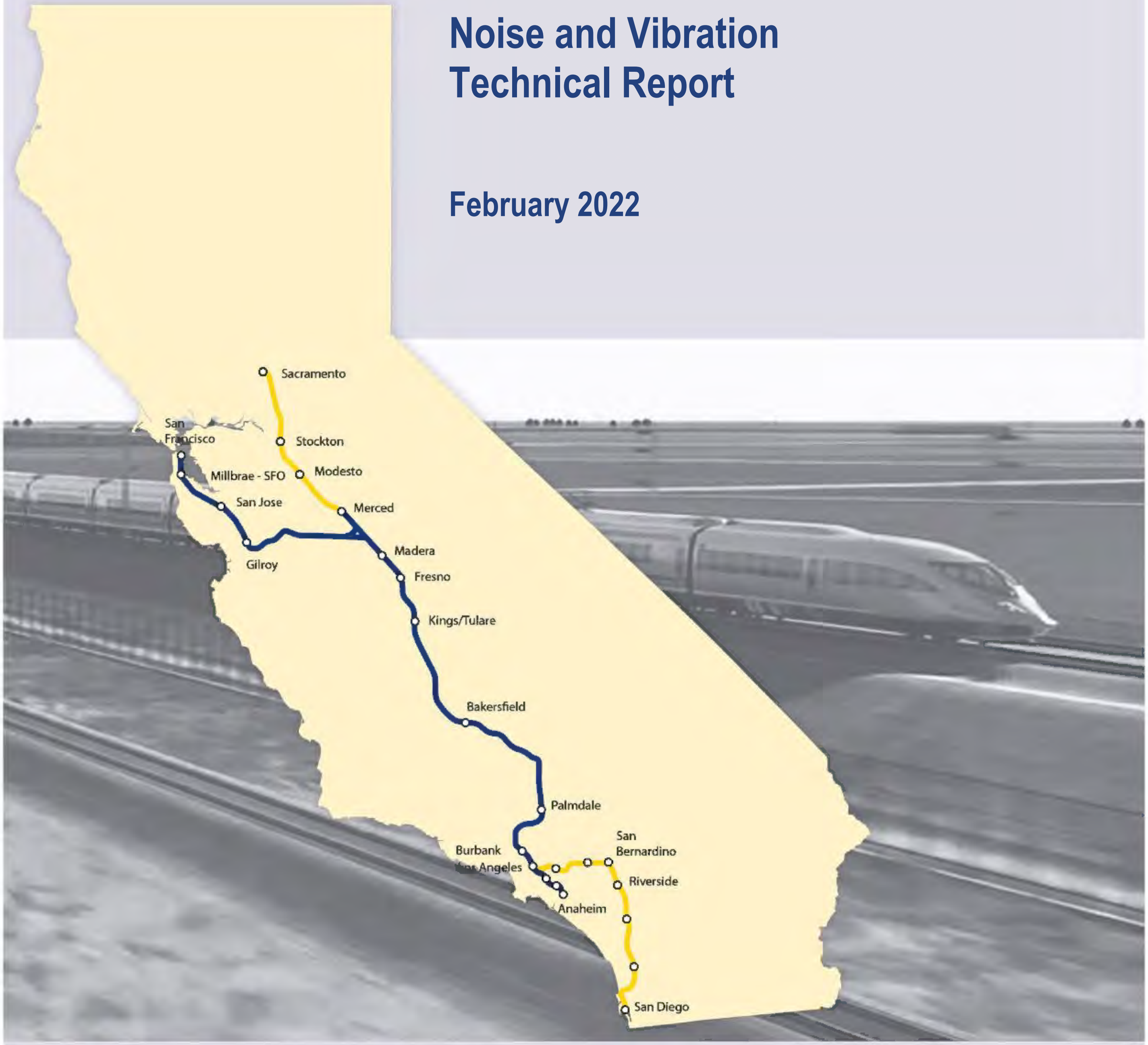
APPENDIX 3.4-A: NOISE AND VIBRATION TECHNICAL REPORT

California High-Speed Rail Authority

San Jose to Merced Project Section



Noise and Vibration Technical Report

February 2022

CALIFORNIA
High-Speed Rail Authority

The environmental review, consultation, and other actions required by applicable federal environmental laws for this project are being or have been carried out by the State of California pursuant to 23 U.S.C. 327 and a Memorandum of Understanding dated July 23, 2019, and executed by the Federal Railroad Administration and the State of California.

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ACRONYMS AND ABBREVIATIONS

2016 Business Plan	Connecting and Transforming California: 2016 Business Plan
2018 Business Plan	California High-Speed Rail 2018 Business Plan
µin/sec	microinch per second
ADT	average daily traffic
ATC	automatic train control
Authority	California High-Speed Rail Authority
BART	Bay Area Rapid Transit
Bay Area	San Francisco Bay Area
C.F.R.	Code of Federal Regulations
Caltrans	California Department of Transportation
CEQA	California Environmental Quality Act
CNEL	community noise equivalent level
CP	Control Point
dB	decibel(s)
dB/sec	decibels per second
dBA	A-weighted decibel(s)
DDV	Diridon design variant
EIR	environmental impact report
EIS	environmental impact statement
EMU	electric multiple unit
FDL	force density level
FHWA	Federal Highway Administration
FRA	Federal Railroad Administration
FRA guidance manual	*High-Speed Ground Transportation Noise and Vibration Impact Assessment*
FTA	Federal Transit Administration
FTA guidance manual	*Transit Noise and Vibration Impact Assessment Manual*
GEA	Grasslands Ecological Area
HSR	high-speed rail
Hz	Hertz, cycles per second
I-	Interstate
IAMF	impact avoidance and minimization feature
in/sec	inches per second
kV	kilovolt
L_{dn}	day-night sound level, dBA

L_{eq}	equivalent sound level, dBA
L_{eq}(h)	hourly equivalent sound level, dBA
L_{max}	maximum sound level
LSR	line source response
L_v	velocity level, VdB
MOWS	maintenance of way siding
MOWF	maintenance of way facility
mph	miles per hour
MT	mainline track
MVA	megavolt amperes
NEPA	National Environmental Policy Act
PCEP	Peninsula Corridor Electrification Project
PG&E	Pacific Gas and Electric
PPV	peak particle velocity
project extent, project	San Jose to Central Valley Wye Project Extent
Project Section	San Jose to Merced Project Section
PS	paralleling station
PTC	positive train control
RMS	root-mean-square
RSA	resource study area
SEL	sound exposure level, dBA
SR	State Route
Statewide Program EIR/EIS	Final Program Environmental Impact Report (EIR) / Environmental Impact Statement (EIS) for the Proposed California High-Speed Train System
SWS	switching station
TBM	tunnel-boring machine
TDV	tunnel design variant
TPF	traction power facility
TPSS	traction power substation
UPRR	Union Pacific Railroad
US	U.S. Highway
U.S.C.	United States Code
VdB	vibration decibel(s)
VHS	very high-speed
VTA	(Santa Clara) Valley Transportation Authority

EXECUTIVE SUMMARY

The California High-Speed Rail Authority (Authority) has prepared this *San Jose to Merced Project Section Noise and Vibration Technical Report* to support the *San Jose to Merced Project Section Final Environmental Impact Report (EIR)/Environmental Impact Statement (EIS).* This technical report characterizes existing conditions and analyzes noise and vibration effects of four alternatives.

This technical report addresses effects resulting from construction and operations of the San Jose to Merced Project Section (Project Section or project), focusing on the portion of the Project Section between San Jose and Carlucci Road (San Jose to Central Valley Wye Project Extent, or simply the project). It describes relevant federal, state, regional, and local regulations and requirements; methods used for the analysis of effects; the affected environment; impact avoidance and minimization features (IAMF) incorporated into the project design that would avoid, minimize, or reduce specific environmental effects; and the potential effects of noise and vibration in the resource study area (RSA) that would result from construction and operations of the project alternatives. Project noise and vibration effects consist of construction-related noise and vibration effects, high-speed rail (HSR) operations noise and vibration effects, including noise from stations and maintenance facilities, and operations traffic noise effects.

Summary of Effects

This analysis evaluates noise and vibration impacts[1] associated with the four project alternatives for both the construction and operations phases. Construction of the project, including Pacific Gas and Electric (PG&E) network upgrades, would require the use of mechanical equipment that would generate temporary increases in noise and ground-borne vibration and result in temporary construction impacts at noise-sensitive locations. The Authority and its contractors would comply with Federal Transit Administration (FTA) and Federal Railroad Administration (FRA) guidelines for minimizing noise and vibration impacts at sensitive receptors during project construction (NV-IAMF#1: Noise and Vibration), but construction noise and vibration effects would remain.

Project operations would permanently increase noise levels above existing ambient noise levels, potentially resulting in environment noise impacts at sensitive receptors. Alternative 4 would have the most severe and moderate operations noise impacts, followed by Alternative 2, Alternative 1, and Alternative 3 under the 2040 Plus Project conditions. Under the 2040 Plus Project condition, there would be 337 severe noise impacts and 1,200 moderate impacts under Alternative 1; there would be 755 severe impacts and 1,844 moderate impacts under Alternative 2; there would be 222 severe impacts and 834 moderate impacts under Alternative 3; and there would be 1,212 severe impacts and 1,666 moderate impacts under Alternative 4.

With the Diridon design variant (DDV) and tunnel design variant (TDV) under the 2040 Plus Project condition, there would be 347 severe noise impacts and 1,195 moderate impacts under Alternative 1; there would be 766 severe impacts and 1,838 moderate impacts under Alternative 2; there would be 233 severe impacts and 845 moderate impacts under Alternative 3; and there would be 1,224 severe impacts and 1,658 moderate impacts under Alternative 4.

Project operations would generate traffic and associated noise at HSR stations. Near the San Jose Diridon Station, the largest day-night sound level (L_{dn}) contribution from the parking facilities at nearby noise receptors would be 29 A-weighted decibels (dBA). Near the Downtown Gilroy Station, the largest L_{dn} contribution from the parking facilities at the nearby noise receptors would be 40 dBA. Near the East Gilroy Station, the largest L_{dn} contribution from the parking facilities at nearby noise receptors would be 28 dBA. The additional noise from parking facilities would be substantially lower (at least 18 dBA lower) than the projected L_{dn} from project operations.

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[1] The terms *impact* and *effect* have the same meaning in this document. The use of the term "impact" in this document does not imply that the impact is necessarily significant as defined in NEPA or CEQA. Instead, the term refers to an effect that may exceed a relevant FRA or FTA impact criteria level. The significance impact determinations are made in the EIR/EIS section and not in this document.

Project operations would also generate additional noise associated with train movements in and out of the maintenance of way facility (MOWF) near Gilroy. Under Alternatives 1 and 2, the L_{dn} contribution from the South Gilroy MOWF at the nearest receptor would be 40 dBA (more than 20 dBA below HSR operations). Under Alternative 3, the L_{dn} contribution from the East Gilroy MOWF at the nearest receptor would be 47 dBA (more than 20 dBA below HSR operations). Under Alternative 4, the L_{dn} contribution from the MOWF at that nearest receptor would be 45 dBA (i.e., more than 18 dBA below HSR operations). The MOWFs would not contribute to noise impacts of nearby sensitive receptors under any of the alternatives.

The potential for passing HSR train noise to startle or surprise humans near the HSR track and result in human annoyance is included in this analysis as "additional information" per FRA guidance (FRA 2012). Annoyance and startle effects for humans would be primarily limited to areas within the project's proposed right-of-way and limited areas adjacent to the right-of-way. Analysts also evaluated the potential for livestock to experience stress associated with the noise of passing trains in exceedance of the FRA's recommended threshold. Livestock within approximately 30 feet of the edge of the HSR right-of-way would experience startle effects and stress from train passbys, and livestock within 65 feet of horn-sounding locations would experience startle effects and stress from horn sounding. Noise effects on wildlife are evaluated separately in the *San Jose to Merced Project Section Biological and Aquatic Resources Technical Report* (Authority 2019a).

Construction of the project would result in temporary and permanent changes in the local roadway network that would require some diversion and rerouting of traffic. The diversion of traffic would not be expected to affect noise levels because traffic on local roadways provides only a minor contribution to overall noise levels.

Project operations would generate additional traffic and traffic-related noise under the 2029 Plus Project and 2040 Plus Project conditions. Permanent increases in traffic-related noise would be similar for all four alternatives and would occur at roadway segments near San Jose Diridon Station, along Monterey Corridor, and near Gilroy. In 2029, seven roadway segments under Alternatives 1 and 2 and six roadway segments under Alternatives 3 and 4 would have the potential for noise level increases greater than or equal to 3 dB compared to existing noise conditions. In 2040, operations of each project alternative would result in 12 roadway segments with the potential for noise level increases greater than or equal to 3 dB. The majority of these traffic noise impacts would occur near the San Jose Diridon Station and along Monterey Road.

Traction power facilities would generate noise, potentially affecting receptors within 110 feet of TPF serving the Project (2029 and 2040). In all cases, receptors would also be affected by HSR train operations TPF operations would not result in moderate or severe noise impacts on their own (absent train operations) for any alternative.

Construction of the project would require the use of mechanical equipment that would generate temporary increases in ground-borne vibration which could result in human annoyance and building damage. Construction activities, such as pile driving, would have the potential to cause structural damage to buildings close to these activities (within 50 feet). Most construction activities would only have the potential to cause annoyance from vibration within 160 feet of the mechanical equipment. Some equipment, such as pile driving or ongoing demolition work would have the potential to cause annoyance from vibration within 300 feet. Construction of tunnels in the Pacheco Pass Subsection would have the potential to generate temporary increases in ground-borne vibration that would reach 64 VdB at the closest receptor at 200 feet slant distance and would not be perceptible in buildings proximate to the tunnel boring machine (TBM) operations.

Project operations would have the potential to result in permanent increases in vibration levels at sensitive receptors. The evaluation of potential vibration impacts for the project alternatives indicates that there is a greater potential for vibration impacts associated with Alternative 4, followed by Alternative 2, Alternative 3, and Alternative 1.

1 INTRODUCTION

Since publication of the Draft Environmental Impact Report (EIR)/Environmental Impact Statement (EIS), the following substantive changes have been made to this appendix:

- Where appropriate, the verb "would," when used specifically to describe impact avoidance and minimization features (IAMF) or mitigation measures, as well as their directly related activities, was changed to "will," indicating their integration into project design.
- A typographic error in the noise measurement data for noise measurement location N128 was corrected in Table 5-1. Corrections to Figures B-168, B-169, and B-170 for this measurement site were made in Appendix B, Noise Measurement Data, and Draft EIR/EIS Figure B-171 for this measurement site was deleted.
- Analysis about the DDV and TDV was included in this appendix. Figures 5-9, 5-11, 5-13, 5-17, 5-21, and 5-25 were added to illustrate these effects, and Tables 5-6, 5-7, 5-8, 5-9, 5-10, 5-11, 5-12, and 5-13 were updated to include effects of the DDV and TDV.
- As a result of public comments, revisions were made to the Alternative 4 noise impact assessment to correct errors in the analysis. This changed the number of noise impacts in the San Jose Diridon Station Approach, Monterey Corridor, and the Morgan Hill and Gilroy Subsections. Changes were made to Figures 5-22, 5-23, and 5-24 and Tables 5-6, 5-7, and 5-8.
- Changes were made to Figures 5-6, 5-7, 5-8, 5-14, 5-15, 5-16, 5-18, 5-19, and 5-20.
- Additional noise-sensitive receptors were identified and determined to have noise impacts under all alternatives in the Pacheco Pass and San Joaquin Valley Subsections. Changes were made to Figures 5-10, 5-11, 5-12, and 5-13 and Tables 5-6, 5-7, and 5-8.

This report presents a noise and vibration technical evaluation for the California High-Speed Rail San Jose to Merced Project Section (Project Section or project), focusing on the portion of the Project Section between San Jose and Carlucci Road (San Jose to Central Valley Wye Project Extent, or simply the project), prepared in support of environmental reviews required under the National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA).

1.1 Background of the HSR Program

The California High-Speed Rail Authority (Authority) proposes to build, operate, and maintain an electric-powered high-speed rail (HSR) system in California, connecting the San Francisco Bay Area and Central Valley to Southern California. When completed, the nearly 800-mile train system would provide new passenger rail service to more than 90 percent of the state's population. More than 200 weekday trains would serve the statewide intercity travel market. The system would be capable of operating speeds up to 220 miles per hour (mph) in certain HSR sections, with state-of-the art safety, signaling, and automatic train control systems. The California HSR System would connect and serve the state's major metropolitan areas, extending from San Francisco to Los Angeles and Anaheim in Phase 1, with extensions to Sacramento and San Diego in Phase 2.

The Authority and Federal Railroad Administration (FRA) commenced their tiered environmental planning process with the *2005 Final Program Environmental Impact Report (EIR)/Environmental Impact Statement (EIS) for the Proposed California High-Speed Train System* (Statewide Program EIR/EIS) (Authority and FRA 2005), followed by the *Bay Area to Central Valley High-Speed Train Final Program EIR/EIS* (Authority and FRA 2008). These documents established the HSR sections constituting the California HSR System and evaluated the impacts of proposed HSR corridors. After completion of the first-tier programmatic environmental documents, the Authority and FRA approved the HSR system, selected corridors and stations for further study, and began preparing second-tier project environmental evaluations for sections of the statewide HSR system. Chapter 2, Description of the San Jose to Central Valley Wye Project Extent, provides details of the project and the four alternatives under consideration.

1.2 Purpose of this Technical Report

This report supports the San Jose to Merced Project Section Final EIR/EIS. The resource assessment presented in this report is consistent with the Authority and FRA's *California High Speed Rail Project EIR/EIS Environmental Methodology Guidelines Version 5.09* (Version 5 Environmental Methods), adopted in April 2017 (Authority and FRA 2017) and the following federal guidelines established by the FRA, Federal Transit Administration (FTA), and Federal Highway Administration (FHWA):

- ***High-Speed Ground Transportation Noise and Vibration Impact Assessment* (FRA guidance manual) (FRA 2012)—** Establishes guidelines for the evaluation of noise and vibration impacts associated with HSR trains;
- ***Transit Noise and Vibration Impact Assessment* (FTA guidance manual) (FTA 2018)—** Establishes methodology applicable to HSR station activities, yard and maintenance facility activities, and conventional-speed rail operations;
- ***Roadway Construction Noise Model* (FHWA 2006)—**Guidance used in conjunction with the FRA guidance manual to assess construction noise.

1.3 Organization of this Technical Report

This technical report comprises the following chapters in addition to this introductory chapter:

- Chapter 2 describes the project alternatives as currently proposed.
- Chapter 3, Laws, Regulations, and Orders, describes federal, state, regional and local laws, regulations, and policies relevant to noise and vibration.
- Chapter 4, Methods for Evaluating Effects, provides an overview of noise and vibration descriptors, describes the noise and vibration resource study area (RSA), the impact assessment criteria, and the noise and vibration prediction methodology used in the assessment.
- Chapter 5, Existing Conditions and Effects Analysis, describes the environmental setting and assesses the construction and operations effects related to noise and vibration.
- Chapter 6, References, provides complete reference information for the published, online, agency, institutional, and individual sources consulted in preparation of this report.
- Chapter 7, Preparer Qualifications, presents the credentials of the staff who oversaw the preparation of this report.
- Supporting information is provided in the following appendices:
  - Appendix A, Measurement Site Photographs
  - Appendix B, Noise Measurement Data
  - Appendix C, Vibration Propagation Measurement Data

2 DESCRIPTION OF THE SAN JOSE TO CENTRAL VALLEY WYE PROJECT

The Project Section would provide HSR service between Diridon Station in downtown San Jose and a station in downtown Merced, with a Gilroy station either in downtown Gilroy or east of Gilroy. The Project Section is designed to allow trains to and from the Bay Area to transition smoothly from north-south to east-west travel with a minimum reduction in speed to achieve the Proposition 1A operational service time requirement. Proposition 1A requires that the system be designed to be capable of a nonstop operational service time of 2 hours and 10 minutes between San Jose and Los Angeles Union Station.[2] The Project Section follows existing transportation corridors to the extent feasible, as directed by Proposition 1A.[3]

The Project Section is comprised of three project extents (Figure 2-1):

- From Scott Boulevard in Santa Clara to Carlucci Road in Merced County, at the western terminus of the Central Valley Wye (the project)
- The Central Valley Wye, which connects the east-west portion of HSR from the Bay Area to the Central Valley with the north-south portion from Merced to Fresno
- The northernmost portion of the Merced to Fresno Project Section, from the northern limit of the Central Valley Wye (Ranch Road) to the Merced Station

The project would connect San Jose to the Central Valley portion of the HSR system at the Central Valley Wye in Merced County, which in turn connects to the portion of the system running north to Merced and south to Fresno and Southern California. Because the portion of the Project Section between Carlucci Road and Merced has been analyzed in the *Merced to Fresno Section Final EIR/EIS* (Authority and FRA 2012) and the *Merced to Fresno Section: Central Valley Wye Supplemental EIR/EIS* (Authority 2019b), the analysis in this document focuses on the project extent between Scott Boulevard and Carlucci Road (the project).

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[2] Proposition 1A requires that the HSR system be designed to achieve a nonstop operational service time of 2 hours and 40 minutes between San Francisco and Los Angeles Union Station, including a 30-minute ride between San Francisco and San Jose (Streets & Highways Code § 2704.09(b)(4)).

[3] Proposition 1A directs that the HSR system maximize use of existing transportation and utility corridors to the extent feasible (Streets & Highways Code § 2704.09(g)).

Source: Authority 2019c JUNE 2019

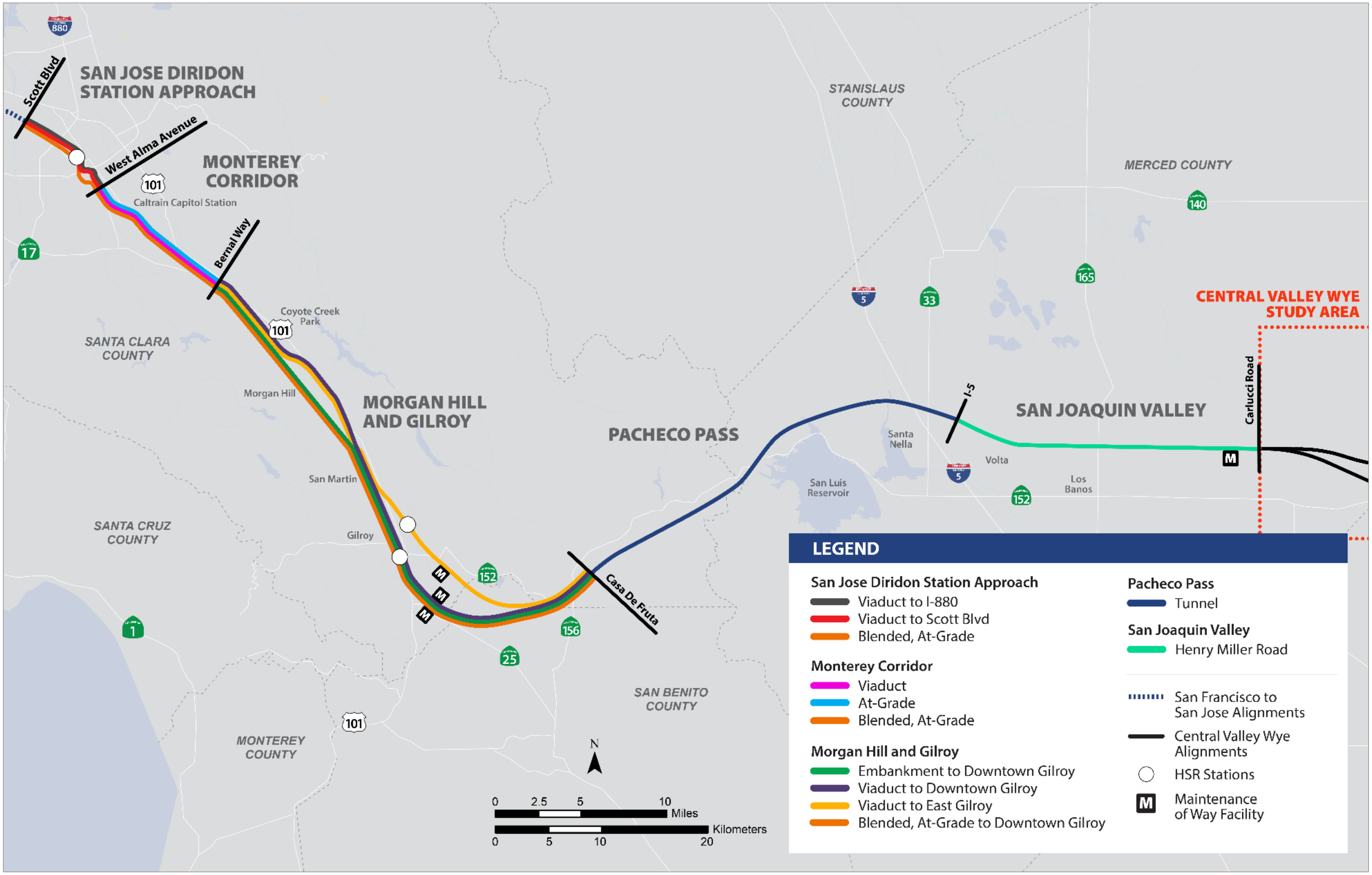
Figure 2-1 Proposed San Jose to Merced Project Section

2.1 Summary of Design Features

While the northern service limit of the project would be the San Jose Diridon Station, the engineering design and evaluation includes infrastructure and train operations north to Scott Boulevard to serve the San Jose Diridon Station; this additional analysis overlaps with the analysis of the San Francisco to San Jose Project Section to the north. The project is an approximately 90-mile portion of the 145-mile-long Project Section, which includes dedicated or blended[4] HSR track and systems; HSR stations located at San Jose Diridon and Gilroy; a maintenance of way facility (MOWF) in the Gilroy area; and a maintenance of way siding (MOWS) near Turner Island Road in the Central Valley (Figure 2-2). HSR stations at San Jose Diridon and Gilroy would support transit-oriented development, provide an interface with regional and local mass transit services, and provide connectivity to the South Bay and Central Valley highway network.[5] While the northern service limit of the project would be the San Jose Diridon Station, the engineering design and evaluation includes train operations north to Scott Boulevard in Santa Clara to support the independent utility of an HSR station at Diridon Station and to describe the proposed interface of HSR alternatives with blended Caltrain railroad infrastructure. This additional analysis between San Jose Diridon Station and Scott Boulevard overlaps with the analysis of the San Francisco to San Jose Project Section to the north. Under three alternatives, the transition of HSR infrastructure and operations from the blended system between San Francisco and Santa Clara to a fully dedicated system south of the San Jose Diridon Station would occur at either Scott Boulevard or near Interstate (I-) 880. A fourth alternative would extend the blended system through San Jose to Gilroy. The project would extend south from San Jose to Gilroy, then east through the Pacheco Pass to the Central Valley to end at Carlucci Road, the western boundary of the Central Valley Wye.

4 *Blended* refers to operating HSR trains with existing intercity, commuter, and regional trains on shared infrastructure.

5 *South Bay* refers to Santa Clara County.



Source: Authority 2019c

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Figure 2-2 Overview of Subsection Design Options

The project comprises the following five subsections:

- **San Jose Diridon Station Approach**—Extends approximately 6 miles from north of San Jose Diridon Station at Scott Boulevard in Santa Clara to West Alma Avenue in San Jose. This subsection includes San Jose Diridon Station and overlaps the southern portion of the San Francisco to San Jose Project Section.
- **Monterey Corridor**—Extends approximately 9 miles from West Alma Avenue to Bernal Way in the community of South San Jose. This subsection is entirely within the city of San Jose.
- **Morgan Hill and Gilroy**—Extends approximately 30–32 miles from Bernal Way in the community of South San Jose to Casa de Fruta Parkway/State Route (SR) 152 in the community of Casa de Fruta in Santa Clara County.
- **Pacheco Pass**—Extends approximately 25 miles from Casa de Fruta Parkway/SR 152 to I-5 in Merced County.
- **San Joaquin Valley**—Extends approximately 18 miles from I-5 to Carlucci Road in unincorporated Merced County.

The Authority and FRA have developed four end-to-end alternatives for the project (Figure 2-2). Table 2-1 shows the design options that distinguish the alternatives by subsection; Figures 2-3 through 2-7 illustrate the features of the four alternatives by subsection.

