#1, which requires the contractor to prepare a noise monitoring program for Authority approval and requires that construction noise shall not exceed the FRA standards, potential construction noise impacts would be less than significant under CEQA.

Potential noise impacts from short-term construction-related worker commutes and equipment transport would be less than significant under CEQA. Therefore, CEQA does not require mitigation.

Impact N&V #2: Construction Vibration

Rail Corridor Construction

Bakersfield Station—Fresno to Bakersfield (Locally Generated Alternative) Alignment from the Intersection of 34th Street and L Street to Oswell Street

The mobilization, demolition, land clearing, earthmoving, and demobilization phase does not anticipate pile driving, caisson drilling, or bulldozing. Therefore, no vibration impacts would occur under these rail corridor construction phases. However, the road and canal overcrossing phase may require pile driving, and the track construction phase anticipates drilling and may require pile driving. Fragile or historic structures within 77 feet or residential structures within 55 feet of pile driving would experience vibration levels that exceed the construction damage criteria. Vibration

levels generated from pile-driving and bulldozing activities would not result in annoyance or damage to school buildings.

Pile-driving and bulldozing activities within 232 feet and 63 feet, respectively, would result in annoyance for schools. In addition, pile-driving and bulldozing activities within 55 feet and 15 feet, respectively, would result in damage to school buildings. As pile-driving activities associated with rail corridor construction would typically occur at the location of the track structure and would not be near the construction boundary, there are no school buildings within 232 feet of pile-driving activities. Therefore, vibration levels generated from pile-driving activities would not result in annoyance or damage to school buildings. Although bulldozing activities associated with rail corridor construction would occur near the construction boundary, no school buildings are within 63 feet of the construction boundary. Therefore, vibration levels generated from bulldozing would not result in annoyance or damage to school buildings. No vibration impacts from construction-related activities would occur. Detailed rail corridor construction vibration analyses are provided in the *Fresno to Bakersfield Section Noise and Vibration Technical Report* (Authority 2017a).

Bakersfield to Palmdale Station Alignment

The damage criteria were used to evaluate potential vibration impacts from construction of the proposed project. The potential vibration impacts are associated with all four alternatives as well as the CCNM Design Option and the Refined CCNM Design Option. During construction of the HSR project, 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 levels for various pieces of construction equipment, which are listed in Table 3.4-15. Table 3.4-15 shows the peak particle velocity in inches per second and the corresponding root-mean-square velocity level (L_v) 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 (inches per second)	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 inch per second
Lv = RMS velocity level RMS = root-mean-square
PPV = peak particle velocity VdB = vibration velocity decibels

Based on the equations provided below, 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 3.4-5 and are shown in Table 3.4-16. In addition, the distances within which the damage criteria of 0.12 peak particle velocity (inches per second) for buildings that are extremely susceptible to vibration damage and the damage criteria of 0.20 peak particle velocity (inches per second) for buildings constructed of non-engineered timber and masonry were calculated and 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.

$$PPV_{equip} = PPV_{ref} \times \left(\frac{25}{D}\right)^{1.5}$$

and

$$L_v(D) = L_v(25ft) - 30\log\left(\frac{D}{25}\right) \; L_v(D) = L_v(25ft) - 30\log\left(\frac{D}{25}\right)$$

Table 3.4-16 Distances to Construction Vibration Annoyance Criteria

Construction Equipment	Vibration Source Level (approximate L_v at 25 feet)	Approximate Vibration Impact Distance to 65 VdB for Category 1[1] Land Use (feet)	Approximate Vibration Impact Distance to 72 VdB for Category 2[2] Land Use (feet)	Approximate Vibration Impact Distance to 75 VdB for Category 3[3] Land Use (feet)
Pile Driver (impact)	104	499	291	232
Caisson Drilling	87	135	79	63
Large Bulldozer	87	135	79	63

Source: California High-Speed Rail Authority, 2019
[1] Category 1 comprises buildings where vibration would interfere with interior operations.
[2] Category 2 comprises residences and buildings where people normally sleep.
[3] Category 3 comprises institutional land uses with primarily daytime use.
Lv = root-mean-square vibration level VdB = vibration velocity decibels

Table 3.4-17 Distances to Construction Vibration Damage Criteria

Source	Vibration Source Level PPV at 25 feet (inches per second)	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

Source: California High-Speed Rail Authority, 2019
[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.
PPV = peak particle velocity

The list of construction equipment for all phases of rail corridor construction is provided in Appendix C of the *Bakersfield to Palmdale Project Section Noise and Vibration Technical Report* (Authority 2018). Because pile driving, caisson drilling, or bulldozing are not anticipated under the mobilization, demolition, land clearing, earthmoving, and demobilization phase, no vibration impacts would occur under these phases.

Pile driving may be required during the road and canal overcrossing and track construction (at-grade track, elevated track, and elevated structure) phase. Land uses within the distances of road and canal overcrossing construction activities shown in Table 3.4-16 would experience annoyance or interference with vibration-sensitive activities. In addition, as shown in Table 3.4-17, fragile or historic structures within 77 feet or residential structures within 55 feet of pile driving would experience vibration levels that exceed the construction damage criteria. Because vibration-sensitive structures are within the distances mentioned above from rail corridor construction that would exceed the construction damage criteria, potential vibration impacts would occur. However, the implementation of Mitigation Measure N&V-MM#2, which requires the use of alternative methods to pile driving, such as cast-in-drilled-holes, would reduce potential vibration impacts.

As shown in Table 3.4-16, pile-driving and bulldozing activities within 232 feet and 63 feet, respectively, would result in annoyance for schools. Table 3.4-17 shows that pile-driving and bulldozing activities within 55 feet and 15 feet, respectively, would result in damage to school buildings. As pile-driving activities associated with rail corridor construction would typically occur at the location of the track structure and would not be located near the construction boundary, there are no school buildings within 232 feet of pile-driving activities. Therefore, vibration levels generated from pile-driving activities would not result in annoyance or damage to school buildings. Although bulldozing activities associated with rail corridor construction would occur near the construction boundary, no school buildings are within 63 feet of the construction boundary. Therefore, vibration levels generated from bulldozing would not result in annoyance or damage to school buildings. No vibration impacts from construction-related activities would occur at schools.

Roadway Construction

Bakersfield Station—Fresno to Bakersfield (Locally Generated Alternative) Alignment from the Intersection of 34th Street and L Street to Oswell Street

Bulldozing associated with roadway construction would occur near the construction boundary. As schools, residences, and other noise-sensitive land uses would be within 63 to 135 feet of bulldozing, vibration levels generated from bulldozing would result in annoyance. However, schools and residences would not be within 15 feet of bulldozing, and fragile or historic structures would not be within 20 feet of bulldozing that would result in building damage. Therefore, no vibration impacts would occur from vibration levels generated by bulldozing activities.

In addition, pile driving associated with roadway construction would typically occur at the location of the roadway structure and would not be near the construction boundary. As schools, residences, and other noise-sensitive land uses would be within 232 to 499 feet of pile driving, vibration levels generated from pile driving would result in annoyance. However, schools and residences would not be within 55 feet of pile driving, and fragile or historic structures would not be within 77 feet of pile driving that would result in building damage. Therefore, no vibration impacts would occur from vibration levels generated by pile-driving activities. Details of the roadway construction vibration impact analysis are provided in Section 6.5 of the *Fresno to Bakersfield Section Noise and Vibration Technical Report* (Authority 2017a).

Bakersfield to Palmdale Station Alignment

Roadway construction would likely use a bulldozer and may require the use of pile drivers. The potential vibration impacts are associated with all four B-P Build Alternatives. Land uses within the distances shown in Table 3.4-16 for bulldozing and pile driving would experience annoyance or interference with vibration-sensitive activities. In addition, land uses within the distances shown in Table 3.4-17 for bulldozing and pile driving would damage building structures. Bulldozing associated with roadway construction would occur near the construction boundary. As schools, residences, and other noise-sensitive land uses would be within 63 to 135 feet of bulldozing, vibration levels generated from bulldozing would result in annoyance. However, schools and residences would not be within 15 feet of bulldozing driving, and fragile or historic structures would not be within 20 feet of bulldozing that would result in building damage. Therefore, no vibration impacts would occur from vibration levels generated by bulldozing activities.

In addition, pile driving associated with roadway construction would typically occur at the of the roadway structure and would not be near the construction boundary. As schools, residences, and

other noise-sensitive land uses would be within 232 to 499 feet of pile driving, vibration levels generated from pile driving would result in annoyance. However, schools and residences would not be within 55 feet of pile driving and fragile or historic structures would not be within 77 feet of pile driving that would result in building damage. No vibration impacts would occur from vibration levels generated by pile-driving activities.

Station

Bakersfield Station—Fresno to Bakersfield (Locally Generated Alternative) Alignment from the Intersection of 34th Street and L Street to Oswell Street

The list of construction equipment for the Bakersfield Station—F-B LGA is provided in Table C-11 in Appendix C of the *Bakersfield to Palmdale Project Section Noise and Vibration Technical Report* (Authority 2018). Drilling and pile driving are not anticipated under this phase. However, bulldozing is anticipated, and land uses within the distances shown in Table 3.4-16 would experience annoyance or interference with vibration-sensitive activities. In addition, as shown in Table 3.4-17, fragile or historic structures within 20 feet, or residential structures within 15 feet of bulldozing activities, would experience vibration levels that exceed the construction damage criteria. No residential or fragile structures are within 79 feet of the construction boundary of the proposed F-B LGA. Construction of the proposed F-B LGA would not result in annoyance or damage to residential or fragile structures, and no vibration impacts from construction-related activities would occur.

As all schools within the project vicinity would be more than 63 feet from the construction boundary of the proposed F-B LGA, construction-related vibration levels would not result in annoyance or damage to school structures. No vibration impacts from construction-related activities would occur.

Palmdale Station

Vibration levels generated for construction of the proposed Palmdale Station would be similar to the F-B LGA as discussed above. No residential or fragile structures are within 79 feet of the construction boundary of the proposed Palmdale Station. Therefore, construction of the proposed Palmdale Station would not result in annoyance or damage to residential or fragile structures, and no vibration impacts from construction-related activities would occur.

As all schools within the project vicinity would be more than 63 feet from the construction boundary of the proposed Palmdale Station, construction-related vibration levels would not result in annoyance or damage to school structures. No vibration impacts from construction-related activities would occur.

Maintenance-of-Way Facilities

Lancaster North A and North B Sites

The list of construction equipment for the proposed co-located LMF/MOWF is provided in Table C-9 in Appendix C of the *Bakersfield to Palmdale Project Section Noise and Vibration Technical Report* (Authority 2018). Because pile driving, caisson drilling, and bulldozing are not anticipated, no vibration impacts from short-term construction of the proposed co-located LMF/MOWF would occur.

In addition, because construction of the proposed co-located LMF/MOWF does not anticipate pile driving, caisson drilling, or bulldozing, construction-related vibration levels would not result in annoyance or damage to school structures. No vibration impacts from construction-related activities would occur.

Avenue M

The list of construction equipment for the proposed LMF is provided in Table C-9 in Appendix C of the *Bakersfield to Palmdale Project Section Noise and Vibration Technical Report* (Authority 2018). Because pile driving, caisson drilling, and bulldozing are not anticipated, no vibration impacts from short-term construction of the proposed LMF would occur.

In addition, because the construction plan for the LMF does not anticipate pile driving, caisson drilling, or bulldozing, construction-related vibration levels would not result in annoyance or damage to school structures. No vibration impacts from construction-related activities would occur.

Traction Power Substations

Bakersfield Station—Fresno to Bakersfield (Locally Generated Alternative) Alignment from the Intersection of 34th Street and L Street to Oswell Street

Information about the TPSS is provided in the *Fresno to Bakersfield Section Noise and Vibration Technical Report* (Authority 2017a). Because pile driving, caisson drilling, and bulldozing are not anticipated, no vibration impacts would occur.

In addition, because the construction plan for the proposed TPSS does not anticipate pile driving, caisson drilling, or bulldozing, construction-related vibration levels would not result in annoyance or damage to school structures. No vibration impacts from construction-related activities would occur.

Bakersfield to Palmdale Station Alignment

The list of construction equipment for the TPSS is provided in Table C-10 in Appendix C of the *Bakersfield to Palmdale Project Section Noise and Vibration Technical Report* (Authority 2018). Because pile driving, caisson drilling, and bulldozing are not anticipated, no vibration impacts would occur.

In addition, as the construction plan for the proposed TPSS does not anticipate pile driving, caisson drilling, or bulldozing, construction-related vibration levels would not result in annoyance or damage to school structures. No vibration impacts from construction-related activities would occur.

Electric Power Utility Improvements

Electric power utility improvements would require the use of drilling and bulldozing, and land uses within the distances shown in Table 3.4-16 would experience annoyance or interference with vibration-sensitive activities. In addition, as shown in Table 3.4-17 fragile or historic structures within 20 feet, or residential structures within 15 feet of drilling or bulldozing activities, would experience vibration levels that exceed the construction damage criteria. Therefore, if land uses are within the distances shown in Table 3.4-16, potential vibration impacts from construction of the proposed electric power utility improvements would occur. However, the implementation of Mitigation Measures F-B LGA N&V-MM#2 and N&V-MM#2, which requires the use of alternative methods to pile driving, such as cast-in-drilled-holes, would reduce potential vibration impacts.

As all schools within the project vicinity would be more than 63 feet from the construction of the proposed electric power utility improvements, construction-related vibration levels would not result in annoyance or damage to school structures. No vibration impacts from construction-related activities would occur.

CEQA Conclusion

Even with implementation of the above-stated IAMF during construction of the proposed project, the impact under CEQA would be potentially significant should vibration levels exceed the annoyance criteria presented in Table 3.4-16. Therefore, CEQA requires mitigation. Mitigation Measures F-B LGA N&V-MM#2 and N&V-MM#2 would be needed and is described in more detail in Section 3.4.7. With the implementation of F-B LGA N&V-MM#2 and N&V-MM#2, which requires the use of alternative methods to pile driving (e.g., cast-in-drilled-holes) during construction of the proposed project, the impact under CEQA would be less than significant. No impacts related to potential vibration damage are expected.

Operations Impacts

Operation of the proposed project would include inspection and maintenance along the track and railroad right-of-way, as well as on the structures, fencing, power system, and train control, electric interconnection, and communications facilities. Chapter 2, Alternatives, more fully describes operations and maintenance of the B-P Build Alternatives.