Table 2-1 San Jose to Central Valley Wye Design Options by Subsection

Subsection/Design Options	Alternative 1	Alternative 2	Alternative 3	Alternative 4
San Jose Diridon Station Approach				
Viaduct to Scott Boulevard		X	X	
Viaduct to I-880	X			
Blended, At-Grade				X
Monterey Corridor				
Viaduct	X		X	
At grade		X		
Blended, At-Grade				X
Morgan Hill and Gilroy				
Embankment to downtown Gilroy		X		
Viaduct to downtown Gilroy	X			
Viaduct to east Gilroy			X	
Blended, At-Grade to downtown Gilroy				X
Pacheco Pass				
Tunnel	X	X	X	X
San Joaquin Valley				
Henry Miller Road	X	X	X	X

Source: Authority 2019c

Source: Authority 2019c

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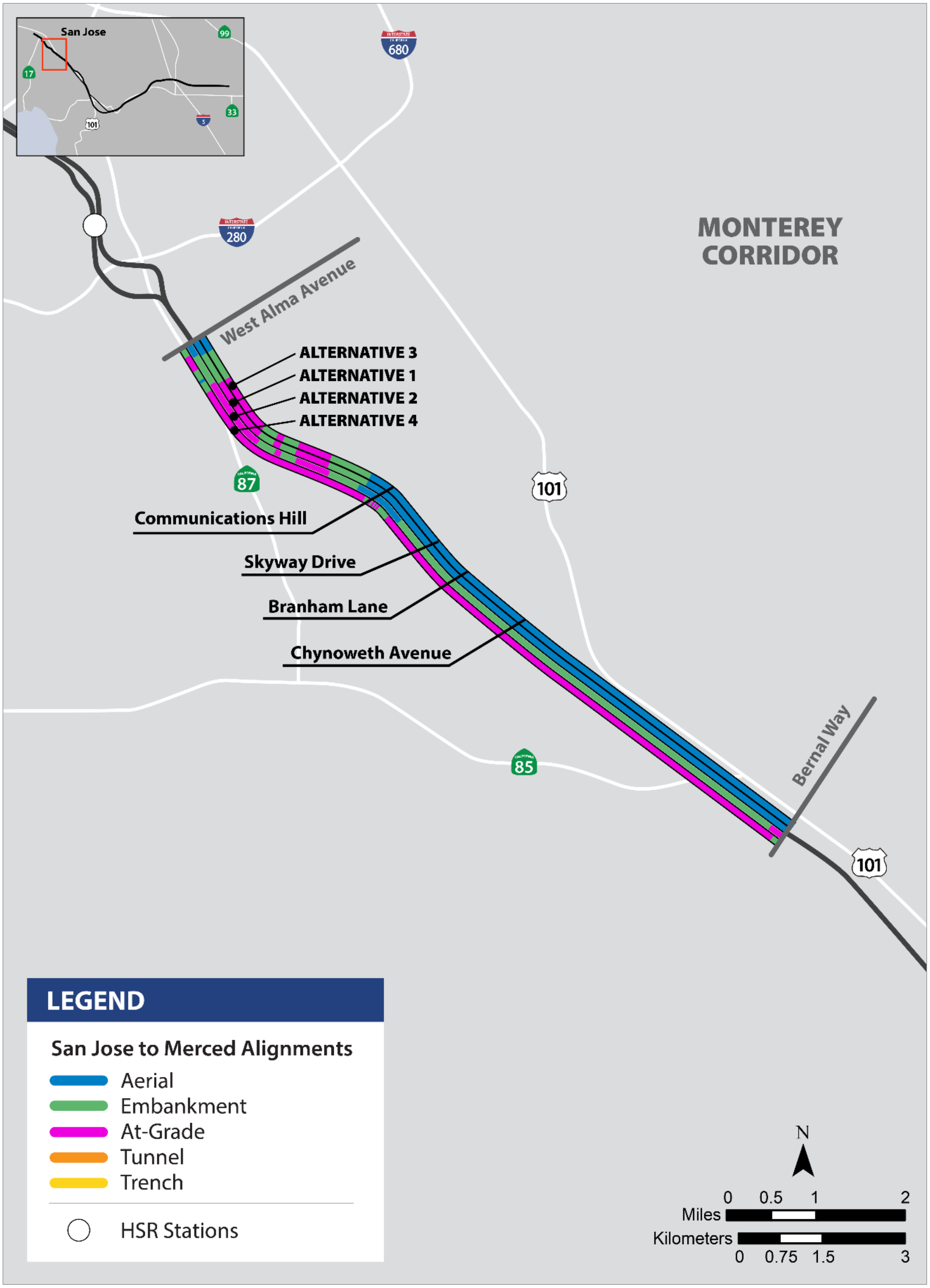
CEMOF = Centralized Equipment Maintenance and Operation Facility

Figure 2-3 San Jose Diridon Station Approach Subsection



Source: Authority 2019c

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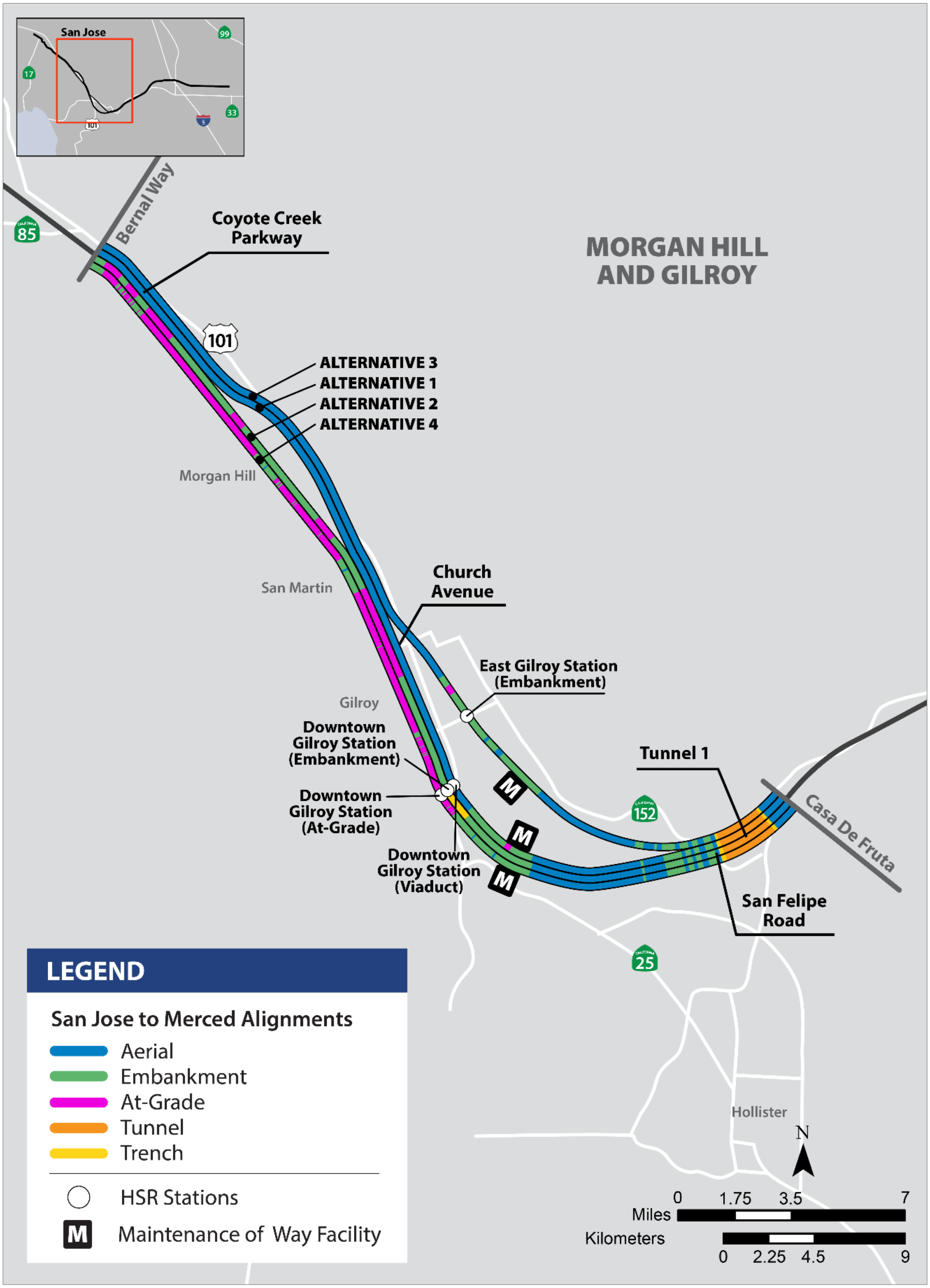
Figure 2-4 Monterey Corridor Subsection



Source: Authority 2019c

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Figure 2-5 Morgan Hill and Gilroy Subsection

Source: Authority 2019c

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Figure 2-6 Pacheco Pass Subsection

Source: Authority 2019c

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Figure 2-7 San Joaquin Valley Subsection

2.2 Description of Alternatives

This section describes the proposed design options of the project alternatives in each subsection. The alternatives are similar in length, differing only in the Morgan Hill and Gilroy Subsection, where divergent alignments in Morgan Hill and the alternative alignments through the Downtown Gilroy Station and the East Gilroy Station result in linear variations.

2.2.1 Alternative 1

Development of Alternative 1 was intended to minimize the project footprint, minimize ground disturbance, minimize continuous surface features, and decrease necessary right-of-way acquisition through extensive use of viaduct structures and bypassing downtown Morgan Hill. The HSR alignment for this alternative would consist of 45.4 miles of viaduct, 4.3 miles at grade, 21.9 miles of embankment, two tunnels totaling 15.0 miles, and 2.3 miles in trench.

2.2.1.1 San Jose Diridon Station Approach Subsection

Alignment and Ancillary Features

The San Jose Diridon Station Approach Subsection, from Scott Boulevard in Santa Clara to West Alma Avenue in San Jose, would be approximately 6 miles through the cities of Santa Clara and San Jose (Figure 2-3). The existing Caltrain track in this subsection consists of a predominantly two-track and three-track at-grade alignment. South of De La Cruz Boulevard, the Union Pacific Railroad (UPRR) tracks of the Coast Line from the northeast converge with the Caltrain corridor tracks and continue south adjacent to the east side of the railroad corridor to the Santa Clara Caltrain Station. Between the Caltrain College Park Station and San Jose Diridon Station, Caltrain's Central Equipment Maintenance and Operations Facility comprises three mainline tracks, a maintenance building, and nine yard tracks. San Jose Diridon Station includes five passenger platforms served by nine yard tracks along the west side of the station house. HSR diverges from the Caltrain corridor at Park Avenue, just south of San Jose Diridon Station, and returns to the Caltrain corridor at the north end of the Caltrain Tamien Station, which includes a passenger platform served by two tracks and a single through-track.

Alternative 1 would begin at Scott Boulevard in blended service with Caltrain at grade. The blended service would entail several minor realignments of existing Caltrain track between Scott Boulevard and I-880. New UPRR and Caltrain track would be constructed just north of the HSR guideway beginning north of I-880 to just past the Santa Clara Station.

Beginning at I-880 on the southbound approach to West Hedding Street, Caltrain tracks would be realigned to accommodate the HSR tracks. Dedicated HSR tracks would diverge from the Caltrain Mainline Track (MT) 2 and MT3 tracks and continue southeast along the north side of the existing Caltrain corridor, crossing under West Hedding Street. To accommodate the new track configuration, the West Hedding Street roadway overpass would be replaced with a new overpass bridge that would also pass over Stockton Avenue.

Southeast of West Hedding Street, the dedicated HSR tracks would transition from a two-track at-grade configuration to retained fill and finally to a two-track aerial profile. The HSR alignment would begin the short viaduct option by rising on embankment to an approximately 70-foot-high aerial structure. A new bridge structure would be built to carry the realigned UPRR/Caltrain MT2 tracks over the West Taylor Street underpass. University Avenue would become a cul-de-sac. A new pedestrian underpass would be constructed near the alignment of Emory Street to allow Caltrain riders to reach both platforms of the Caltrain College Park Station. The HSR viaduct would also cross over West Taylor Street, then shift horizontally a maximum of 500 feet east of the existing UPRR/Caltrain mainline tracks to maintain high-speed track curvature.

Both legs of the UPRR Warm Springs Subdivision Lenzen Wye would be relocated, and North Montgomery Street would be extended north of the alignment of Lenzen Avenue almost to the former Lenzen Wye to maintain property access beneath the 60-foot-high HSR viaduct. The HSR viaduct would cross over Cinnabar Street, both legs of the relocated Lenzen Wye and North Montgomery Street, West Julian Street, and West Santa Clara Street while curving west toward the UPRR/Caltrain mainline tracks to enter a new aerial dedicated HSR station at San Jose Diridon Station.

Continuing on an aerial structure, the alignment would diverge from the Caltrain right-of-way south of the San Jose Diridon Station HSR platforms by turning sharply east at the Park Avenue undercrossing of UPRR/Caltrain tracks. The HSR aerial structure would cross over Los Gatos Creek and San Carlos Street, then over Royal Avenue and the intersection of Bird Avenue and Auzerais Avenue, then over the I-280/SR 87 interchange. Continuing south along the east side of SR 87, the HSR aerial structure would cross over West Virginia Street and the Guadalupe River Trail, then over the Caltrain rail bridge, the Guadalupe River, and Willow Street. The HSR aerial structure would continue south over the Caltrain Tamien Station on an alignment between Tamien Station and the SR 87 freeway, transitioning to the Monterey Corridor Subsection at West Alma Avenue.

Wildlife Crossings

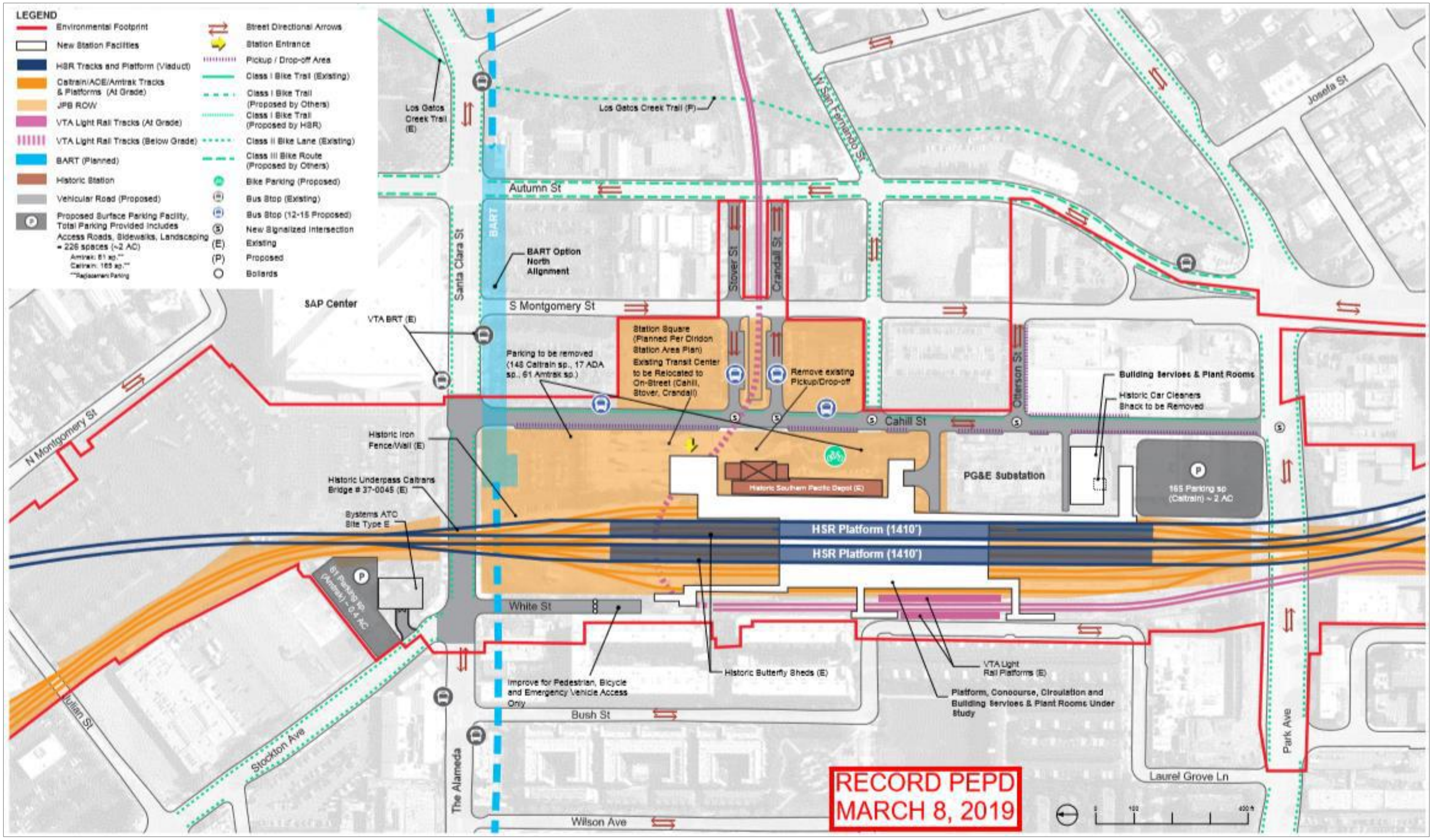
There would be no wildlife crossings in this subsection.

Stations

The HSR San Jose Diridon Station would entail a four-track aerial alignment over the existing Diridon Station at approximately 62 feet to top of rail with 1,410-foot-long platforms above the existing Caltrain rail yard centered between Santa Clara Street and Park Avenue. The existing historic train station would remain in place. As illustrated on Figures 2-8 and 2-9, the primary HSR station building would be constructed north of the existing station building but would continue to the south, wrapping around the existing Caltrain station building. The HSR station building would be accessed from the east at three entrances—the main entrance on the east side of the tracks north of the existing Historic Depot next to the future Bay Area Rapid Transit (BART) alignment; an entrance south of the existing historic Diridon Station building; and an entrance on the east side south of the Pacific Gas and Electric Company (PG&E) power station. There would also be three entrances to the HSR station on the west side of the tracks—a north entrance at the end of White Street and two entrances on Laurel Grove Lane, one north and one south. The aerial station would require viaduct columns within the PG&E substation. The HSR station building would encompass 99,289 square feet with a 4,400-square-foot substation and systems building. The concourse would consist of a mezzanine level above the existing Caltrain tracks and below the HSR platforms, with three east-west connections across the tracks at the north, south, and middle.

Existing parking spaces (226) at Cahill Street would be displaced and replaced 1:1 with new parking areas at Cahill and Park Streets and at Stockton and Alameda Streets. HSR parking demand of 1,050 spaces in 2040 would be met by commercially available parking downtown or at the airport. The Authority has provided a Station Area Planning grant to the City of San Jose to advance the implementation of the Diridon Station Area Plan adopted by the San Jose City Council. Through this effort, the City would address short-term parking needs during HSR and BART Phase II construction and would also address plans for transitioning the parking needed during construction to the highest and best use after construction. Another Station Area Planning grant to the (Santa Clara) Valley Transportation Authority (VTA) would fund a San Jose Diridon Station Facilities Master Plan. This grant would develop a parking program to manage parking demand and supply over time to reflect changes in ridership and park-and-ride mode share. These two studies would provide input into a multimodal access plan for the station that would be developed prior to final station design and construction.

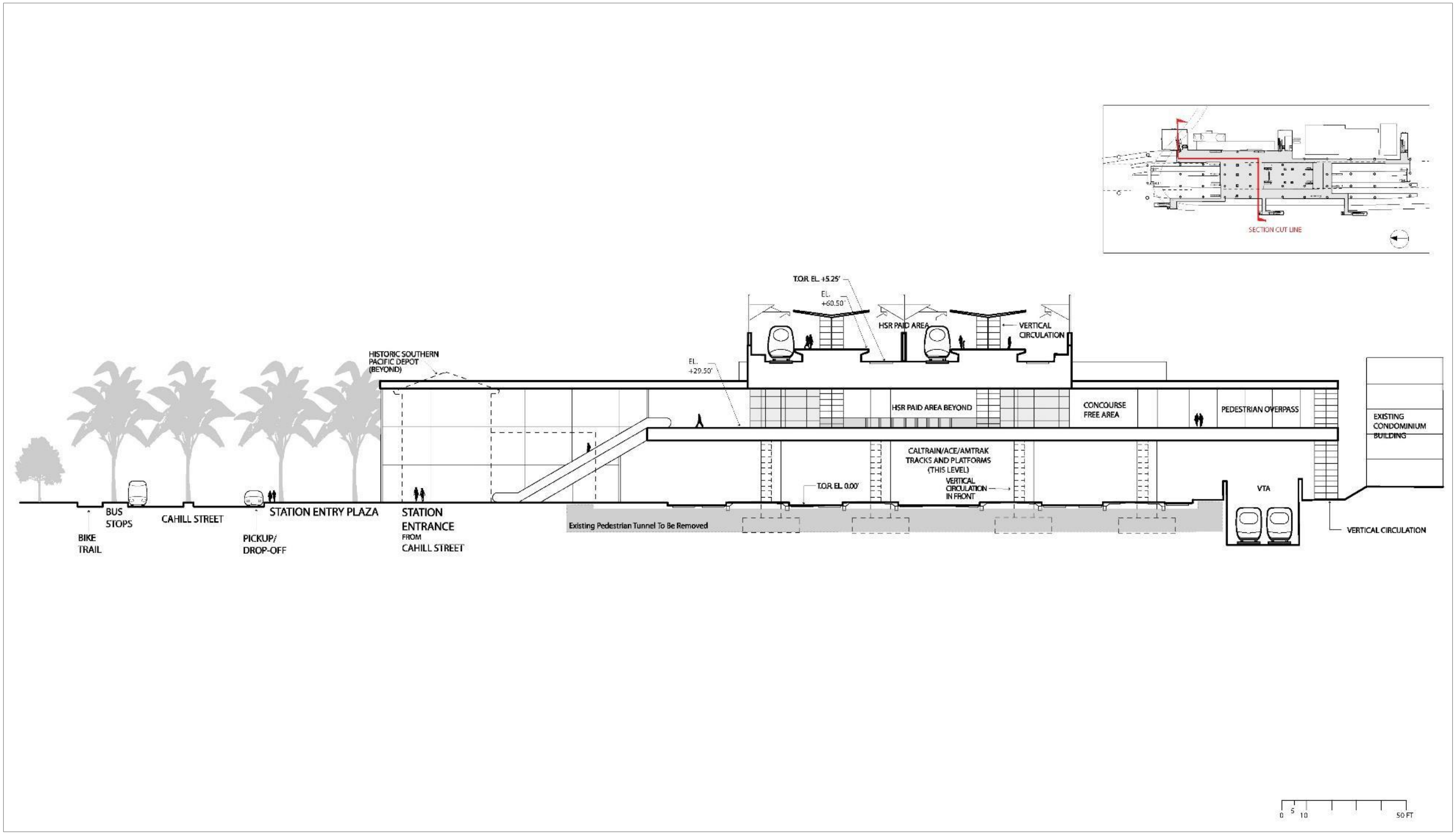
Existing underutilized parking capacity at and around the station would be used to meet the estimated HSR parking demand until a station area parking policy and program are implemented. The Authority would rely on commercially available parking to meet HSR parking demand, provided and priced in accordance with local conditions. HSR riders would be able to walk or take a shuttle, such as the City of San Jose's DASH, from parking located downtown or adjacent to the station.



Source: Authority 2019c

JUNE 2019

Figure 2-8 Conceptual Diridon Aerial Station Plan



Source: Authority 2019c

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Figure 2-9 Conceptual San Jose Diridon Station Cross Section

The existing off-site bus transit center would be relocated to an on-street facility on Cahill, Stover, and Crandall Streets. Street improvements would include reconfiguring and extending Cahill Street from Santa Clara Street to Park Avenue, and converting Cahill, Stover, and Crandall Streets to a transit street with 12–15 bus stops. Montgomery Street would be reconfigured to provide curb space for a bus layover. A pick-up/drop-off zone of 1,900 square feet would be provided. New two-way cycle tracks would be installed on the east side of Cahill Street. A 4,000-square-foot bicycle facility would be constructed. New signals and pedestrian crossings would be developed at Cahill and Park, Otterson, Stover, West San Fernando, and Crandall Streets.

Other rail operators in the station area are Caltrain, Altamont Corridor Express, Amtrak, VTA light rail, and future BART. VTA has plans to construct new light rail station platforms as a separate project, and BART plans to extend service from the Berryessa Station to Santa Clara with a stop at Diridon by 2026. As a separate project, VTA has plans to construct new light rail station platforms.

Traction Power Sites and Power Connections

One new traction power substation (TPSS) would be constructed in this subsection on the east side of the Caltrain corridor south of I-880 in San Jose (just southeast of the I-880 overcrossing). The TPSS would be interconnected to two new gas-insulated substation breaker-and-a-half bays. The bays would be installed within the fenceline of the PG&E FMC substation, just north of the I-880 overcrossing, via an aerial double-circuit 115-kilovolt (kV) tie-line.

Train Control and Communication Facilities

An enhanced ATC system would control the trains and comply with the FRA-mandated positive train control requirements, including safe separation of trains, over-speed prevention, and work zone protection. This system would include communications towers at intervals of approximately 1.5–3 miles. Signaling and train control elements within the right-of-way would include 10- by 8-foot communications shelters that house signal relay components and microprocessor components, cabling to the field hardware and track, signals, and switch machines on the track. Communications towers in these facilities would use a 6- to 8-foot-diameter 100-foot-tall pole. The communications facilities would be located near track switches and would be grouped with other traction power, maintenance, station, and similar HSR facilities where possible. Where communications towers cannot be co-located with TPSSs or other HSR facilities, the communications facilities would be sited near the HSR corridor in a fenced area approximately 20 by 15 feet.

Under Alternative 1, there would be six ATC sites located between I-880 in San Jose and the I-280 and SR 87 interchange:

- Two sites near the TPSS facility
- One site just north of the San Jose Diridon Station
- Three sites between Park Avenue and the proposed HSR crossing of SR 87

One stand-alone communications radio site would be constructed, at one of two alternative locations, both south of Scott Boulevard along the east side of the Caltrain corridor.

Maintenance Facility

No maintenance facilities are proposed for this subsection.

2.2.1.2 Monterey Corridor Subsection

Alignment and Ancillary Features

The Monterey Corridor Subsection would be approximately 9 miles long and entirely within the San Jose city limits. From the San Jose Diridon Station Approach Subsection at West Alma Avenue, just south of the Caltrain Tamien Station, the alignment would extend primarily southeast to Bernal Way (Figure 2-4). Alternative 1 would be on viaduct in the median of Monterey Road. UPRR MT1, Caltrain MT2, and Caltrain storage tracks would be shifted east between West Alma Avenue and Caltrain/UPRR control point (CP) Lick, at the southeast base of Communications Hill.

Railroad bridges over Almaden Road and Almaden Expressway would be extended to accommodate the track shift. The UPRR Luther spur track south of Almaden Expressway would also be relocated to accommodate the MT shifts.

From West Alma Avenue, the HSR alignment would descend from a viaduct 54 feet above grade to embankment (i.e., 5 feet or higher) north of Almaden Road. The alignment would continue primarily on embankment to cross over Almaden Road on a short aerial structure, then under Almaden Expressway, then continue south on embankment to at grade under Curtner Avenue. The alignment would continue south primarily at grade along the northern base of Communications Hill and ascend to aerial structure before crossing over and entering the Monterey Road median just south of Hillsdale Avenue. Construction of the viaduct over the existing Caltrain Capitol Station would require falsework over the station if constructed by cast-in-place methods or would require relocating the station 500 feet to the south if constructed by precast segments. The alignment would continue south on viaduct in the median of Monterey Road, crossing over Capitol Expressway, Skyway Drive, Branham Lane, Roeder Road/Chynoweth Avenue, Blossom Hill Highway, SR 85/West Valley Freeway, and Bernal Road.

The design assumes a reduction from six to four travel lanes on Monterey Road, beginning south of Southside Drive and continuing to a short distance south of Blossom Hill Road where the existing roadway is already four travel lanes. Three existing mid-block left-turn lanes would be closed because of substandard stopping sight distance. Additionally, the design assumes a combined left-turn and through lane at Palm Avenue.

Wildlife Crossings

There would be no wildlife crossings in this subsection.

Stations

No new HSR stations are proposed for this subsection.

Traction Power Facilities

Two traction power paralleling stations would be constructed in this subsection:

- North of the alignment near Curtner Avenue or south of the alignment at Communications Hill
- South of SR 85 or between Bernal Road and the Bernal Road ramp onto Monterey Road

Train Control and Communication Facilities

One ATC site would be constructed in the Monterey Corridor Subsection at one of two locations east of the guideway in the vicinity of Chynoweth Avenue.

Three stand-alone communications radio sites are proposed:

- Near Almaden Road on the east side of the Caltrain corridor (two site options)
- Near Capitol Expressway (two site options)

Maintenance Facility

No maintenance facilities are proposed for this subsection.

2.2.1.3 Morgan Hill and Gilroy Subsection

Alignment and Ancillary Features

The Morgan Hill and Gilroy Subsection would be approximately 30 to 32 miles long and located south of the Monterey Corridor Subsection (Figure 2-5). From Bernal Way in South San Jose, the alignment would extend through Morgan Hill and San Martin to the Downtown Gilroy Station, then curve generally east across the Pajaro River floodplain and through a portion of northern San Benito County before entering a tunnel (Tunnel 1) at the base of the Diablo Range. The alignment would exit the tunnel at Casa de Fruta Parkway/SR 152 in unincorporated eastern Santa Clara County, where it would transition to the Pacheco Pass Subsection. Alternative 1 in this subsection would construct the Viaduct to downtown Gilroy design option and an aerial Downtown Gilroy Station.

Beginning at the southern limit of the Monterey Corridor Subsection, the alignment would be on viaduct in the median of Monterey Road. In this four-lane section of the road, the design assumes a combined left-turn and through lane to Palm Avenue. The alignment would begin curving east on viaduct (approximately 40 feet above grade) near Ogier Avenue in Santa Clara County. The northbound lanes of Monterey Road would be realigned at this transition to cross beneath the HSR viaduct between columns of the aerial structure.

After crossing the Coyote Valley on viaduct, the alignment would cross over Burnett Avenue in Morgan Hill and parallel US 101 on the west side of the freeway. Continuing south, the alignment would bypass downtown Morgan Hill by crossing over Cochrane Road and associated freeway ramps, East Main Avenue, East Dunne Avenue and associated freeway ramps, and Tennant Avenue and associated freeway ramps.

South of Tennant Avenue and the city limits of Morgan Hill, the alignment would turn west, relocating the cul-de-sac at Fisher Avenue to the west of the HSR facility, then crossing over Maple Avenue, West Little Llagas Creek, East Middle Avenue, and Llagas Creek before rejoining Monterey Road and the UPRR corridor in the community of San Martin. The crossing of Llagas Creek would allow for wildlife movement by clear-spanning both banks and riparian habitat. New storm drainage infrastructure would be constructed on the west side of the alignment along Llagas Creek. The alignment would continue on viaduct along the east side of UPRR and cross over East San Martin Avenue.

South of Las Animas Avenue and the west branch of Llagas Creek, the alignment would curve east over Leavesley Road and Casey Lane. Continuing south, the viaduct would cross the Gilroy Prep School/South Valley Middle School sports field, a portion of the Gilroy Prep School campus, and Upper Miller Slough (with armor added to the channel to strengthen the stormwater conveyance) before crossing over IOOF Avenue, Lewis Street, Martin Street, East 6th Street, and a realigned East 7th Street, to arrive at the downtown Gilroy station on low viaduct (approximately 33 feet high).

South of the Downtown Gilroy Station, the alignment would continue on viaduct over East 10th Street l. Banes Lane would be reconstructed to provide a standard cul-de-sac. South of the Princevale Channel crossing, the alignment would ascend, still on viaduct, over Luchessa Avenue, US 101, and one spur UPRR track. After branching from the main UPRR track and crossing under the HSR viaduct, the new UPRR track for freight access to the MOWF would be provided to travel at grade on the east side of the new HSR track toward the South Gilroy MOWF site. Both the UPRR track and HSR tracks would cross the City of Gilroy wastewater disposal ponds. Continuing south, the alignment would ascend onto embankment. New storm drainage infrastructure would be constructed on the west side of the alignment at Carnadero Avenue, which would be closed where it meets the alignment. Bloomfield Avenue would be realigned to cross over the South Gilroy MOWF site. Sheldon Avenue would become a cul-de-sac south of the HSR alignment and would be abandoned north of the alignment. Before crossing the Pajaro River, the alignment would ascend onto viaduct.

The HSR alignment south and east of Gilroy would cross an agricultural area in Santa Clara and San Benito Counties that is part of the upper Pajaro River floodplain, historically referred to as Soap Lake. HSR guideway on viaduct would be built over the major watercourses to provide a floodplain crossing that is neutral to the hydrology and hydraulics of the floodplain and to accommodate wildlife movement. Because of the Calaveras fault crossing at this location, Tequisquita Slough would be partially filled by approximately 800 feet of HSR embankment. The embankment area would include cross-culverts and 1.3 acres of adjacent floodwater detention basins; in addition, an extended viaduct over Pacheco Creek would serve to maintain floodplain capacity and function. HSR would be on embankment between Pacheco Creek and Lovers Lane. The alignment would return to viaduct at Lovers Lane. After Lovers Lane, the alignment would continue in a combination of embankment and viaduct until reaching the portal for Tunnel 1 on the east side of SR 152.

After exiting the 1.4-mile Tunnel 1 on the west side of SR 152, the alignment would cross over SR 152 and the southern portion of the Pacheco Creek Valley on an aerial structure south of Casa de Fruta. The alignment would move onto embankment just beyond Southside Way at the western transition to the Pacheco Pass Subsection.

Wildlife Crossings

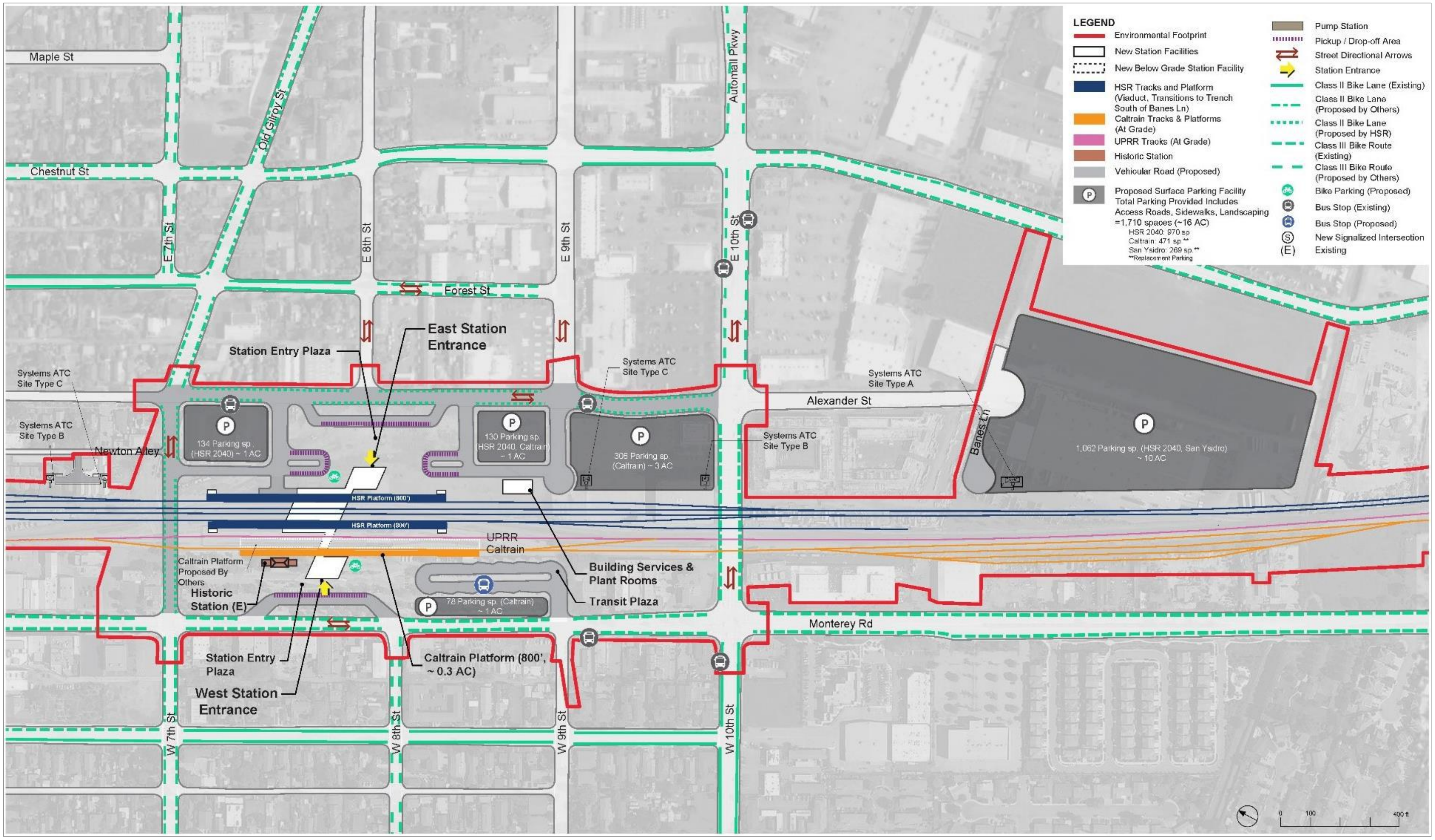
Three wildlife crossings would be provided at the base of Tulare Hill north of the Metcalf Substation connecting to Coyote Creek. The existing culvert under Monterey Road at Fisher Creek would be realigned and replaced with a larger box culvert to improve wildlife movement under Monterey Road and the HSR track. The crossing of Llagas Creek would allow for wildlife movement by clear-spanning both banks and riparian habitat. The alignment would be primarily on viaduct through the Soap Lake area to allow for wildlife movement. Viaducts have heights, widths and depths considered to be very favorable for wildlife movement.

Stations

Alternative 1 would enter the Downtown Gilroy Station on aerial structure (Figures 2-10 and 2-11). The HSR Downtown Gilroy Station would be constructed south of the existing Caltrain station. The station approach would be on a low viaduct—approximately 33 feet to top of rail—with dedicated HSR tracks to the east of UPRR between relocated Old Gilroy/7th Streets and 9th Street. The 800-foot platforms would be on the east and west side of the HSR tracks. The new HSR station building would have both east and west entrances: the main entrance for passengers arriving by auto or bicycle would be on the east side while the main entrance for passengers arriving on foot or by transit would be on the west side. The HSR station building would encompass 60,513 square feet with a 4,400-square-foot substation and systems building. The concourse would be below the new HSR tracks.

The existing 471 Caltrain parking spaces on the west side of the station would be replaced 1:1 by either reconfiguring parking on the west side of the station or relocating it to the east side of the station. The existing 269 San Ysidro housing development parking spaces would be replaced 1:1 with new surface parking at the south end of Alexander Street. HSR parking demand would be 970 spaces in 2040. In addition, the station site plan provides 970 new parking spaces in five areas, for a total of 1,710 parking spaces in 2040. One site would be west of the station along Monterey Road at 9th Street. The other four would be east of the station along Alexander Street at Old Gilroy Street, 9th Street, 10th Street, and Banes Lane. A multimodal access plan would be developed prior to design and construction of the station. The plan would be developed in coordination with local agencies and would include a parking strategy that would confirm the location, amount, and phasing of parking.

A total of eight bus bays would be provided. Street improvements would include realignment of Old Gilroy Street at East 7th Street; existing grade crossings would remain unchanged. A 4,000-square-foot bicycle facility would be constructed. Class II bike lanes would be provided on 7th and Alexander Streets.



Source: Authority 2019c

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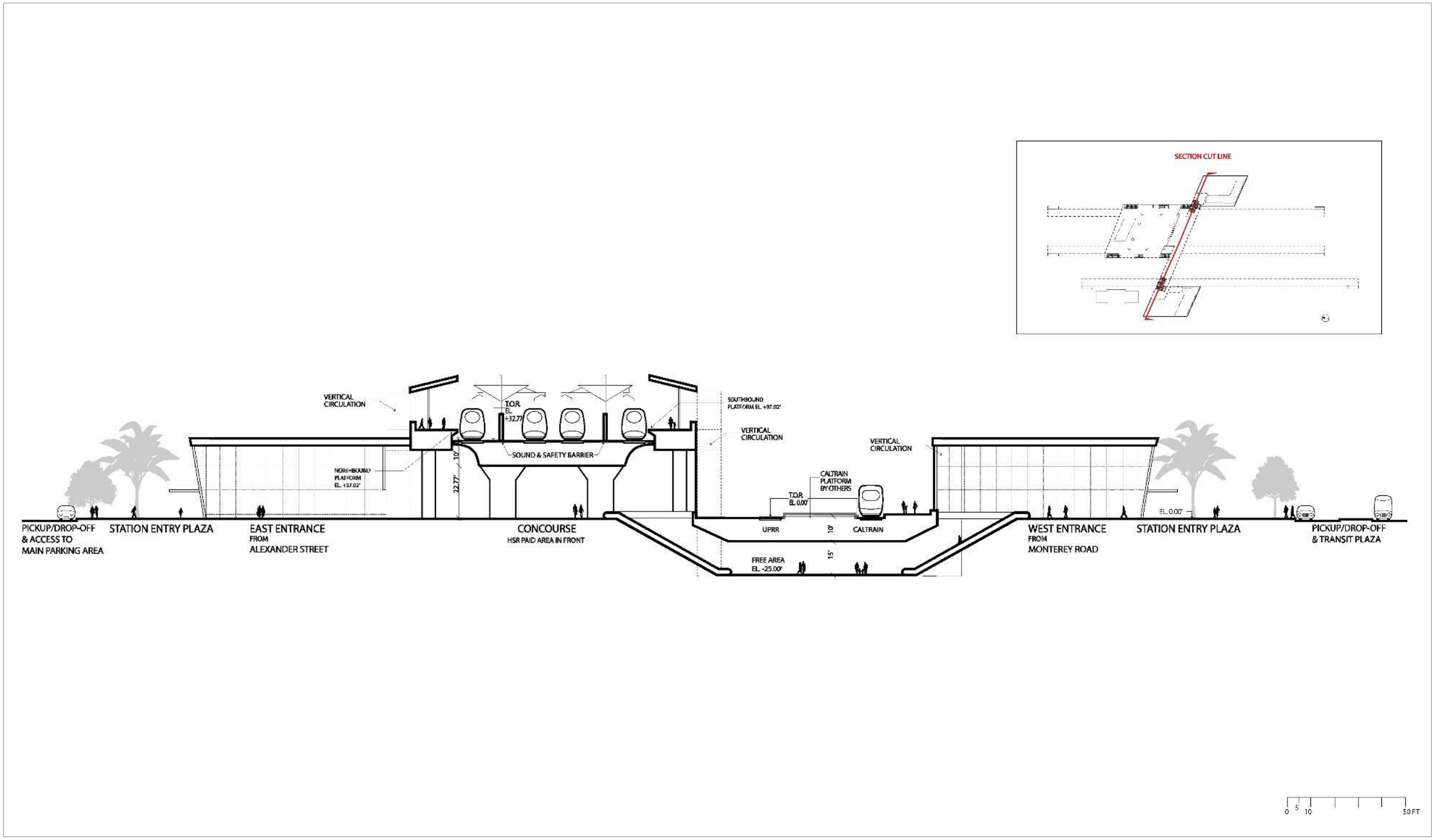
Figure 2-10 Conceptual Downtown Gilroy Aerial Station Plan



Source: Authority 2019c

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Figure 2-11 Cross Section of Downtown Gilroy Station (Viaduct)

Traction Power Facilities

One new TPSS, Site 4—Gilroy, would be constructed at one of two alternate locations on the north side of the alignment: either east or west of Bloomfield Avenue. At this site, one new PG&E switching station would be co-located with the TPSS. Communication facilities (i.e., redundant [two underground or one underground and one overhead on existing power structures] fiber optic lines) would also be required to support the electrical interconnections connecting the TPSS to a new utility switching station, to existing PG&E facilities, or both, typically within tie-line/utility corridors. North of Site 4—Gilroy, a traction power switching station would be constructed east of the HSR alignment at a location north of Palm Avenue.

Four traction power paralleling stations would be constructed adjacent to the guideway at the following locations:

- South of the alignment, either south of Diana Avenue or at the intersection of San Pedro Avenue and Walnut Grove Drive
- North of the alignment, either south of Masten Avenue or south of Rucker Avenue
- In the vicinity of Lovers Lane, either south of the alignment and west of Lovers Lane or north of the alignment and west of Lovers Lane
- At Tunnel 1 east portal

PG&E would reinforce the electric power distribution network to meet HSR traction and distribution power requirements by replacing (reconductoring) the 9.8-mile Metcalf to Morgan Hill and the 10.8-mile Morgan Hill to Llagas 115-kV power lines. The existing power lines to be reconductored, reusing the poles and towers, begin at the Metcalf Energy Center in San Jose and continue southeast parallel to the alignment on the east side before crossing to the west side near Ogier Avenue. Continuing on the west side to the Morgan Hill Substation on West Main Avenue in Morgan Hill, the lines then cross the east side of Peak Avenue and Dewitt Avenue, spanning West Dunne Avenue, Chargin Drive, Spring Avenue, and several residences. The alignment would continue south across an open-space area, then follow Sunnyside Avenue for approximately 0.5 mile. The alignment would continue south for approximately 4 miles, spanning additional open-space areas of wineries and the Corde Valle Golf Course. The alignment would then turn east along the north side of Day Road before heading south for approximately 2.5 miles and terminating at the Llagas Substation in Gilroy. Reconductoring at Metcalf Energy Center in San Jose would be required as well.

A permanent overhead distribution electrical power line from TPSS Site 4 to the Tunnel 1 portal location would provide power to the tunnel boring machine during construction and the tunnel fire-life-safety system during operation.

There are alternative sites for power drops at both portals for Tunnel 1. At each portal, one site is north of the alignment and one is south.

Train Control and Communication Facilities

A total of 17 ATC sites would be constructed in the Morgan Hill and Gilroy Subsection for this alternative:

- One site east of Monterey Road near Palm Avenue (two site options)
- One site at East Middle Avenue (two site options)
- One site between Las Animas Avenue and Leavesley Road
- One site south of Leavesley Road
- One site south of Lewis Street
- One site north of 6th Street in Gilroy
- Two sites south of 6th Street in Gilroy
- Two sites north of 10th Street in Gilroy
- One site south of Banes Lane
- Five sites north of Carnadero Avenue

- Three sites east of the Pajaro River
- One site near Lake Road (two site options)

Six stand-alone communication radio sites would be constructed within this subsection:

- Forsum Road or Blanchard Road (two site options)
- Near Bailey Avenue (two site options)
- Between Barnhart Avenue and Kirby Avenue (two site options)
- South of Cochrane Road along US 101 (two site options)
- North of Cox Avenue and south of West San Martin Avenue (two site options)
- East of the Pajaro River, south of Gilroy

Maintenance Facilities

The MOWF under Alternative 1 would be located in South Gilroy between Carnadero Road and Bloomfield Avenue (Figure 2-12) to accommodate machinery and inspection and maintenance staff. The MOWF would cover approximately 75 acres. The freight connection would be provided as described above.

2.2.1.4 Pacheco Pass Subsection

Alignment and Ancillary Features

The Pacheco Pass Subsection would be approximately 25 miles long. The alignment would generally follow the existing SR 152 corridor east from Casa de Fruta for approximately 17 miles, then diverge north around the Cottonwood Creek ravine of the San Luis Reservoir for approximately 8 miles before transitioning to the San Joaquin Valley Subsection near I-5 (Figure 2-6). Tunnel is the only design option in this subsection.

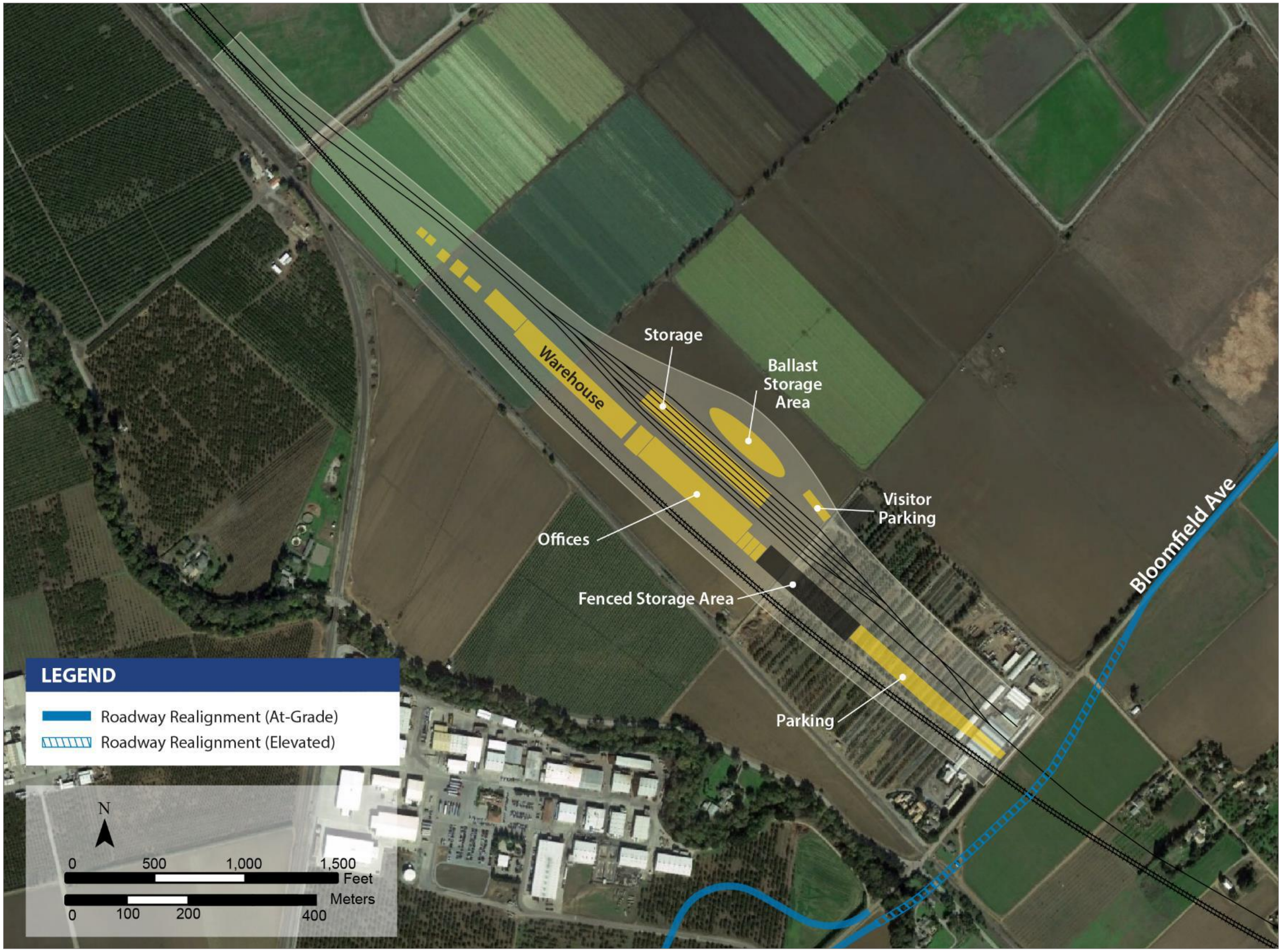
From the eastern limit of the Morgan Hill and Gilroy Subsection, the guideway would transition from aerial structure to embankment along the southern boundary of Casa de Fruta. This stretch of embankment would be on fill or in excavated hillside cuts to accommodate a level HSR guideway profile over varied surface elevations and to control unstable slopes known for vulnerability to landslip (i.e., areas subject to the downward falling or sliding of a mass of soil, detritus, or rock on or from a steep slope). The alignment would ascend to viaduct over Pacheco Creek along the south side of SR 152 and remain on viaduct to the Tunnel 2 portal. This portal would include a staging area for tunnel construction and a permanent area for traction and facility power with access provided by a service road from SR 152. Tunnel 2 would extend northeast approximately 13.5 miles. Access to the Tunnel 2 east portal for HSR construction, operations, and maintenance would be on McCabe Road north of Romero Ranch. Continuing east, the HSR guideway would be predominantly on a combination of embankment and aerial structures, with viaducts over Romero Creek and the California Aqueduct. Romero Road would be realigned at its intersection with I-5. East of I-5, the alignment would cross over SR 33/Santa Nella Road and the CCID Outside Canal before transitioning to the San Joaquin Valley Subsection at Fahey Road.

Wildlife Crossings

Four wildlife crossing culverts would be provided west of the California Aqueduct, with an additional two wildlife crossings between the California Aqueduct and the Delta-Mendota Canal and one between the Delta-Mendota Canal and I-5. Three wildlife crossings would be provided between I-5 and Santa Nella Road, and three more between Santa Nella Road and Fahey Road. Viaducts would also function as wildlife movement areas in this subsection.

Stations

No new HSR stations are proposed for this subsection.



Source: Authority 2019c

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Figure 2-12 South Gilroy Maintenance of Way Facility

Traction Power Facilities

One new TPSS, Site 5—O'Neill, would be constructed approximately 1.2 miles west of the California Aqueduct. A new 230-kV double-circuit tie-line would be constructed from the expanded Quinto switching station to the TPSS, paralleling an existing PG&E transmission line for approximately 0.6 mile. The tie-line would be installed either underground in a utility easement or overhead, requiring the existing 500-kV transmission line to be raised. No reinforcements to the PG&E power system would be required for this site. Communication facilities (i.e., redundant [two underground or one underground and one overhead on existing power structures] fiber optic lines) would also be required to support the electrical interconnection. The interconnection would link the TPSS to a new PG&E switching station, to existing PG&E facilities, or both—typically within tie-line/utility corridors.

A traction power switching station would be constructed at each Tunnel 2 portal. A power drop site would be co-located with the switching stations. A new permanent distribution power line from the Quinto switching station along McCabe Road to the Tunnel 2 east portal location would provide power for tunnel construction and fire and life safety systems during operations. The existing PG&E 230-kV Quinto switching station would be expanded within the fence line to support the HSR system.

Traction power paralleling stations would be constructed at three locations:

- Two stations within Tunnel 2 cross passages, approximately 5 miles apart
- One station located either southeast or northwest of the alignment crossing of Fahey Road

Train Control and Communication Facilities

Three ATC sites would be constructed in the Pacheco Pass Subsection at the following locations:

- West portal of Tunnel 2
- Underground within the limits of Tunnel 2
- Adjacent to TPSS Site 5

One stand-alone communications radio antenna site would be constructed in the Pacheco Pass Subsection:

- Near SR 152 and the Tunnel 2 west portal
- 1 mile west of Tunnel 2
- Delta-Mendota Canal crossing

Maintenance Facilities

No maintenance facilities are proposed for this subsection.

2.2.1.5 San Joaquin Valley Subsection

Alignment and Ancillary Features

The San Joaquin Valley Subsection would be approximately 18 miles long, from east of I-5 (at Fahey Road) to the intersection of Henry Miller Road and Carlucci Road in Merced County, where the alignment would connect to the Central Valley Wye (Figure 2-7). The single design option in this subsection is a combination of viaduct and embankment along Henry Miller Road, identified as the Henry Miller Road design option.

South of Fahey Road, the guideway would continue east and cross over three irrigation ditches, Cherokee Road, the CCID Main Canal, two additional irrigation ditches, and adjacent farmland on viaduct. Continuing east, the alignment would be on embankment (including four proposed culvert crossings for irrigation ditches) before ascending on an approximately 1.4-mile-long viaduct over the San Luis (Volta) Wasteway, the UPRR West Side branch line, and Ingomar Grade Road.

The alignment would descend to embankment west of Volta Road while turning southeast before crossing to the south side of Henry Miller Road. Henry Miller Road would be realigned to pass over the HSR alignment on a bridge. The HSR embankment between the Volta Road overcrossing and Los Banos Creek would cross over two proposed culverts to maintain irrigation canals. The alignment would then ascend to cross over Los Banos Creek and Badger Flat Road on a 0.8-mile-long viaduct before descending onto embankment.

The alignment would continue east for 3.6 miles on embankment, over several combined wildlife crossing/drainage culverts and drainage culverts, including an irrigation ditch at Wilson Road, an irrigation ditch at Johnson Road, two irrigation ditches at Nantes Avenue, the Santa Fe Canal, the San Luis Canal, the San Luis Drain, and the Porter-Blake Bypass. A road would be constructed between Badger Flat Road and Nantes Avenue. SR 165/Mercey Springs Road would be raised to cross over the HSR alignment and Henry Miller Road on a bridge. East of SR 165 and the Santa Fe Grade, the alignment would ascend to an approximately 1.8-mile viaduct south of the Los Banos State Wildlife Area across Mud Slough to maintain wildlife movement within the Grasslands Ecological Area (GEA). Baker Road, Midway Road, and Hereford/Salt Slough would be closed south of Henry Miller Road. Box Car Road would become a cul-de-sac with a new road to the east. Hutchins Road would be abandoned. The alignment would continue on embankment to the eastern limit of the subsection and the project. Culvert crossings would be provided for the San Pedro Canal, Boundary Drain, Lone Tree Canal, Devon Drain, West Delta Drain, West Delta Canal, Dambrosia Ditch, Delta Canal and seepage drain, East Delta Canal, Poso Drain, Belmont Drain, Delta Canal #1, West San Juan Drain, San Juan #1, and several other irrigation ditches and drains in the section of viaduct over the GEA. Several local roadways—Delta Road, Turner Island Road, and Carlucci Road—would be elevated over the HSR guideway, maintaining access to adjacent properties. The alignment would transition to the Central Valley Wye at Carlucci Road.

Wildlife Crossings

The rail alignment would be primarily on viaduct where it overlaps with the GEA boundary and modeled wildlife movement corridors. Three additional wildlife crossing culverts would be added between Fahey Road and Cherokee Road. Regularly spaced wildlife crossing culverts would be provided through the remainder of this subsection. In total, there would be 64 wildlife crossings in this subsection.

Stations

No new HSR stations are proposed for this subsection.

Traction Power Facilities

A traction power switching station would be constructed on the north or south side of the alignment at one of two alternate sites east of the intersection of Henry Miller Road and Santa Fe Grade. Traction power paralleling stations would be constructed at the following locations:

- Either east or west of the Henry Miller Road overcrossing of the HSR alignment near Volta Road (two site options)
- Intersection of Henry Miller Road and Box Car Road (two site options either north or south of the alignment)

Train Control and Communication Facilities

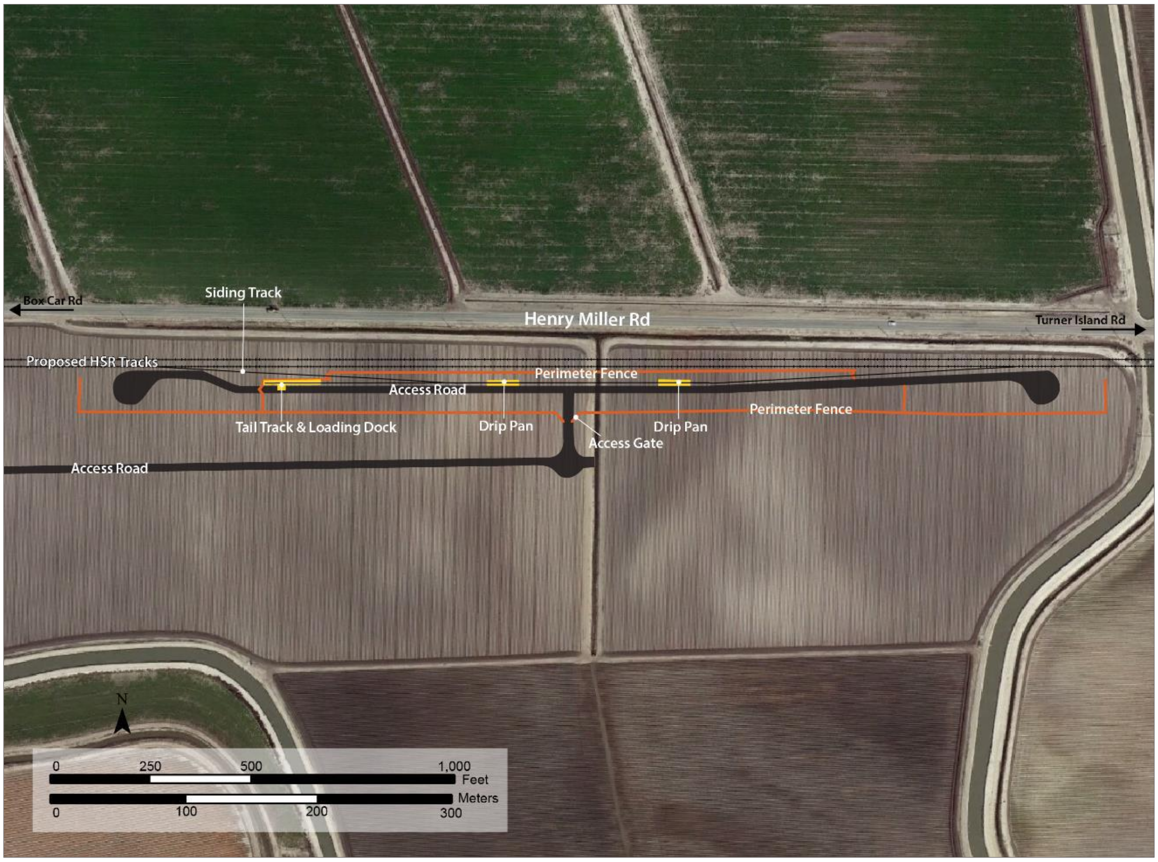
Four ATC sites would be constructed in the San Joaquin Valley Subsection:

- One site east of the CCID Main Canal (two options)
- Three sites near Johnson Road
- One site near Box Car Road (two site options)

One stand-alone communication radio site would be constructed: at Wilson Road (two site options): east of the San Pedro Canal and at Carlucci Road.

Maintenance Facility

An MOWS is proposed near Turner Island Road near the eastern limit of the project (Figure 2-13). The MOWS would be about 0.5 mile long, encompassing about 4 acres. The facility would be constructed near Henry Miller Road to avoid the GEA and other sensitive habitat.



Source: Authority 2019c JUNE 2019

Figure 2-13 Maintenance of Way Siding near Turner Island Road

2.2.2 Alternative 2

Alternative 2 is the alternative that most closely approximates the alignment and structure types identified in the prior program-level documents, implemented by limiting longitudinal encroachment into the UPRR right-of-way to combine railroad grade separations with minimum property displacements. The HSR guideway under this alternative would be comprised of 20.9 miles on viaduct, 8.5 miles at grade, 41.0 miles on embankment, two tunnels totaling 15.0 miles, and 3.2 miles in trench.

2.2.2.1 San Jose Diridon Station Approach Subsection

Alignment and Ancillary Features

Alternative 2 would begin at Scott Boulevard at grade in blended service with Caltrain. Approximately 300 feet south of Scott Boulevard, the HSR tracks would separate from the Caltrain tracks and begin ascending to embankment and then to the 50-foot-tall dedicated viaduct at Main Street. The long viaduct under Alternative 2 would have a wider footprint than the short viaduct to I-880 under Alternative 1, requiring more curve straightening of the Caltrain tracks north of I-880. At the Lafayette Street crossing, the project would replace the existing pedestrian overpass with an underpass. The existing De La Cruz Boulevard overcrossing would be replaced with an undercrossing to enable the HSR aerial structure to cross 43 feet high over De La Cruz Boulevard, the relocated UPRR MT1 and two industry tracks, and the Caltrain Santa Clara Station. The Santa Clara Station northbound platform would be reconstructed to accommodate the supports for the HSR aerial structure. South of Santa Clara Station, the three relocated UPRR tracks would cross under the HSR viaduct so that all Caltrain and UPRR tracks would be west of the HSR viaduct. The HSR viaduct would then ascend to 68 feet to cross over I-880.

Farther south, the existing West Hedding Street roadway overcrossing would be replaced by an undercrossing under the rail corridor. A short section of retained fill would be used to support the tracks over the future BART to San Jose tunnel. The intersection of Stockton Avenue and University Avenue would be replaced by cul-de-sacs; Emory Street would be a new cul-de-sac on the north side of HSR. The curve from westbound West Taylor Street to northbound Chestnut Street would be realigned for the HSR crossing over West Taylor Street; the alignment would then ascend on a viaduct to cross over Cinnabar Street. The UPRR Warm Springs Subdivision Lenzen Wye would be relocated to the southwest. North Montgomery Street would be extended to Cinnabar Street to maintain property access beneath the 68-foot-high HSR viaduct. The alignment would curve west toward the UPRR/Caltrain MTs before crossing over the western part of the SAP Center parking lot, then over West Santa Clara Street to enter the new dedicated HSR aerial platforms at the San Jose Diridon Station.

Between San Jose Diridon Station and West Alma Avenue, Alternative 2 would be identical to Alternative 1. Continuing on an aerial structure, the alignment would diverge from the Caltrain right-of-way south of the San Jose Diridon Station HSR platforms by turning sharply east at the Park Avenue undercrossing of UPRR/Caltrain tracks. The HSR aerial structure would cross over Los Gatos Creek and San Carlos Street, then over Royal Avenue and the intersection of Bird Avenue and Auzerais Avenue, then over the I-280/SR 87 interchange. Continuing south along the east side of SR 87, the HSR aerial structure would cross over West Virginia Street and the Guadalupe River Trail, then over the Caltrain rail bridge, the Guadalupe River, and Willow Street. The HSR aerial structure would continue south over the Caltrain Tamien Station on an alignment between Tamien Station and the SR 87 freeway, transitioning to the Monterey Corridor Subsection at West Alma Avenue.

Wildlife Crossings

There would be no wildlife crossings in this subsection.

Stations

The San Jose Diridon Station would be the same as described for Alternative 1.

Traction Power Facilities

One new TPSS would be constructed on the east side of the Caltrain corridor south of I-880 as described for Alternative 1.

Train Control and Communication Facilities

Alternative 2 would have six ATC sites within this subsection:

- One site at Scott Boulevard
- One site at Main Street
- One site just north of the San Jose Diridon Station
- Three sites between Park Avenue and the proposed HSR crossing of SR 87 (same as under Alternative 1)

No stand-alone communications radio sites would be built in this subsection under Alternative 2.

Maintenance Facilities

No maintenance facilities are proposed for this subsection.

2.2.2.2 Monterey Corridor Subsection

Alignment and Ancillary Features

The Monterey Corridor Subsection is approximately 9 miles long and entirely within the San Jose city limits. However, Alternative 2 would begin the viaduct transition to the Monterey Road/UPRR corridor approximately 400 feet north of the transition under Alternatives 1 and 3 but would be primarily at grade or on embankment upon entering the road/rail corridor. Alterations of existing railroad track and systems between West Alma Avenue and CP Lick (near the east base of Communications Hill) would be the same as under Alternatives 1 and 3, except for a new, continuous intrusion barrier between the existing UPRR tracks and HSR tracks.