Impact N&V #3: Moderate and Severe Noise Impacts from Project Operation to Sensitive Receivers

Table 3.4-18 summarizes the operational parameters used to model future with-project noise levels. These parameters were provided by the Authority's environmental program manager. This data includes 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 at-grade and aerial portions of the project alignment. 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 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. In order to conduct a conservative analysis, the speed of the trains was assumed to be 220 mph along the entire project corridor for all trains even though trains would reduce their speed when approaching or departing from stations or may have designated reduced speeds at certain sections of the alignment.

Table 3.4-18 High-Speed Rail 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	188
Number of Nighttime Operations	37
Number of Peak-Hour Trains	24
Maximum Speed	220 mph
Track Geometry	Two-track; 16.5 feet on center
Geometric Cross-Sections	Two types: at-grade and aerial
Near Track to Noise Barrier—At-Grade	21.5 feet
Near Track to Noise Barrier—Aerial	15.5 feet

mph = miles per hour

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.

Any changes to the speeds of the modeled operations will result in a change in the corresponding noise impacts. It is assumed that the HSR track would be constructed of ballast and slab track with continuous welded rail, which is consistent with the assumptions in the FRA 2012 guidance

manual and allows for a conservative assessment. If slab construction would be used for structures exceeding 1,000 feet in length and where operating speeds are planned for 220 mph operations, noise emanating from trains operating on a slab-track system would be approximately 3 dB louder than trains operating on a ballast-and-tie track system because of the decreased acoustic absorption compared to that provided by the ballast and changes to the track stiffness.

The projected HSR noise levels were calculated at each noise measurement location along the project alignment using the operational assumptions listed above. The calculated noise levels were then compared to the measured noise levels at each location, and the moderate impact and severe impact distances were determined. Noise modeling projections do not include the effects of atmospheric absorption. However, using atmospheric absorption of sound based on the International Organization for Standardization's ISO 9613-2 would result in an additional 1 dBA drop in noise level per 1,000 feet from the alignment.

A detailed noise impact analysis was conducted for the proposed project using the FRA methodology. Noise impacts using the FRA methodology are determined by the increase in noise exposure levels attributed to the proposed project based on the existing noise environment. Figure 3.4-1, taken from the FRA's *High-Speed Ground Transportation Noise and Vibration Impact Assessment* (2012), shows the FRA's noise impact criteria for the proposed project. As shown on Figure 3.4-1, the noise criteria and noise descriptor depend on the land use. In addition, noise impacts are classified as "no impact," "moderate impact," or "severe impact."

Bakersfield Station—Fresno to Bakersfield (Locally Generated Alternative) Alignment from the Intersection of 34th Street and L Street to Oswell Street

A preliminary noise impact analysis conducted for the long-term and short-term measurement locations to show potential noise impacts within the project vicinity is provided in the *Fresno to Bakersfield Section Noise and Vibration Technical Report* (Authority 2017a). The measured existing noise level and the project noise levels were used to determine the total noise level and the project-related noise level increase at each measurement location.

A noise impact analysis was conducted for all noise-sensitive receivers within the project vicinity. Details of the noise impact analysis for all noise-sensitive receivers are also provided in the *Fresno to Bakersfield Section Noise and Vibration Technical Report* (Authority 2017a). Table 3.4-19 summarizes the results of the noise impact analysis by reporting the number of impacted noise-sensitive receivers based on their land use category and their noise impact classification (either moderate or severe impacts). Figures 3.4-B-2 through 3.4-B-5 in Appendix 3.4-A show land use category 2 noise-sensitive receivers under Alternatives 1, 2, 3, and 5, respectively. Figures 3.4-B-6 through 3.4-B-9 show land use categories 1 and 3 noise-sensitive receivers under Alternatives 1, 2, 3, and 5, respectively. Table D-1 in Appendix D in the *Bakersfield to Palmdale Project Section Noise and Vibration Technical Report* (Authority 2018) provides an inventory of the severely impacted receivers. The implementation of Mitigation Measure F-B LGA N&V-MM#3 would reduce project noise impacts.

Table 3.4-19 Noise Impact Summary without Mitigation—Fresno to Bakersfield (Locally Generated Alternative)

Level of Impact	Category 1		Category 2			Category 3			
	Recording Studio	Concert Hall	Residential	Hospital	Other[1]	School	Church	Park	Other[2]
Severe	2	0	2,726	1	8	3	7	4	7
Moderate	1	0	4,509	0	1	13	21	1	10

Source: California High-Speed Rail Authority, 2017

[1] Other category 2 land uses include two homeless shelters and seven hotels.

[2] Other category 3 land uses include one prison/correctional facility, one disability services, one day care, two theaters, two mortuaries, two museums, and 8 meeting halls.

Schools

More detailed impact information on schools within 2,500 feet of the HSR alignment is provided in Table 3.4-20. As shown in Table 3.4-20, of the 17 schools within 2,500 feet of the Noise RSA, 3 schools would experience a severe or moderate noise impact. The implementation of Mitigation Measure F-B LGA N&V-MM#3 would reduce project noise impacts.

Table 3.4-20 Impact on Schools—Fresno to Bakersfield (Locally Generated Alternative)

School Name	Existing Noise Exposure (dBA L_{eq})	Total Noise Level Unmitigated (dBA L_{eq})	FRA Manual Impact Rating (No Mitigation)
Williams Elementary School	55	62	Moderate
Bakersfield Adult School	64	67	Moderate
International S Sikaran Academy	64	67	Moderate
Amerillo College – Hairdressing	64	68	Moderate
Lyles College of Beauty	64	68	Moderate
Valley Oaks Charter School	55	70	Severe
Stella Hills Elementary	59	62	None
Summit Bible College	62	69	Moderate
University of La Verne	60	67	Moderate
Blanton Center	58	63	Moderate
Bakersfield Play Center	55	69	Severe
Owens Intermediate School	55	66	Moderate
Mt Vernon Elementary	60	65	Moderate
Bethel Christian School	60	71	Severe
Head Start	60	68	Moderate
Sierra Middle School	61	68	Moderate
Ramon Garza Elementary	61	68	Moderate

Source: California High-Speed Rail Authority, 2017
dBA = A-weighted decibels FRA = Federal Railroad Administration L_{eq} = equivalent continuous sound level

Nuestra Señora Reina de La Paz/César E. Chávez National Monument (La Paz)

La Paz, at 29700 Woodford-Tehachapi Road in Keene, is listed on the National Register of Historic Places. As part of the Section 106 consultation for the Bakersfield to Palmdale Project Section, potential alignment refinements were considered and their respective noise impacts were analyzed. As part of that consultation, a noise reduction measure in the form of a track-side barrier was analyzed at a height of 12 feet for both the CCNM Design Option and the Refined CCNM Design Option and a no impact determination was made for La Paz under both design options. For the other B-P Build Alternatives, La Paz would be severely impacted from operations associated with the HSR project. In order to reduce noise impacts on La Paz, noise mitigation in the form of a sound barrier along the edge of track would be implemented to reduce noise levels to a no-impact classification. The necessary height to meet the desired reduction is 12 feet. Because this barrier was incorporated to minimize impacts on a historic property, it is not required to meet the minimum selection criteria for a sound barrier as presented in N&V-MM#3.

Bakersfield to Palmdale Station Alignment

A preliminary noise impact analysis was conducted for the long-term and short-term measurement locations to show potential noise impacts within the project vicinity. The measured existing noise level and the project noise levels were used to determine the total noise level and the project-related noise level increase at each measurement location. Tables 6-21 through 6-24 in the *Bakersfield to Palmdale Project Section Noise and Vibration Technical Report* (Authority

2018) show the results of the impact analysis for the long-term and short-term measurement locations under Alternatives 1, 2, 3, and 5, respectively, along with the various parameters used to determine the noise impact. These parameters include the track elevation, receiver base elevation, land use, land use category, existing noise level, project noise level unmitigated, total noise level unmitigated, noise level increase, and FRA impact. The noise levels shown in Tables 6-21 through 6-24 in the *Bakersfield to Palmdale Project Section Noise and Vibration Technical Report* (Authority 2018) are described in terms of either 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}. The existing noise level, project noise level (unmitigated), and total noise level (unmitigated) were rounded to the nearest whole number. Tables 6-21 through 6-24 in the *Bakersfield to Palmdale Project Section Noise and Vibration Technical Report* (Authority 2018) also provide the calculated distances to the severe and moderate impacts for each measurement location for generalization purposes.

A noise impact analysis was then conducted for all noise-sensitive receivers within the project vicinity. The existing noise levels at noise-sensitive receivers were established using the representative long-term and short-term measurement results. The existing noise levels for some of the noise-sensitive receivers were averaged from the long-term and short-term noise level measurements to obtain a general background noise level for areas that would have similar noise environments. The project noise levels were calculated at each noise-sensitive receiver location to determine the total noise level and the project-related noise level increase.

Table 3.4-21, Table 3.4-22, Table 3.4-23, and Table 3.4-24 summarize the results of the noise impact analysis by reporting the number of impacted noise-sensitive receivers based on their land use category and their noise impact classification (either moderate or severe impacts) for Alternatives 1,2, 3, and 5, respectively. Figures 3.4-B-2 through 3.4-B-5 in Appendix 3.4-A of this EIR/EIS show land use category 2 noise-sensitive receivers under Alternatives 1, 2, 3, and 5, respectively. Figures 3.4-B-6 through 3.4-B-9 show land use categories 1 and 3 noise-sensitive receivers under Alternatives 1, 2, 3, and 5, respectively. Tables D-3 through D-6 in Appendix D in the *Bakersfield to Palmdale Project Section Noise and Vibration Technical Report* (Authority 2018) provides an inventory of the severely impacted receivers for Alternatives 1, 2, 3, and 5, respectively. The implementation of Mitigation Measure N&V-MM#3 would reduce project noise impacts.

Table 3.4-21 Noise Impact Summary without Mitigation—Alternative 1—Bakersfield to Palmdale (between Station Areas)

Level of Impact	Category 1		Category 2			Category 3			
	Recording Studio	Concert Hall	Residential	Hospital	Other[1]	School	Church	Park	Other[2]
Severe	0	0	1,845	0	7	1	2	0	2
Moderate	1	0	3,577	0	4	8	11	4	4

Source: California High-Speed Rail Authority, 2017a
[1] Other category 2 land uses include 1 homeless shelter and 10 hotels.
[2] Other category 3 land uses include one club, three meeting halls, and two museums.

Table 3.4-22 Noise Impact Summary without Mitigation—Alternative 2—Bakersfield to Palmdale (between Station Areas)

Level of Impact	Category 1		Category 2			Category 3			
	Recording Studio	Concert Hall	Residential	Hospital	Other[1]	School	Church	Park	Other[2]
Severe	0	0	1,803	0	7	1	2	0	2
Moderate	1	0	3,622	0	4	8	11	4	4

Source: California High-Speed Rail Authority, 2017a
[1] Other category 2 land uses include 1 homeless shelter and 10 hotels.
[2] Other category 3 land uses include one club, three meeting halls, and two museums.

Table 3.4-23 Noise Impact Summary without Mitigation—Alternative 3—Bakersfield to Palmdale (between Station Areas)

Level of Impact	Category 1		Category 2			Category 3			
	Recording Studio	Concert Hall	Residential	Hospital	Other[1]	School	Church	Park	Other[2]
Severe	0	0	1,843	0	7	1	2	0	2
Moderate	1	0	3,577	0	4	8	11	4	4

Source: California High-Speed Rail Authority, 2017a
[1] Other category 2 land uses include 1 homeless shelter and 10 hotels.
[2] Other category 3 land uses include one club, three meeting halls, and two museums.

Table 3.4-24 Noise Impact Summary without Mitigation—Alternative 5—Bakersfield to Palmdale (between Station Areas)

Level of Impact	Category 1		Category 2			Category 3			
	Recording Studio	Concert Hall	Residential	Hospital	Other[1]	School	Church	Park	Other[2]
Severe	0	0	1,943	0	4	1	3	0	2
Moderate	1	0	3,645	0	3	8	11	3	5

Source: California High-Speed Rail Authority, 2017a
[1] Other category 2 land uses include one homeless shelter and six hotels.
[2] Other category 3 land uses include one club, one library, three meeting halls, and two museums.

Schools

More detailed impact information on schools within 2,500 feet of the HSR alignment is provided in Table 3.4-25. As shown in Table 3.4-25, of the 22 schools within 2,500 feet of the Noise RSA, 1 school would experience a severe noise impact under all B-P Build Alternatives (Alternatives 1, 2, 3, and 5). Eight schools would experience a moderate noise impact under Alternatives 1, 2, and 3 while 9 schools would experience a moderate noise impact under Alternative 5. In addition, 13 schools would experience a moderate noise impact under Alternatives 1, 2, and 3 while 12 schools would experience a moderate noise impact under Alternative 5. The implementation of Mitigation Measure N&V-MM#3 would reduce project noise impacts.

Palmdale Station Area

A preliminary noise impact analysis was conducted for the long-term and short-term measurement locations to show potential noise impacts. The measured existing noise level and the project noise levels were used to determine the total noise level and the project-related noise level increase at each measurement location. Table 3.4-25 summarizes the results of the noise impact analysis by reporting the number of impacted noise-sensitive receivers based on their land use category and their noise impact classification (either moderate or severe impacts). Figures 3.4-B-2 through 3.4-B-5 in Appendix 3.4-A show land use category 2 noise-sensitive receivers. Figures 3.4-B-6 through 3.4-B-9 show land use categories 1 and 3 noise-sensitive receivers. The implementation of Mitigation Measure N&V-MM#3 would reduce project noise impacts.

Schools

As shown in Table 3.4-26, HSR system operations would not result in impacts on schools. No mitigation measures are required.

Table 3.4-25 Impact on Schools—Bakersfield to Palmdale (between Station Areas)

School Name	Existing Noise Exposure (dBA L_{eq})	Alternatives 1 & 3 Total Noise Level Unmitigated (dBA L_{eq})	Alternative 2 Total Noise Level Unmitigated (dBA L_{eq})	Alternative 5 Total Noise Level Unmitigated (dBA L_{eq})	Alternatives 1 & 3 FRA Manual Impact Rating (No Mitigation)	Alternative 2 FRA Manual Impact Rating (No Mitigation)	Alternative 5 FRA Manual Impact Rating (No Mitigation)
University of Antelope Valley	58.6	66.0	66.0	--[1]	Mod	Mod	Mod
Penny Lane Center	53.3	67.2	67.2	67.2	Severe	Severe	Severe
Pioneer Drive Elementary School	66.3	66.5	66.5	66.5	None	None	None
Ruggenberg Career Center	52.1	63.5	63.5	63.5	Mod	Mod	Mod
Virginia Avenue Elementary	63.5	64.7	64.7	64.7	None	None	None
Foothill High School	65.3	67.5	67.5	67.5	None	None	None
Edison Middle School	70.6	72.8	72.4	72.8	None	None	None
Mariposa Elementary School	49.2	58.9	58.9	59.3	Mod	Mod	Mod
Lancaster University Center	58.3	64.3	64.3	64.3	Mod	Mod	Mod
Antelope Valley High School	66.6	66.8	66.8	66.8	None	None	None
Sacred Heart School	57.9	62.5	62.5	63.1	None	None	Mod
Global Citizen Kids Preschool Academy	61.2	64.7	64.7	65.3	None	None	None
Lancaster School District	61.2	63.4	63.4	63.7	None	None	None
Antelope Valley Adventist School	59.6	64.5	64.5	64.8	Mod	Mod	Mod
Desert Montessori Academy	58.8	60.1	60.1	60.2	None	None	None
Assistance League of Antelope Valley	58.8	59.7	59.7	59.7	None	None	None
Lancaster Alternative and Virtual Academy	54.0	56.5	56.5	56.6	None	None	None
Lancaster Christian School	54.0	62.8	62.8	63.6	Mod	Mod	Mod
Joshua Elementary School	53.0	59.7	59.7	59.7	None	None	None
Gorman Learning Center	78.9	79.5	79.5	79.5	Mod	Mod	Mod
Assurance Learning Center	78.9	79.5	79.5	79.5	Mod	Mod	Mod
Charter College	78.9	79.3	79.3	79.3	None	None	None

[1] The University of Antelope Valley would be fully acquired as part of Alternative 5.
dBA = A-weighted decibels
FRA = Federal Railroad Administration
L_{eq} = equivalent continuous sound level

Table 3.4-26 Noise Impact Summary—Bakersfield to Palmdale (between Station Areas)

Level of Impact	Category 1		Category 2			Category 3			
	Recording Studio	Concert Hall	Residential	Hospital	Other[1]	School	Church	Park	Other
Severe	0	0	122	0	0	0	0	0	0
Moderate	0	0	43	0	0	0	0	0	0

Source: California High-Speed Rail Authority, 2017

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

As discussed in the *Bakersfield to Palmdale Project Section Noise and Vibration Technical Report* (Authority 2018: page 6-47), 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. Noise-sensitive human receivers within 90 feet of the track would experience annoyance from onset rates caused by the proposed HSR system. In addition, noise-sensitive human receivers within 45 feet of the track would experience startle effects from onset rates caused by the proposed HSR system. Because there are a number of unresolved issues regarding the application of the U.S. Air Force research (Stusnick et al. 1992) to determine the startle effects of HSR, and without further direction from research, the FRA 2012 guidance manual recommends that sensitive receivers be identified when located in the area where startle effects would occur. As the proposed HSR would be on a viaduct that is more than 50 feet above the ground, people and animals would be more than 45 feet from the HSR track and would not experience startle effect from onset rates caused by the proposed HSR system.

Tunnel Portal Noise

Based on the current tunnel designs, it is anticipated that roughly half of the sound generated in the tunnel would pass out through the 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 is achieved with long, flared portals and low blockage ratios. 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. This tunnel and 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 proposed project to sensitive receivers would be significant under CEQA due to the increase in noise levels over the existing conditions that falls into the severe category in the FRA criteria. Therefore, CEQA requires mitigation. Mitigation Measures F-B LGA N&V-MM#3 through F-B LGA N&V-MM#6 and N&V-MM#3 through N&V-MM#6 would be needed and are described in more detail in Section 3.4.7. Although the implementation of F-B LGA N&V-MM#3 through F-B LGA N&V-MM#6 and N&V-MM#3 through N&V-MM#6 would reduce the proposed project's operational noise impacts, noise impacts as a result of the proposed project would still remain significant under CEQA. The noise barrier analysis in Table 3.4-29, Table 3.4-30, Table 3.4-31, Table 3.4-32, Table 3.4-33, and Table 3.4-34 (provided later in Section 3.4.7.2) shows that even with the implementation of F-B LGA N&V-MM#3 and N&V-MM#3, severe residual impacts would remain.

Impact N&V #4: Noise Effects on Wildlife and Domestic Animals

As discussed in the *Bakersfield to Palmdale Project Section Noise and Vibration Technical Report* (Authority 2018: page 6-47), all domestic and wild birds and mammals near the HSR project railway corridor may be affected by train pass-bys if they are subjected to sound exposure

level values of 100 dBA or higher. Generally, the animals that are of concern are dairy cows, horses, and other farm animals. While it is possible for some animals to become habituated to higher noise levels and exhibit reduced response to noise after prior exposure, there is no developed general criterion level or threshold for habituation. Wildlife responses to noise are species-dependent. Their responses to noise depend upon the same components as any other noise-sensitive receiver, but each animal's responses and thresholds are unique enough that noise standards cannot be established. The duration of the noise, the type of noise, and the level of existing ambient noise weigh differently upon what type of response to expect from individual species. The types and locations of wildlife along the proposed alignment under Alternatives 1, 2, 3, and 5 have been identified within the technical biology studies for the Bakersfield to Palmdale Project Section. One specific use of concern is equestrian use of the Pacific Crest Trail, which would have a crossing underneath the aerial structure of the HSR system. Specific mitigation (N&V-MM#8) has been designed to reduce impacts on equestrian uses on the trail.

The habitat these species may use currently may be disrupted during construction of the HSR system. Some species may choose to leave, while others would remain in close proximity. When these species are within 150 feet of the HSR centerline, the distance to the 100 dBA sound exposure level contour, they may be impacted. Additionally, 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 for unconfined wild animals and livestock due to the ability to avoid ground-borne noise levels by moving away from the track as trains approach, and noise from pass-bys would be short. Confined animals could move away from the tracks in some cases and could become habituated to train noise. Impacts on equestrian activity along the Pacific Crest Trail would become less than significant with the implementation of N&V-MM#8.

Impact N&V #5: Impacts from Project Vibration

The FRA Detailed Vibration Assessment was used to determine potential vibration impacts on vibration-sensitive land uses in the project vicinity from long-term operation of the proposed project. The FRA Detailed Vibration Assessment is utilized in order to get an in-depth analysis.

A transfer mobility test was conducted for each segment of the Bakersfield to Palmdale Project Section to determine the actual transmission characteristics of vibration through the soils along the project right-of-way. Transfer mobility test results were used to develop a better understanding of how vibrations from HSR operations would propagate through different soil types throughout the length of the project section.

Rail Corridor Operation

Bakersfield Station—Fresno to Bakersfield (Locally Generated Alternative) Alignment from the Intersection of 34th Street and L Street to Oswell Street

Table 3.4-27 shows the vibration impact under each land use category from the proposed HSR project. The results show that 14 residential units, 2 hotel/motel uses, and 2 shelters would be impacted. Details of the vibration impact analysis and the transfer of mobility test is provided in Section 6.9 of the *Fresno to Bakersfield Section Noise and Vibration Technical Report* (Authority 2017a). Implementation of Mitigation Measure F-B LGA N&V-MM#5 requires special trackwork and mitigation strategies to reduce operational vibration levels.

Table 3.4-27 Vibration Impacts—Fresno to Bakersfield (Locally Generated Alternative)

Land Use Category 1	Land Use Category 2				Land Use Category 3		
Vibration-Sensitive Buildings	Residential	Hotel/Motel	Hospital	Shelter	School	Church	Park
0	14	2	0	2	0	0	0

Bakersfield to Palmdale Station Alignment

The site-specific details of the transfer mobility tests are presented in Appendix E in the *Bakersfield to Palmdale Project Section Noise and Vibration Technical Report* (Authority 2018). The potential vibration impacts are associated with all four alternatives. The vibration contours are based on the fall-off rate equation determined by the transfer mobility measurements. Details of the transfer of mobility test are provided in Section 6.9.3 of the *Bakersfield to Palmdale Project Section Noise and Vibration Technical Report* (Authority 2018). Table 3.4-28 shows that land use categories 1, 2, and 3, located within a distance of 262 feet, 205 feet, and 77 feet, respectively, from the nearest rail line on at-grade or retained profile, would be impacted by vibration levels generated by the proposed HSR project. When the alignment is on a viaduct or straddle-bent structure, Table 8-2 (page 8-6) of FRA's *High-Speed Ground Transportation Noise and Vibration Impact Assessment* (FRA 2012) indicates that an aerial/viaduct structure reduces vibration levels by approximately 10 VdB. Therefore, land use categories 1, 2, and 3, located within a distance of 77 feet, 61 feet, and 23 feet, respectively, from the nearest rail line on structure profiles, would be impacted by vibration levels generated by the proposed HSR project.

Table 3.4-28 Distances to Vibration Criterion Level Contours—Bakersfield to Palmdale (between Station Areas)

Land Use	Vibration Criterion Level (VdB)	Distance to Vibration Contour (feet)[1]
Category 1—At-Grade/Retained Profile	65	262
Category 2—At-Grade/Retained Profile	72	205
Category 3—At-Grade/Retained Profile	75	77
Category 1—Viaduct/Straddle Bents	65	77
Category 2—Viaduct/Straddle Bents	72	61
Category 3—Viaduct/Straddle Bents	75	23

[1] The distance to vibration criterion was calculated based on the fall-off rate from the transfer of mobility measurements.

Of the 57 vibration-sensitive receivers, 8 receivers would be fully acquired by the proposed project, while the remaining 49 receivers would not be impacted by proposed project under Alternatives 1, 2, and 3. For Alternative 5, of the 60 vibration-sensitive receivers, 10 receivers would be fully acquired by the proposed project, while the remaining 50 receivers would not be impacted. In summary, no vibration-sensitive receivers would be impacted under any B-P Build Alternatives.

Stations, Maintenance and Infrastructure Facilities, Traction Power Substations, and Electric Power Utility Improvements

The long-term operation of the resources listed below would not create any vibration impacts at any receptor, including schools, as no vibration-generating equipment is expected to be used. Therefore, no long-term operational vibration impacts would occur.

- F Street Station
- Palmdale Station
- Co-located LMF/MOWF (also known as the Lancaster North A and North B Sites)
- Avenue M LMF zone
- TPSSs throughout the corridor
- Electric power utility improvements

CEQA Conclusion

Vibration and ground-borne noise impacts resulting from operation of the proposed project would be potentially significant under CEQA due to exceedance of the established vibration annoyance criteria. Therefore, CEQA requires mitigation. Mitigation Measures F-B LGA N&V-MM#5 and N&V-MM#5 would be needed and is described in more detail in Section 3.4.7. With the

implementation of F-B LGA N&V-MM#5 and N&V-MM#5 during operation of the B-P Build Alternatives, which requires the implementation of special types of trackwork to eliminate gaps that would reduce noise levels generated from rail turnouts, the impact under CEQA would be less than significant.

Impact N&V #6: Traffic Noise

The Bakersfield to Palmdale Project Section would increase traffic noise in areas surrounding each HSR stationary facility, including the train station and maintenance facilities. The existing and future traffic volumes with and without the HSR project were used to determine the traffic noise increase, based on the high ridership forecast in 2040 (56.8 million). The average daily traffic (ADT) volumes were used to determine the CNEL change, and the peak-hour traffic volumes were used to determine the L_{eq} change. The potential traffic noise impacts are associated with all four alternatives.

Traffic in the City of Bakersfield

The traffic analysis completed for the F-B LGA alignment provided a traffic noise analysis for Bakersfield. Details of the traffic noise analysis in Bakersfield are provided in the *Fresno to Bakersfield Section Noise and Vibration Technical Report* (Authority 2017a). The proposed HSR project in the Bakersfield area, along with the F-B LGA, would result in a project-related traffic noise increase of less than 3 dBA (an increase considered barely perceptible to the human ear in an outdoor environment and one unlikely to result in an impact).

The F-B LGA alignment would also increase traffic noise in areas surrounding the TPSS. Details of the traffic noise analysis in the area surrounding the TPSS are provided in the *Fresno to Bakersfield Section Noise and Vibration Technical Report* (Authority 2017a) and *Fresno to Bakersfield Noise and Vibration Technical Report* (Authority 2014). Although traffic volumes are not available in the *Fresno to Bakersfield Section Transportation Technical Report* (Authority 2018) for roadways surrounding the proposed TPSS, traffic noise increases would be similar to traffic noise increases from the proposed heavy maintenance facilities evaluated in the *Fresno to Bakersfield Noise and Vibration Technical Report* (Authority 2014) and would be less than 3 dBA (an increase considered barely perceptible to the human ear in an outdoor environment and unlikely to result in an impact). Traffic noise increases would be less than those associated with the proposed F-B LGA.

Traffic in Kern County

Traffic noise in Kern County was evaluated using the existing and future volumes obtained from the *Bakersfield to Palmdale Project Section Transportation Technical Report* (Authority 2018). Traffic noise in Kern County is characterized by vehicular traffic in the surrounding area. Tables 6-11 through 6-14 from the *Bakersfield to Palmdale Project Section Noise and Vibration Technical Report* (Authority 2018) show the project-related change in traffic noise levels in the Kern County area under the existing and future with and without project scenarios. The change in traffic noise levels is described in both CNEL (when ADT 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). The results of the analysis show that the project-related traffic noise increase would be less than 3 dBA (an increase considered barely perceptible to the human ear in an outdoor environment and one unlikely to result in an impact) for both daily and peak-hour conditions.

Traffic in the City of Tehachapi

Traffic noise in the City of Tehachapi was evaluated using the existing and future volumes obtained from the *Bakersfield to Palmdale Project Section Transportation Technical Report* (Authority 2019b). Traffic noise in the City of Tehachapi is characterized by vehicular traffic in the surrounding area. Tables 6-11 through 6-14 from the *Bakersfield to Palmdale Project Section Noise and Vibration Technical Report* (Authority 2018) shows the project-related change in traffic noise levels in the City of Tehachapi area under the existing and future with and without project scenarios. The change in traffic noise levels is described in both CNEL (when ADT 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). The results of the analysis show that the project-

related traffic noise increase would be less than 3 dBA (an increase considered barely perceptible to the human ear in an outdoor environment and one unlikely to result in an impact) for both daily and peak-hour conditions.