From West Alma Avenue, the HSR alignment would descend from a viaduct 54 feet above grade to embankment north of Almaden Road. The alignment would continue primarily on embankment on the west side of the Caltrain/UPRR tracks, crossing over Almaden Road on a short aerial structure, then proceeding at grade under West Almaden Expressway and Curtner Avenue. South of Curtner Avenue, the alignment would continue south at grade along the west side of the Caltrain/UPRR tracks around the northern base of Communications Hill, ascending to aerial structure before crossing over and entering the Monterey Road/UPRR corridor just south of Hillsdale Avenue. On the approach to Monterey Road, the aerial structure would cross over the UPRR tracks and the Caltrain Capitol Station while curving southeast to return to grade within the road/rail corridor northwest of the Capitol Expressway. Monterey Road would be realigned to the east, while HSR would run along the east side of UPRR. South of Fehren Drive, Monterey Road would be reduced from six to four lanes. Continuing south, the alignment would descend into trench beneath a widened Capitol Expressway bridge before ascending to grade at Skyway Drive. Under Skyway Drive Variant A, Monterey Road would retain its current at-grade configuration, and a new connector ramp located northwest of the intersection of Skyway Drive and Monterey Road would connect Monterey Road to the depressed Skyway Drive underpass. San Jose Fire Station #18 would have access along the connector ramp. Skyway Drive Variant B would depress Monterey Road to connect to the Skyway Drive underpass. Under this variant, access to the mobile home park northwest of the intersection of Skyway Drive and Monterey Road would be provided by a driveway across the northern portion of the San Jose South Service Yard property. Variant B would not provide access to the fire station.

Continuing south, the HSR alignment would be at grade or on embankment between Monterey Road and UPRR for the remainder of the subsection. Branham Lane and Roeder Road/Chynoweth Avenue would be lowered to be separated from the HSR and existing railroad crossings. Because of the new grade difference between Branham Lane and Roeder Road/Chynoweth, access to Rice Way and four driveways from Monterey Road would be closed. A new Branham Lane pedestrian bridge would span the combined railroad and Monterey Road corridor. The westbound Blossom Hill Road ramp at Monterey Road would be shifted to the east side of Monterey Road. A new pedestrian bridge would be built to maintain connectivity between Ford Road and the Caltrain Blossom Hill Station. The alignment would continue south at grade under SR 85/West Valley Freeway, with modifications to the existing highway bridge to allow HSR to pass underneath. The alignment would then cross under Bernal Road before transitioning to the Morgan Hill and Gilroy Subsection at Bernal Way.

Like the other alternatives, the design assumes a reduction from six to four travel lanes on Monterey Road, beginning north of Capitol Expressway and continuing to just south of Blossom Hill Road, where the existing roadway is already four travel lanes. Under Alternative 2, one left turn lane would be removed south of Senter Street and one left turn lane would be removed south of Roeder where Monterey Road would be depressed and grade separated from adjacent properties. Existing mid-block left-turn lanes would be closed because of substandard stopping sight distance. Alternative 2 (and Alternative 4) differs from Alternatives 1 and 3 by shifting all Monterey Road travel lanes and median to the east of their current locations.

Wildlife Crossings

There would be no wildlife crossings in this subsection.

Stations

No new HSR stations are proposed for this subsection.

Traction Power Facilities

In the Monterey Corridor Subsection, traction power stations would be in the same area under Alternatives 1, 2 and 3. Traction power paralleling stations would be constructed at the following locations:

- Either the north side of the alignment near Curtner Avenue or the south side of the alignment at Communications Hill (same as Alternative 1)
- Either the south side of SR 85 or between Bernal Road and the Bernal Road ramp onto Monterey Road

Train Control and Communication Facilities

Train control and communication facilities under Alternative 2 would be the same as described for Alternative 1.

Maintenance Facilities

No maintenance facilities are proposed for this subsection.

2.2.2.3 Morgan Hill and Gilroy Subsection

Alignment and Ancillary Features

The Morgan Hill and Gilroy Subsection under Alternative 2 would be approximately 31 miles long and located south of the Monterey Corridor Subsection. From Bernal Way in South San Jose, the alignment would extend through Morgan Hill and San Martin to the Downtown Gilroy Station, then curve generally eastward across the Pajaro River floodplain and through a portion of northern San Benito County before entering a tunnel (Tunnel 1) at the base of the Diablo Range. The alignment would exit the tunnel at Casa de Fruta Parkway/SR 152 in unincorporated eastern Santa Clara County, and then transition to the Pacheco Pass Subsection (Figure 2-8).

Continuing from the southern limit of the Monterey Corridor Subsection, Alternative 2 would be at grade on retained fill between the UPRR right-of-way and Monterey Road in South San Jose. Due to the proximity of the alignment to UPRR, a 3-foot-thick continuous intrusion barrier would be constructed between the proposed HSR and UPRR tracks. In contrast to the other alternatives, Alternative 2 would require the construction of new roadway grade separations to maintain east-west connectivity across the Monterey Corridor. Before turning south near Kittery Court, the two UPRR tracks would be realigned to the west to accommodate the alignment curvature required for HSR operations until returning to the existing alignment adjacent to the south side of the Calpine Metcalf Energy Center. The existing Fisher Creek culvert would be improved with a new culvert installed beneath the new HSR alignment and realigned Monterey Road and UPRR. The creek crossing would be improved to provide a suitable wildlife crossing. The Blanchard Road grade crossing would be closed.

As the UPRR and Monterey Road rights-of-way converge to the south approaching Bailey Avenue, the four-lane Monterey Road would be realigned eastward to accommodate the HSR alignment at grade between the railroad and roadway. The existing Bailey Avenue bridge would remain in place and HSR would cross beneath the road. The alignment would continue south, ascending onto embankment, crossing beneath a new Palm Avenue bridge and a new Live Oak Avenue bridge (which would also cross over UPRR, eliminating both existing at-grade crossings). Tilton Avenue would become a cul-de-sac. Madrone Parkway would be lowered to allow HSR and UPRR to cross over the roadway. At Cochrane Road, the realigned Monterey Road would converge with the existing roadway alignment.

As the alignment proceeds south along the UPRR alignment through Morgan Hill, a new culvert would be placed in the HSR embankment for Fisher Creek. The alignment would then cross over Monterey Road on a clear-span bridge. Continuing south on embankment along the east side of

UPRR, the HSR and UPRR alignments would cross over Main, East/West Dunne, San Pedro, and Tennant Avenues on short bridges over the roadways, which would be lowered 17–30 feet below grade to maintain east-west connections. A new pedestrian underpass would be provided to maintain access from east of the HSR corridor to the Morgan Hill Caltrain Station. Railroad Avenue would be closed between San Pedro Avenue and Barrett Avenue and relocated eastward between Barrett Avenue and Maple Avenue to accommodate the HSR alignment adjacent to UPRR. The existing bridge at Butterfield Boulevard would be extended to cross over the realigned Railroad Avenue and at-grade HSR alignment. The Butterfield Canal would be relocated to the east to accommodate the HSR alignment adjacent to UPRR.

Continuing south, the alignment would ascend onto embankment, and West Little Llagas Creek would flow through a new culvert. The existing East Middle Avenue would become cul-de-sacs on both sides of the alignment. A new alignment of East Middle Avenue would be constructed to the south, where it would cross over the HSR tracks and Monterey Road on a bridge. Monterey Road and UPRR would be realigned westward between East Middle Avenue and Roosevelt Avenue to accommodate the southward alignment curvature required for HSR operations. The realigned roadway and UPRR and the new HSR alignment would cross Llagas Creek on new clear-span bridges. South of Llagas Creek, Monterey Road would return to the existing alignment near Roosevelt Avenue.

San Martin Avenue would be realigned between Murphy and Harding Avenues to connect to Oak Street at Llagas Avenue (north of the HSR alignment) in San Martin. HSR would cross over San Martin Avenue and Oak Street, which would be below grade. A pedestrian path under the HSR embankment would be provided south to San Martin Avenue. Depot Street, UPRR, and Monterey Road, which parallel the HSR tracks at Oak Street, would cross the newly depressed San Martin (formerly Oak) Street on bridges supported by retained fill. HSR would continue south at grade adjacent to the east side of UPRR. Church Avenue would be raised onto a bridge over both HSR and UPRR. Fitzgerald and Masten Avenues would be realigned to the south and would be depressed beneath Monterey Road, UPRR, and HSR. Similarly, Rucker Avenue and Buena Vista Avenue would be depressed beneath Monterey Road, UPRR, and HSR. Both Cohansey Avenue and Las Animas Avenue would remain at grade with bridges for HSR and UPRR to cross over the existing streets.

Continuing south into Gilroy, the alignment would shift east for the approach to the Downtown Gilroy HSR Station. The existing culvert for the West Branch of Llagas Creek would be extended to the east to accommodate the rail alignment shift. HSR and UPRR would be on embankment (approximately 15–25 feet high) and cross over Leavesley Road, Casey Street, IOOF Avenue, Lewis Street, East 6th Street, and the realigned East 7th Street/Old Gilroy on bridges before arriving at the Downtown Gilroy Station embankment (approximately 16 feet high). East 7th Street and Old Gilroy would be realigned (as under Alternative 1). Each of these streets would be lowered approximately 20 feet beneath existing grade, and a pedestrian underpass would replace Martin Street across the rail alignment. Miller Slough would be realigned eastward in a new culvert beneath the railroad alignment. HSR and UPRR would continue on embankment, crossing over East 9th Street and East 10th Street.

The HSR alignment would continue on embankment south from the Downtown Gilroy Station to the Princevale Channel, then descend into a trench under Luchessa Avenue and US 101, where existing bridges would be demolished and reconstructed to accommodate the freeway undercrossing, and two UPRR spur tracks. Just south of the US 101 overcrossing, a freight connection would be made from UPRR on the south side of HSR, crossing over the HSR trench to connect to the South Gilroy MOWF on the north side of HSR. Two UPRR spur tracks would be realigned to connect to the MOWF freight track north of HSR.

The remainder of this subsection—to Casa de Fruta—would be the same as under Alternative 1.

Wildlife Crossings

Three adjacent box culverts would be installed to provide wildlife with a connection between Tulare Hill and Coyote Creek south of Metcalf Road. The box culverts under Monterey Road and

UPRR would be replaced with larger box culverts at Fisher Creek. HSR would also be on a box culvert over Fisher Creek. These three box culverts would have larger openings than existing culverts to improve wildlife movement. There would be seven additional crossings at Emado Avenue, Laguna Avenue, Richmond Avenue, Fox Lane, Paquita Espana Court, south of Palm Avenue, and south of Live Oak Avenue.

Stations

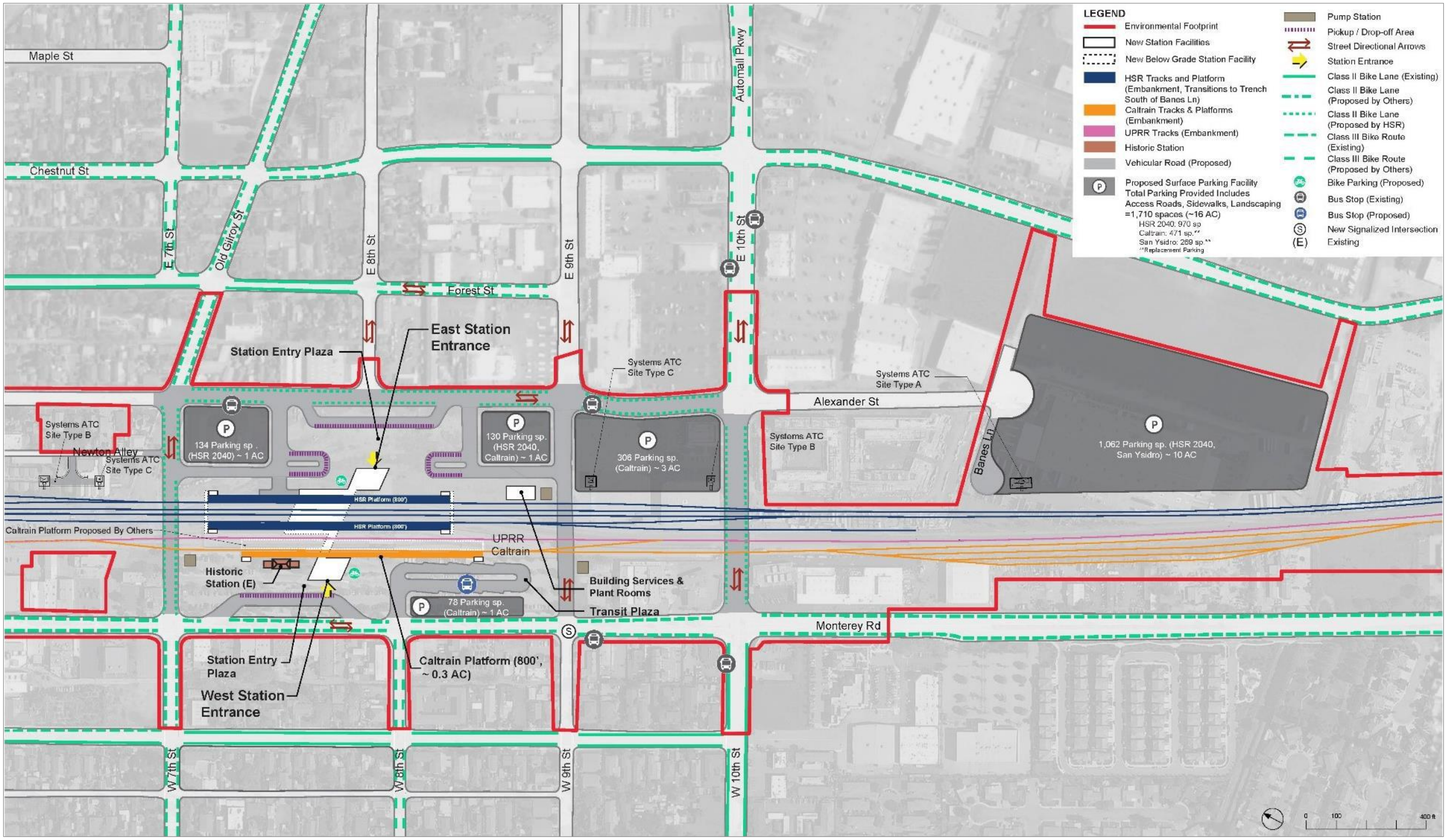
Alternative 2 would enter the Downtown Gilroy Station on embankment (Figures 2-14 and 2-15). The station layout and configuration would be similar to that described for Alternative 1, except that UPRR and Caltrain would be elevated to the same height as HSR on the embankment. The embankment station would also lower East 7th/Old Gilroy Street, East 9th Street, and East 10th Street by approximately 16 feet to maintain street access.

As under Alternative 1, the existing 471 Caltrain parking spaces on the west side of the station would be replaced 1:1 by either reconfiguring parking on the west side of the station or relocating it to the east side of the station. The existing 269 San Ysidro housing development parking spaces would be replaced 1:1 with new surface parking along Automall Parkway with access from the south end of Alexander Street. HSR would provide an additional 970 spaces in 2040, for a total of 1,710 parking spaces in 2040 (including existing demand). The station site plan provides 970 new parking spaces in five areas. One site would be located west of the station along Monterey Road at 9th Street. The other four would be on the east side of the station along Alexander Street at Old Gilroy Street, 9th Street, 10th Street, and Banes Lane. A multimodal access plan that includes a parking strategy would be developed in coordination with local agencies prior to design and construction of the station. A total of eight bus bays would be provided. Street improvements would include realignment of Old Gilroy Street at East 7th Street; existing grade crossings would remain unchanged. A 4,000-square-foot bicycle facility would be constructed. Class II bike lanes would be provided on 7th, Alexander, and 10th Streets.

Traction Power Facilities

As under Alternative 1, one new TPSS, Site 4—Gilroy, would be constructed at one of two alternate sites on the north side of the alignment: either east or west of Bloomfield Avenue. At this location, one new utility switching station would be co-located with the TPSS. Communication facilities (i.e., redundant [two underground or one underground and one overhead on existing power structures] fiber optic lines) would also be required to support the electrical interconnection of the TPSS to a new utility switching station or to existing PG&E facilities, typically within tie-line/utility corridors. Site 4—Gilroy would connect to the Llagas PG&E substation via existing and proposed transmission or distribution lines along SR 152, Frazier Lake Road, and Bloomfield Avenue. Fiber optic and high-voltage lines would be reconductored overhead on existing towers where available. Where no overhead connections exist, both fiber optic and high-voltage lines would be undergrounded within or adjacent to the public right-of-way.

A traction power switching station would be constructed east of the HSR alignment at a location north of Paquita Espana Court or north of Palm Avenue.



Source: Authority 2019c

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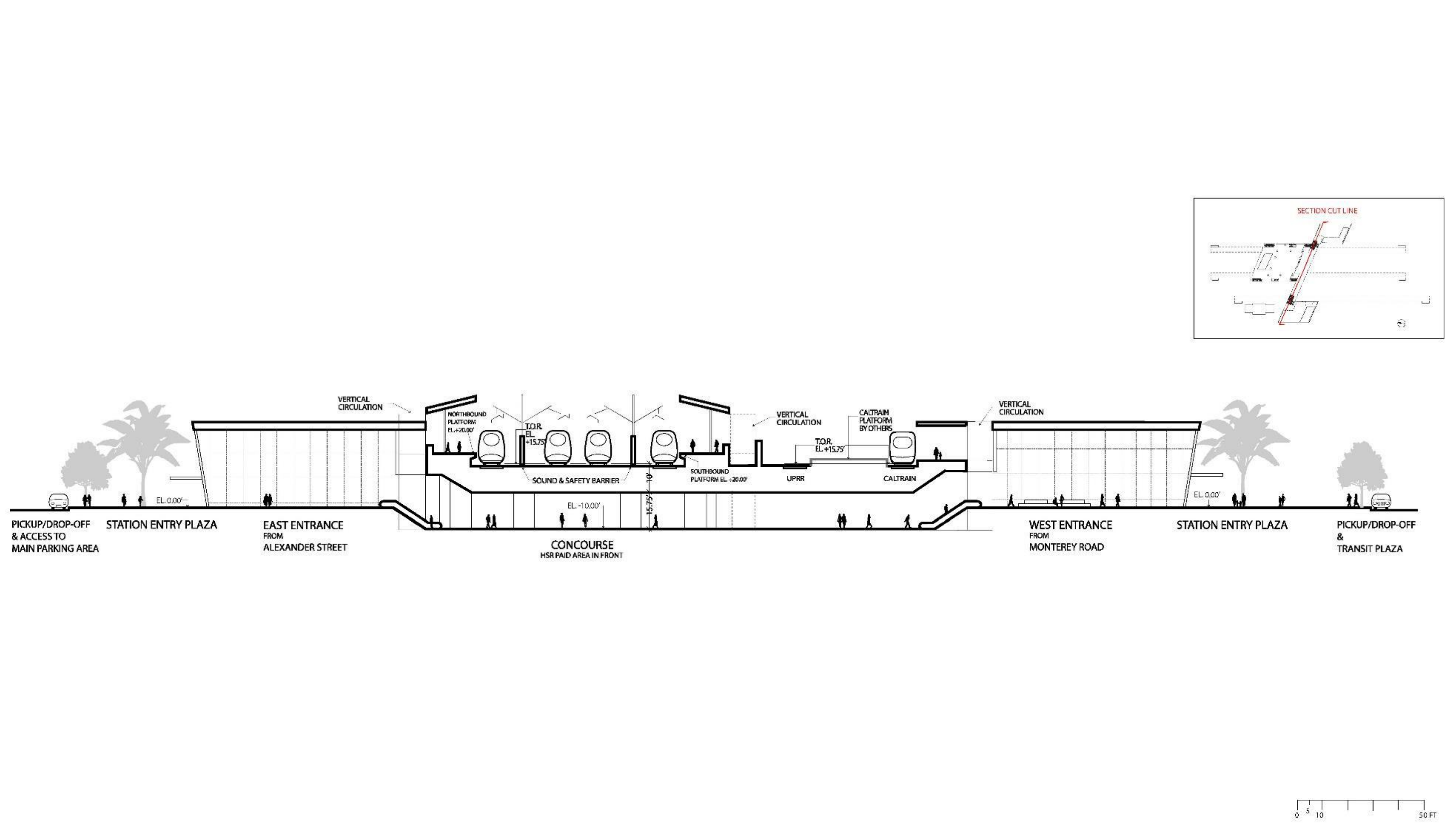
Figure 2-14 Conceptual Downtown Gilroy Embankment Station Plan



Source: Authority 2019c

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Figure 2-15 Cross Section of Downtown Gilroy Station (Embankment)

Four traction power paralleling stations would be constructed at the following locations:

- Either the east side of the alignment between East Dunne and San Pedro Avenues or south of San Pedro Avenue
- East of the alignment, either north or south of a new Masten Avenue/Fitzgerald Avenue in-trench alignment

South of US 101, Alternative 2 would have the same two switching stations as Alternative 1:

- Either south of the alignment and west of Lovers Lane or north of the alignment and west of Lovers Lane
- In the vicinity of the Tunnel 1 east portal, either at the portal or east of SR 152 in the southern area of Casa de Fruta

PG&E would reinforce the electric power distribution network to meet HSR traction and distribution power requirements by replacing (reconductoring) the approximately 9.8-mile Metcalf to Morgan Hill and 10.6-mile Morgan Hill to Llagas 115-kV power lines. These PG&E transmission network upgrades described under Alternative 1 would also be necessary under Alternative 2.

Train Control and Communication Facilities

A total of 20 ATC sites would be constructed in the Morgan Hill and Gilroy Subsection for this alternative:

- One site east of Monterey Road north of Paquita Espana Court or at Palm Avenue, co-located with the TPSS (two site options)
- One site north of East Middle Avenue (two site options)
- One site between Las Animas Avenue and Leavesley Road
- One site south of Leavesley Road
- One site south of Lewis Street
- One site north of 6th Street in Gilroy
- Two sites south of 6th Street in Gilroy
- Two sites between 9th and 10th Streets in Gilroy
- One site south of Banes Lane

South of US 101, Alternative 2 would have the same ATC sites as Alternative 1:

- Five sites north of Carnadero Avenue
- Three sites east of the Pajaro River
- One site near Lake Road (two site options)

A total of six stand-alone communication radio sites would be constructed in this subsection at the following locations:

- Between Forsum Road and Blanchard Road (two site options)
- Near Bailey Avenue (two site options)
- Near Kirby Avenue (two site options)
- West of the intersection of Cochrane Road and Monterey Road (two site options)
- Near South Street (two site options)

South of US 101, Alternative 2 would have the same radio sites as Alternative 1:

- East of the Pajaro River south of Gilroy.

Maintenance Facilities

The MOWF under Alternative 2 would be constructed along the HSR alignment near Carnadero Avenue as described for Alternative 1 and illustrated on Figure 2-12. The freight connection would be provided as described above.

2.2.2.4 Pacheco Pass Subsection

Alignment and Ancillary Features

The characteristics of the Pacheco Pass Subsection under Alternative 2 would be the same as those described for Alternative 1 in Section 2.2.1.4, Pacheco Pass Subsection.

Wildlife Crossings

The wildlife crossings under Alternative 2 would be the same as described for Alternative 1.

Stations

No new HSR stations are proposed for this subsection.

Traction Power Facilities

One new TPSS, Site 5—O’Neill, would be constructed approximately 1.2 miles west of the California Aqueduct as described for Alternative 1.

Train Control and Communication Facilities

Train control and communications facilities of Alternative 2 would be the same as for Alternative 1.

Maintenance Facilities

No maintenance facilities are proposed for this subsection.

2.2.2.5 San Joaquin Valley Subsection

Alignment and Ancillary Features

The characteristics of the San Joaquin Valley Subsection of Alternative 2 would be the same as those described for Alternative 1 in Section 2.2.1.5, San Joaquin Valley Subsection.

Wildlife Crossings

The wildlife crossings under Alternative 2 would be as described for Alternative 1.

Stations

No new HSR stations are proposed for this subsection.

Traction Power Facilities

Traction power facilities under Alternative 2 would be as described for Alternative 1.

Train Control and Communication Facilities

Train control and communications facilities of Alternative 2 would be as described for Alternative 1.

Maintenance Facilities

An MOWS would be constructed near Turner Island Road near Carlucci Road as described for Alternative 1 and illustrated on Figure 2-15.

2.2.3 Alternative 3

Alternative 3 was designed to minimize the project footprint through the use of viaduct and by going around downtown Morgan Hill, as is proposed in Alternative 1. Alternative 3 would bypass downtown Gilroy to an East Gilroy Station, further minimizing interface with the UPRR corridor in comparison to Alternative 1. The HSR guideway under this alternative would comprise 43.2 miles on viaduct, 1.8 miles at grade, 24.9 miles on embankment, 2.4 miles in trench, and two tunnels totaling 15.0 miles.

2.2.3.1 San Jose Diridon Station Approach Subsection

Alignment and Ancillary Features

Under Alternative 3, the alignment and characteristics of this subsection would be the same as described for Alternative 2 in Section 2.2.2.1, San Jose Diridon Station Approach Subsection.

Wildlife Crossings

As under Alternative 2, there would be no wildlife crossings in this subsection.

Stations

The San Jose Diridon Station would be as described for Alternatives 1 and 2.

Traction Power Facilities

Traction power facilities under Alternative 3 would be as described for Alternative 2.

Train Control and Communication Facilities

Train control and communications facilities of Alternative 3 would be as described for Alternative 2. No stand-alone communication radio antenna would be constructed in this subsection of Alternative 3.

Maintenance Facilities

No maintenance facilities are proposed for this subsection.

2.2.3.2 Monterey Corridor Subsection

Alignment and Ancillary Features

The alignment and characteristics of Alternative 3 in this subsection would the same as those described for Alternative 1 in Section 2.2.1.2, Monterey Corridor Subsection.

Wildlife Crossings

As under Alternative 1, there would be no wildlife crossings in this subsection.

Stations

No new HSR stations are proposed for this subsection.

Traction Power Facilities

Traction power facilities of Alternative 3 would be as described for Alternative 1.

Train Control and Communication Facilities

Train control and communications facilities of Alternative 3 would be as described for Alternative 1 and Alternative 2.

Maintenance Facilities

No maintenance facilities are proposed for this subsection.

2.2.3.3 Morgan Hill and Gilroy Subsection

Alignment and Ancillary Features

The Morgan Hill and Gilroy Subsection under Alternative 3 would be approximately 30 miles long and located south of the Monterey Corridor Subsection. From Bernal Way in South San Jose, the alignment through Morgan Hill and San Martin would be the same as described for Alternative 1 in Section 2.2.1.3, Morgan Hill and Gilroy Subsection. The Alternative 3 alignment would diverge from Alternative 1 by turning east north of Gilroy to arrive at the East Gilroy Station and an MOWF near SR 152. South of the MOWF, the alignment would curve generally east across the Pajaro River floodplain and through a portion of northern San Benito County before entering a tunnel (Tunnel 1) at the base of the Diablo Range. The Morgan Hill and Gilroy Subsection would end in the Pacheco Pass at Casa de Fruta Parkway/SR 152 (Figure 2-8), where the Alternative 3 alignment would converge with that of Alternatives 1 and 2.

South of the Monterey Corridor Subsection, Alternative 3 would diverge east from Alternative 1 north of Gilroy, near the intersection of Monterey Road and Church Avenue. Beginning at Church Avenue, a new freight track would diverge from the UPRR mainline to provide a freight connection to the MOWF. The freight track would continue parallel to the HSR alignment on the west side to the MOWF. The HSR alignment would cross over Church Avenue, Lena Avenue, Masten Avenue, and US 101 at Rucker Avenue on viaduct approximately 60 feet above grade. The aerial alignment would also cross over Denio Avenue and Buena Vista Avenue on viaduct before descending onto embankment. Cohansey Avenue would be closed. At the north end of the East Gilroy Station site, the alignment would cross beneath Las Animas Avenue; at the south end of the station site, Leavesley Road would be raised on a bridge over the HSR embankment. At the south end of the East Gilroy Station site, the Llagas Creek overbank flow would be directed across the HSR alignment through two culvert crossings. Farther southeast, the alignment would cross over Gilman Avenue on viaduct. The alignment would cross Llagas Creek on a low viaduct, and Holsclaw Road would be closed to vehicular traffic. Levee Road would be realigned south of Llagas Creek.

Continuing south, the alignment would ascend to approximately 25 feet above grade on embankment approaching the MOWF site. SR 152 would be grade separated and realigned, crossing over the MOWF on a bridge. Both Frazier Lake Road and Holsclaw Road would connect to the grade-separated SR 152. The MOWF, on the south side of the alignment, would have the same features as the MOWF under Alternatives 1 and 2 and would similarly be on an embankment. Additional flood detention basins would be installed around the eastern edge of the MOWF to provide sufficient flood capacity in the Soap Lake floodplain. Jones Creek would be realigned around the eastern boundary of the MOWF, crossing beneath the HSR viaduct over Bloomfield Avenue. Continuing on a 40-foot-high embankment and then on viaduct, the alignment would cross the Pajaro River, Millers Canal, Lake Road, Pacheco Creek, Lovers Lane, San Felipe Road, and SR 152 before entering the west portal of Tunnel 1. Tequisquita Slough would be partially filled by the HSR embankment, which would include cross-culverts, 3.1 acres of adjacent floodwater detention basins, and extended viaduct over Pacheco Creek to maintain floodplain capacity and function.

The Alternative 3 alignment would converge at Tunnel 1 with those of the other alternatives.

Wildlife Crossings

Wildlife crossings would be provided between Bernal Way and San Martin as described for Alternative 1 with crossings at Tulare Hill, Fisher Creek, and Llagas Creek. Although Alternative 3 would include more embankment than Alternative 1, it would be similar to Alternative 1 by continuing primarily on viaduct through the Soap Lake area to allow for wildlife movement.

Stations

Alternative 3 would enter the East Gilroy Station on embankment (approximately 17 feet to top of rail) north of Leavesley Road (Figures 2-16 and 2-17). The station platforms would be 800 feet long and the station buildings would be constructed on both the east and west sides of the tracks with a connections concourse under the tracks. The MOWF freight access track would continue through the station on the west side of the west station platform. Access for passengers arriving by auto would be available from either the east or west entrance, while the main entrance on the west side would also provide access for passengers arriving by transit or bicycle. The HSR station buildings would encompass 58,611 square feet with a 4,400-square-foot substation and systems building. The concourse would be below the tracks and embankment. Approximately 1,520 on-site parking spaces would be provided to meet the projected demand in 2040. Spaces would be located on the east and west sides of the building. The west side station parking would be accessed from Leavesley Road and a new station access road east of the outlet mall. The east side station parking would be accessed from Marcella Avenue. A multimodal access plan would be developed prior to design and construction of the station.

Seven bus bays would be provided on site on the west side of the station. A 4,000-square-foot bicycle parking facility would be constructed; a new Class III bike route would be provided from the outlet mall to the site entrance; then Class II lanes from the station entrance to the parking. Class I bidirectional off-street path would be provided adjacent to parking which connects to the bike station. This would be a new station without any other rail operators in the station area.

Traction Power Facilities

Under Alternative 3, one new TPSS, Site 4—Gilroy, would be constructed at one of two sites: north of HSR either east or west of the former SR 152. Communication facilities (i.e., redundant [two underground or one underground and one overhead on existing power structures] fiber optic lines) would also be required to support the electrical interconnection of the TPSS to a new utility switching station and/or to existing PG&E facilities, typically within tie-line/utility corridors.

As under Alternative 1, a traction power switching station would be constructed at one of two locations north of Palm Avenue and east of the alignment.