Traffic in Los Angeles County

Traffic noise in in unincorporated areas within Los Angeles County was evaluated using the existing and future volumes obtained from the *Bakersfield to Palmdale Project Section Transportation Technical Report* (Authority 2019b). Traffic noise in Los Angeles County is characterized by vehicular traffic in the surrounding area. Tables 6-11 through 6-14 from the *Bakersfield to Palmdale Project Section Noise and Vibration Technical Report* (Authority 2018) show the project-related change in traffic noise levels in the Los Angeles County area under the existing and future with and without project scenarios. The change in traffic noise levels is described in both CNEL (when ADT 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). The results of the analysis show that the project-related traffic noise increase would be less than 3 dBA (an increase considered barely perceptible to the human ear in an outdoor environment and one unlikely to result in an impact) for both daily and peak-hour conditions except for the segment of W Avenue E between 15th Street and 10th Street W. Traffic noise levels along W Avenue E between 15th Street and 10th Street W would be low, and the 60 dBA CNEL impact zone would remain within the roadway right-of-way. Therefore, the resulting change in traffic noise would not raise noise levels to above Los Angeles County's standard and would not cause a significant impact.

Traffic in the City of Lancaster

Traffic noise in the City Lancaster was evaluated using the existing and future volumes obtained from the *Bakersfield to Palmdale Project Section Transportation Technical Report* (Authority 2019b). Traffic noise in the City of Lancaster is characterized by vehicular traffic in the surrounding area. Tables 6-11 through 6-14 from the *Bakersfield to Palmdale Project Section Noise and Vibration Technical Report* (Authority 2018) show the project-related change in traffic noise levels in the City of Lancaster area under the existing and future with and without project scenarios. The change in traffic noise levels is described in both CNEL (when ADT 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). The results of the analysis show that the project-related traffic noise increase would be less than 3 dBA (an increase considered barely perceptible to the human ear in an outdoor environment and one unlikely to result in an impact) for both daily and peak-hour conditions except for the segment of W Milling Street between Cedar Avenue and Sierra Highway. The increase in project-related traffic noise is the result of the proposed roadway improvements on W Milling Street that would involve permanent road closures to Cedar Avenue and Trevor Avenue at W Milling Street. Roadway improvements on W Milling Street are further discussed below.

Traffic in the City of Palmdale

Traffic noise in the City of Palmdale was evaluated using the existing and future volumes obtained from the *Bakersfield to Palmdale Project Section Transportation Technical Report* (Authority 2019b). Traffic noise in the City of Palmdale is characterized by vehicular traffic in the surrounding area. Tables 6-11 through 6-14 from the *Bakersfield to Palmdale Project Section Noise and Vibration Technical Report* (Authority 2018) show the project-related change in traffic noise levels in the City of Palmdale area under the existing and future with and without project scenarios. The change in traffic noise levels is described in both CNEL (when ADT 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). The results of the analysis show that the project-related traffic noise increase would be less than 3 dBA (an increase considered barely perceptible to the human ear in an outdoor environment and one unlikely to result in an impact) for both daily and peak-hour conditions.

The project-related traffic noise increase would be less than 3 dBA (an increase considered barely perceptible to the human ear in an outdoor environment and one unlikely to result in an impact) except for the segment of Sierra Highway between E Avenue N-12 and E Avenue P-8.

The increase in project-related traffic noise is the result of the proposed realignment of Sierra Highway. The roadway realignment of Sierra Highway is further discussed below.

Traffic Noise from Roadway Improvements
Roadway modification projects, which include either road closures, overcrossings, or undercrossings, are required to accommodate the HSR system. These projects are listed in Table 2-A-1 in Appendix 2-A of this Draft EIR/EIS.

Under 23 C.F.R. Part 772.7, roadway improvements that result in the physical alteration of an existing roadway where there is either a substantial horizontal or substantial vertical alteration, or other activities that increase roadway capacity, require a more detailed noise analysis.

Some of the roadway modifications, according to 23 C.F.R. Part 772, do not require further noise analysis because they pass the Noise Analysis Screening Procedure Checklist (Checklist) in Section 4.5 of the November 2009 Technical Noise Supplement (Caltrans 2009). The November 2009 Technical Noise Supplement was used because the Checklist was not used in the most current (September 2013) Technical Noise Supplement. For the purpose of the roadway modifications included in the Bakersfield to Palmdale Project Section of the HSR system, the Checklist is a practical methodology for determining which roadway modifications would require further noise analysis according to 23 C.F.R. Part 772. Roadway modifications that pass the Checklist include the absence of receptors, the project's potential to increase traffic noise levels by less than 3 dBA, or the existing worst hourly noise level being more than 5 dBA below the NAC. Passing the Checklist indicates that the proposed roadway modification is not likely to result in traffic noise impacts that either approach or exceed the NAC or that increase traffic noise levels by 12 dBA or more over their corresponding existing noise level.

Table 6-16 in the *Bakersfield to Palmdale Project Section Noise and Vibration Technical Report* (Authority 2018) shows the roadway modifications that would not pass the Checklist. This analysis focuses on receptors that are classified under Activity Categories B, C, and D, which are consistent with the sensitive land use categories in the FTA *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018). It is likely that uses in Activity Categories E, F, and G, including commercial and industrial uses, would have either non-sensitive exterior use areas or no exterior use areas at all. The remaining roadway modifications listed in Table 2-A-1 in Appendix 2-A of this Draft EIR/EIS that are not mentioned do not require further analysis according to 23 C.F.R. Part 772.

Table 6-17 in the *Bakersfield to Palmdale Project Section Noise and Vibration Technical Report* (Authority 2018) shows the results of the additional roadway improvement analyses. The results show that impacts for Improvements 1 through 3, 5, and 7 through 11 would not generate traffic noise impacts that approach or exceed the NAC and would not increase noise levels by 12 dBA or more over existing levels. The results of the analysis show that the private patios and balconies facing Sierra Highway at the multifamily development southwest of the W Ivesbrook Street/Sierra Highway intersection would approach the NAC under Alternatives 1, 2, and 3, creating a potential impact related to traffic noise levels. None of the receptors would experience a substantial traffic noise increase of 12 dBA or more over their corresponding existing noise level under Alternatives 1, 2, and 3. These receptors would be fully acquired under Alternative 5.

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. Therefore, CEQA does not require any mitigation. The Authority would implement F-B LGA N&V-MM#7 and N&V-MM#7: Additional Noise Analysis during Final Design, which would require additional noise analysis during final design.

Impact N&V #7: Noise from High-Speed Rail Stationary Facilities

The following discussion evaluates potential long-term operation noise impacts from stationary noise sources generated by HSR stationary facilities (stations, maintenance facilities, and electric power facility improvements). The potential long-term operational noise impacts from mobile noise sources generated by the HSR system are discussed above under Impact N&V #3.

Stationary noise sources generated by HSR stationary facilities include public address systems, signal horns, impact tools, human activity, and vehicle activity.

Stations

Bakersfield Station—Fresno to Bakersfield (Locally Generated Alternative) Alignment from the Intersection of 34th Street and L Street to Oswell Street

Potential long-term operational noise impacts from the proposed Bakersfield Station—F-B LGA HSR station were evaluated using a screening distance of 250 feet for commuter rail without horn-blowing from the FTA *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018). There are a total of 70 noise-sensitive receivers within 250 feet of the boundary of the proposed HSR station. Of these 70 noise-sensitive receivers, 65 would be fully acquired by the proposed HSR project. The remaining five receivers include two residences, one museum, one school, and one recreational area. The Kern County Museum is at 3801 Chester Avenue in the City of Bakersfield (Assessor's Parcel Number 332-200-05). Valley Oaks Charter School is at 3501 Chester Avenue in the City of Bakersfield (Assessor's Parcel Number 120-080-15). The Northwest Bakersfield Baseball Complex is at 40th Street in the City of Bakersfield (Assessor's Parcel Number 332-200-04). Mitigation measures would be required to reduce noise levels at these receivers.

As discussed above, Valley Oaks Charter School is the only school that would be potentially impacted from long-term operations of the proposed Bakersfield Station—F-B LGA. Implementation of Mitigation Measure F-B LGA N&V-MM#7 includes noise barriers to reduce long-term operational noise impacts.

Palmdale Station

Based on the FTA noise impact screening procedure, noise impacts are not anticipated from operations at the Palmdale Station. However, to provide room for the HSR parking lots at the Palmdale Station, Fifth Street would be relocated to the west, closer to the residential neighborhood to the west of Fifth Street, between Avenue Q and Palmdale Boulevard. Additionally, a row of buildings, which currently provide some shielding from the noise on Fifth Street for the residences behind them, would be removed to accommodate the relocated road. Finally, with the project in place, the traffic volume on Fifth Street is projected to grow, which would also increase the noise levels experienced by the residences to the west of the Palmdale Station. These changes together would result in a substantial increase in noise for the residential neighborhood to the west of the Palmdale Station. The results indicate that noise impacts are projected at the following residential locations adjacent to the proposed Palmdale Station:

- **E Avenue P-8 to E Avenue R—**Severe noise impacts are projected in this area at 173 residences on the west side of the tracks. These impacts would be due to the proximity of the receivers to the relocated roadway, the increased traffic on the roadway due to the station, and the removal of the row of residential buildings between the residences and the existing roadway. However, the implementation of Mitigation Measure N&V-MM#7 includes noise barriers to reduce long-term operational noise impacts.

Maintenance-of-Way Facilities

Potential long-term operational noise impacts from the proposed Lancaster North A and B sites and Avenue M LMF Zone were evaluated using information for yards and shops from the FTA 2018 guidance manual using a screening distance of 1,000 feet from FTA's *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018).

Lancaster North A and North B Sites

Based on a distance of 1,000 feet from the boundary of the proposed Lancaster North A and B sites, there are a total of two noise-sensitive receivers. These two receivers would be fully acquired by the project under all B-P Build Alternatives. Therefore, no noise impacts from the long-term operations of the co-located LMF/MOWF would occur.

Because schools would not be within 1,000 feet of the boundary of the proposed co-located LMF/MOWF, no noise impacts would occur from long-term operations.

Avenue M
Based on a distance of 1,000 feet from the boundary of the proposed Avenue M LMF Zone, there are a total of 17 noise-sensitive receivers. Of the 17 noise-sensitive receivers, 12 receivers would be fully acquired by the project under all B-P Build Alternatives, while 5 receivers would remain under all B-P Build Alternatives and would be potentially affected. However, the implementation of Mitigation Measure N&V-MM#7, which includes noise barriers to reduce long-term operational noise impacts, would reduce impacts.

Because schools would not be within 1,000 feet of the boundary of the proposed co-located LMF/MOWF, no noise impacts would occur from long-term operations.

Traction Power Substation

Bakersfield Station—Fresno to Bakersfield (Locally Generated Alternative) Alignment from the Intersection of 34th Street and L Street to Oswell Street
The operation of the TPSS is provided in the *Fresno to Bakersfield Section Noise and Vibration Technical Report* (Authority 2017a). Potential long-term operational noise impacts from the proposed TPSS were evaluated for power substations using a screening distance of 250 feet from FTA's *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018). Based on a distance of 250 feet from the boundary of the proposed TPSS, there is a total of one noise-sensitive receiver represented by the Capri Motel at 2020 Union Avenue in the City of Bakersfield (Assessor's Parcel Number 016-140-01). Implementation of Mitigation Measure F-B LGA N&V-MM#7 includes noise barriers to reduce long-term operational noise impacts.

Because schools would not be located within 250 feet from the boundary of the proposed TPSS, no noise impacts would occur from long-term operations of the proposed TPSS.

Bakersfield to Palmdale Station Alignment
Potential long-term operational noise impacts from the proposed TPSS were evaluated using a screening distance of 250 feet for power substations from the FTA *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018). Based on a distance of 250 feet from the boundary of the proposed TPSS, there is one noise-sensitive receiver represented by a single-family residence at 45900 Schamise Street in the City of Lancaster (Assessor's Parcel Number 3135-034-013). However, implementation of Mitigation Measure N&V-MM#7, which includes noise barriers to reduce long-term operational noise impacts, would reduce impacts.

Because schools would not be within 250 feet from the boundary of the proposed TPSS, no noise impacts would occur from long-term operations of the proposed TPSS.

Electric Power Utility Improvements
Long-term operational noise impacts from the proposed electric power utility improvements would generate corona noise. Corona noise is noise generated from transmission or sub-transmission lines in operation due to the ionization of the air that occurs at the surface of the energized conductor, or generated by suspension hardware due to very high electric field strength at the surface of the metal during certain conditions. However, noise generated from corona noise would not exceed noise standards established by the local jurisdictions. No noise impacts would occur from the operation of the proposed electric power utility improvements.

Noise generated from corona noise would not exceed noise standards for schools within the local jurisdictions. No noise impacts would occur from the operation of the proposed electric power utility improvements.

CEQA Conclusion
Noise impacts from HSR stationary facilities would be potentially significant under CEQA where receivers would be within the FTA screening distances as described above, but the affected property would not be fully acquired for the project. Therefore, CEQA requires mitigation. Mitigation Measures F-B LGA N&V-MM#7 and N&V-MM#7 would be needed and is described in more detail in Section 3.4.7. F-B LGA N&V-MM#7 and N&V-MM#7 would effectively reduce noise from the stations, maintenance facility, and traction power substation to a level that the receivers near these facilities would therefore be outside the screening distances. With the implementation

of F-B LGA N&V-MM#7 and N&V-MM#7 during operation of the proposed project, the impact under CEQA would be less than significant.

3.4.7 Mitigation Measures

Section 3.4.7 lists the applicable mitigation measures for the Bakersfield to Palmdale Project Section. The project section from the north, beginning at the Bakersfield Station, includes the portion of the alignment from the intersection of 34th Street and L Street to Oswell Street. The mitigation measures discussion for this portion are included in Section 3.4.6 of the *Fresno to Bakersfield Section Final Supplemental EIR* (Authority 2018) and the *Fresno to Bakersfield Section Locally Generated Alternative Final Supplemental EIS* (Authority 2019a) and Section 3.4.7 of the *Fresno to Bakersfield Section Final EIR/EIS* (Authority 2014a), respectively. The mitigation measures included in Section 3.4.7.1 through 3.4.7.7 also reflect the portion of the alignment from the intersection of 34th Street and L Street to Oswell Street. These measures would be implemented to mitigate for impacts that cannot be rectified, reduced, eliminated, or avoided.

3.4.7.1 Fresno to Bakersfield LGA Mitigation Measures from 34th Street and L to Oswell Street

The *Fresno to Bakersfield Section Final Supplemental EIR* (Authority 2018) and the *Fresno to Bakersfield Section Final Supplemental EIS* (Authority 2019a) identified the following noise and vibration-related mitigation measures applicable to the portion of the F-B LGA from 34th Street and L Street to Oswell Street (see Section 3.1.3.7 for further detail):

- **F-B LGA N&V-MM#1:** During construction, the contractor will monitor construction noise to verify compliance with the noise limits shown in Table 3.4-1 of the (Fresno to Bakersfield Section) Final EIR/EIS. The contractor would be given the flexibility to meet the FRA construction noise limits in the most efficient and cost-effective manner. This would be done by either prohibiting certain noise-generating activities during nighttime hours or providing additional noise control measures to meet the noise limits. A noise- monitoring program will be developed to meet required noise limits, and the following noise control mitigation measures will be implemented as necessary, for nighttime and daytime:
  - Install a temporary construction barrier near the noise source
  - Avoid nighttime construction in residential neighborhoods
  - Locate stationary construction equipment as far as possible from noise-sensitive sites.
  - During nighttime work, use smart backup alarms, which automatically adjust the alarm levels 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 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.

- **F-B LGA N&V-MM#2:** Building damage from construction vibration is only anticipated from impact pile driving at very close distances to buildings. If pile driving occurs more than 77 feet from fragile or historic buildings, 55 feet from residential structures 25 to 50 feet from buildings, or if alternative methods such as push piling, or auger piling, or cast-in-drill-hole (CIDH) can be used, damage from construction vibration is not expected to occur. Other sources of construction vibration do not generate high enough vibration levels for damage to occur. When a construction scenario has been established, preconstruction surveys are conducted 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 Authority will arrange for the repair of damaged buildings or will pay compensation to the property owner. Although vibration impacts would occur during construction activities, the construction activities are considered temporary, as they would cease after completion.
- **F-B LGA N&V-MM#3:** To determine the appropriate mitigation measure for properties experiencing severe noise impacts, noise mitigation guidelines would be applied as follows:
  - Prior to operation of the HSR, the Authority will install sound barriers where they can achieve between 5 and 15 dBA 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 (examples are shown in Figure 3.4-14 of the Final EIR/EIS). Depending on the situation, sound barriers can become visually intrusive. Typically, the sound barriers style is selected with input from the local jurisdiction to reduce the visual effect of barriers on adjacent lands uses. For example, sound barriers could be solid or transparent, and made of various colors, materials, and surface treatments.
  - The minimum number of affected sites should be at least 10, and the length of a sound barrier should be at least 800 feet. 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.
  - The Authority will work with the communities to identify how the use and height of sound barriers would be determined using jointly developed performance criteria. Other solutions may result in higher numbers of residual impacts than reported herein. Options may be to reduce the height of sound barriers and combine barriers with sound insulation or to accept higher noise thresholds than the FRA's current noise thresholds.
  - If sound walls are not proposed or do not reduce sound levels to below a severe impact level, building sound insulation can be installed. 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 dBA) 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 dBA) 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. Performance criteria would be established to balance existing noise events and ambient roadway noise conditions as factors for determining mitigation measures.

- If sound walls or sound installation is not effective, the Authority can acquire easements on properties severely affected by noise. Another option for mitigating noise impacts is for the authority to acquire easements on residences likely to be impacted by HSR operations in which the homeowners would accept the future noise conditions. This approach is usually taken only in isolated cases where other mitigation options are infeasible, impractical, or too costly.

- **F-B LGA N&V-MM#4:** In the procurement of an HSR vehicle technology, the Authority will require bidders to meet the federal regulations (40 CFR Part 201.12/13) at the time of procurement for locomotives (currently a 90-dBA-level standard), for cars operating at speeds of greater than 45 mph. Depending on the available technology, this could significantly reduce the number of impacts throughout the corridor.
- **F-B LGA N&V-MM#5:** Because the impacts of HSR wheels over rail gaps at turnouts increases HSR noise by approximately 6 dBA over typical operations, turnouts can be a major source of noise impact. If the turnouts cannot be moved from sensitive areas, the project can use special types of trackwork that eliminate the gap.

  Table 3.4-29 [of the Fresno to Bakersfield Section Final Supplemental EIR/EIS] provides additional mitigation measures that would reduce operational vibration levels when the train, railway, and railway structures are already in good condition. As shown in Table 3.4-29, mitigation would take place at the source, sensitive receptor, or along the propagation path from the source to the sensitive receptor. If mitigation measures provided in Table 3.4-29 are not feasible, the Authority would attempt to negotiate a vibration easement with property owners or the Authority would negotiate to relocate the property owner outside of the area subject to significant vibration impacts.
- **F-B LGA N&V-MM#6:** If final design or final vehicle specifications result in changes to the assumptions underlying the noise and vibration analysis (including analysis regarding resident and business displacements), reassess noise and vibration impacts and recommendations for mitigation and provide supplemental environmental documentation, as required by law.

  Several single-family homes will be subject to traffic peak-hour noise levels in excess of 66 dBA L_{eq}. These noise levels would exceed the Caltrans Noise Abatement Criteria and potentially require the preparation of Noise Study Reports and noise abatement measures. In determining the reasonableness of abatement, FHWA highway traffic noise regulation requires, among other factors, the feasibility of the noise mitigation measure as well as the consideration of the viewpoints of the affected residents and property owners. Feasibility generally deals with considering whether it is possible to build an abatement measure, given site constraints; and whether the abatement measure provides a minimum reduction in noise levels. Feasibility also requires that all of the homes potentially affected face the roadway from which the noise emanates. As a result, noise mitigation measures would be infeasible for any home with a driveway for which access must be maintained. The noise barrier would not be continuous, and subsequently would not provide the minimum 5 dBA of noise reduction. A noise abatement measure is not feasible unless the measure achieves a noise reduction of at least 5 dBA for front-row receivers. Highway noise barriers are designed to protect areas of “frequent human use,” which generally do not include the front yards of homes. Caltrans does not generally put noise barriers across the front yards of homes because they are acoustically infeasible and because most homeowners wish to maintain the views from the fronts of their homes.

- **F-B LGA N&V-MM#7:** In order to reduce the noise from the facilities, the following noise mitigation measures are recommended:
  - Enclose as many of the activities within the facility as possible.
  - Eliminate windows in the building that would face toward noise-sensitive land uses adjacent to the facility. If windows are required to be located on the side of the facility facing noise-sensitive land uses, they should be the fixed type of windows with a sound transmission class (STC) rating of at least 35. If the windows must be operable, they should be closed during nighttime activities.
  - Close facility doors where the rails enter the facility during nighttime activities.
  - Tracks that cannot be located within the facility should be located on the far side of the facility from adjacent noise-sensitive receivers.
  - For tracks that cannot be installed away from noise-sensitive receivers, install sound barrier along the maintenance tracks in order to protect the adjacent noise-sensitive receivers.
  - All mechanical equipment (compressors, pumps, generators, etc.) should be located within the facility structure.
  - Any mechanical equipment located exterior to the facility (compressors, pumps, generators, etc.) should be located on the far side of the facility from adjacent noise-sensitive receivers. If this is not possible, this equipment should be located within noise enclosures to mitigate the noise during operation.
  - All ventilation ducting for the facility should be pointed away from the adjacent noise-sensitive receivers.

3.4.7.2 Bakersfield to Palmdale Project Section Mitigation Measures

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

During construction, the contractor will monitor construction noise to verify compliance with the noise limits shown in Table 3.4-7. 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) where a noise-sensitive receptor is present. 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 project section 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 representative of the Authority 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 a log of the in-coming 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.

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

Prior to construction involving impact pile driving within 50 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 receptor 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 to 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.

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

Various options exist to address the potentially severe noise effects from high-speed train operations. 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 exterior noise level from HSR operations from severe to moderate, according to the provisions of the FRA noise and vibration manual (FRA 2012) and Figure 3.4-1.

The Noise Mitigation Guidelines, included as Appendix 3.4-B, describe the following mitigation measures and approach:

Sound Barriers

Prior to operation of the HSR, the Authority will install sound barriers where they can achieve between 5 and 15 dB of exterior 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 four 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 barriers 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, 2017. For example, sound barriers could be solid or transparent, and made of various colors, materials, and surface treatments.

Pursuant to the Noise Mitigation Guidelines, recommended sound barriers must meet the following criteria to be considered a reasonable and feasible mitigation measure:

- 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.

The maximum sound barrier height would be 14 feet for at-grade sections. 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. All sound barriers would be designed to be as low as possible to achieve a substantial noise reduction.

Table 3.4-29 through Table 3.4-34 show the reasonableness of each feasible noise barrier (achieve a minimum 5 dBA reduction) along with their height, approximate length, number of benefited receivers, total construction cost, number of unmitigated severe impacts, and number of residual impacts (with mitigation) for each barrier height. Noise barriers were determined to be reasonable when the cost to construct the barriers would not exceed combined dollar amount of each benefited receiver.

Table 3.4-29 shows that two noise barriers were evaluated under the Bakersfield Station—F-B LGA alignment. Noise Barrier Nos. 5 and 6 were determined to be both feasible and reasonable. Details of the noise barrier analysis are provided in the *Fresno to Bakersfield Section Noise and Vibration Technical Report* (Authority 2017a).

Table 3.4-30, Table 3.4-31, Table 3.4-32, and Table 3.4-33 show that 14 noise barriers were evaluated under Alternatives 1, 2, 3, and 5, respectively, for the Bakersfield to Palmdale (Between Station Areas) alignment. For each alternative, 9 barriers were determined to be both feasible and reasonable.

Table 3.4-34 shows that two noise barriers were evaluated in the Palmdale Station area. Noise Barrier Nos. 1 and 2 were determined to be both feasible and reasonable.

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Table 3.4-29 Noise Barrier Analysis: Bakersfield Station—Fresno to Bakersfield (Locally Generated Alternative) Alignment

Barrier	Track	Location	Track Type	Total Length (feet)	Height (feet) [1]	Area (square feet)	Total Cost	Benefited Receivers	Cost per Benefited Receiver	Cost Exceed $55,000?	Is Barrier Reasonable?	5 dBA Reduction?	Unmitigated Severe Impacts	Severe Residual Impacts (with Mitigation)
NB No. 5	Southbound Track	North of Elm Street to Oswell Street	Viaduct	26,700	10	267,000	$12,816,000	759	$16,885	No	Yes	Yes	1,060	154
					12	320,400	$15,379,200	3,200	$4,806	No	Yes	Yes		7
					14	373,800	$17,942,400	3,200	$5,607	No	Yes	Yes		0
NB No. 6	Northbound Track	North of H Street to Oswell Street	Viaduct	23,275	10	232,750	$11,172,000	900	$12,413	No	Yes	Yes	1,743	436
					12	279,300	$13,406,400	5,334	$2,513	No	Yes	Yes		87
					14	325,850	$15,640,800	5,334	$2,932	No	Yes	Yes		29

Source: California High-Speed Rail Authority, 2019
[1] Height above the top of the rail.
dBA = A-weighted decibel(s)
NB = Noise Barrier

Table 3.4-30 Noise Barrier Analysis: Bakersfield to Palmdale (between Station Areas) Alignment—Alternative 1

Barrier	Track	Location	Track Type	Total Length (feet)	Height (feet)[1]	Area (square feet)	Total Cost	Benefited Receivers	Cost per Benefited Receiver	Cost Exceed $80,000?	Is Barrier Reasonable?	5 dBA Reduction?	Unmitigated Severe Impacts	Severe Residual Impacts (with mitigation)
NB No. 1	Northbound track	Oswell Street to East of Fairfax Road	Viaduct	6,700	10	67,000	$4,216,980	493	$8,554	No	Yes	Yes	173	48
					12	80,400	$5,060,376	1,596	$3,171	No	Yes	Yes		7
					14	93,800	$5,903,772	1,596	$3,699	No	Yes	Yes		0
NB No. 2	Northbound track	East of Fairfax Road to S Vineland Road	Viaduct/Fill (fill = 1,500 ft)	10,260	10	102,600	$6,744,000	168	$40,143	No	Yes	Yes	52	0
					12	123,120	$7,903,793	703	$11,243	No	Yes	Yes		0
					14	143,640	$9,221,092	739	$12,478	No	Yes	Yes		0
NB No. 3	Southbound track	Oswell Street to Weedpatch Highway	Viaduct	11,052	10	110,520	$4,720,500	167	$28,266	No	Yes	Yes	88	3
					12	132,624	$5,664,600	671	$8,442	No	Yes	Yes		0
					14	154,728	$6,608,700	671	$9,849	No	Yes	Yes		0
NB No. 4	Southbound track	Core Mark Court to West of S Vineland Road	Viaduct/Fill (fill = 700 ft)	3,699	10	36,990	$2,388,281	0	--	--	No	No	10	0
					12	44,388	$2,865,937	12	$238,828	Yes	No	Yes		0
					14	51,786	$3,415,090	12	$284,591	Yes	No	Yes		0
NB No. 5	Northbound track	West of S Edison Road to West of Malaga Road	Fill	5,050	10	50,500	$3,612,265	84	$43,003	No	Yes	Yes	48	0
					12	60,600	$4,334,718	84	$51,604	No	Yes	Yes		0
					14	70,700	$5,057,171	84	$60,204	No	Yes	Yes		0
NB No. 6	Southbound track	Quail Canyon Road to South of Dove Tail Court	Viaduct/Cut (cut = 3,500 ft)	6,602	10	66,020	$1,952,399	5	$390,480	Yes	No	Yes	23	12
					12	79,224	$5,347,139	6	$891,190	Yes	No	Yes		10
					14	92,428	$6,238,328	8	$779,791	Yes	No	Yes		7
NB No. 7	Northbound track	North of Arabian Drive to North of E Tehachapi Boulevard	Viaduct/Fill (fill = 2,230 ft)	4,446	10	44,460	$2,989,869	10	$298,987	Yes	No	Yes	31	25
					12	53,352	$3,587,843	37	$96,969	Yes	No	Yes		3
					14	62,244	$4,185,817	44	$95,132	Yes	No	Yes		2
NB No. 8	Southbound track	North of Barnett Road to North of Goodrick Drive	Viaduct/Fill (fill = 1,660 ft)	3,000	10	30,000	$2,030,794	0	--	--	No	No	18	4
					12	36,000	$2,436,953	73	$33,383	No	Yes	Yes		0
					14	42,000	$2,843,112	73	$38,947	No	Yes	Yes		0
NB No. 9	Northbound track	Fisher Avenue to North of Holiday Avenue	Fill	9,080	10	90,800	$6,494,924	11	$590,448	Yes	No	Yes	127	80
					12	108,960	$7,793,909	99	$78,726	No	Yes	Yes		29
					14	127,120	$9,092,894	145	$62,710	No	Yes	Yes		9
NB No. 10	Southbound track	South of Fisher Avenue to North of Buckhorn Avenue	Fill	12,496	10	124,960	$8,938,389	4	$2,234,597	Yes	No	Yes	65	47
					12	149,952	$10,726,067	52	$206,271	Yes	No	Yes		26
					14	174,944	$12,513,744	70	$178,768	Yes	No	Yes		10
NB No. 11	Northbound track	North of Avenue I to Avenue K-6	Fill	13,660	10	136,600	$9,770,998	0	--	--	No	No	133	73
					12	163,920	$11,725,198	3	$3,908,399	Yes	No	Yes		8
					14	191,240	$13,679,397	1,246	$10,979	No	Yes	Yes		2
NB No. 12	Southbound track	North of Avenue H to North of Avenue K-4	Fill	18,235	10	182,350	$13,043,496	1	$13,043,496	Yes	No	No	423	114
					12	218,820	$15,652,195	166	$94,290	Yes	No	Yes		53
					14	255,290	$18,260,894	2,937	$6,218	No	Yes	Yes		14