Four traction power paralleling stations would be constructed at the following locations:

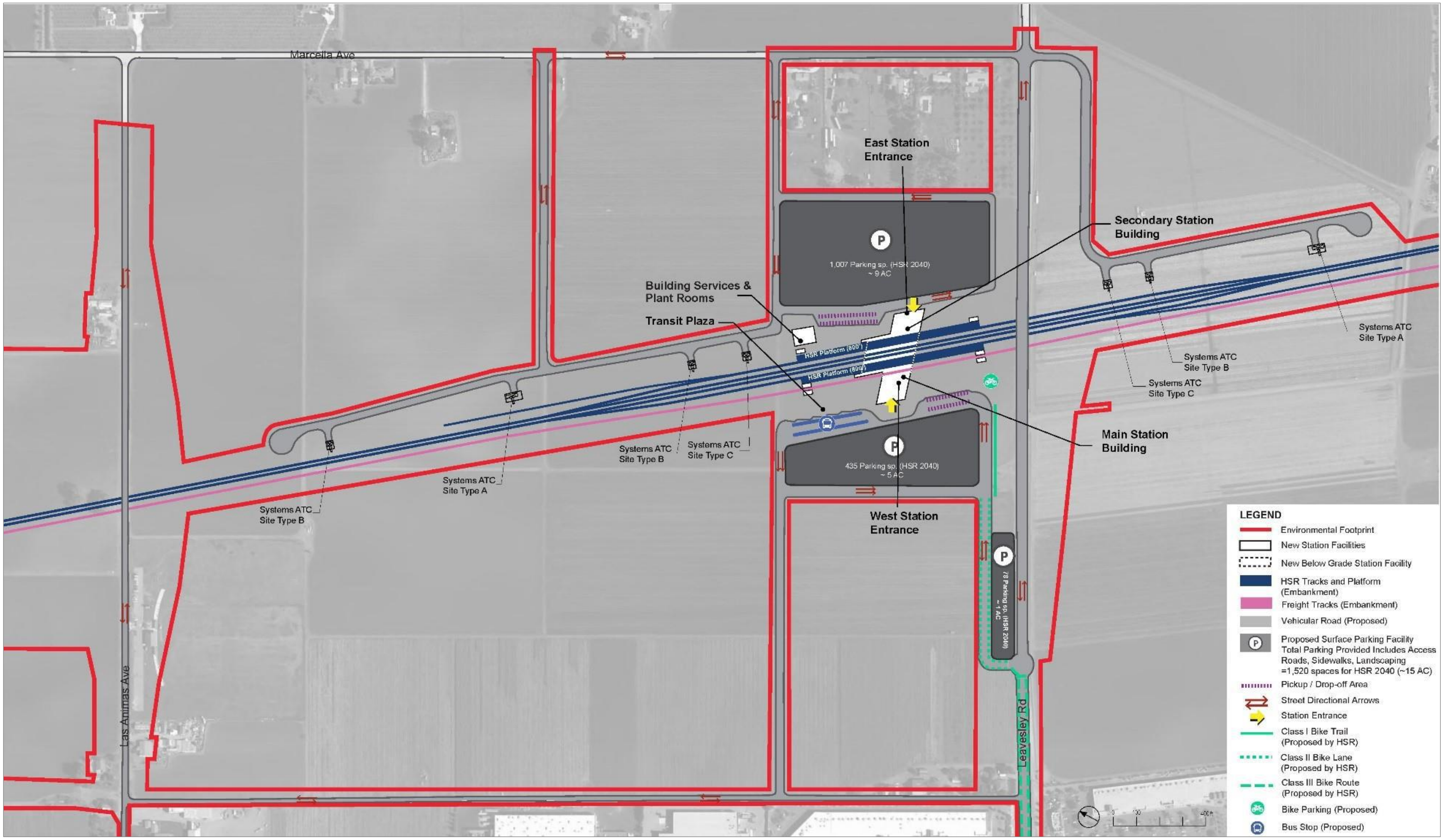
- South of the alignment, located either south of Diana Avenue or at the intersection of San Pedro Avenue and Walnut Grove Drive (like Alternative 1)
- Either at the northwest or southeast corner of the HSR crossing of Masten Avenue
- South of Gilroy at one of three site options: on Lake Road north of the alignment, on Lake Road south of the alignment, or at Lovers Lane south of the alignment
- Near the Tunnel 1 east portal, either at the portal or east of SR 152 in the southern area of Casa de Fruta

The PG&E transmission network upgrades from Metcalf to Morgan Hill and from Morgan Hill to Llagas described for Alternative 1 would also be necessary under Alternative 3. In addition to a new utility switching station co-located with the TPSS, a tie-line route and power distribution to the Tunnel 1 portal under this alternative would be the same, albeit with shorter electrical line routes, as those described for Alternative 1. A distribution power line for the Tunnel 1 portals would be constructed on the south side of the alignment northeast of the intersection of Walnut Lane and SR 152, crossing over and connecting with the TPSS from the north. One power drop site would be provided at the east and west portals (two options for each portal location).

Train Control and Communication Facilities

A total of 19 ATC sites would be constructed in the Morgan Hill and Gilroy Subsection for this alternative:

- One site east of Monterey Road near Palm Avenue (two site options)
- One site near East Middle Avenue (two site options)
- Two sites near Cohansey Way
- Four sites between Las Animas Avenue and Leavesley Road
- Three sites south of Leavesley Road
- Four sites north of SR 152, east of Gilroy
- Two sites within the MOWF
- Three sites north of Bloomfield Avenue
- One site near Lake Road (two site options)



Source: Authority 2019c

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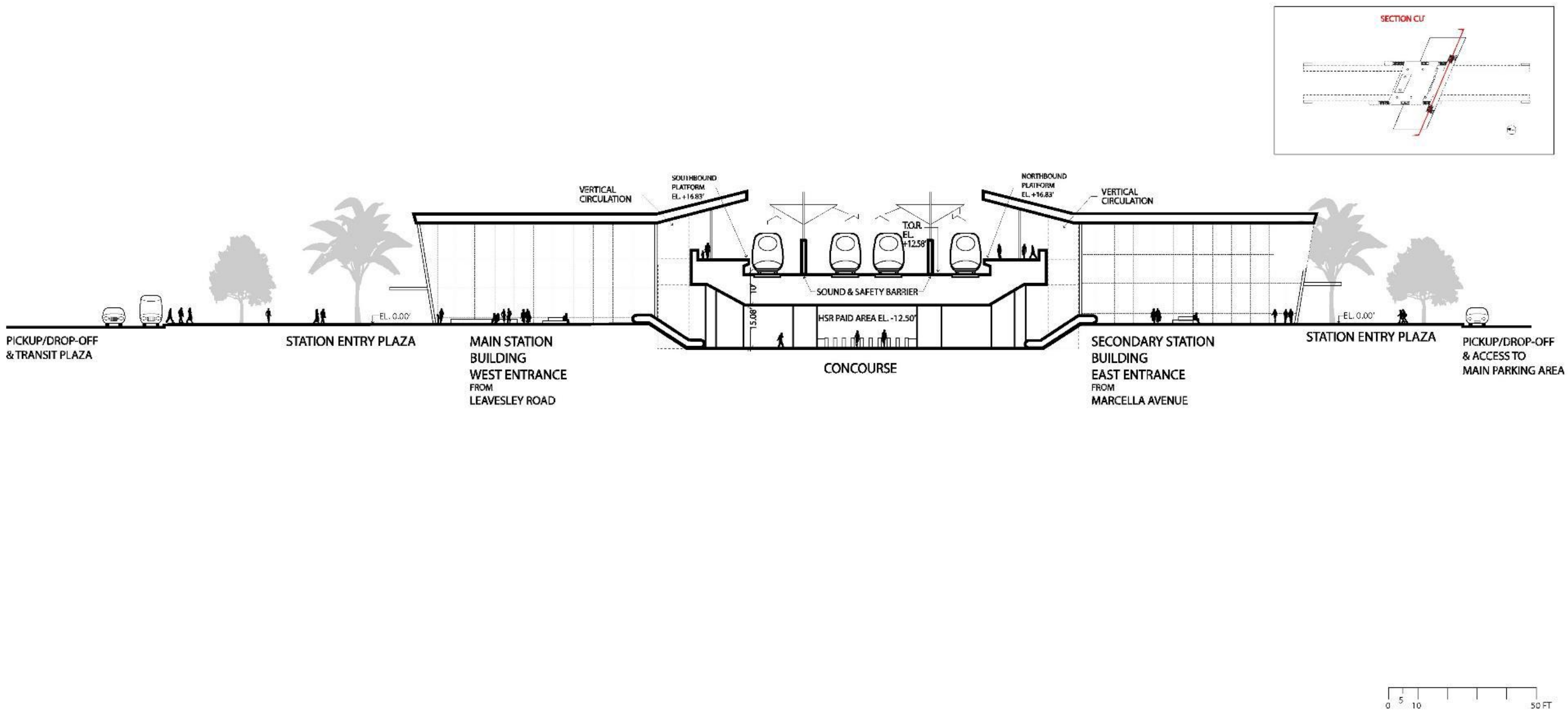
Figure 2-16 Conceptual East Gilroy Station Plan



Source: Authority 2019c

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Figure 2-17 Cross Section of East Gilroy Station

A total of six stand-alone communication radio sites would be constructed in this subsection (five locations are the same as those for Alternative 1):

- Between Barnhart Avenue and Kirby Avenue (two site options)
- South of Cochrane Road along US 101 (two site options)
- North of Cox Avenue and south of West San Martin Avenue (two site options)
- At Bloomfield Avenue

Maintenance Facilities

The East Gilroy MOWF would be located west of the HSR mainline, south of the community of Old Gilroy. The MOWF would encompass approximately 75 acres and extend along the west side of the HSR alignment from the intersection of the SR 152 and Frazer Lake Road south to Jones Creek (Figure 2-18). The freight connection would be provided as described in the discussion of the alignment and ancillary facilities.

2.2.3.4 Pacheco Pass Subsection

Alignment and Ancillary Features

The characteristics of the Pacheco Pass Subsection of Alternative 3 would be the same as Alternatives 1 and 2.

Wildlife Crossings

The wildlife crossings under Alternative 3 would be as described under Alternative 1.

Stations

No new HSR stations are proposed for this subsection.

Traction Power Facilities

Traction power facilities of Alternative 3 would be as described for Alternatives 1 and 2.

Train Control and Communication Facilities

Train control and communications facilities of Alternative 3 would be as described for Alternatives 1 and 2.

Maintenance Facilities

No maintenance facilities are proposed for this subsection.

2.2.3.5 San Joaquin Valley Subsection

Alignment and Ancillary Features

The characteristics of the San Joaquin Valley Subsection under Alternative 3 would be the same as under Alternatives 1 and 2.

Wildlife Crossings

The wildlife crossings under Alternative 3 would be as described for Alternatives 1 and 2.

Stations

No new HSR stations are proposed for this subsection.

Traction Power Facilities

Traction power facilities of Alternative 3 would be as described for Alternatives 1 and 2.

Train Control and Communication Facilities

Train control and communications facilities would be as described for Alternatives 1 and 2.

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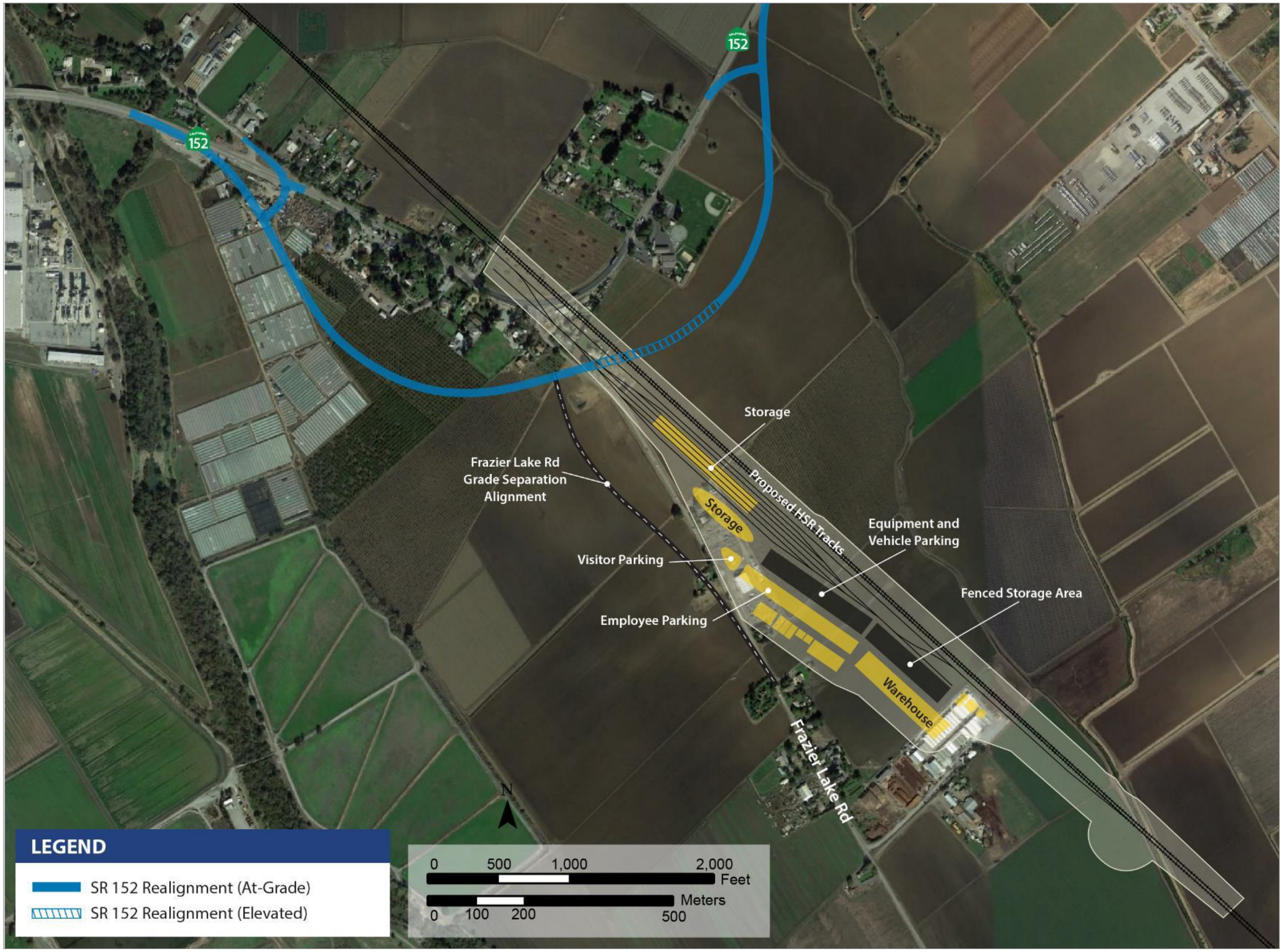

Source: Authority 2019c

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Figure 2-18 East Gilroy Maintenance of Way Facility

Maintenance Facilities

An MOWS would be constructed near Turner Island Road near Carlucci Road as described for Alternatives 1 and 2 (Figure 2-13).

2.2.4 Alternative 4 (State's Preferred Alternative, CEQA Proposed Project)

On September 17, 2019, the Authority Board of Directors reviewed a staff recommendation on the State's Preferred Alternative and a summary of key identified outreach concerns. The Board confirmed that Alternative 4 is the State's Preferred Alternative for purposes of the Draft EIR/EIS and serves as the CEQA proposed project for purposes of State CEQA Guidelines Section 15124.

The process for considering and the rationale for selecting the State's Preferred Alternative are presented in Chapter 8, Preferred Alternative, of the Final EIR/EIS.

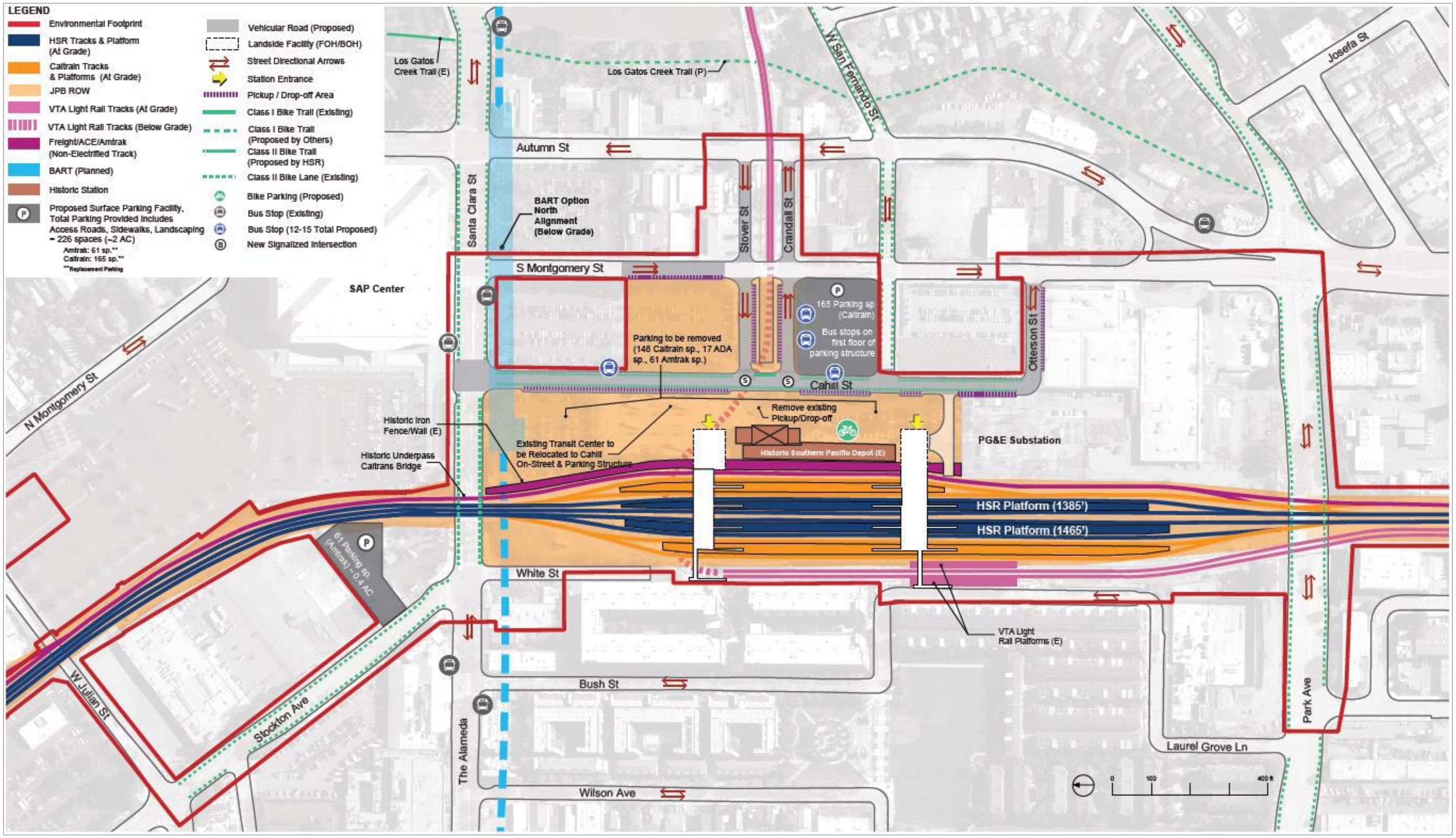
Development of Alternative 4 was intended to extend blended electric-powered passenger railroad infrastructure from the southern limit of the Caltrain Peninsula Corridor Electrification Project through Gilroy. South and east of Gilroy, HSR would operate in a dedicated guideway similar to Alternatives 1, 2, and 3. The objectives of this approach are to minimize property displacements and natural resource impacts, retain local community development patterns, improve the operational efficiency and safety of the existing railroad corridor, and accelerate delivery of electrified passenger rail services in the increasingly congested southern Santa Clara Valley corridor. The alternative is distinguished from the three other project alternatives by a blended, at-grade alignment that would operate on two electrified passenger tracks and one conventional freight track predominantly within the existing Caltrain and UPRR rights-of-way. The maximum train speed of 110 mph in the blended guideway would be enabled by continuous access-restriction fencing; four-quadrant gates, roadway lane channels, and railroad trespass deterrents at all public road grade crossings; and fully integrated communications and controls for train operations, grade crossings, and roadway traffic. Caltrain stations would be reconstructed to enable directional running as part of blended operations. Overall, this alternative would be comprised of 15.2 miles on viaduct, 30.3 miles at grade, 25.9 miles on embankment, 2.3 miles in trench, and two tunnels with a combined length of 15.0 miles.

2.2.4.1 San Jose Diridon Station Approach Subsection

Alignment and Ancillary Features

Alternative 4 would begin at Scott Boulevard in blended service with Caltrain on an at-grade profile following Caltrain MT2 and MT3 south along the east side of the existing Caltrain corridor. The existing Lafayette Street pedestrian overpass would remain in place, as would the De La Cruz Boulevard and West Hedding Street roadway overpasses. New UPRR track would start just south of Emory Street to maintain freight movement capacity north of San Jose Diridon Station. The new UPRR track would be east of Caltrain MT1. The existing College Park Caltrain Station would be reconstructed just north of Emory Street on the west side of the Caltrain Corridor on the existing siding track to eliminate the existing holdout rule at the station. A portion of both legs of the UPRR Warm Springs Subdivision Lenzen Wye would undergo minor track adjustments, and a new bridge would be built over Taylor Street for UPRR to tie into the Lenzen Wye.

The blended at-grade alignment would continue along MT2 and MT3 to enter new dedicated HSR platforms at grade at the center of San Jose Diridon Station (Figure 2-19). HSR platforms would be extended south to provide 1,385-foot and 1,465-foot platforms and would be raised to provide level boarding with the HSR trains. The existing Santa Clara Street underpass would remain, but the track in the throat and yard would require modification. There would be no need for modifications to the VTA light rail.



Source: Authority 2019c

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Figure 2-19 Conceptual San Jose Diridon At-Grade Station Plan

Continuing south, the blended at-grade three-track alignment would remain in the Caltrain right-of-way through the Gardner neighborhood. The existing underpass at Park Avenue and the existing overpass at San Carlos Street would remain in place. Four-quadrant gates with channelization would be built at Auzerais Avenue and West Virginia Street. A new bridge for the blended HSR/MT3 track over I-280 would be constructed. The existing underpasses at Bird Avenue and Delmas Avenue would be reconstructed, as would the rail bridge overpasses. New standalone rail bridges over Prevost Street, SR 87, the Guadalupe River, and Willow Street would be built for MT3. MT1 and MT2 would remain on the existing structures. The existing Tamien Caltrain Station would remain in place.

Wildlife Crossings

There would be no wildlife crossings in this subsection.

Stations

The San Jose Diridon Station would entail a four-track at-grade alignment through the center of the existing Diridon station, with 1,385- and 1,465-foot platforms centered between Santa Clara Street and Park Avenue (Figure 2-19). The existing historic train station would remain in place. A pedestrian concourse would be built above the yard to provide access to the platforms below. The concourse would consist of a pedestrian walkway above the existing Caltrain tracks and below the HSR platforms, with two entrances on the east side and one on the west.

Construction of San Jose Diridon Station would require displacement of 226 parking spaces. These would be replaced 1:1 in a parking structure at Cahill/Crandall Streets and a second site at Stockton/Alameda Streets. The existing on-site/off-street bus transit center would be relocated to an off-street facility between Cahill, Crandall, South Montgomery, and West San Fernando Streets. Street improvements would include reconfiguring and extending Cahill Street from Santa Clara Street to Otterson Street and extending Stover and Crandall Streets to South Montgomery Street. New bike lanes would be installed on the east side of Cahill Street. New signals and pedestrian crossings would be developed at Cahill and Stover Streets and Cahill and Crandall Streets.

Phasing for interim operations (2027) includes a pedestrian overhead crossing (PED OC) south of the existing historic station and would provide circulation access from the PED OC only to HSR platforms. Caltrain would continue to use the existing tunnel for access. Phasing for Valley-to-Valley (2029) includes access to and from all Caltrain and HSR platforms. At this stage, the existing tunnel would be used only for exiting purposes on HSR platforms. At buildout, there would be an additional PED OC north of the historic station with access to all Caltrain and HSR platforms. From the HSR platforms, the existing tunnel would continue to be used only for exiting.

Train Control and Communication Facilities

Under Alternative 4, HSR would use the existing ATC sites included as part of the Caltrain Positive Control and Electrification Project.

One stand-alone communications radio site would be constructed at one of two locations, both south of Scott Boulevard along the east side of the Caltrain corridor.

Maintenance Facilities

No maintenance facilities are proposed within this subsection.

2.2.4.2 Monterey Corridor Subsection

Alignment and Ancillary Features

The Monterey Corridor Subsection would be approximately 9 miles long and entirely within the San Jose city limits. From the San Jose Diridon Station Approach at West Alma Avenue, just south of the Caltrain Tamien Station, the alignment would extend primarily southeast to Bernal Way (Figure 2-4). Unlike Alternatives 1, 2, and 3, Alternative 4 would be in blended service with Caltrain on an at-grade profile within the Caltrain and UPRR right-of-way. HSR and Caltrain would operate on the electrified MT2 and MT3 tracks, while UPRR would operate on a nonelectrified MT1. The two existing tracks would be shifted to accommodate the third track. The existing Tamien Caltrain Station would remain in place with two new electrified turnback tracks constructed south of the station to facilitate turning trains outside the station platform areas. The Michael Yard would be reconfigured to a double-ended facility to accommodate storage of Altamont Corridor Express trains and relocated to the east side of the corridor. A new standalone bridge over West Alma Avenue would be constructed for MT3 and a maintenance track, with MT1 and 2 remaining on the existing structure. A new bridge over Almaden Road would be constructed for MT2 and MT3, while MT1 would remain on the existing structures. The existing pedestrian overpass at Communications Hill would remain in place. Capitol Caltrain Station would be reconstructed with a new center platform between MT2 and MT3. The platform would be reached by a new pedestrian overpass built at the north end of the platform. The existing Capitol Expressway overpass would remain in place. Four-quadrant barrier gates with channelization would be built at Skyway Drive, Branhan Lane, and Chynoweth Avenue. The existing Blossom Hill Road overpass and adjacent pedestrian overpass would remain in place. The Blossom Hill Caltrain Station would be reconstructed; the existing pedestrian overpass and platform would be removed and a new center platform constructed between MT2 and MT3. The platform would be reached by a new pedestrian overpass built at the south end of the platform. Great Oaks Parkway would be realigned for approximately 1,350 feet to accommodate the widened rail corridor. SR 85 and Bernal Road overpasses would remain in place.

Wildlife Crossings

There would be no wildlife crossings in this subsection.

Stations

There would be no HSR stations within this subsection.

Traction Power Facilities

One traction power paralleling station would be built on the west side of the Caltrain Corridor near the Blossom Hill Caltrain Station.

Train Control and Communication Facilities

Five ATC sites would be built in the subsection:

- Near Communications Hill on the east side of the Caltrain corridor near Chateau La Salle Drive
- Near Communications Hill on the east side of the Caltrain corridor near Montecito Vista Way
- Near Communications Hill on the east side of the Caltrain corridor near Chateau La Salle Drive or Montecito Vista Way (two site options)
- Near Monterey Road on the west side of the Caltrain corridor near Capitol Caltrain Station
- Near Skyway Drive on the west side of the Caltrain corridor (two site options)
- Near Branham Lane on the west side of the Caltrain corridor

Two stand-alone communications radio sites built:

- Near Almaden Road on the east side of the Caltrain corridor
- Near Branham Lane on the west side of the Caltrain corridor

PTC sites would be constructed at the following locations:

- Two sites south of Almaden Road
- One site north of Capitol Caltrain Station
- One site co-located with the ATC site at Branham Lane

2.2.4.3 Morgan Hill and Gilroy Subsection

Alignment and Ancillary Features

The Morgan Hill and Gilroy Subsection under Alternative 4 would be approximately 32 miles long, continuing south from the Monterey Corridor Subsection. From Bernal Way in South San Jose, the alignment would extend through Morgan Hill and San Martin to the Downtown Gilroy Station, then curve generally east across the Pajaro River floodplain and through a portion of northern San Benito County before entering Tunnel 1 at the base of the Diablo Range. The alignment would exit the tunnel at Casa de Fruta Parkway/SR 152 in unincorporated eastern Santa Clara County, where it would transition to the Pacheco Pass Subsection. This subsection under Alternative 4 would be blended service with Caltrain on an at-grade profile within the Caltrain and UPRR right-of-way with an at-grade Downtown Gilroy Station. Past the Downtown Gilroy Station and south of the US 101 overpass, HSR would enter the fully grade-separated, dedicated track needed to operate HSR trains at speeds faster than 125 mph.

Beginning at the southern limit of the Monterey Corridor Subsection, the alignment would continue in blended service with Caltrain on an at-grade profile in the existing UPRR right-of-way. HSR and Caltrain would operate on the electrified MT2 and MT3 tracks, while UPRR would operate on MT1. A UPRR siding track would be provided between Blanchard Road and Bailey Avenue. Four-quadrant barrier gates would be installed at all existing public road crossings. Intrusion deterrents would be installed at all at-grade crossings. Three private roads crossing would be eliminated and alternate access provided to those properties. The existing Bailey Avenue overpass would remain in place. Under Alternative 4 the Monterey Road underpass would be reconstructed to accommodate the future widening of Monterey Road to four lanes. The Morgan Hill Caltrain Station would be reconstructed with two new side platforms built outside MT2 and MT3. The platform would be reached by a new pedestrian underpass constructed at the north end of the platform. The existing Butterfield Boulevard overpass would remain in place. Upper Llagas Creek bridge would be reconstructed.

The San Martin Caltrain Station would be reconstructed—the existing platform would be removed and a new center platform would be built between MT2 and MT3. The platform would be reached by a new pedestrian overpass constructed at the south end of the platform. The existing bridge at Miller Slough would be replaced with a triple-cell box. Blended service would end just south of the Downtown Gilroy Station, where Caltrain would have access to turn back and stabling tracks relocated from the station area to south of 10th Street on the west side of the UPRR right-of-way. The Gilroy Caltrain Station would be reconstructed—the existing Caltrain platform would be shifted south and served by a southbound station track. A northbound Caltrain side platform would be provided to the east of a northbound station track. Two side platforms would be provided for HSR on the outside of the MT2 and MT3 tracks. The platforms would be reached by a new pedestrian overpass constructed over the center of the platforms. HSR would continue south under the US 101 overpass, which would remain in place. Past the Industry spur, HSR would ascend onto embankment and then a bridge over the UPRR. Two bridges would be constructed, one for MT2 and MT3 and a separate one for the MOWF lead track. The UPRR Hollister branch line would be realigned to the west to accommodate HSR bridging over the UPRR tracks at a single location. HSR MT2 and MT3 would descend from the embankment before crossing over Bloomfield Avenue on a new structure. Four-quadrant barrier gates and intrusion deterrents would be installed at Bloomfield Avenue for the MOWF lead track and UPRR service track. HSR would continue past the MOWF and transition to a new viaduct structure to cross over Pajaro Creek. Continuing on viaduct until just west of Millers Canal, Alternative 4 would join Alternative 1 as described for Alternative 1.

Wildlife Crossings

Twelve wildlife crossings or jump-outs would be built in this subsection:

- Three adjacent wildlife crossings with jump-outs integrated into the wing walls at Tulare Hill
- Fisher Creek culvert under UPRR and Monterey Road replaced with a larger box culvert to improve wildlife crossing potential at this location
- Wildlife crossings and integrated jump-outs south of Emado Avenue, south of Fisher Road, and south of Live Oak
- Wildlife crossings at Richmond Avenue, Paquita Espana Court, and north of Kalana Avenue
- Dedicated jump-outs north of Fisher Creek, south of Blanchard Road, north of Kalana Avenue, and at Miramonte Avenue

Wildlife intrusion deterrents would be constructed for at-grade crossings at Blanchard Road, Palm Avenue, Live Oak Avenue, and Bloomfield Avenue.

Stations

The Downtown Gilroy Station approach would be at grade with dedicated HSR tracks to the west of UPRR between Old Gilroy Street/7th Street, which would be closed, and 9th Street (Figure 2-20). A new HSR station with 800-foot platforms would be built south of the existing Caltrain station. A pedestrian concourse would be built above the UPRR and Caltrain tracks to provide access to the platforms below.