Barrier	Track	Location	Track Type	Total Length (feet)	Height (feet)[1]	Area (square feet)	Total Cost	Benefited Receivers	Cost per Benefited Receiver	Cost Exceed $80,000?	Is Barrier Reasonable?	5 dBA Reduction?	Unmitigated Severe Impacts	Severe Residual Impacts (with mitigation)
NB No. 13	Northbound track	North of Avenue K-15 to Wedge Way	Cut/Fill	6,896	10	68,960	$4,932,709	0	--	--	No	No	46	21
					12	82,752	$5,919,251	0	--	--	No	No		6
					14	96,544	$6,905,792	54	$127,885	Yes	No	Yes		1
NB No. 14	Southbound track	North of Avenue N-12 to South of Avenue O	Cut	2,444	10	24,440	$1,748,193	44	$39,732	No	Yes	Yes	44	0
					12	29,328	$2,097,832	44	$47,678	No	Yes	Yes		0
					14	34,216	$2,447,470	44	$55,624	No	Yes	Yes		0

Source: California High-Speed Rail Authority, 2019
[1] Height above the top of the rail.
dBA = A-weighted decibel(s)
ft = feet
NB = Noise Barrier

Table 3.4-31 Noise Barrier Analysis: Bakersfield to Palmdale (between Station Areas) Alignment—Alternative 2

Barrier	Track	Location	Track Type	Total Length (feet)	Height (feet)[1]	Area (square feet)	Total Cost	Benefited Receivers	Cost per Benefited Receiver	Cost Exceed $80,000?	Is Barrier Reasonable?	5 dBA Reduction?	Unmitigated Severe Impacts	Severe Residual Impacts (with mitigation)
NB No. 1	Northbound track	Oswell Street to East of Fairfax Road	Viaduct	6,700	10	67,000	$4,216,980	493	$8,554	No	Yes	Yes	173	48
					12	80,400	$5,060,376	1,596	$3,171	No	Yes	Yes		7
					14	93,800	$5,903,772	1,596	$3,699	No	Yes	Yes		0
NB No. 2	Northbound track	East of Fairfax Road to S Vineland Road	Viaduct/Fill (fill = 1,500 ft)	10,260	10	102,600	$6,744,000	168	$40,143	No	Yes	Yes	52	0
					12	123,120	$7,903,793	703	$11,243	No	Yes	Yes		0
					14	143,640	$9,221,092	739	$12,478	No	Yes	Yes		0
NB No. 3	Southbound track	Oswell Street to Weedpatch Highway	Viaduct	11,052	10	110,520	$4,720,500	167	$28,266	No	Yes	Yes	88	3
					12	132,624	$5,664,600	671	$8,442	No	Yes	Yes		0
					14	154,728	$6,608,700	671	$9,849	No	Yes	Yes		0
NB No. 4	Southbound track	Core Mark Court to West of S Vineland Road	Viaduct/Fill (fill = 700 ft)	3,699	10	36,990	$2,388,281	0	--	--	No	No	10	0
					12	44,388	$2,865,937	12	$238,828	Yes	No	Yes		0
					14	51,786	$3,415,090	12	$284,591	Yes	No	Yes		0
NB No. 5	Northbound track	West of S Edison Road to West of Malaga Road	Fill	5,050	10	50,500	$3,612,265	81	$44,596	No	Yes	Yes	48	0
					12	60,600	$4,334,718	81	$53,515	No	Yes	Yes		0
					14	70,700	$5,057,171	84	$60,204	No	Yes	Yes		0
NB No. 6	Southbound track	Quail Canyon Road to South of Dove Tail Court	Viaduct/Cut (cut = 3,500 ft)	6,602	10	66,020	$1,952,399	0	--	--	No	No	23	18
					12	79,224	$5,347,139	0	--	--	No	No		16
					14	92,428	$6,238,328	1	$6,238,328	Yes	No	No		14
NB No. 7	Northbound track	North of Arabian Drive to North of E Tehachapi Boulevard	Viaduct/Fill (fill = 2,230 ft)	4,446	10	44,460	$2,989,869	10	$298,987	Yes	No	Yes	31	25
					12	53,352	$3,587,843	37	$96,969	Yes	No	Yes		3
					14	62,244	$4,185,817	44	$95,132	Yes	No	Yes		2
NB No. 8	Southbound track	North of Barnett Road to North of Goodrick Drive	Viaduct/Fill (fill = 1,660 ft)	3,000	10	30,000	$2,030,794	0	--	--	No	No	18	4
					12	36,000	$2,436,953	73	$33,383	No	Yes	Yes		0
					14	42,000	$2,843,112	73	$38,947	No	Yes	Yes		0

Barrier	Track	Location	Track Type	Total Length (feet)	Height (feet)[1]	Area (square feet)	Total Cost	Benefited Receivers	Cost per Benefited Receiver	Cost Exceed $80,000?	Is Barrier Reasonable?	5 dBA Reduction?	Unmitigated Severe Impacts	Severe Residual Impacts (with mitigation)
NB No. 9	Northbound track	Fisher Avenue to North of Holiday Avenue	Fill	9,080	10	90,800	$6,494,924	11	$590,448	Yes	No	Yes	127	80
					12	108,960	$7,793,909	99	$78,726	No	Yes	Yes		29
					14	127,120	$9,092,894	145	$62,710	No	Yes	Yes		9
NB No. 10	Southbound track	South of Fisher Avenue to North of Buckhorn Avenue	Fill	12,496	10	124,960	$8,938,389	4	$2,234,597	Yes	No	Yes	65	47
					12	149,952	$10,726,067	52	$206,271	Yes	No	Yes		26
					14	174,944	$12,513,744	70	$178,768	Yes	No	Yes		10
NB No. 11	Northbound track	North of Avenue I to Avenue K-6	Fill	13,660	10	136,600	$9,770,998	0	--	--	No	No	133	73
					12	163,920	$11,725,198	3	$3,908,399	Yes	No	Yes		8
					14	191,240	$13,679,397	1,246	$10,979	No	Yes	Yes		2
NB No. 12	Southbound track	North of Avenue H to North of Avenue K-4	Fill	18,235	10	182,350	$13,043,496	1	$13,043,496	Yes	No	No	423	114
					12	218,820	$15,652,195	166	$94,290	Yes	No	Yes		53
					14	255,290	$18,260,894	2,937	$6,218	No	Yes	Yes		14
NB No. 13	Northbound track	North of Avenue K-15 to Wedge Way	Cut/Fill	6,896	10	68,960	$4,932,709	0	--	--	No	No	46	21
					12	82,752	$5,919,251	0	--	--	No	No		6
					14	96,544	$6,905,792	54	$127,885	Yes	No	Yes		1
NB No. 14	Southbound track	North of Avenue N-12 to South of Avenue O	Cut	2,444	10	24,440	$1,748,193	0	--	--	No	No	44	0
					12	29,328	$2,097,832	0	--	--	No	No		0
					14	34,216	$2,447,470	0	--	--	No	No		0

Source: California High-Speed Rail Authority, 2019
[1] Height above the top of the rail.
dBA = A-weighted decibel(s)
ft = feet
NB = Noise Barrier

Table 3.4-32 Noise Barrier Analysis: Bakersfield to Palmdale (between Station Areas) Alignment—Alternative 3

Barrier	Track	Location	Track Type	Total Length (feet)	Height (feet)[1]	Area (square feet)	Total Cost	Benefited Receivers	Cost per Benefited Receiver	Cost Exceed $80,000?	Is Barrier Reasonable?	5 dBA Reduction?	Unmitigated Severe Impacts	Severe Residual Impacts (with mitigation)
NB No. 1	Northbound track	Oswell Street to East of Fairfax Road	Viaduct	6,700	10	67,000	$4,216,980	493	$8,554	No	Yes	Yes	173	48
					12	80,400	$5,060,376	1,596	$3,171	No	Yes	Yes		7
					14	93,800	$5,903,772	1,596	$3,699	No	Yes	Yes		0
NB No. 2	Northbound track	East of Fairfax Road to S Vineland Road	Viaduct/Fill (fill = 1,500 ft)	10,260	10	36,990	$6,744,000	168	$40,143	No	Yes	Yes	52	0
					12	44,388	$7,903,793	703	$11,243	No	Yes	Yes		0
					14	51,786	$9,221,092	739	$12,478	No	Yes	Yes		0
NB No. 3	Southbound track	Oswell Street to Weedpatch Highway	Viaduct	11,052	10	110,520	$4,720,500	167	$28,266	No	Yes	Yes	88	3
					12	132,624	$5,664,600	671	$8,442	No	Yes	Yes		0
					14	154,728	$6,608,700	671	$9,849	No	Yes	Yes		0
NB No. 4	Southbound track	Core Mark Court to West of S Vineland Road	Viaduct/Fill (fill = 700 ft)	3,699	10	36,990	$2,388,281	0	--	--	No	No	10	0
					12	44,388	$2,865,937	12	$238,828	Yes	No	Yes		0
					14	51,786	$3,415,090	12	$284,591	Yes	No	Yes		0
NB No. 5	Northbound track	West of S Edison Road to West of Malaga Road	Fill	5,050	10	50,500	$3,612,265	0	--	--	No	No	48	23
					12	60,600	$4,334,718	0	--	--	No	No		18
					14	70,700	$5,057,171	0	--	--	No	No		0
NB No. 6	Southbound track	Quail Canyon Road to South of Dove Tail Court	Viaduct/Cut (cut = 3,500 ft)	6,602	10	66,020	$1,952,399	0	--	--	No	No	23	18
					12	79,224	$5,347,139	0	--	--	No	No		16
					14	92,428	$6,238,328	1	$6,238,328	Yes	No	No		14
NB No. 7	Northbound track	North of Arabian Drive to North of E Tehachapi Boulevard	Viaduct/Fill (fill = 2,230 ft)	4,446	10	44,460	$2,989,869	10	$298,987	Yes	No	Yes	31	25
					12	53,352	$3,587,843	37	$96,969	Yes	No	Yes		3
					14	62,244	$4,185,817	44	$95,132	Yes	No	Yes		2
NB No. 8	Southbound track	North of Barnett Road to North of Goodrick Drive	Viaduct/Fill (fill = 1,660 ft)	3,000	10	30,000	$2,030,794	0	--	--	No	No	18	4
					12	36,000	$2,436,953	73	$33,383	No	Yes	Yes		0
					14	42,000	$2,843,112	73	$38,947	No	Yes	Yes		0
NB No. 9	Northbound track	Fisher Avenue to North of Holiday Avenue	Fill	9,080	10	90,800	$6,494,924	11	$590,448	Yes	No	Yes	127	80
					12	108,960	$7,793,909	99	$78,726	No	Yes	Yes		29
					14	127,120	$9,092,894	145	$62,710	No	Yes	Yes		9
NB No. 10	Southbound track	South of Fisher Avenue to North of Buckhorn Avenue	Fill	12,496	10	124,960	$8,938,389	4	$2,234,597	Yes	No	Yes	65	47
					12	149,952	$10,726,067	52	$206,271	Yes	No	Yes		26
					14	174,944	$12,513,744	70	$178,768	Yes	No	Yes		10
NB No. 11	Northbound track	North of Avenue I to Avenue K-6	Fill	13,660	10	136,600	$9,770,998	0	--	--	No	No	133	73
					12	163,920	$11,725,198	3	$3,908,399	Yes	No	Yes		8
					14	191,240	$13,679,397	1,246	$10,979	No	Yes	Yes		2
NB No. 12	Southbound track	North of Avenue H to North of Avenue K-4	Fill	18,235	10	182,350	$13,043,496	1	$13,043,496	Yes	No	No	423	114
					12	218,820	$15,652,195	166	$94,290	Yes	No	Yes		53
					14	255,290	$18,260,894	2,937	$6,218	No	Yes	Yes		14

Barrier	Track	Location	Track Type	Total Length (feet)	Height (feet)[1]	Area (square feet)	Total Cost	Benefited Receivers	Cost per Benefited Receiver	Cost Exceed $80,000?	Is Barrier Reasonable?	5 dBA Reduction?	Unmitigated Severe Impacts	Severe Residual Impacts (with mitigation)
NB No. 13	Northbound track	North of Avenue K-15 to Wedge Way	Cut/Fill	6,896	10	68,960	$4,932,709	0	--	--	No	No	46	21
					12	82,752	$5,919,251	0	--	--	No	No		6
					14	96,544	$6,905,792	54	$127,885	Yes	No	Yes		1
NB No. 14	Southbound track	North of Avenue N-12 to South of Avenue O	Cut	2,444	10	24,440	$1,748,193	0	--	--	No	No	44	0
					12	29,328	$2,097,832	0	--	--	No	No		0
					14	34,216	$2,447,470	0	--	--	No	No		0

Source: California High-Speed Rail Authority, 2019
[1] Height above the top of the rail.
dBA = A-weighted decibel(s)
ft = foot/feet
NB = Noise Barrier

Table 3.4-33 Noise Barrier Analysis: Bakersfield to Palmdale (between Station Areas) Alignment—Alternative 5

Barrier	Track	Location	Track Type	Total Length (feet)	Height (feet)[1]	Area (square feet)	Total Cost	Benefited Receivers	Cost per Benefited Receiver	Cost Exceed $80,000?	Is Barrier Reasonable?	5 dBA Reduction?	Unmitigated Severe Impacts	Severe Residual Impacts (with mitigation)
NB No. 1	Northbound track	Oswell Street to East of Fairfax Road	Viaduct	6,700	10	67,000	$4,216,980	493	$8,554	No	Yes	Yes	173	48
					12	80,400	$5,060,376	1,596	$3,171	No	Yes	Yes		7
					14	93,800	$5,903,772	1,596	$3,699	No	Yes	Yes		0
NB No. 2	Northbound track	East of Fairfax Road to S Vineland Road	Viaduct/Fill (fill = 1,500 ft)	10,260	10	102,600	$6,744,000	168	$40,143	No	Yes	Yes	52	0
					12	123,120	$7,903,793	703	$11,243	No	Yes	Yes		0
					14	143,640	$9,221,092	739	$12,478	No	Yes	Yes		0
NB No. 3	Southbound track	Oswell Street to Weedpatch Highway	Viaduct	11,052	10	110,520	$4,720,500	167	$28,266	No	Yes	Yes	88	3
					12	132,624	$5,664,600	671	$8,442	No	Yes	Yes		0
					14	154,728	$6,608,700	671	$9,849	No	Yes	Yes		0
NB No. 4	Southbound track	Core Mark Court to West of S Vineland Road	Viaduct/Fill (fill = 700 ft)	3,699	10	36,990	$2,388,281	0	--	--	No	No	10	0
					12	44,388	$2,865,937	12	$238,828	Yes	No	Yes		0
					14	51,786	$3,415,090	12	$284,591	Yes	No	Yes		0
NB No. 5	Northbound track	West of S Edison Road to West of Malaga Road	Fill	5,050	10	50,500	$3,612,265	0	--	--	No	No	48	23
					12	60,600	$4,334,718	0	--	--	No	No		18
					14	70,700	$5,057,171	0	--	--	No	No		0
NB No. 6	Southbound track	Quail Canyon Road to South of Dove Tail Court	Viaduct/Cut (cut = 3,500 ft)	6,602	10	66,020	$1,952,399	0	--	--	No	No	23	18
					12	79,224	$5,347,139	0	--	--	No	No		16
					14	92,428	$6,238,328	1	$6,238,328	Yes	No	No		14
NB No. 7	Northbound track	North of Arabian Drive to North of E Tehachapi Boulevard	Viaduct/Fill (fill = 2,230 ft)	4,446	10	44,460	$2,989,869	10	$298,987	Yes	No	Yes	31	25
					12	53,352	$3,587,843	37	$96,969	Yes	No	Yes		3
					14	62,244	$4,185,817	44	$95,132	Yes	No	Yes		2
NB No. 8	Southbound track	North of Barnett Road to North of Goodrick Drive	Viaduct/Fill (fill = 1,660 ft)	3,000	10	30,000	$2,030,794	0	--	--	No	No	18	4
					12	36,000	$2,436,953	73	$33,383	No	Yes	Yes		0
					14	42,000	$2,843,112	73	$38,947	No	Yes	Yes		0
NB No. 9	Northbound track	Fisher Avenue to North of Holiday Avenue	Fill	9,080	10	90,800	$6,494,924	11	$590,448	Yes	No	Yes	127	80
					12	108,960	$7,793,909	99	$78,726	No	Yes	Yes		29
					14	127,120	$9,092,894	145	$62,710	No	Yes	Yes		9
NB No. 10	Southbound track	South of Fisher Avenue to North of Buckhorn Avenue	Fill	12,496	10	124,960	$8,938,389	4	$2,234,597	Yes	No	Yes	65	47
					12	149,952	$10,726,067	52	$206,271	Yes	No	Yes		26
					14	174,944	$12,513,744	70	$178,768	Yes	No	Yes		10
NB No. 11	Northbound track	North of Avenue I to Avenue K-6	Fill	13,660	10	136,600	$9,770,998	1	$9,770,998	Yes	No	No	140	75
					12	163,920	$11,725,198	10	$1,172,520	Yes	No	Yes		10
					14	191,240	$13,679,397	1,276	$10,721	No	Yes	Yes		1
NB No. 12	Southbound track	North of Avenue H to North of Avenue K-4	Fill	18,235	10	182,350	$13,043,496	0	--	--	No	No	463	186
					12	218,820	$15,652,195	288	$54,348	No	Yes	Yes		97
					14	255,290	$18,260,894	2,863	$6,378	No	Yes	Yes		33

Barrier	Track	Location	Track Type	Total Length (feet)	Height (feet)[1]	Area (square feet)	Total Cost	Benefited Receivers	Cost per Benefited Receiver	Cost Exceed $80,000?	Is Barrier Reasonable?	5 dBA Reduction?	Unmitigated Severe Impacts	Severe Residual Impacts (with mitigation)
NB No. 13	Northbound track	North of Avenue K-15 to Wedge Way	Cut/Fill	6,896	10	68,960	$4,932,709	0	--	--	No	No	46	19
					12	82,752	$5,919,251	2	$2,959,625	Yes	No	Yes		6
					14	96,544	$6,905,792	53	$130,298	Yes	No	Yes		1
NB No. 14	Southbound track	North of Avenue N-12 to South of Avenue O	Cut	2,444	10	24,440	$1,748,193	0	--	--	No	No	44	0
					12	29,328	$2,097,832	0	--	--	No	No		0
					14	34,216	$2,447,470	0	--	--	No	No		0

Source: California High-Speed Rail Authority, 2019
[1] Height above the top of the rail.
dBA = A-weighted decibel(s) NB = Noise Barrier

Table 3.4-34 Noise Barrier Analysis: Palmdale Alignment

Barrier	Track	Location	Track Type	Total Length (feet)	Height (feet)	Area (square feet)	Total Cost	Benefited Receivers	Cost per Benefited Receiver	Cost Exceed $55,000?	Is Barrier Reasonable?	5 dBA Reduction?	Unmitigated Severe Impacts	Severe Residual Impacts (with mitigation)
NB. No. 1	Southbound track	South of E Avenue P14 to North of E Palmdale Boulevard	At-Grade	3,205	14	44,870	$2,584,512	170	$15,203	No	Yes	Yes	--	--
NB. No. 2	Southbound track	North of East Avenue Q12 to South of Avenue R	At-Grade	1,535	14	21,490	$1,237,824	326	$3,797	No	Yes	Yes	--	--

Source: California High-Speed Rail Authority, 2019
dBA = A-weighted decibel(s) NB = Noise Barrier

Figures 3.4-B-10 through 3.4-B-13 in Appendix 3.4-A show the proposed noise barrier locations. The Authority will work with the communities to identify how the use and height of sound barriers would be determined. Also, as shown in Table 3.4-29, Table 3.4-30, Table 3.4-31, Table 3.4-32, Table 3.4-33, and Table 3.4-34, some receptors have the potential to remain severely impacted after mitigation is considered, or in some cases, implemented. All such receptors would be classified as residual severe impacts. Table 3.4-35, Table 3.4-36, and Table 3.4-37 show the breakdown of receptors also classified as residual severe impacts, based on land use in each category, that were not evaluated with a noise barrier because they are located in areas that do not meet the minimum number of 10 severely impacted receivers and the minimum barrier length of 800 feet. As shown in Table 3.4-35, there are no residual severe impacts under the Bakersfield Station—F-B LGA Alignment. Table 3.4-36 and Table 3.4-37 show the residual severe impacts under the Bakersfield to Palmdale (Between Station Areas) Alignment and the Palmdale Station Alignment, respectively, for each B-P Build Alternative.

Table 3.4-35 Bakersfield Station—Fresno to Bakersfield (Locally Generated Alternative) Alignment—Severe Residual Impacts without Mitigation

Alternative[1]	Category 1		Category 2			Category 3			
	Recording Studio	Concert Hall	Residential	Hospital	Other	School	Church	Park	Other
Alternative 1	0	0	0	0	0	0	0	0	0

Source: California High-Speed Rail Authority, 2017a

[1] The receivers that do not meet the eligibility requirements for a noise barrier specified in F-B LGA N&V-MM#3.

Table 3.4-36 Bakersfield to Palmdale (Between Station Areas) Alignment—Severe Residual Impacts: Mitigation Not Considered

Alternative[1,2]	Category 1		Category 2			Category 3			
	Recording Studio	Concert Hall	Residential	Hospital	Other	School	Church	Park	Other
Alternative 1	0	0	264	0	0	0	0	0	1
Alternative 2	0	0	264	0	0	0	0	0	1
Alternative 3	0	0	262	0	0	0	0	0	1
Alternative 5	0	0	264	0	0	0	0	0	1

Source: California High-Speed Rail Authority, 2017a

[1] The receivers that do not meet the eligibility requirements for a noise barrier specified in N&V-MM#3.

[2] The receptor numbers for each B-P Build Alternative are the same without and with the inclusion of the CCNM Design Option or the Refined CCNM Design Option.

Table 3.4-37 Palmdale Station Alignment—Severe Residual Impacts Without Mitigation

Alternative[1]	Category 1		Category 2			Category 3			
	Recording Studio	Concert Hall	Residential	Hospital	Other	School	Church	Park	Other
Palmdale	0	0	90	0	0	0	0	0	0

Source: California High-Speed Rail Authority, 2017a

[1] The receivers that do not meet the eligibility requirements for a noise barrier specified in N&V-MM#3.

As discussed under F-B LGA N&V-MM#6 and N&V-MM#6, below, an updated noise and vibration assessment will be completed in final design prior to the start of construction

Install Building Sound Insulation

If sound walls are not proposed for receptors with severe impacts, or if proposed sound walls do not reduce exterior 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 outdoor-to-indoor noise reduction is a mitigation measure that can be considered when the use of sound barriers is not feasible in providing a reasonable level (5 to 7 dBA) 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 dBA) 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.

Noise Easements

If a substantial noise reduction cannot be completed 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. An agreement between the Authority and the property owner can be established wherein the property owner releases the right to petition the Authority regarding the noise level and subsequent disruptions. This would take the form of an easement that would encompass the property boundaries to the right-of-way of the rail line. The Authority would consider this mitigation measure only in isolated cases where other mitigation is ineffective or infeasible.

N&V-MM#4: Vehicle Noise Specification

During high-speed rail (HSR) vehicle technology procurement, the Authority will require bidders to meet the federal regulations (40 C.F.R. Part 201.12/13) at the time of procurement for locomotives (currently a 90-dB-level standard) operating at speeds of greater than 45 mph.

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 trackwork that eliminate the gap. The Authority will require the project design to follow the recommendations in the approved noise impact report.

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

Prior to construction, the contractor 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 CEQA and NEPA, to reassess noise impacts and mitigation. Table 3.4-38 shows potential vibration mitigation procedures.

Table 3.4-38 Potential Vibration Mitigation Procedures and Descriptions

Mitigation Procedure	Location of Mitigation	Description
Maintenance	Source	Installation of 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.

N&V-MM#7: Station, Maintenance-of-Way Facility, and Traction Power Substation

In order to reduce the noise from the facilities, the Authority will implement the following noise mitigation measures, which will be accomplished as part of facility design:

- Enclose as many of the activities within the facility as possible.
- Eliminate windows in the building that would face toward noise-sensitive land uses adjacent to the facility. If windows are required to be located on the side of the facility facing noise-sensitive land uses, they should be the fixed type of windows with a sound transmission class rating of at least 35. If the windows must be operable, they should be closed during nighttime activities.
- Close facility doors where the rails enter the facility during nighttime activities.
- Locate tracks that cannot be located within the facility on the far side of the facility from adjacent noise-sensitive receivers.
- For tracks that cannot be installed away from noise-sensitive receivers, install sound barrier along the tracks in order to protect the adjacent noise-sensitive receivers.
- Locate all mechanical equipment (compressors, pumps, generators, etc.) within the facility structure.
- Locate any mechanical equipment located exterior to the facility (compressors, pumps, generators, etc.) on the far side of the facility from adjacent noise-sensitive receivers. If this is

not possible, this equipment should be located within noise enclosures to mitigate the noise during operation.

- Point all ventilation ducting for the facility away from the adjacent noise-sensitive receivers.

N&V-MM#8: Startle Effect Warning Signage

The following signage will be posted along the Pacific Crest Trail:

- A passive warning sign at approximately 1,300 feet or farther from the alignment warning of an upcoming train crossing
- An active warning sign at 60+ feet of the alignment warning users of an upcoming train crossing and the approximate time for the crossing (number of minutes)

Impacts from Implementing Mitigation Measures

Mitigation Measures F-B LGA N&V-MM#1 and N&V-MM#1, implemented to reduce construction-related noise levels, would not expand the construction area, and the increase in noise associated with the erection of temporary noise barriers would be minimal in comparison to the scope of the project.

Mitigation Measures F-B LGA N&V-MM#2 and N&V-MM#2, implemented to reduce construction-related vibration levels, may require pre-construction surveys and repair of damaged buildings outside the construction boundary. However, these efforts would not result in additional vibration impacts.

Mitigation Measures F-B LGA N&V-MM#3 and N&V-MM#3 would reduce operations-related noise from the proposed HSR project. The installation of sound barriers along the HSR alignment would remain within the construction boundary, within the HSR right-of-way, and would not be additional obstacles to wildlife movement. Secondary impacts could potentially occur at the locations where the project would install sound barriers. The changes to visual and aesthetic qualities and the existing environment that might occur because of the installation of these barriers are covered in Section 3.16, Aesthetics and Visual Resources, but these changes are not assessed in site-specific locations because of uncertainty about the locations of these barriers, their heights, and their applications.

No secondary effects are associated with the implementation of Mitigation Measures F-B LGA N&V-MM#4 and N&V-MM#4 because the measure involves bidding and procurement.

Mitigation Measures F-B LGA N&V-MM#5 and N&V-MM#5 would require special types of trackwork to eliminate gaps that would reduce noise levels generated from rail turnouts. Because this measure would be conducted within the HSR right-of-way and staging areas, this measure would have no secondary effects.