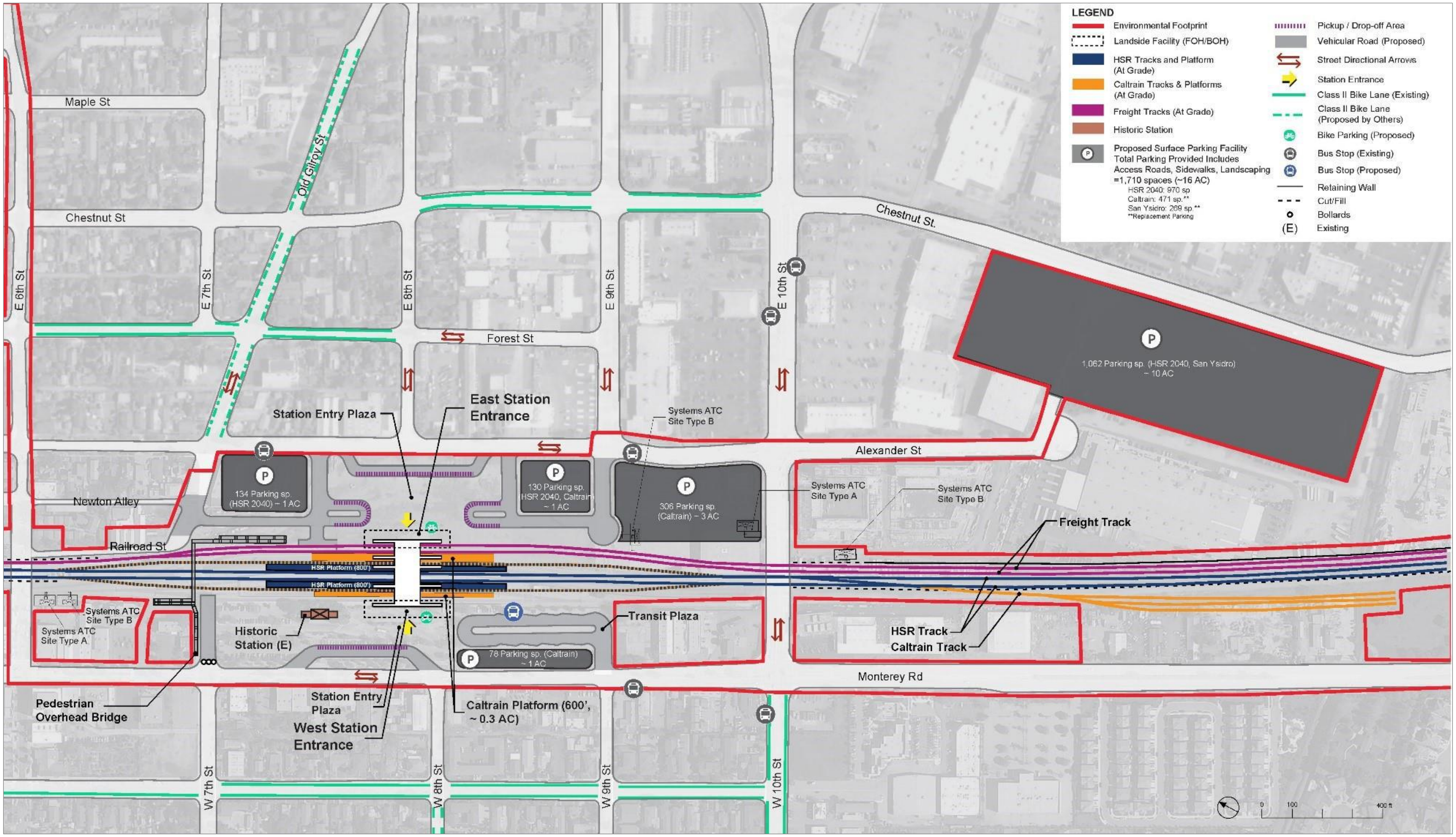
The existing 489 Caltrain parking spaces on the west side of the station would be replaced 1:1 in parking lots on the east and west sides of the alignment. The existing 269 parking spaces at the San Ysidro housing development would be replaced 1:1 with new surface parking at the south end of Alexander Street. HSR parking demand would be 970 spaces in 2040, for a total of 1,728 aggregated parking spaces in 2040. The station site plan provides 970 new parking spaces in five areas. One site would be west of the station along Monterey Road at 9th Street. The other four would be on the east side of the station along Alexander Avenue at 7th Street, 9th Street, 10th Street, and Banes Lane. A multimodal access plan would be developed prior to design and construction of the station. The plan would be developed in coordination with local agencies and would include a parking strategy that would specify the location, amount, and phasing of parking.

A total of eight bus bays would be provided, adding one bay to the existing seven. East 7th Street would be closed and East 10th Street would be modified with quadrant gates and channelization. A pedestrian overcrossing would be installed to provide access between East and West 7th Street. A 4,000-square-foot bicycle facility would be constructed. Figure 2-20 illustrates the conceptual at-grade Downtown Gilroy Station.

The Morgan Hill Caltrain Station would be reconstructed with two new side platforms built outside MT2 and MT3. The platform would be reached by a new pedestrian underpass built at the north end of the platform. The San Martin Caltrain Station would be reconstructed where the existing platform would be removed and a new center platform would be built between MT2 and MT3. The platform would be reached by a new pedestrian overpass constructed at the south end of the platform.

Traction Power Facilities

One new TPSS, Site 4—Gilroy, would be constructed at one of two locations on the east side of the alignment: south of Buena Vista Avenue or north of Cohansey Avenue. At this site, one new utility switching station could be co-located with the TPSS. Communication facilities (i.e., redundant [two underground or one underground and one overhead on existing power structures] fiber optic lines) would also be required to support the electrical interconnections of the TPSS to a new PG&E switching station and/or to existing PG&E facilities, typically within tie-line/utility corridors.



Source: Authority 2019c

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Figure 2-20 Conceptual Downtown Gilroy At-Grade Station Plan

A traction power switching station would be constructed west of the HSR alignment at Richmond Avenue.

Three traction power paralleling stations would be constructed adjacent to the guideway:

- Either south of San Pedro Avenue on the west side of the alignment or just north of Butterfield Boulevard on the east side of the alignment
- West of Lovers Lane either south of the alignment or north of the alignment (like Alternative 1)
- Near the Tunnel 1 east portal, either at the portal or east of SR 152 in the southern area of Casa de Fruta (like Alternatives 1 and 2)

PG&E would reinforce the electric power distribution network to meet HSR traction and distribution power requirements by replacing (reconductoring) approximately 11.1 miles of existing power line associated with the Spring to Llagas and Green Valley to Llagas 115-kV power lines. The existing power lines to be reconductored, reusing the poles and towers, begin at the Morgan Hill Substation on West Main Avenue in Morgan Hill, then cross the east side of Peak Avenue and Dewitt Avenue, spanning West Dunne Avenue, Chargin Drive, Spring Avenue, and several residences. The alignment would continue south across an open-space area, then follow Sunnyside Avenue for approximately 0.5 mile. The alignment would continue south for approximately 4 miles, spanning additional open-space areas of wineries and the Corde Valley Golf Course. The alignment would then turn east along the north side of Day Road before heading south for approximately 2.5 miles and terminating at the Llagas Substation in Gilroy.

A permanent overhead distribution electrical power line from TPSS Site 4 to the Tunnel 1 portal location would provide power to the tunnel boring machine during construction and the tunnel fire-life-safety system during operations.

Train Control and Communication Facilities

Twenty-two ATC sites would be constructed:

- One site south of Blanchard Road on the east side of the alignment (two site options)
- Three sites south of Live Oak Avenue on the west side of the alignment
- One site north of San Pedro Avenue on the west side of the alignment
- One site north of Barrett Avenue on the west side of the alignment (two site options)
- One site north of East Middle Avenue on the west side of the alignment
- One site in the vicinity of either Church Avenue or Lena Avenue on the east side of the alignment (two site options)
- One site between Leavesley Road and IOOF Avenue
- Two sites south north of Lewis Street on the east side of the alignment
- Two sites south of 6th Street on the west side of the alignment
- Three sites in the vicinity of 10th Street on the east side of the alignment
- Four sites north of Carnadero Avenue on the west side of the alignment
- Two sites east of the Pajaro River
- One site near Lake Road (two site options) (like Alternative 1)

PTC sites would be constructed at the following locations:

- One site south of Blanchard Road
- One site north of Bailey Avenue
- One site co-located with ATC site south of Live Oak Avenue

- One site at Cohansey Avenue
- One site south of Lewis Street
- One site south of East 6th Street

Five stand-alone communications radio sites would be constructed:

- Near Bernal Way on the west side of the alignment (two site options)
- South of Live Oak Avenue on the west side of the alignment (two site options)
- In the vicinity of East Central Avenue (two site options, one on either side of the alignment)
- South of California Avenue on the east side of the alignment
- East of the Pajaro River south of Gilroy

Maintenance Facilities

The South Gilroy MOWF (Figure 2-21) near Bloomfield Avenue would encompass approximately 50 acres and the program and layout would be as described for Alternatives 1 and 2. In contrast to Alternatives 1 and 2, the MOWF for Alternative 4 would be located on the west side of the tracks between Carnadero Avenue and the Pajaro River. This configuration would require realignment of the UPRR Hollister Subdivision. HSR mainline and MOWF lead track would pass over UPRR Coast Subdivision tracks.

2.2.4.4 Pacheco Pass Subsection

Alignment and Ancillary Features

Alternative 4 would be as described for Alternatives 1–3 for this subsection.

Wildlife Crossings

The wildlife crossings under Alternative 4 would be as described for Alternatives 1–3.

Stations

No new HSR stations are proposed for this subsection.

Traction Power Facilities

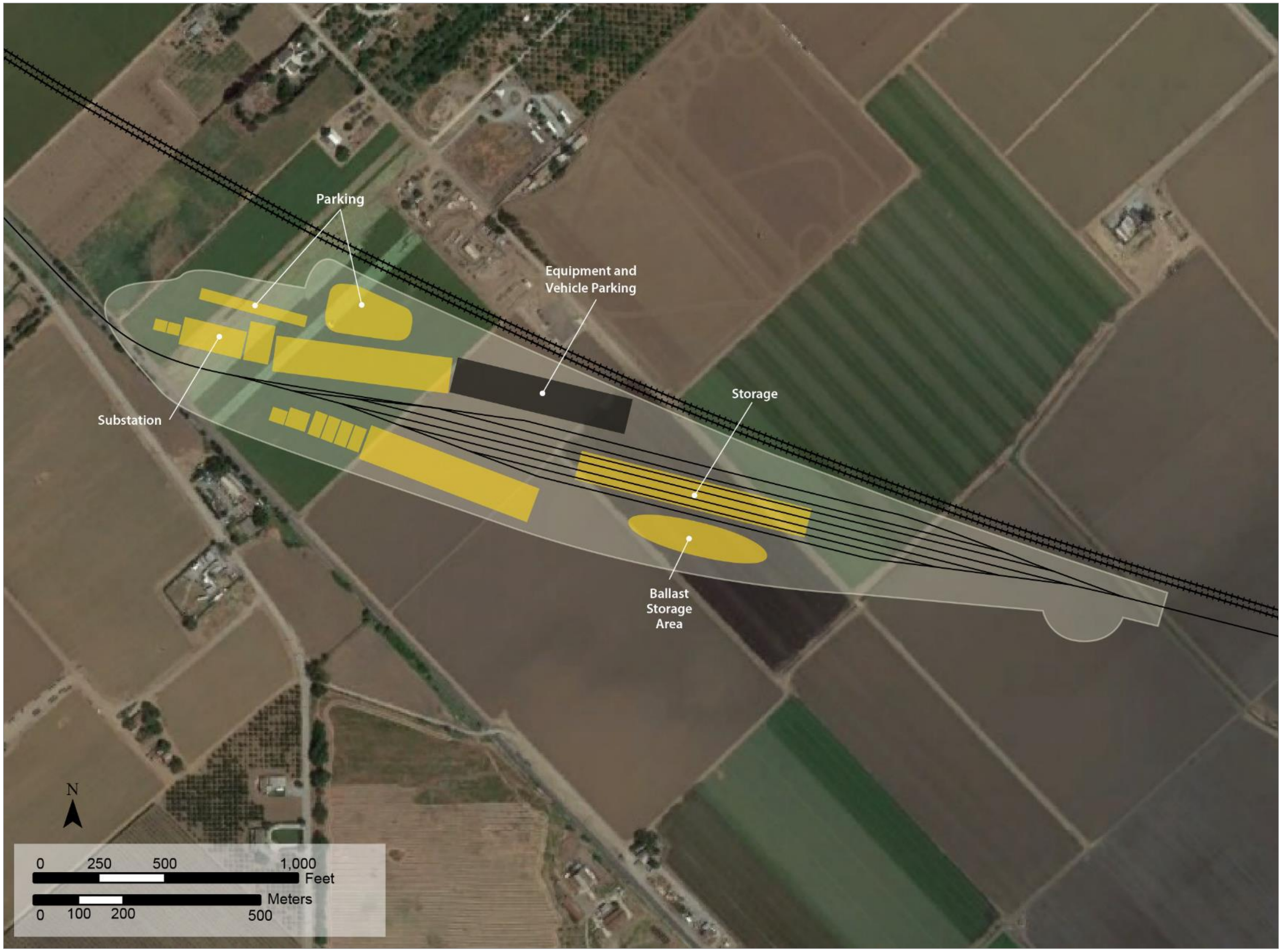
Traction power facilities of Alternative 4 would be as described for Alternatives 1–3.

Train Control and Communication Facilities

Train control and communications facilities would be as described for Alternatives 1–3.

Maintenance Facilities

An MOWS would be built near Turner Island Road near Carlucci Road as described for Alternatives 1–3 (Figure 2-13).



Source: Authority 2019c

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Figure 2-21 South Gilroy Maintenance of Way Facility for Alternative 4

2.2.4.5 San Joaquin Valley Subsection

Alignment and Ancillary Features

Alternative 4 would be the same as described for Alternatives 1–3 for this subsection.

Wildlife Crossings

The wildlife crossings under Alternative 4 would be as described for Alternatives 1–3.

Stations

No new HSR stations are proposed for this subsection.

Traction Power Facilities

Traction power facilities would be as described for Alternatives 1–3.

Train Control and Communication Facilities

Train control and communications facilities would be as described for Alternatives 1–3.

Maintenance Facilities

An MOWS would be built near Turner Island Road near Carlucci Road as described for Alternatives 1–3 (Figure 2-13).

2.3 Impact Avoidance and Minimization Features

The Authority has developed impact avoidance and minimization features (IAMF) that would avoid or minimize potential noise and vibration effects. IAMFs are incorporated into the project design and construction to avoid or minimize environmental effects. The description of each IAMF details the means and effectiveness of the feature in avoiding or minimizing effects, as well as the environmental benefits of implementing the measure. Table 2-2 shows complete descriptions of all IAMFs that the Authority and FRA would implement to address potential effects related to noise and vibration.

Table 2-2 Noise and Vibration Impact Avoidance and Minimization Features

IAMF	Description
NV-IAMF#1: Noise and Vibration	Prior to construction, the contractor will 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 receptors. 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 where possible. ▪ Construct walled enclosures around especially noisy activities or around clusters of noisy 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.

Source: Authority and FRA 2019
FTA = Federal Transportation Administration
FRA = Federal Railroad Administration

3 LAWS, REGULATIONS, AND ORDERS

This chapter provides a summary of federal, state, and local laws, regulations, orders, or plans that pertain to noise and vibration in the geographic area that would be affected by the project.

3.1 Federal

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

The Noise Control Act of 1972 (42 United States Code [U.S.C.] § 4910) 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 municipal governments. For example, the noise elements of community general plans and local noise ordinances studied as part of this technical report were largely created in response to passage of the act.

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

The Occupational Safety and Health Administration has regulated worker noise exposure to a time-weighted-average of 90 A-weighted decibels (dBA) over an 8-hour work shift. Areas where levels exceed 85 dBA must be designated and labeled as high-noise-level areas where hearing protection is required. This noise exposure criterion for workers would apply to construction activities in the RSA. Noise from construction activities might also elevate noise levels at nearby construction sites to levels that exceed 85 dBA and thus trigger the need for administrative or engineering controls and hearing conservation programs for worker safety, as detailed by the Occupational Safety and Health Administration.

3.1.3 Federal Railroad Administration

3.1.3.1 Noise and Vibration Impact Assessment Guidelines

The FRA provides guidance regarding the evaluation of noise and vibration impacts of HSR trains in the FRA guidance manual (FRA 2012). The manual includes prediction methodology, assessment procedures, and impact criteria for noise and vibration. The noise and vibration impact criteria are discussed in this technical report in Section 4.1.3, Impact Criteria, and Section 4.2.3, Impact Criteria, respectively.

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

The FRA's Railroad Noise Emission Compliance Regulation (49 Code of Federal Regulations [C.F.R.] Part 210) prescribes minimum compliance regulations for enforcement of Noise Emission Standards for Transportation Equipment; Interstate Rail Carriers (40 C.F.R. Part 201) adopted by the U.S. Environmental Protection Agency. New locomotives must meet the following noise standards: 70 dBA at 100 feet while stationary at idle throttle setting, 87 dBA at 100 feet while stationary at all other throttle settings, 90 dBA at 100 feet while moving. Rail cars must meet the following noise standards: 88 dBA at 100 feet while moving at speeds of 45 mph or less, and 93 dBA at 100 feet while moving at speeds greater than 45 mph.

Whether or not the EPA standard applies to high-speed trainsets, the analysis in this EIR/EIS does not assume that Authority trainsets will comply with it because the Authority and FRA are 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 TSI Standard), and a trainset manufactured to that standard complies with the US EPA 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 US EPA standard (if applicable). The analysis in this EIR/EIS – both prior to mitigation and after mitigation – assumes a trainset generating noise in compliance with the European TSI standard, because trainsets currently in manufacture and operation in Europe can meet this standard; the analysis does not assume a trainset that meets the US EPA standard.

3.1.3.3 Locomotive Horn Rule (49 C.F.R. Part 222 & Part 229)

FRA regulations require that engineers sound their locomotive horns while approaching public grade crossings until the lead locomotive fully occupies the crossing. In general, the regulations require locomotive engineers to begin to sound the train horn for a minimum of 15 seconds, and a maximum of 20 seconds, in advance of public grade crossings. Engineers must also sound the train horn in a standardized pattern of two long, one short and one long blast and the horn must continue to sound until the lead locomotive or train car occupies the grade crossing. Additionally, the minimum sound level for the locomotive horn is 96 dB(A), while the maximum sound level is 110 dB(A), both measured at 100 feet forward of the locomotive.

FRA allows public authorities to establish a quiet zone, which is segment of a rail line, within which is situated one or a number of consecutive public road-rail crossings at which locomotive horns are not routinely sounded, provided sufficient safety measures are implemented at the crossing to prevent/minimize the potential for accidents to occur. Railroad authorities, including Caltrain, CHSRA and railroad companies (such as UPRR) cannot establish quiet zones; only local cities and counties can establish them by applying to the FRA.

At a minimum, new quiet zones must be at least one-half mile in length and contain at least one public grade crossing (i.e., a location where a public highway, road, or street crosses one or more railroad tracks at grade). Every public grade crossing in a quiet zone must be equipped at a minimum with active grade crossing warning devices consisting of flashing lights and gates.

If a public authority wants to establish a new quiet zone, it must conduct an assessment of hazards related to the crossings in the proposed zone and implement sufficient safety measures to reduce the proposed quiet zone's risk level to an acceptable level. Improvements may include: Roadway medians or channelization devices to discourage motorists from driving around a lowered crossing gate; a four-quadrant gate system to block all lanes of highway traffic; converting a two-way street into a one-way street and installing crossing gates, and permanent or temporary (nighttime) closure of the crossing to highway traffic. As an alternative, communities may also choose to silence routine locomotive horn sounding through the installation of wayside horns at public grade crossings. Wayside horns are train-activated stationary acoustic devices at grade crossings that are directed at highway traffic as a one-for-one substitute for train horns.

As described in Chapter 2, Alternatives, the project includes the following improvements in all blended service segments with at-grade crossings: fencing of the right of way; four-quadrant gates and roadway channelization at at-grade crossings, and intrusion detection and monitoring systems The installation of these features would assist local cities and counties to establish quiet zones should they decide to do so but cities or counties would need to go through the quiet zone process with the FRA first to establish such zones.

3.1.4 Federal Transit Administration Guidelines

The FTA provides guidance regarding the evaluation of noise and vibration impacts associated with construction and operations of non-high-speed trains in the FTA guidance manual (FTA 2018). The manual includes prediction methods, assessment procedures, and impact criteria for noise and vibration. Although it was originally developed for use on public mass transit projects the FTA guidance manual includes a method that is applicable to HSR station activities, yard and maintenance facility activities, and conventional-speed rail operations. The FTA construction noise and vibration assessment method is consistent with the FRA method. The noise and vibration impact criteria are discussed in this technical report in Section 4.1.3 and Section 4.2.3, respectively.

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

The 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 on all major highway projects if the project would cause a substantial increase in traffic noise levels or if projected traffic noise levels approach or exceed the noise abatement criteria level for activities occurring on adjacent lands. These noise criteria are assigned to exterior and interior activities.

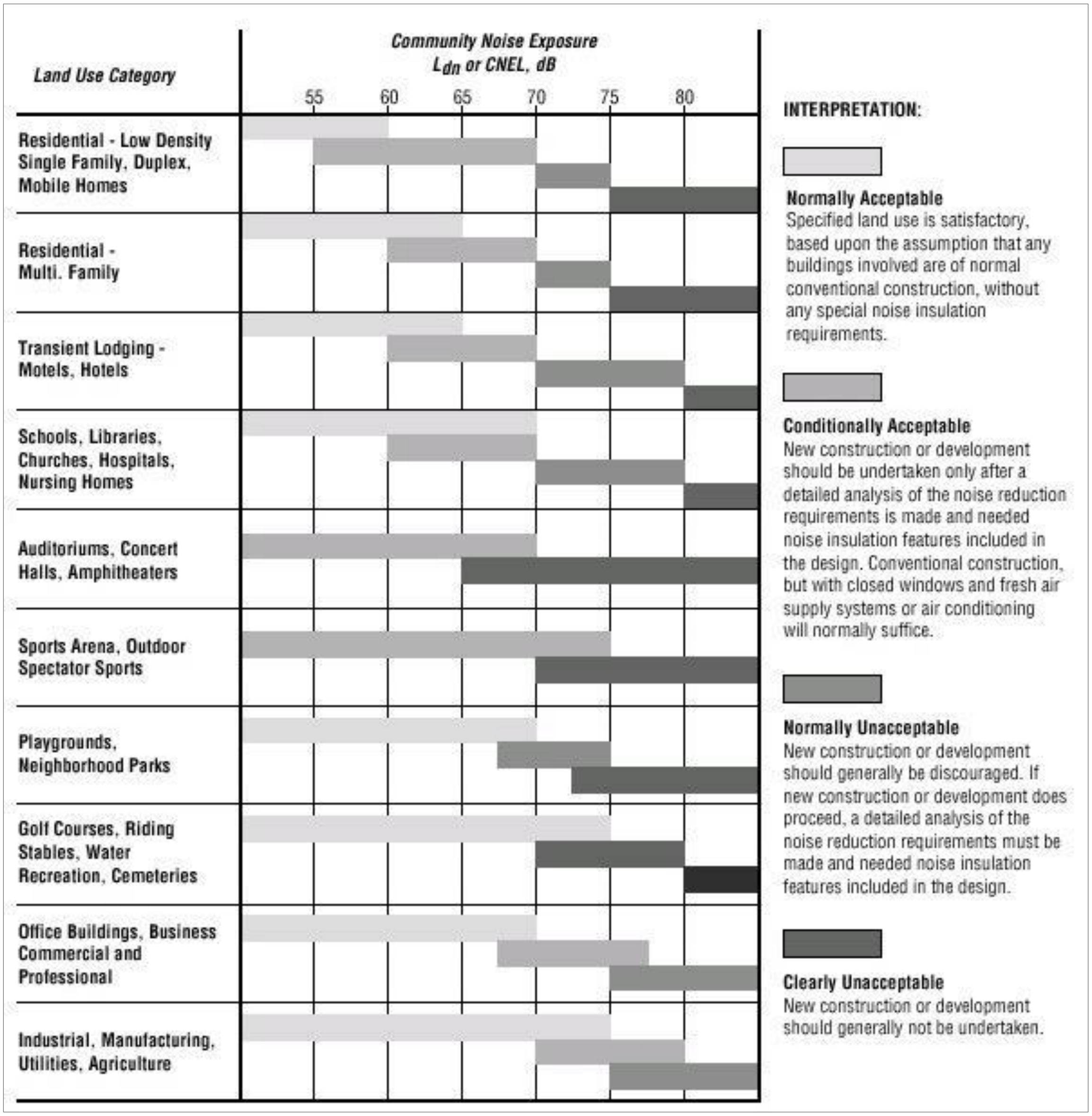
If motor vehicle traffic noise from federally funded projects is predicted to approach or exceed the noise abatement criteria during the noisiest 1-hour period, noise abatement measures must be considered, and, if determined to be reasonable and feasible, they must be incorporated as part of the project. Consistent with FHWA guidelines, the California Department of Transportation (Caltrans) defines *approach* as being within 1 dBA of the noise abatement criteria. Caltrans criteria also consider that a 12-decibel (dB) increase in peak-noise-hour traffic noise is a significant increase as defined by the FHWA procedures.

3.2 State

3.2.1 General Plan Guidelines (Cal. Gov. Code § 65302(f)), Appendix C, Noise Element Guidelines

The noise element of a community's general plan provides a basis for a comprehensive local program to control and abate environmental noise and to protect citizens from excessive exposure. The California Governor's Office of Planning and Research *General Plan Guidelines* (OPR 2003) outlines the development of the noise element for local agencies.

Figure 3-1 from the noise compatible land use planning guidance is often adopted by city and county agencies for land use planning purposes 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.



Source: OPR 2003

Figure 3-1 State of California Land Use Compatibility Guidelines

3.2.2 California Department of Transportation Traffic Noise Analysis Protocol

The Caltrans *Traffic Noise Analysis Protocol* (Caltrans 2011) establishes guidelines for evaluating traffic noise impacts along highways where frequent outdoor use takes place and for determining reasonable and feasible noise abatement measures. These criteria are relevant to the extent that the project would result in reconstruction or reconfiguration of an existing highway or traffic lanes, or would affect traffic patterns. Under FHWA (23 C.F.R. Part 772) and Caltrans policies, noise barriers should be considered for transportation improvement projects when various traffic noise abatement criteria are exceeded.

3.2.3 California Noise Control Act of 1973 (Cal. Health and Safety Code, Division 28, Noise Control Act, § 46000 et seq.)

The relevant legacy of the California Noise Control Act of 1973 was the development of the required content of the Noise Element of General Plans. This legislation provides guidance to local governments for preparing the required noise elements in city and county general plans, pursuant to California Government Code Section 65302(f).

3.3 Regional and Local

Counties and cities in California prepare general plans with noise policies and ordinances (outlined in the discussion of state regulations). 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. These sources may include 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). Noise-level contours must be mapped for these sources using the community noise equivalent level (CNEL) or the day-night sound level (L_{dn}), and are to be used as a guide in land use decisions to minimize the exposure of community residents to excessive noise.

These noise elements often incorporate specific allowable noise levels to achieve a quality environment. Where airports exist- many airports identify an airport noise impact area, which identifies adverse noise impacts within the 65 CNEL noise contour generated by the airport. In some instances, general plans include the existing L_{dn} near airports. The HSR system is not subject to local general plan policies and ordinances related to noise limits or to locally based criteria concerning noise and vibration for the project alternatives.

Table 3-1 shows a summary of noise and vibration elements in the plans and policies adopted by the cities and counties in the RSA that were identified and considered in the preparation of this analysis.

Table 3-1 Applicable Local Plans and Policies

Plan/Policy Document	Summary
Santa Clara County	
Santa Clara County General Plan (1994)	The *Santa Clara County General Plan* was adopted in 1994 with amendments published in 2016. The general plan includes the following strategies, policies, and implementation recommendations relevant to noise and vibration: **Strategy 1: Prevent or Minimize Noise Conflicts** ▪ Policy C-HS 24: Environments for all residents of Santa Clara County free from noises that jeopardize their health and well-being should be provided through measures which promote noise and land use compatibility. ▪ Policy C-HS 25: Noise impacts from public and private projects should be mitigated. – Implementation C-HS(i) 24: Where necessary, construct sound walls or other noise mitigations. – Implementation C-HS(i) 25: Prohibit construction in areas which exceed applicable interior and exterior standards, unless suitable mitigation measures can be implemented.
Santa Clara County Ordinance Code (2016)	The Santa Clara Ordinance Code was originally adopted in 1972. The Code establishes the following sections of Division B11, Chapter VIII, Control of Noise and Vibration, relevant to noise and vibration: **Section B11-152. – Exterior noise limits** Maximum permissible sound levels by receiving land use:

Plan/Policy Document	Summary
	▪ The noise standards for the various receiving land use categories as presented in [the following bullets, derived from Table B11-152] will apply to all property within any zoning district: – One and Two-Family Residential – 45 dBA between 10 pm to 7 am, and 55 dBA between 7 am to 10 pm; – Multiple Family Dwelling – 50 dBA between 10 pm and 7 am; – Residential Public Space – 55 dBA between 7 am to 10 pm; – Commercial – 60 dBA between 10 pm and 7 am, and 65 dBA between 7 am to 10 pm; – Light Industrial – 70 dBA at all times; and – Heavy Industrial – 75 dBA at all times. ▪ No person may operate or cause to be operated any source of sound at any location within the unincorporated territory of the County or allow the creation of any noise on property owned, leased, occupied or otherwise controlled by the person, which causes the noise level when measured on any other property either incorporated or unincorporated, to exceed: a) The noise standard for that land use as specified [above] for a cumulative period of more than 30 minutes in any hour; or b) The noise standard plus five dB for a cumulative period of more than 15 minutes in any hour; or c) The noise standard plus ten dB for a cumulative period of more than five minutes in any hour; or d) The noise standard plus 15 dB for a cumulative period of more than one minute in any hour; or e) The noise standard plus 20 dB or the maximum measured ambient, for any period of time. **Sec. B11-153. – Interior noise standards** Maximum permissible dwelling interior sound levels: ▪ The interior noise standards for multifamily residential dwellings as presented in [the following bullet, derived from Table B11-153] will apply, unless otherwise specifically indicated, within all dwellings: – Multi-Family Dwelling – 35 dBA allowable interior noise level between 10 pm and 7 pm, and 45 dBA between 7 am and 10 pm. ▪ No person will operate or cause to be operated within a dwelling unit any source of sound or allow creation of any noise which causes the noise level when measured inside a neighboring receiving dwelling unit to exceed: a) The noise standard as specified [above] for a cumulative period of more than five minutes in any hour; or b) The noise standard plus five dB for a cumulative period of more than one minute in any hour; or c) The noise standard plus ten dB or the maximum measured ambient, for any period of time. – If the measured ambient level exceeds that permissible within any of the noise limit categories above, the allowable noise exposure standard will be increased in five-dB increments in each category as appropriate to reflect the ambient noise level. **Section B11-154. – Prohibited acts**

Plan/Policy Document	Summary
	• Construction/demolition a) Operating or causing the operation of any tools or equipment used in construction, drilling, repair, alteration or demolition work between weekdays and Saturday hours of 7 p.m. and 7 a.m., or at any time on Sundays or holidays, that the sound therefrom creates a noise disturbance across a residential or commercial real property line, except for emergency work of public service utilities or by variance. b) Where technically and economically feasible, construction activities will be conducted in a manner that the maximum noise levels at affected properties will not exceed those listed in the following schedule: i. Mobile equipment. Maximum noise levels for nonscheduled, intermittent, short-term operation (less than ten days) of mobile equipment: [See full ordinance for table of maximum noise levels] ii. Stationary equipment. Maximum noise levels for repetitively scheduled and relatively long-term operation (periods of ten days or more) of stationary equipment are as follows: [See full ordinance for table of maximum noise levels] ▪ Vibration a) Operating or permitting the operation of any device that creates a vibrating or quivering effect that: i. Endangers or injures the safety or health of human beings or animals; or ii. Annoys or disturbs a person of normal sensitivities; or iii. Endangers or injures personal or real properties.
City of Santa Clara	
City of Santa Clara 2010-2035 General Plan (2010)	The City of Santa Clara adopted the 2010-2035 General Plan on November 16, 2010. Updates were published in 2013 and 2014. The general plan includes the following environmental quality goals and policies which are applicable to noise and vibration: Goals ▪ 5.10.6-G1 Noise sources restricted to minimize impacts in the community. ▪ 5.10.6-G2 Sensitive uses protected from noise intrusion. Policies ▪ 5.10.6-P2 Incorporate noise attenuation measures for all projects that have noise exposure levels greater than General Plan “normally acceptable” levels. ▪ 5.10.6-P6 Discourage noise sensitive uses, such as residences, hospitals, schools, libraries and rest homes, from areas with high noise levels, and discourage high noise generating uses from areas adjacent to sensitive uses. ▪ 5.10.6-P10 Encourage transit agencies to develop and apply noise reduction technologies for their vehicles to reduce the noise and vibration impacts of Caltrain, Bay Area Rapid Transit, future High Speed Rail, light rail and bus traffic.