No secondary effects are associated with the implementation of Mitigation Measures F-B LGA N&V-MM#6 and N&V-MM#6 because the measure involves conducting additional noise and vibration analysis.

Mitigation Measures F-B LGA N&V-MM#7 and N&V-MM#7 would reduce noise levels generated from long-term operations of stationary facilities associated with the HSR project. No secondary effects are expected from the implementation of the proposed mitigation measure, with the exception of the potential sound barrier mitigation at the stations and the LMF site. The changes to visual and aesthetic qualities and the existing environment that might occur because of the installation of sound barriers are covered in Section 3.16, Aesthetics and Visual Resources, but these changes are not assessed in site-specific locations because of uncertainty about the locations of these barriers, their heights, and their applications. The project design will incorporate the affected communities' input on the appearance of the sound barriers to reduce secondary visual and aesthetic impacts.

Mitigation Measures F-B LGA N&V-MM#8 and N&V-MM#8 would create a change in the existing environment from the installation of the signs, but that they would not substantially degrade the existing visual environment.

3.4.8 NEPA Impact Summary

This section summarizes the impacts of the B-P Build Alternatives and compares them to the anticipated impacts of the No Project Alternative. Under NEPA, project effects are evaluated based on the criteria of context and intensity. Effects are assessed after implementation of the project IAMFs described in Section 3.4.4.2 and the mitigation measures described in Section 3.4.7.

Table 3.4-39 provides a comparison of the potential impacts of the B-P Build Alternatives. The B-P Build Alternatives would have no construction impacts related to noise and vibration. The B-P Build Alternatives would have no operational impacts related to noise effects on wildlife and domestic animals, or traffic noise.

The B-P Build Alternatives would result in noise impacts from HSR stationary facilities near the Palmdale Station area and as a result of the TPSS. However, the implementation of Mitigation Measures F-B LGA N&V-MM#7 and N&V-MM#7, which include noise barriers, would reduce long-term operational noise impacts.

Under NEPA, operation of the B-P Build Alternatives would result in noise impacts on sensitive receivers. The implementation of Mitigation Measures F-B LGA N&V-MM#3 through N&V-MM#6 and N&V-MM#3 through N&V-MM#6 would reduce B-P Build Alternative noise impacts.

Table 3.4-39 Comparison of Bakersfield to Palmdale Project Section Build Alternative Impacts for Noise and Vibration

Resource Category	Alternative 1	Alternative 2	Alternative 3	Alternative 5
Impact NV#1: Construction Noise—Rail Corridor Construction	Impact within 190 to 317 feet and within 580 to 603 feet from the construction boundary without and with pile driving, respectively, during daytime hours. Impact within 601 to 1,004 feet and within 1,835 to 1,906 feet from the construction boundary without and with pile driving, respectively, during nighttime hours. Standard daytime classes and activities would not be impacted by nighttime construction activity.	Impact within 190 to 317 feet and within 580 to 603 feet from the construction boundary without and with pile driving, respectively, during daytime hours. Impact within 601 to 1,004 feet and within 1,835 to 1,906 feet from the construction boundary without and with pile driving, respectively, during nighttime hours. Standard daytime classes and activities would not be impacted by nighttime construction activity.	Impact within 190 to 317 feet and within 580 to 603 feet from the construction boundary without and with pile driving, respectively, during daytime hours. Impact within 601 to 1,004 feet and within 1,835 to 1,906 feet from the construction boundary without and with pile driving, respectively, during nighttime hours. Standard daytime classes and activities would not be impacted by nighttime construction activity.	Impact within 190 to 317 feet and within 580 to 603 feet from the construction boundary without and with pile driving, respectively, during daytime hours. Impact within 601 to 1,004 feet and within 1,835 to 1,906 feet from the construction boundary without and with pile driving, respectively, during nighttime hours. Standard daytime classes and activities would not be impacted by nighttime construction activity.
Impact NV#1: Construction Noise—Roadway Construction	Impacts within 141 feet and within 315 feet of the construction boundary without and with pile driving, respectively, during daytime hours. Impact within 446 feet and within 995 feet of the construction boundary without and with pile driving, respectively, during nighttime hours. Standard daytime classes and activities would not be impacted by nighttime construction activity.	Impacts within 141 feet and within 315 feet of the construction boundary without and with pile driving, respectively, during daytime hours. Impact within 446 feet and within 995 feet of the construction boundary without and with pile driving, respectively, during nighttime hours. Standard daytime classes and activities would not be impacted by nighttime construction activity.	Impacts within 141 feet and within 315 feet of the construction boundary without and with pile driving, respectively, during daytime hours. Impact within 446 feet and within 995 feet of the construction boundary without and with pile driving, respectively, during nighttime hours. Standard daytime classes and activities would not be impacted by nighttime construction activity.	Impacts within 141 feet and within 315 feet of the construction boundary without and with pile driving, respectively, during daytime hours. Impact within 446 feet and within 995 feet of the construction boundary without and with pile driving, respectively, during nighttime hours. Standard daytime classes and activities would not be impacted by nighttime construction activity.
Impact NV#1: Construction Noise—Maintenance-of-Way Facilities	No impact.	No impact.	No impact.	No impact.

Resource Category	Alternative 1	Alternative 2	Alternative 3	Alternative 5
Impact NV#1: Construction Noise—Traction Power Substations	Impact within 133 feet from the construction boundary during daytime hours. Impact within 421 feet from the construction boundary during nighttime hours. Standard daytime classes and activities would not be impacted by nighttime construction activity.	Impact within 133 feet from the construction boundary during daytime hours. Impact within 421 feet from the construction boundary during nighttime hours. Standard daytime classes and activities would not be impacted by nighttime construction activity.	Impact within 133 feet from the construction boundary during daytime hours. Impact within 421 feet from the construction boundary during nighttime hours. Standard daytime classes and activities would not be impacted by nighttime construction activity.	Impact within 133 feet from the construction boundary during daytime hours. Impact within 421 feet from the construction boundary during nighttime hours. Standard daytime classes and activities would not be impacted by nighttime construction activity.
Impact NV#1: Construction Noise—Electric Power Utility Improvements	Impact within 133 feet from the construction boundary during daytime hours. Impact within 421 feet from the construction boundary during nighttime hours. Standard daytime classes and activities would not be impacted by nighttime construction activity.	Impact within 133 feet from the construction boundary during daytime hours. Impact within 421 feet from the construction boundary during nighttime hours. Standard daytime classes and activities would not be impacted by nighttime construction activity.	Impact within 133 feet from the construction boundary during daytime hours. Impact within 421 feet from the construction boundary during nighttime hours. Standard daytime classes and activities would not be impacted by nighttime construction activity.	Impact within 133 feet from the construction boundary during daytime hours. Impact within 421 feet from the construction boundary during nighttime hours. Standard daytime classes and activities would not be impacted by nighttime construction activity.
Impact NV#2: Construction Vibration—Rail Corridor Construction	No impact.	No impact.	No impact.	No impact.
Impact NV#2: Construction Vibration—Roadway Construction	No impact.	No impact.	No impact.	No impact.
Impact NV#2: Construction Vibration—Station	No impact.	No impact.	No impact.	No impact.
Impact NV#2: Construction Vibration—Maintenance-of-Way Facilities	No impact.	No impact.	No impact.	No impact.
Impact NV#2: Construction Vibration—Traction Power Substations	No impact.	No impact.	No impact.	No impact.

Resource Category	Alternative 1	Alternative 2	Alternative 3	Alternative 5
Impact NV#2: Construction Vibration—Electric Power Utility Improvements	Impact within 77 feet and 20 feet from fragile or historic structures from pile driving and bulldozing/ drilling, respectively. Impact within 55 feet and 15 feet from residential structures from pile driving and bulldozing/drilling, respectively. No impacts for school structures.	Impact within 77 feet and 20 feet from fragile or historic structures from pile driving and bulldozing/ drilling, respectively. Impact within 55 feet and 15 feet from residential structures from pile driving and bulldozing/drilling, respectively. No impacts for school structures.	Impact within 77 feet and 20 feet from fragile or historic structures from pile driving and bulldozing/ drilling, respectively. Impact within 55 feet and 15 feet from residential structures from pile driving and bulldozing/drilling, respectively. No impacts for school structures.	Impact within 77 feet and 20 feet from fragile or historic structures from pile driving and bulldozing/ drilling, respectively. Impact within 55 feet and 15 feet from residential structures from pile driving and bulldozing/drilling, respectively. No impacts for school structures.
Impact NV#3: Severe Noise Impacts from Project Operation to Sensitive Receivers	1,845 – Residential 7 – Other[1] 1 – School 2 – Church 2 – Other[2]	1,803 – Residential 7 – Other[1] 1 – School 2 – Church 2 – Other[2]	1,843 – Residential 7 – Other[1] 1 – School 2 – Church 2 – Other[2]	1,943 – Residential 7 – Other[1] 1 – School 2 – Church 2 – Other[2]
Impact NV#3: Moderate Noise Impacts from Project Operation to Sensitive Receivers	1 – Recording Studio 3,577 – Residential 4 – Other[1] 8 – School 11 – Church 4 – Parks 4 – Other[2]	1 – Recording Studio 3,622 – Residential 4 – Other[1] 8 – School 11 – Church 4 – Parks 4 – Other[2]	1 – Recording Studio 3,577 – Residential 4 – Other[1] 8 – School 11 – Church 4 – Parks 4 – Other[2]	1 – Recording Studio 3,645 – Residential 3 – Other[1] 8 – School 11 – Church 3 – Parks 5 – Other[2]
Impact NV#4: Noise Effects on Wildlife and Domestic Animals	No impact.	No impact.	No impact.	No impact.
Impact NV#5: Impacts from Project Vibration	No impact.	No impact.	No impact.	No impact.
Impact NV#6: Traffic Noise	No impact.	No impact.	No impact.	No impact.
Impact NV#6: Traffic Noise—Type 1 Projects	Noise impact southwest of the W Ivesbrook Street/Sierra Highway intersection.	Noise impact southwest of the W Ivesbrook Street/Sierra Highway intersection.	Noise impact southwest of the W Ivesbrook Street/Sierra Highway intersection.	No impact.
Impact NV#7: Noise from High-Speed Rail Stationary Facilities—Stations	173 – Residences	173 – Residences	173 – Residences	173 – Residences

Resource Category	Alternative 1	Alternative 2	Alternative 3	Alternative 5
Impact NV#7: Noise from High-Speed Rail Stationary Facilities—Maintenance-of-Way Facilities	5 – Receivers No impact on schools.	5 – Receivers No impact on schools.	5 – Receivers No impact on schools.	5 – Receivers No impact on schools.
Impact NV#7: Noise from High-Speed Rail Stationary Facilities—Traction Power Substation	1 – Single-Family Residence No impact on schools.	1 – Single-Family Residence No impact on schools.	1 – Single-Family Residence No impact on schools.	1 – Single-Family Residence No impact on schools.
Impact NV#7: Noise from High-Speed Rail Stationary Facilities—Electric Power Utility Improvements	No impact.	No impact.	No impact.	No impact.

Source: California High-Speed Rail Authority, 2018
[1] Other Category 2 land uses include 1 homeless shelter and 10 hotels.
[2] Other Category 3 land uses include one club, three meeting halls, and two museums.

3.4.9 CEQA Significance Conclusions

Table 3.4-40 summarizes noise-related impacts, their associated mitigation measures, and the level of significance after mitigation. Under CEQA, significant impacts remain after mitigation because some noise-sensitive receivers might still experience operational noise levels that are considered severe even after the installation of sound barriers. Building sound insulation and noise easement may be considered as additional mitigation for HSR operational noise on a case-by-case basis, but these measures do not reduce exterior noise levels, which is the metric used in the threshold for determining significance under CEQA. Vehicle noise specifications and special trackwork may reduce noise at the source, but operational noise impacts are still considered significant and unavoidable at some locations.

Table 3.4-40 Summary of CEQA Significance Conclusions for Noise and Vibration[1]

Impact	CEQA Level of Significance before Mitigation	Mitigation Measure	CEQA Level of Significance after Mitigation
Construction			
N&V #1: Construction Noise	Potentially Significant	F-B LGA N&V-MM#1, N&V-MM#1	Less than Significant
N&V #2: Construction Vibration	Potentially Significant	F-B LGA N&V-MM#2, N&V-MM#2	Less than Significant
Operations			
N&V #3: Project Noise Impacts Locally Generated Alternative (LGA): ▪ 2,758 Severe Impacts ▪ 4.556 Moderate Impacts B-P Alignment Between Stations—Alternative 1: ▪ 1,857 Severe Impacts ▪ 3,609 Moderate Impacts B-P Alignment Between Stations—Alternative 2: ▪ 1,815 Severe Impacts ▪ 3,654 Moderate Impacts B-P Alignment Between Stations—Alternative 3: ▪ 1,855 Severe Impacts ▪ 3.609 Moderate Impacts B-P Alignment Between Stations—Alternative 5: ▪ 1,953 Severe Impacts 3,676 Moderate Impacts	Significant	F-B LGA N&V-MM#3 through F-B LGA N&V-MM#6, N&V-MM#3 through N&V-MM#6	Significant and Unavoidable in Some Locations Residual Severe Impacts: ▪ LGA[2]: 29 B-P Alignment Between Stations: ▪ Alternative 1: 473 ▪ Alternative 2: 473 ▪ Alternative 3: 487 ▪ Alternative 5: 549 ▪ Palmdale: 90
N&V #4: Noise Effects on Wildlife and Domestic Animals	Potentially Significant (for equestrian uses at the Pacific Crest Trail)	N&V-MM#8	Less than Significant after Mitigation
N&V #5: Impacts from Project Vibration	Potentially Significant	F-B LGA N&V-MM#4 through F-B LGA N&V-MM#6, N&V-MM#4 through N&V-MM#6	Less than Significant

Impact	CEQA Level of Significance before Mitigation	Mitigation Measure	CEQA Level of Significance after Mitigation
N&V #5: Traffic Noise	Less than Significant	No mitigation necessary	Less than Significant
N&V #7: Noise Impacts from HSR Stationary Facilities	Potentially Significant	F-B LGA N&V-MM#7, N&V-MM#7	Significant and Unavoidable in Some Locations

[1] Unless specified, the impact assessment and mitigation measures apply to all B-P Build Alternatives.
[2] The portion of the Fresno to Bakersfield Locally Generated Alternative alignment from the intersection of 34th Street and L Street to Oswell Street
B-P = Bakersfield to Palmdale
HSR = high-speed rail

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