Plan/Policy Document	Summary
Santa Clara City Code (2017)	The Santa Clara City Code is current through Ordinance 1969, passed in 2017. Chapter 9.10, Regulation of Noise and Vibration, is relevant to noise and vibration: **9.10.040 Noise or sound regulation:** [. . .] The maximum noise or sound levels are set forth, as follows: ▪ Category 1: Single Family and Duplex Residential – 55 dBA between 7 am to 10 pm, and 50 dBA between 10 pm to 7 am; ▪ Category 2: Multiple Family Residential – 55 dBA between 7 am to 10 pm; 50 dBA between 10 pm and 7 am; ▪ Category 3: Commercial, Office – 65 dBA between 7 am and 10 pm, and 60 dBA between 10 pm and 7 am; ▪ Light Industrial – 70 dBA at all times; and ▪ Heavy Industrial – 75 dBA at all times. **9.10.050 Vibration regulation:** [. . .] Vibration [should not exceed] the vibration perception threshold of an individual at the closest property line point to the vibration source on the real property affected by the vibration.
City of San Jose	
Envision San Jose 2040 General Plan (2011)	The *Envision*: *San Jose 2040 General Plan* was adopted in 2011. The Plan establishes the following goals and policies relevant to noise and vibration: **Goal EC-1 – Community Noise Levels and Land Use Compatibility.** Minimize the impact of noise on people through noise reduction and suppression techniques, and through appropriate land use policies. ▪ **Policy EC-1.1:** Locate new development in areas where noise levels are appropriate for the proposed uses. Consider federal, state and City noise standards and guidelines as a part of new development review. **Interior Noise Levels** – The City's standard for interior noise levels in residences, hotels, motels, residential care facilities, and hospitals is 45 dBA DNL. […] **Exterior Noise Levels** – The City's acceptable exterior noise level objective is 60 dBA DNL or less for residential and most institutional land uses. The acceptable exterior noise level objective is established for the City, except in the environs of the San José International Airport and the Downtown, as described below: – For new multi-family residential projects, the residential component of mixed-use development, [and single family residential uses] use a standard of 60 dBA DNL in usable outdoor activity areas [. . .] ▪ **Policy EC-1.2:** Minimize the noise impacts of new development on land uses sensitive to increased noise levels (Categories 1, 2, 3 and 6) by limiting noise generation and by requiring use of noise attenuation measures such as acoustical enclosures and sound barriers, where feasible. The City considers significant noise impacts to occur if a project would: – Cause the DNL at noise sensitive receptors to increase by five dBA DNL or more where the noise levels would remain "Normally Acceptable"; or – Cause the DNL at noise sensitive receptors to increase by three dBA DNL or more where noise levels would equal or exceed the "Normally Acceptable" level. ▪ **EC-1.7** Require construction operations within San José to use best available noise suppression devices and techniques and limit construction hours near residential uses per the City's Municipal Code. The City considers significant construction noise

Plan/Policy Document	Summary
	impacts to occur if a project located within 500 feet of residential uses or 200 feet of commercial or office uses would: – Involve substantial noise generating activities (such as building demolition, grading, excavation, pile driving, use of impact equipment, or building framing) continuing for more than 12 months. For such large or complex projects, a construction noise logistics plan that specifies hours of construction, noise and vibration minimization measures, posting or notification of construction schedules, and designation of a noise disturbance coordinator who would respond to neighborhood complaints will be required to be in place prior to the start of construction and implemented during construction to reduce noise impacts on neighboring residents and other uses. ▪ **Policy EC-1.9** Require noise studies for land use proposals where known or suspected loud intermittent noise sources occur which may impact adjacent existing or planned land uses. For new residential development affected by noise from heavy rail, light rail, BART or other single-event noise sources, implement mitigation so that recurring maximum instantaneous noise levels do not exceed 50 dBA Lmax in bedrooms and 55 dBA Lmax in other rooms. **Goal EC-2 – Vibration. Minimize vibration impacts on people, residences, and business operations.** ▪ **Policy EC-2.1:** Near light and heavy rail lines or other sources of ground-borne vibration, minimize vibration impacts on people, residences, and businesses through the use of setbacks and/or structural design features that reduce vibration to levels at or below the guidelines of the Federal Transit Administration. Require new development within 100 feet of rail lines to demonstrate prior to project approval that vibration experienced by residents and vibration sensitive uses would not exceed these guidelines. ▪ **Policy EC-2.2:** Require new sources of ground-borne vibration, such as transit along fixed rail systems or the operation of impulsive equipment, to minimize vibration impacts on existing sensitive land uses to levels at or below the guidelines of the Federal Transit Administration. ▪ **Policy EC-2.3** Require new development to minimize vibration impacts to adjacent uses during demolition and construction. For sensitive historic structures, a vibration limit of 0.08 in/sec PPV (peak particle velocity) will be used to minimize the potential for cosmetic damage to a building. A vibration limit of 0.20 in/sec PPV will be used to minimize the potential for cosmetic damage at buildings of normal conventional construction.

Plan/Policy Document	Summary
San Jose Municipal Code (2017)	The San Jose Municipal Code, codified through Ordinance No. 29912, was last adopted in May 2017. The Code includes the following titles and chapters relevant to noise and vibration: **Chapter 20.100: Administration and Permits** The City of San José does not establish quantitative noise limits for demolition or construction activities occurring in the City. According to San José Municipal Code, the legal hours of construction within 500 feet of a residential unit are limited to the hours of 7:00 a.m. to 7:00 p.m. on Monday through Friday. The City's Municipal Code also contains a Zoning Ordinance that limits noise levels generated by stand-by/backup and emergency generators. The noise level emitted by these generators shall not exceed 55 decibels at the property line of residential properties. The standards and criteria for stand-by/ backup generators are set as follows: ▪ Maximum noise levels, based upon a noise analysis by an acoustical engineer, will not exceed the applicable noise standards set forth in Title 20.80.2030. ▪ Testing of generators is limited to 7 a.m. to 7 p.m., Monday through Friday.

Plan/Policy Document	Summary
City of Morgan Hill	
Morgan Hill 2035 General Plan (2016)	The Morgan Hill 2035 General Plan was adopted in 2016. The Plan includes the following goals and policies relevant to noise and vibration: **Goal SSI-8. Prevention of noise from interfering with human activities or causing health problems Policies** ▪ **Policy SSI-8.1 Exterior Noise Level Standards.** Require new development projects to be designed and constructed to meet acceptable exterior noise level standards, as follows: – Apply a maximum exterior noise level of 60 dBA Ldn in residential areas where outdoor use is a major consideration (e.g., backyards in single-family housing developments and recreation areas in multi-family housing projects). Where the City determines that providing an Ldn of 60 dBA or lower cannot be achieved after the application of reasonable and feasible mitigation, an Ldn of 65 dBA may be permitted. – Indoor noise levels should not exceed an Ldn of 45 dBA in new residential housing units. – Noise levels in new residential development exposed to an exterior Ldn 60 dBA or greater should be limited to a maximum instantaneous noise level (e.g., trucks on busy streets, train warning whistles) in bedrooms of 50 dBA. Maximum instantaneous noise levels in all other habitable rooms should not exceed 55 dBA. The maximum outdoor noise level for new residences near the railroad shall be 70 dBA Ldn, recognizing that train noise is characterized by relatively few loud events. ▪ **Policy SSI-8.3 Commercial and Industrial Noise Level Standards**. Evaluate interior noise levels in commercial and industrial structures on a case-by-case basis based on the use of the space. ▪ **Policy SSI-8.4 Office Noise Level Standards.** Interior noise levels in office buildings should be maintained at 45 dBA Leq (hourly average) or less, rather than 45 dBA Ldn (daily average). ▪ **Policy SSI-8.5 Traffic Noise Level Standards.** Consider noise level increases resulting from traffic associated with new projects significant if: a) the noise level increase is 5 dBA Ldn or greater, with a future noise level of less than 60 dBA Ldn, or b) the noise level increase is 3 dBA Ldn or greater, with a future noise level of 60 dBA Ldn or greater. ▪ **Policy SSI-8.6 Stationary Noise Level Standards.** Consider noise levels produced by stationary noise sources associated with new projects significant if they substantially exceed existing ambient noise levels. ▪ **Policy SSI-9.3 Sound Wall Design.** The maximum height of sound walls shall be eight feet [. . .]

<table>
<tr><th>Plan/Policy Document</th><th>Summary</th></tr>
<tr><td>Morgan Hill Municipal Code (2017)</td><td>The Morgan Hill Municipal Code was originally published in 1987. The current code is updated through Ordinance Number 2256 N.S., enacted June 28, 2017. The following sections from Chapter 8.28, Noise, of Title 8, Health and Safety, of the municipal code are applicable to noise and vibration:

8.28.040 – Enumeration of unlawful noises.

Unlawful noises include:

D.1. Construction activities as limited below. “Construction activities” are defined as including but not limited to excavation, grading, paving, demolition, construction, alteration or repair of any building, site, street or highway, delivery or removal of construction material to a site, or movement of construction materials on a site. Construction activities are prohibited other than between the hours of seven a.m. and eight p.m., Monday through Friday and between the hours of nine a.m. to six p.m. on Saturday. Construction activities may not occur on Sundays or federal holidays. […]

I. Noises Adjacent to Schools, Courts, Churches and Hospitals. The creation of any excessive noise on any street adjacent to any school, institution of learning, church or court while the same is in use or adjacent to any hospital, which noise unreasonably interferes with the workings of such institution or which disturbs or unduly annoys patients in the hospital; provided, conspicuous signs are displayed in such streets indicating that the street is adjacent to a school, hospital or court;

J. Pile Drivers, Hammers and Similar Equipment. The operation, between the hours of eight p.m. and seven a.m. of any pile driver, steam shovel, pneumatic hammer, derrick, steam or electric hoist or other appliance, the use of which is attended by loud or unusual noise.</td></tr>
<tr><td colspan="2">City of Gilroy</td></tr>
<tr><td>The City of Gilroy 2002-2020 General Plan (2002)</td><td>The City of Gilroy 2002-2020 General Plan was adopted in 2002. The Plan includes the following goals and policies relevant to noise and vibration from Chapter 8, Community Resources and Potential Hazards.

GOAL: Protection of Gilroy residents from exposure to excessive noise and its effects through appropriate mitigation measures and responsive land use planning, especially in regard to noise-sensitive land uses such as schools, hospitals, and housing for seniors.

▪ Policy 26.02 Maximum Permissible Noise Levels. Ensure that outdoor and indoor noise levels are within the maximum permitted levels (see Figure A- 27).
▪ Policy 26.04 Acoustical Design. Consider the acoustical design of projects in the development review process to reduce noise to an acceptable level. Ensure that noise mitigation features are designed and implemented in an aesthetically pleasing and consistent manner.
▪ Policy 26.05 Earth Berms. Require landscaped earth berms as an alternative to soundwalls where feasible to buffer noise along major thoroughfares adjacent to residential areas. Where an earth berm is not feasible, a masonry wall screened with drought tolerant, low maintenance landscaping should be required.</td></tr>
</table>

<table>
<tr><th>Plan/Policy Document</th><th>Summary</th></tr>
<tr><td>Gilroy Municipal Code (2017)</td><td>The Gilroy Municipal Code is current through Ordinance 2017-03, passed in 2017. The Code includes the following chapters relevant to noise and vibration:

Chapter 16, Offences—Miscellaneous

Section 16.38 Hours of construction of the Gilroy Municipal Code states the following regarding construction noise:

2 Unless otherwise provided for in a validly issued permit or approval, construction activities shall be limited to the hours of 7 a.m. and 7 p.m., Monday through Friday and 9 a.m. to 7 p.m. on Saturday. Construction activities shall not occur on Sundays or city holidays, which include: New Years Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day and Christmas. “Construction activities” are defined as including but not limited to, excavation, grading, paving, demolitions, construction, alteration or repair of any building, site, street or highway, delivery or removal of construction material to a site, or movement of construction materials on a site. […]

Chapter 30, Zoning Ordinance

30.41.31 Specific provisions—Noise.

It shall be unlawful to generate noise within the city limits that exceeds the limits established in this section.

(b) Maximum Outdoor Noise Levels.

(2) Commercial and Industrial Noise Impacting Residentially Zoned Properties. Noise emanating from properties that are zoned for uses other than residential is limited to a maximum of 70 dBA (L10) measured at the residential property line. Such noise is limited to the hours of 7 a.m. to 10 p.m., and prohibited between the hours of 10 p.m. and 7 a.m.</td></tr>
<tr><td colspan="2">San Benito County</td></tr>
<tr><td>San Benito County 2035 General Plan (2015)</td><td>The San Benito County 2035 General Plan was adopted in 2015. The Plan includes the following goals and policies relevant to noise and vibration:
Health and Safety

Goal HS-8: To protect the health, safety, and welfare of county residents through the elimination of annoying or harmful noise levels.

▪ Policy HS-8.1 Project Design. The County shall require new development to comply with the noise standards shown in the tables in Figure A-29 through proper site and building design, such as building orientation, setbacks, barriers (e.g., earthen berms), and building construction practices. The County shall only consider the use of soundwalls after all design-related noise mitigation measures have been evaluated or integrated into the project or found infeasible.
▪ Policy HS-8.2 Acoustical Analysis. The County shall require an acoustical analysis to be performed prior to development approval where proposed land uses may produce or be exposed to noise levels exceeding the “normally acceptable” criteria (e.g. “conditionally acceptable”, “normally unacceptable”) shown in Table 9-2. Land uses should be prohibited from locating, or required to mitigate, in areas with a noise environment within the “unacceptable” range.
▪ Policy HS-8.3 Construction Noise. The County shall control the operation of construction equipment at specific sound intensities and frequencies during day time hours between 7 a.m. and 6 p.m. on weekdays and 8 a.m. and 5 p.m. on Saturdays. No construction shall be allowed on Sundays or federal holidays.</td></tr>
</table>

Plan/Policy Document	Summary
	▪ **Policy HS-8.7 Acceptable Vibration Levels.** The County shall require construction projects anticipated to generate a significant amount of vibration to ensure acceptable interior vibration levels at nearby noise-sensitive uses based FTA criteria. ▪ **Policy HS-8.10 Reduction in Noise Levels at Existing Land Uses**. Reduce traffic noise levels where expected to significantly impact sensitive receptors through the installation of noise control measures such as quiet pavement surfaces, noise barriers, traffic calming measures, and interior sound insulation treatments. ▪ **Policy HS-8.12 Construction Noise Control Plans.** Require all construction projects to be constructed within 500 feet of sensitive receptors to develop and implement construction noise control plans that consider the following available controls in order to reduce construction noise levels as low as practical: – Utilize ‘quiet’ models of air compressors and other stationary noise sources where technology exists; – Equip all internal combustion engine-driven equipment with mufflers, which are in good condition and appropriate for the equipment; – Locate all stationary noise-generating equipment, such as air compressors and portable power generators, as far away as possible from adjacent land uses; – Locate staging areas and construction material areas as far away as possible from adjacent land uses; – Prohibit all unnecessary idling of internal combustion engines; – Notify all abutting land uses of the construction schedule in writing; and – Designate a “disturbance coordinator” (e.g. contractor foreman or authorized representative) who would be responsible for responding to any local complaints about construction noise. The disturbance coordinator will determine the cause of the noise complaint (e.g., starting too early, bad muffler, etc.) and will require that reasonable measures warranted to correct the problem be implemented. Conspicuously post a telephone number for the disturbance coordinator at the construction site and include it in the notice sent to neighbors regarding the construction schedule.

Plan/Policy Document	Summary
San Benito County Ordinance Code (2016)	The San Benito County Ordinance Code, codified through Ordinance 937, was most recently adopted in 2015. The Code includes Chapter 19.39, Noise Control Regulations, of Title 19, Land Use and Environmental Regulations, relevant to noise and vibration: **Article IV. Sound Level Restrictions** **19.39.030 MAXIMUM PERMISSIBLE SOUND PRESSURE LEVELS.** No person shall operate, or permit to be operated, on private property any source of sound in such a manner as to create: (A) A sound pressure level which exceeds the limits set forth for the receiving land use category in Table 1 [summarized in the following bullets] which may be measured at or within the real property boundary of the receiving land use, or its vertical extension: ▪ Rangeland, Productive Rural Lands, and Rural Transitional – 45 dBA day and 35 dBA night ▪ Single Family Residential, Residential Multiple, and Planned Unit Development – 50 dBA day, 40 dBA night ▪ Commercial – 65 dBA day and 55 dBA night ▪ Controlled Manufacturing, Light Industrial, and Heavy Industrial – 70 dBA day and 60 dBA night (B) A sound pressure level which exceeds the limits set forth for the receiving land use category in Table A- 5 for more than 15 minutes in 60 minutes which may be measured at or within the real property boundary of the receiving land use, or its vertical extension; or I An equivalent A-weighted sound level that exceeds the limits set forth for the receiving land use category in Table A- 5 which may be measured at or within the real property boundary of the receiving land use or its vertical extension. (D) A sound level that exceeds the ambient sound level by 5 dB which may be measured at or within the real property boundary of the receiving land use or its vertical extension.

Plan/Policy Document	Summary
Frazier Lake Airpark Comprehensive Land Use Plan (2001)	The Frazier Lake Airpark Comprehensive Land Use Plan was adopted by the San Benito County Airport Land Use Commission in 2001. The following compatibility guidelines are relevant to noise and vibration: **4.3.1 Noise Compatibility:** The objective of noise compatibility criteria is to minimize the number of people exposed to frequent and/or high levels of aircraft noise. ▪ The maximum CNEL considered clearly acceptable for residential uses in the vicinity of the Airport is 55 dB CNEL. ▪ Noise level compatibility standards for other types of land uses shall be applied in the same manner as the above residential noise level criteria. Table 4-1 presents acceptable noise levels for other land uses in the vicinity of the Airport. ▪ Single-event noise levels should be considered when evaluating the compatibility of highly noise sensitive land uses such as schools, libraries, and outdoor theaters. Single-event noise levels are especially important in the areas regularly overflown by aircraft, but which do not produce significant CNEL contours.
Merced County	

2030 Merced County General Plan (2013)	The 2030 Merced County General Plan was adopted in 2013. The Plan includes the following goals and policies relevant to noise and vibration:
	Public Facilities and Services
	▪ **Policy PFS-8.7: Incompatible Land Uses near Schools.** Coordinate with school districts to reduce the effects of incompatible land uses and noise adjacent to school facilities.
	Health and Safety
	Goal HS-7: Protect residents, employees, and visitors from the harmful and annoying effects of exposure to excessive noise.
	▪ **Policy HS-7.4: New Noise or Groundborne Vibration Generating Uses.** Require new commercial and industrial uses to minimize encroachment on incompatible noise or groundborne vibration sensitive land uses. Also consider the potential for encroachment by residential and other noise or groundborne vibration sensitive land uses on adjacent lands that could significantly impact the viability of the commercial or industrial areas.
	▪ **Policy HS-7.5: Noise Generating Activities.** Limit noise generating activities, such as construction, to hours of normal business operation.
	▪ **Policy HS-7.9: Transportation Project Construction/Improvements.** Require transportation project proponents to prepare all acoustical analysis for all roadway and railway construction projects in accordance with Policy HS-7.2; additionally, rail projects shall require the preparation of a groundborne vibration analysis in accordance with Policy HS-7.2. Consider noise mitigation measures to reduce traffic and/or rail noise levels to comply with Table HS-1 standards if pre-project noise levels already exceed the noise standards of Table HS-1 and the increase is significant. The County defines a significant increase as follows:
	  ▪ Pre-Project Noise Environment of Less than 60 dB – 5+ dB would result in a significant increase
	  ▪ Pre-Project Noise Environment of between –0 - 65 dB – 3+ dB would result in a significant increase
	  ▪ Pre-Project Noise Environment greater than 65 dB – 1.5+ dB would result in a significant increase
	▪ **Policy HS-7.11: Train Whistle Noise.** Support improvements to crossings in urban areas in order to eliminate the need for train whistle blasts near or within communities.

Plan/Policy Document	Summary
Merced County Ordinance Code (2016)	The Merced County Ordinance Code is current through Ordinance 1951, passed in 2017. The Code includes Chapter 10.60, Noise Control, of Title 10, Public Health and Safety, relevant to noise and vibration: **10.60.030 Sound level limitations.** A. No person shall cause, suffer, allow, or permit the operation of any sound source on private property in such a manner as to create a sound level that results in any of the following, when measured at or within the real property line of the receiving property: 1. Exceeds the background sound level by at least 10 dBA during daytime hours (7 a.m. to 10 p.m.) and by at least 5 dBA during nighttime hours (10 p.m. to 7 a.m.). The background sound level for purposes of this section shall be determined as set forth in Section 10.60.060; or 2. Exceeds 65 dBA Ldn on residential real property or 70 dBA Ldn on nonresidential real property; or 3. Exceeds 75 dBA Lmax on residential real property or 80 dBA Lmax on nonresidential real property. B. The following are exempt from the sound level limits of Section 10.60.030(A): 5. Noise from construction activity, provided that all construction in or adjacent to urban areas shall be limited to the daytime hours between 7 a.m. and 6 p.m., and all construction equipment shall be properly muffled and maintained.

Sources: City of Gilroy 2002; City of Morgan Hill 2016; City of San Jose 2011; City of Santa Clara 2010; County of Merced 2013; County of San Benito 2015; County of Santa Clara 1994; San Benito County Airport Land Use Commission 2001

dBA = A-weighted decibel
dB = decibel
SCCC = Santa Clara County Code
DNL = day/night sound level
BART = Bay Area Rapid Transit
Lmax = maximum sound level
PPV = peak particle velocity
SENL = single-event noise level
L_{dn} = day-night sound level
L_{eq} = sound level equivalent
FTA = Federal Transit Administration
CNEL = community noise equivalent level

4 METHODS FOR EVALUATING IMPACTS

Analysts evaluated the effects of noise and vibration from construction and operations of the project quantitatively using FRA-approved methods. Construction noise and vibration and high-speed ground transportation noise and vibration were evaluated in accordance with methods and criteria from the FRA guidance manual (FRA 2012). Non-high-speed transit noise and vibration and noise levels from passenger stations, transfer power facilities and maintenance facilities were evaluated in accordance with the FTA guidance manual (FTA 2018). Train horn noise was evaluated using the FRA horn noise model. Highway noise was evaluated in accordance with the FHWA's *Procedures for Abatement of Highway Traffic Noise and Construction Noise* (23 C.F.R. Part 772) as defined by the Caltrans *Traffic Noise Analysis Protocol* (Caltrans 2011). Analysts used design information on the project alternatives and operations assumptions from the Authority's *Connecting and Transforming California, 2016 Business Plan* (2016 Business Plan) (Authority 2016) and its *Connecting California, Expanding Economy, Transforming Travel, 2018 Business Plan n* (2018 Business Plan) (Authority 2018) in the noise and vibration models, as well as field noise and vibration measurements, and professional judgment.

This technical report evaluates both direct and indirect noise and vibration effects. Direct effects consist of increases in noise and vibration because of construction activities or operations, while indirect effects for noise include the project's effect on traffic patterns, which indirectly affect noise levels. This chapter provides additional details of the methods for the noise and vibration assessments.

4.1 Noise

4.1.1 Descriptors

Noise is typically described as an unwanted sound[6] that is disagreeable or undesirable. Several factors affect sound as perceived by the human ear, including the amplitude (or loudness), the frequency (or pitch), and the time variation (or duration).

The amplitude of a sound is determined by the magnitude of fluctuation caused by sound waves in the air pressure above and below the atmospheric pressure at equilibrium. It is usually expressed in dB, which are logarithmic values of the ratio of the pressure produced by the sound wave to a reference pressure.[7] Decibels more understandably express the extremely large range of absolute sound pressure values that the human ear is capable of perceiving. For example, a train horn sound of 100 dB has about 5,600 times greater pressure than a very low sound of 35 dB typically found in a quiet rural environment.

The frequency describes the tonal character of noise. Individual frequencies or a range of frequencies are expressed in terms of the rate of fluctuation of the air pressure in cycles per seconds or Hertz (Hz). The average human ear and brain system can generally perceive noise frequencies between 20 Hz and 20,000 Hz. However, the human hearing system does not respond equally to all frequencies; it is more sensitive to mid-band frequencies (e.g., 500 to 2,000 Hz). Thus, when describing sound and its effects on a human population, dBA sound pressure levels are used to account for the response of the human ear by de-emphasizing the low and very high frequency components of the sound. The A-weighted sound level correlates well with human response and is expressed in terms of a single number. Figure 4-1 illustrates typical A-weighted noise levels of high-speed trains (including the German TransRapid TR08 maglev system, the French TGV, and the American Amtrak Acela train), as well as other indoor and outdoor noise sources. Typical A-weighted sound levels range from the 40s to the 90s (dBA), where 40 is very quiet and 90 is very loud. On average, each A-weighted sound level increase of 10 dB corresponds to an approximate doubling of subjective loudness.

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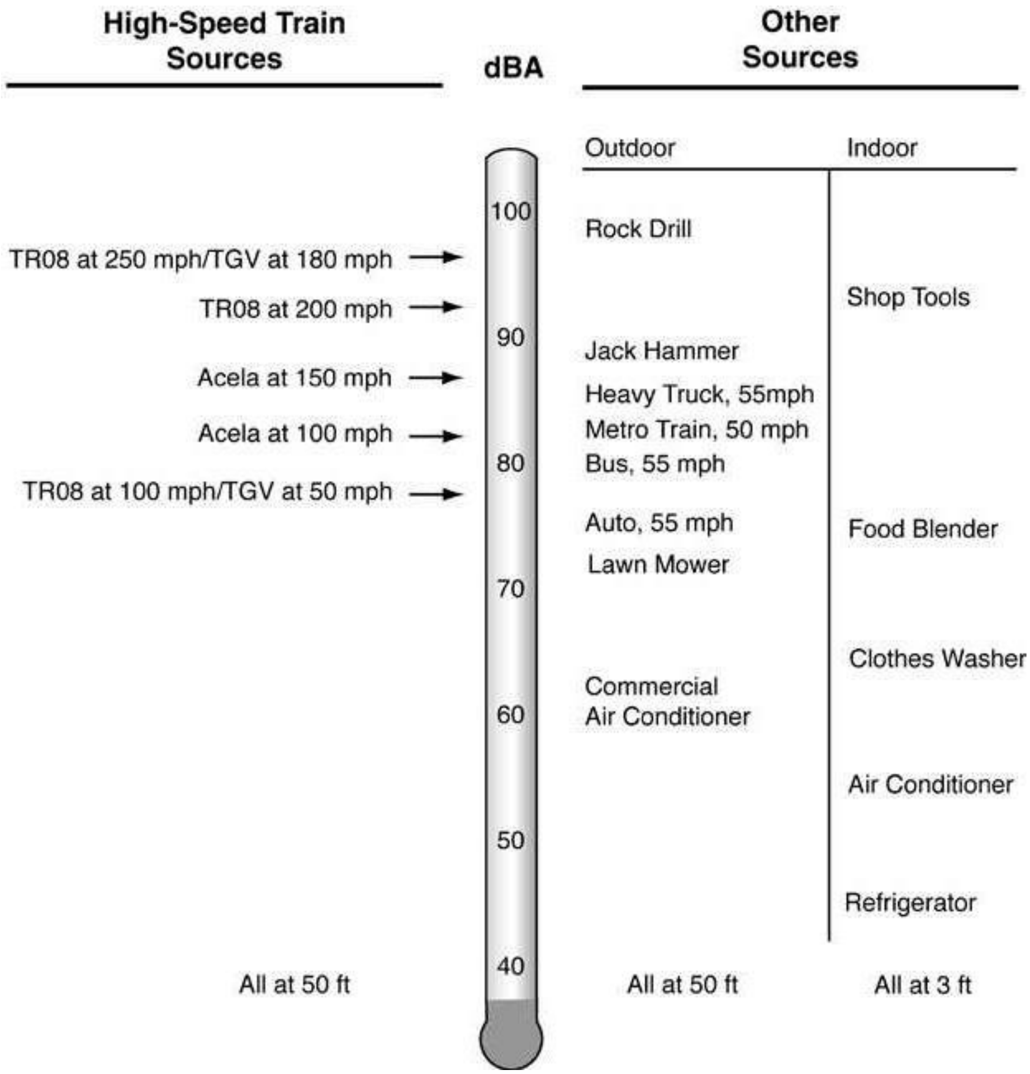
[6] Sound is caused by transmission of energy that propagates as waves of alternating pressure through a medium (fluids, solids, or gases such as the air).

[7] The standard reference sound pressure is 20 micro-Pascals as indicated in ANSI S1.8-1969 *Preferred Reference Quantities for Acoustical Levels.*



Source: FRA 2012

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Figure 4-1 Typical A-Weighted Maximum Sound Levels

The level of environmental noise commonly varies with time. There are several descriptors (also called *metrics*) to characterize environmental noises according to their duration. This analysis uses the following single-number descriptors, all based on the dBA sound pressure levels as the fundamental unit for environmental noise measurements, computations, and assessment:

- **Sound exposure level (SEL)**—The SEL describes noise exposure from a single noise event. It is represented by the total A-weighted sound energy during the event, normalized to a 1-second interval. The SEL decibel value is as if all the sound energy during the event would have occurred in 1 second. This is also the reason that SEL decibels may not be directly compared to normal sound level decibels. The SEL is the primary descriptor of HSR vehicle noise emissions and an intermediate value in the calculation of both equivalent sound level (L_{eq}) and L_{dn} (defined in the following text). Impact criteria for noise effects on livestock are also based on SEL.

- **L_{eq}**—The L_{eq} is the logarithmic summation of noise exposure during a period of interest, and it is widely used as a single-number descriptor of environmental noise. L_{eq} is used in this document to report results of short-term noise measurements and to calculate the L_{dn}. The FRA and FTA have adopted hourly L_{eq} (L_{eq}(h)) as the measure of cumulative noise impact for nonresidential land uses.
- **L_{dn}**—The L_{dn} is the A-weighted L_{eq} for a 24-hour period with a 10 dB penalty applied to noise levels occurring between 10:00 p.m. and 7:00 a.m. As a result, the L_{dn} considers the number of noise events during day and night separately, as well as the duration of each event, which is affected by vehicle speed. Studies have shown that the L_{dn} is well correlated with human annoyance for community noise. The FRA and FTA have adopted it as a measure of cumulative noise impact for residential land uses.
- **CNEL**—The CNEL is a 24-hour average A-weighted sound level for a given day, with the addition of a 5 dB penalty to sound levels occurring from 7:00 p.m. to 10:00 p.m., and with the addition of a 10 dB penalty to sound levels occurring from 10:00 p.m. to 7:00 a.m. Although the CNEL was developed and used in California for many years, L_{dn} is now the descriptor of choice.

The use of different descriptors may result in different numerical values for a given sound or acoustic environment even though the actual properties of the sound or environment such as amplitude, frequency, and duration are not altered. Because of this, some comparisons of dB may not be appropriate or may be invalid, such as comparing the SEL value to the maximum sound level (L_{max}) or to the L_{eq} of a train passby. Comparisons using the same metric however, may be very useful to evaluate different sounds or noise sources. Additional information about these noise descriptors is included in Section A.1 of the FRA guidance manual (FRA 2012).

4.1.2 Resource Study Area

The RSA is the area in which all environmental investigations specific to noise are conducted to determine the resource characteristics and potential effects of the project alternatives. The noise RSA extends approximately 2,500 feet from the alternatives’ centerlines and includes all sensitive receptors potentially exposed to noise impacts. This noise RSA is larger than the maximum FRA-recommended screening distances for high-speed trains shown in Table 4-1. The maximum FRA-recommended screening distance for a new HSR corridor is 1,300 feet in quiet suburban or rural environments with train operation speeds greater than 170 mph; however, this recommendation assumes there would be 50 train operations per day. Consistent with FRA methods, analysts extended the noise RSA for the project farther than the maximum FRA-recommended screening distances to reflect the frequency of train operations, which would exceed 200 trains per day based on the Authority’s 2016 Business Plan and 2018 Business Plan (Authority 2016, 2018).

Table 4-1 Federal Railroad Administration Recommended Screening Distances for Evaluation of HSR Noise Impacts[1]

Corridor Type	Existing Noise Environment	Screening Distance for Project Type and Speed Regime (feet from centerline)[2]	
		90 to 170 mph	> 170 mph
Railroad	Urban/noisy suburban—unobstructed	300	700
	Urban/noisy suburban—intervening buildings[3]	200	300
	Quiet suburban/rural	500	1,200
Highway	Urban/noisy suburban—unobstructed	250	600
	Urban/noisy suburban—intervening buildings[3]	200	350
	Quiet suburban/rural	400	1,100
New Rail	Urban/noisy suburban—unobstructed	350	700
	Urban/noisy suburban—intervening buildings[3]	250	350
	Quiet suburban/rural	600	1,300[4]

Source: FRA 2012
mph = miles per hour
[1] Noise screening distances for Regime II (mechanical noise resulting from wheel/rail interactions and guideway vibrations) and Regime III (aerodynamic noise resulting from airflow moving past the train)
[2] Measured from centerline of guideway or rail corridor. Minimum distance is assumed 50 feet.
[3] Rows of buildings assumed to be at 200 feet, 400 feet, 600 feet, 800 feet, and 1,000 feet parallel to the guideway.
[4] Distance was extended to 2,500 feet for analysis of the project.

4.1.3 Impact Criteria

4.1.3.1 Construction

The FRA guidance manual (FRA 2012) includes construction noise assessment criteria as shown in Table 4-2. An 8-hour L_{eq} and a 30-day average noise exposure L_{dn} are used to assess impacts. A 30-day average L_{dn} is used to assess impacts in residential areas, and a 30-day average 24-hour L_{eq} is used to assess impacts in commercial and industrial areas. The noise emission levels of the construction equipment, utilization factor, hours of operation, and location of equipment are used to calculate 8-hour and 30-day average noise exposures. FRA assessment criteria are used throughout the RSA.

Table 4-2 Detailed Assessment Criteria for Construction Noise

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

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

4.1.3.2 Operations

For the HSR system, analysts used noise impact criteria adopted by the FRA to assess the contribution of the noise from project operations and construction to the existing environment. Analysts used criteria adopted by the FTA to assess the contribution of the noise from conventional speed rail operations and stationary facilities. These guidelines establish methods for analyzing and assessing noise and vibration impacts. The FRA noise impact criteria are based on maintaining a noise environment considered acceptable for land uses where noise may have an effect. Land use also factors into the determination of impact; while impacts on industrial uses are not considered, places where people sleep or where quiet is an integral component of the land use require evaluation to determine if noise impact would occur. Descriptions of the three land use categories are shown in Table 4-3. The noise exposure is measured in terms of L_{dn} for residential land uses or in terms of L_{eq}(h) for other land uses.

Table 4-3 Federal Railroad Administration Land Use Categories for Noise Exposure

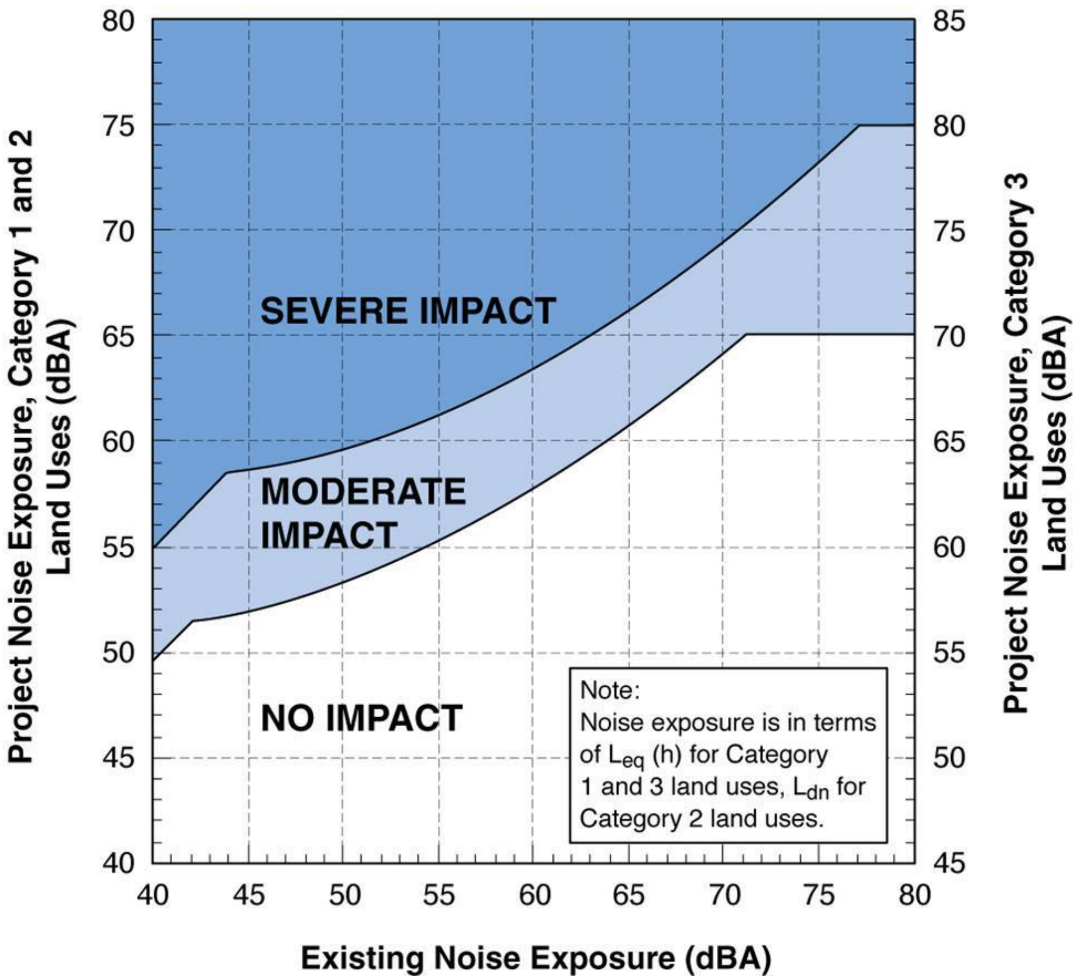
Land Use Category	Noise Metric (dBA)	Land Use Category[1, 2]
1	Outdoor L_{eq}(h)[3]	Tracts of land where quiet is an essential element in their intended purpose. This category includes lands set aside for serenity and quiet, and such land uses as outdoor amphitheaters and concert pavilions, as well as national historic landmarks with significant outdoor use. Also included are recording studios and concert halls.
2	Outdoor L_{dn}	Residences and buildings where people normally sleep. This category includes homes, hospitals, and hotels where a nighttime sensitivity to noise is assumed to be of utmost importance.
3	Outdoor L_{eq}(h)[1]	Institutional land uses with primarily daytime and evening use. This category includes schools, libraries, theaters, and churches, where it is important to avoid interference with such activities as speech, meditation, and concentration on reading material. Places for meditation or study associated with cemeteries, monuments, and museums can be considered to be in this category. Certain historical sites, parks, campgrounds, and recreational facilities are also included.

Source: FRA 2012
dBA = A-weighted decibel
$L_{eq(h)}$ = hourly equivalent sound level
[1] Parks are only considered to be noise sensitive if the park is used in a manner that is noise sensitive; active outdoor land use, for example, such as pedestrian and bike paths, are not considered noise sensitive.
[2] Historic sites and properties protected under Section 4(f) of the U.S. Department of Transportation Act and Section 106 of the National Historic Preservation Act are not intrinsically noise-sensitive; inclusion in noise-sensitive land use categories is dependent upon land use activities (e.g., if outdoor interpretation is a critical component of a historic site, then the site would be included in Category 1)
[3] L_{eq} for the noisiest hour of transit-related activity during hours of noise sensitivity.

FRA noise impact criteria for human annoyance are based on comparison of the existing outdoor noise levels and the future outdoor noise levels from a proposed HSR project. The FRA noise impact criteria specify a comparison of future with existing noise levels, not with projections of future build versus no-build noise exposure, because comparison of a projection with an existing condition is more reflective of impact than a comparison of two projections. Noise-level increases are categorized as no impact, moderate impact, or severe impact. Moderate and severe impacts are defined as follows:

- **Moderate impact—**The change in noise level is noticeable to most people but may not be sufficient to cause strong, adverse reactions from the community. Project-specific factors would be considered to determine the magnitude of impact and the need for mitigation, including the number of affected noise-sensitive sites, the existing level of noise exposure, and the costs associated with mitigation.
- **Severe impact—**Project-generated noise in the severe impact range can be expected to cause a substantial percentage of people to be highly annoyed by the new noise levels. It is FRA policy to implement noise mitigation for sensitive receptors experiencing severe impacts unless there are truly extenuating circumstances that prevent implementation.

The noise impact criteria are illustrated on Figure 4-2. The figure shows the existing noise exposure and the additional noise exposure from project operations that would cause either a moderate impact or severe impact for each land use category. The future noise exposure would be the combination of the existing noise exposure and the additional noise exposure from project operations. The equations used to calculate the impact curves are found in Section A.3.3 of the FRA guidance manual (FRA 2012).



Source: FRA 2012

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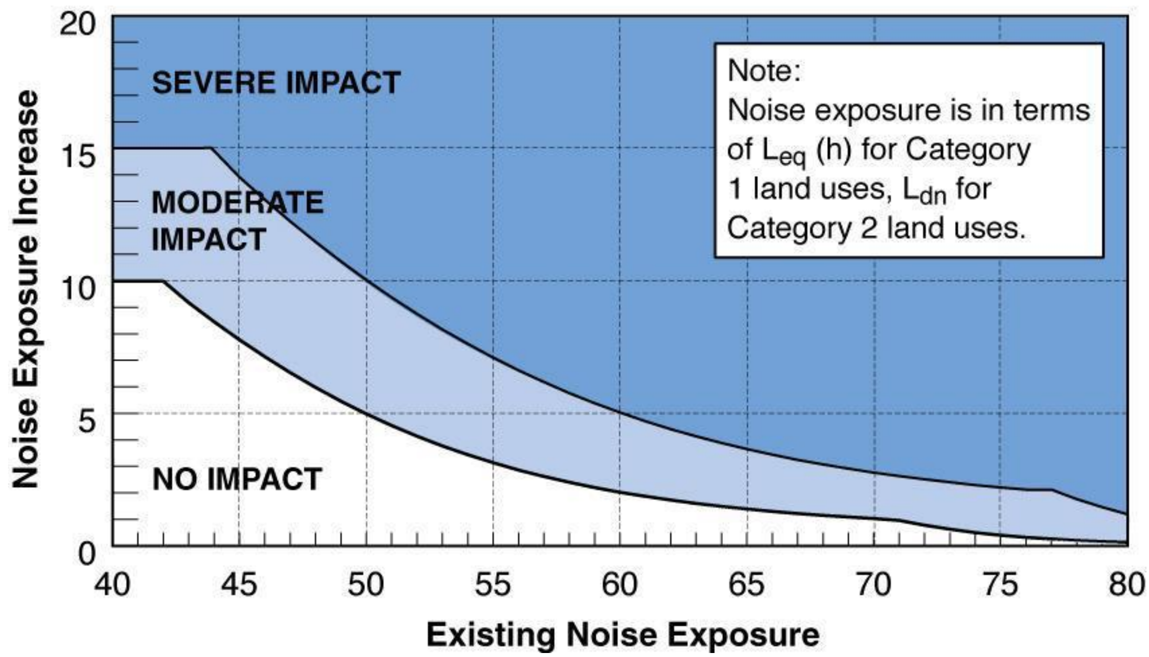
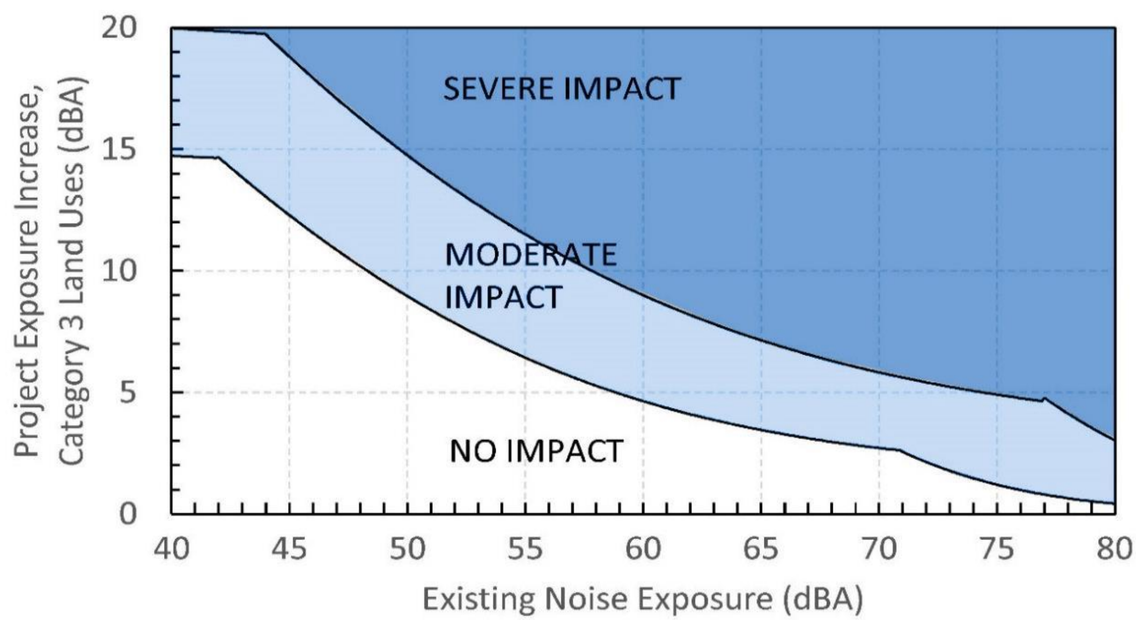
Figure 4-2 Noise Impact Criteria for High-Speed Rail Projects

The absolute criteria illustrated on Figure 4-2 are only applicable to new HSR sources where the existing noise levels generated by existing transit systems, roadways, and other sources would not change because of the project. The FRA criteria can also be presented in terms of relative levels for evaluating the total future noise exposure increases, or increases in cumulative noise exposure, from the project alternatives. If the existing noise is dominated by a source that would change because of the project, it would be incorrect to add the project noise to the existing noise. Therefore, the relative form of the noise criteria must be used for projects involving proposed changes to an existing rail transit system such as a shift in the location or profile of existing passenger or freight tracks or a change in the vehicle technology. Figure 4-3 illustrates the relative form of the criteria as they apply to Category 1 and 2 land uses and Figure 4-4 illustrates the criteria as they apply to Category 3 land uses. These criteria are based on the increase of the existing ambient noise level associated with project operations and can be used to evaluate the project in combination with other new planned projects (i.e., cumulative impact).



Source: FRA 2012 FEBRUARY 2019

Figure 4-3 Allowable Increase in Cumulative Noise Levels (Land Use Categories 1 & 2)



Source: FRA 2012 FEBRUARY 2019

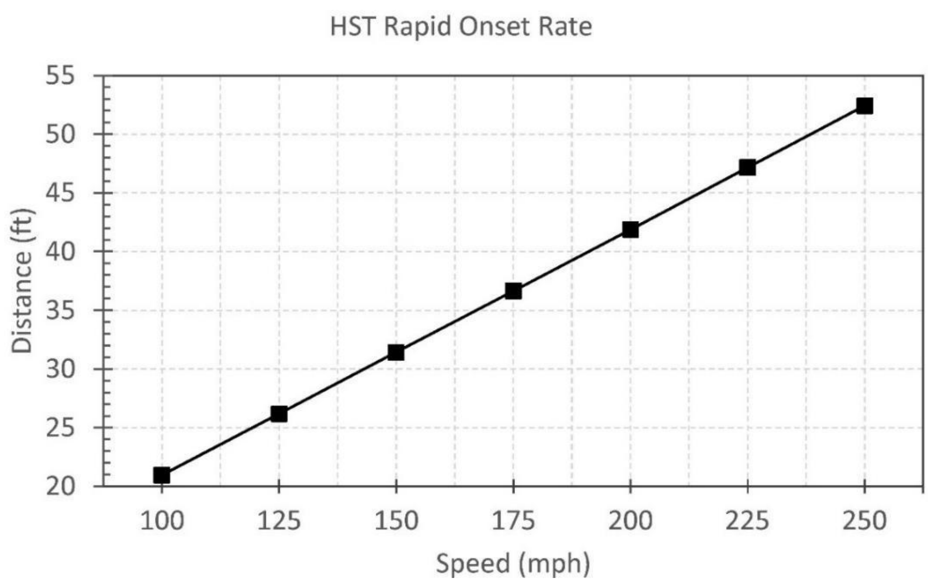
Figure 4-4 Allowable Increase in Cumulative Noise Levels (Land Use Category 3)

The noise criteria are applied at the outside of building locations at noise-sensitive areas. In some instances, the criteria apply to the building façade near doors and windows. Although noise impact is always determined based on exterior noise levels, interior noise levels may need to be evaluated when considering the need for mitigation at locations where land-use activity is solely indoors.

The process of determining impact severity begins with a determination of land use with reference to the land use categories shown in Table 4-2. Once the land use category has been determined, the appropriate noise metric (L_{dn} or L_{eq}) can be selected and used to determine the noise level and the severity of impact. The next steps are to determine the existing exterior noise exposure for each receptor or group of similar receptors and then to determine project noise exposure or the cumulative noise exposure associated with the project alternatives and other projects. Using the data on Figure 4-2 or Figures 4-3 and 4-4, the severity of impact is determined.

A hypothetical example would be to use a residential property that has an existing noise exposure of L_{dn} 60 dBA. The noise exposure resulting from the project alternatives, regional growth, and other planned projects could result in a project noise level exposure of L_{dn} 65 dBA. Adding (on a logarithmic basis) L_{dn} 65 dBA to the existing noise level would result in a total cumulative noise exposure of L_{dn} 66 dBA. This represents a potential increase of 6 dBA over the existing noise level. Using Figure 4-3, a line would be drawn vertically at 60 dBA and another line drawn horizontally at 6 dBA from left-hand axis. The intersection of these two lines determines the severity of impact. In this example, the resulting noise increase would be considered a severe impact on the residential receptor.

An additional environmental concern for HSR is the rapid rise in sound level that can occur for trains travelling at very high speeds. Under certain conditions, a rapid rise of sound level can result in a startle effect, in particular for a receptor near the tracks. The rate at which train sound levels increase is referred to as the *onset rate* and is a function of train speed and distance from the tracks. Research has found that a sudden unexpected increase in sound (a rapid onset rate) can result in greater annoyance than sounds of similar levels that vary less rapidly or are steady. When onset rates exceed about 30 dB per second people tend to be startled or surprised by the sudden onset of the sound. Consequently, analysts evaluated startle as an added annoyance factor and identified sensitive receptors that may experience a startle effect. The potential for startle as a function of train speed and distance from the train is illustrated on Figure 4-5.



Source: FRA 2012

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Figure 4-5 Distance from Tracks within which Startle Can Occur

The FRA guidance manual (FRA 2012) describes that the understanding of startle effects to date is partially based on using U.S. Air Force research for sudden onset of noise from aircraft. The FRA guidance describes that there are a number of unresolved issues regarding application of the U.S. Air Force research to determine the startle effects of high-speed rail, such as the scheduled nature, lower sound levels and lower onset rates of train passbys compared to military aircraft flights. The FRA guidance states that without better definition of the application of results of noise from aircraft overflights to noise from high-speed rail passbys, it is appropriate to consider startle effects as “additional information” included in high-speed rail impact assessments as opposed to being included in the calculation of noise exposure itself. The FRA guidance does not provide a threshold in the form of an “onset rate that could be considered significant enough to cause startle on a regular basis.” Thus, the 30 dB/second onset rate described above is considered indicative of when startle can occur, but is not considered a significance threshold for determining when startle would occur on a regular basis.

The FRA guidance manual (FRA 2012) also addresses potential impacts on livestock and poultry. The land use along the project corridor changes from urban and suburban to rural farmland, including some areas with livestock. Noise exposure limits for screening are shown in Table 4-4.

Table 4-4 Interim Criteria for High-Speed Rail Train Noise Effects on Livestock

Animal Category	Class	Noise Metric	Noise Level (dBA)
Domestic	Mammals (livestock)	SEL	100
	Birds (poultry)	SEL	100

Source: FRA 2012
dBA = A-weighted decibel
SEL = sound exposure level

4.1.4 Methods for Establishing Existing Noise Levels

Analysts established the existing noise levels throughout the noise RSA through extensive field noise measurement programs. Parsons Transportation Group conducted initial ambient noise measurements in 2010 (Authority 2011). Wilson Ihrig conducted additional measurements in 2009 and 2010 (Authority and FRA 2010a), 2013 (Wilson Ihrig 2014), and 2016 and 2017 (this analysis).

Analysts conducted long-term noise measurements (1 to 3 days in duration) to characterize the existing ambient noise in the RSA. The measurements were obtained by means of calibrated, precision, logging, sound level meters installed for a minimum of 24 hours at each location. All noise-measuring instruments used during the noise survey met ANSI S1.4-1993 specifications for Type I sound level meters. The sound level meters monitored the level of noise continuously and provided statistics on the ambient noise level for consecutive 1-hour intervals. During the monitoring period, the L_{max}, and L_{eq} values for each hour were obtained. The L_{eq} values were used to calculate the daily L_{dn} during each measured 24-hour period. For example, at a site where the measurement was conducted over a period of 3 full days, analysts calculated the average of the three hourly L_{eq} values in each hour of the day and subsequently used this to calculate an average L_{dn} at that site.

The L_{dn} describes the total noise exposure over a 24-hour period and is the noise metric FRA uses for residential (Category 2) land uses. The L_{eq} is used as the metric for evaluating noise impacts at institutional (Category 3) land uses with primarily daytime use. The hourly L_{eq} criterion is based on the daytime hour with the loudest sound level. This hour is generally referred to as the *peak-noise-hour*, which could occur at different times of the day depending on whether the noise source is from train operations or vehicular traffic. The long-term noise measurement data provided the peak-noise-hour L_{eq} for Category 3 land uses.

Analysts selected specific locations for conducting the noise measurements throughout the RSA and in a variety of settings. The selection was based on the environmental conditions expected in different areas of the communities along the alignment, the type of receptors potentially affected, the proximity of the receptors to a major arterial road or freeway, and the distance of the receptors (primarily residences) to the existing Caltrain tracks. The measurement locations where ambient noise levels were collected are representative of areas with similar environmental conditions in other areas along the HSR alignment. Areas that have primarily commercial and industrial land uses have fewer noise-sensitive receptors and consequently fewer ambient measurement sites.

Most of the selected measurement sites would have clear line-of-sight to the HSR alignments and, therefore, are representative of receptors that are directly exposed to existing noise from Caltrain and other passenger and freight trains. To categorize the dominant existing noise sources in the RSA, analysts located some measurement sites adjacent to roadways along the alignment, some sites near existing rail sources, some sites near existing roadway sources, and some sites near both existing rail and roadway sources.

Since the existing environment is controlled by noise from conventional passenger and freight rail activity, guidance was taken from the FTA guidance manual. Analysts used the field noise measurement data to validate an existing noise spreadsheet model based on the FTA guidance manual (FTA 2018) methodology and to calculate existing ambient noise levels at all receptors. The existing noise model incorporated the known existing train (passenger and freight) operations, horn noise, and traffic noise from nearby roadways. FRA provides equivalent guidance to determine the existing ambient. (FRA 2012)

The rail noise model followed the method in Chapter 6 of the FTA guidance manual for a detailed noise analysis. Where noise measurement sites were located close to roadways, noise sources were modeled by adjusting the measured levels with distance following the procedures in Appendix D of the FTA guidance manual. In some instances, for smaller roadways, the noise model incorporated the procedures in Section 4.4 of the FTA guidance manual.

4.1.5 Prediction Methods

4.1.5.1 Construction Noise

Analysts assessed construction noise impacts according to the method described in the FRA guidance manual (FRA 2012). Construction noise estimates are always approximate because of the lack of specific information available at the time of the environmental analysis. Decisions about the procedures and equipment to be used would be made by the contractor. Project designers try to minimize constraints on how construction would be performed, and which equipment would be used to facilitate cost-effective construction. Nevertheless, estimated construction scenarios for typical railroad construction projects allow a quantitative construction noise assessment by comparing the predicted noise levels with impact criteria appropriate for the construction stage. The methods included the following data:

- Noise emissions from equipment expected to be used by contractors during typical construction activity types.
- Usage scenarios for how the equipment would be operated.
- Estimated site layouts of equipment along the right-of-way.
- Relationship of the construction operations to nearby noise-sensitive receptors.

Construction of the project would also necessitate PG&E network upgrades. The construction noise impact assessment for these upgrades follows the same methods as the typical construction noise activities discussed in Section 4.1.3.1, Construction. Analysts identified construction scenarios specific to the PG&E upgrades, along with equipment expected to be used by contractors. It is anticipated that helicopters would be used for the PG&E upgrades; therefore, the analysis specifically accounts for the noise from helicopter movements and hovering over construction sites. No annoyance penalties were applied to helicopter noise.

4.1.5.2 Operations Noise

The method used to assess operations noise impacts is consistent with the approach established in the FRA and FTA guidance manuals (FRA 2012; FTA 2018). Both guidelines provide for three levels of analysis during an environmental impact study: screening, general assessment, and detailed analysis. This analysis presents the assessment of potential noise impacts from project operations in the adjacent communities along the project alignment following the methods for detailed analysis.

HSR Rail Traffic

HSR operations would include both revenue service trains and nonrevenue services trains with daily trips to and from the planned MOWF. Table 4-5 shows the number of HSR trains, which would be the same for all four project alternatives, from San Jose to Gilroy, from Gilroy to the planned MOWF near Gilroy, and from the MOWF to the San Joaquin Valley. The summary combines the number of daily trains in both directions of travel. Analysts conducted noise modeling for 2029 No Project, 2029 Plus Project, 2040 No Project, and 2040 Plus Project conditions. This analysis assumes that HSR service would be operational for Phase 1, which would connect San Francisco with Los Angeles via the Central Valley by 2029, and Phase 2, which would subsequently extend service to Sacramento and San Diego. The Phase 1 system analysis for the Final EIR/EIS is based on 2040 conditions. The Phase 1 build-out would be operational in 2029, and full system operations (Phase 2) would occur after the 2040 Phase 1 system operations envisioned in the Final EIR/EIS. The number of daily trains for 2029 and 2040 would be the same.

Table 4-5 Assumed 2029 and 2040 Project Operations for Noise Impact Assessment

Segment	Total Number of HSR Trains (Both Directions) - 2029			Total Number of HSR Trains (Both Directions) - 2040		
	Daytime[1]	Nighttime[2]	Peak Hour[3] (Approximate)	Daytime[1]	Nighttime[2]	Peak Hour[3] (Approximate)
Scott Boulevard to San Jose Diridon Station	40	8	4	108	26	8
San Jose Diridon Station to Gilroy Station	40	8	4	148	28	14
Gilroy Station to Gilroy MOWF	40	8	4	148	28	14
Gilroy MOWF to San Joaquin Valley	40	8	4	148	28	14

HSR = high-speed rail
MOWF = maintenance of way facility
[1] Daytime is defined as between 7:00 a.m. and 10:00 p.m.
[2] Nighttime is defined as between 10:00 p.m. and 7:00 a.m.
[3] There are six peak hours of operation per day from 6:30 AM to 9:30 AM and from 4:30 PM to 7:30 PM. There are 12 hours of nonpeak operation from 6:00 AM to 6:30 AM: 9:30 AM to 4:30 PM, and from 7:30 PM to 12:00 AM.

The specific vehicle technology proposed for the HSR system is a very high-speed (VHS) electric multiple unit (EMU) train. For the purposes of this analysis, the HSR trains are assumed to have a length of 660 feet. The various train technologies under consideration would incorporate 8 to 14 cars, with the length of each car varying to yield a train length of 660 feet.

The project's proposed maximum operation speed is 220 mph. This analysis is based on the maximum design speeds for the track throughout the Project Section. The design speeds used in the analysis were then decreased in some locations based on general operating parameters and track construction.

The noise predictions were based on the noise source reference levels in Table 5-2 of the FRA guidance manual (FRA 2012), which are shown in Table 4-6. The source reference level for VHS

EMU trains is divided into three categories or speed regimes where one sound source contributes most to the total noise level.

- Regime I: Propulsion or machinery noise
- Regime II: Mechanical noise resulting from wheel-rail interactions, guideway vibrations, or both
- Regime III: Aerodynamic noise resulting from airflow moving past the train, including the pantograph (device mounted to top of train to collect power through the overhead lines)

At train speeds up to approximately 125 mph, the propulsion noise subsource is typically the largest contributor to the total noise. The noise from the wheel-rail interface is typically dominant at speeds of 125–160 mph. Aerodynamic noise typically becomes equal to wheel-rail noise and, thus is an important component at speeds faster than 160 mph.

The noise source reference levels shown in Table 4-6 are associated with corresponding reference height, length, and speed reference terms.

Table 4-6 Federal Railroad Administration Noise Source Reference Levels for High-Speed Trains (SELs at 50 feet)

System Category and Features[1]	Example Systems	Subsource Component		Subsource Parameters: Length Definition, Len	Subsource Parameters: Height Above Rails (feet)	Reference Quantities: SEL_{ref} (dBA)	Reference Quantities: Len_{ref} (feet)	Reference Quantities: S_{ref} (mph)	Reference Quantities: K
HS and VHS electric locomotive-hauled trains	Amtrak Acela, TGV, Eurostar, X2000, KTX-I/KTX-II, ETR 500	Propulsion		$Len_{(power)}$	12	86	73	(2)	(2)
		Wheel-rail		$Len_{(train)}$	1	91	634	90	20
		Aero	Train Nose	$Len_{(power)}$	10	89	73	180	60
			Wheel Region	$Len_{(train)}$	5	89	634	180	60
			Pantograph	(3)	15	86	(3)	180	60
		(Only include aerodynamic subsources for VHS trains above 150 mph)							
HS and VHS EMU trains	IC T, ICE 3, AVE S103, ETR450, KTX-III	Propulsion		$Len_{(power)}$	2	86	634	(2)	(2)
		Wheel-rail		$Len_{(train)}$	1	91	634	90	20
		Aero	Train Nose	$Len_{(power)}$	10	89	73	180	60
			Wheel Region	$Len_{(train)}$	5	89	634	180	60
			Pantograph	(3)	15	86	(3)	180	60
		(Only include aerodynamic subsources for VHS trains above 150 mph)							
Hs gas-turbine locomotive-hauled trains	Rohr RTL-2, Bombardier Jet-Train	Propulsion		$Len_{(power)}$	10	83	73	20	10
		Wheel-rail		$Len_{(train)}$	1	91	634	90	20

Source: FRA 2012
HS = high speed
VHS = very-high speed
EMU = electric multiple unit
SEL_{ref} = sound exposure level reference
LEN_{ref} = length reference
S_{ref} = speed reference
dBA = A-weighted decibel
mph = miles per hour
K = reference speed factor
[1] HS maximum speed 150 mph; VHS maximum speed 250 mph
[2] Source level is not adjusted for train speed
[3] Source level is not adjusted for train length

The aerodynamic subsource for a VHS EMU train is further divided by noise from the train nose region, the wheel region, and from the pantograph. The following equation from Section 5.2.2 of the FRA guidance manual (FRA 2012) is used to calculate the SEL for each of the subsources:

$$SEL = (SEL_{ref}) + 10 * Log\left(\frac{len}{len_{ref}}\right) + K * Log\left(\frac{S}{S_{ref}}\right)$$

where:

SEL	=	SEL of component subsource (dBA)
SEL_{ref}	=	Subsource reference SEL (dBA)
len	=	Subsource length (feet)
len_{ref}	=	Subsource reference length (feet)
K	=	Reference speed factor
S	=	Speed (mph)
S_{ref}	=	Reference speed (mph)

The length term in the previous equation, *len*, for the propulsion subsource is defined as the total length of the power units in the train (*len_{power})*, which for an EMU is the total length of all cars (660 feet). The length term for the wheel-rail noise subsource is the total length of the train (660 feet). The length term for the aerodynamic train nose subsource is the length of one car (84 feet) corresponding to an eight-car train. Because the total train length is known and the number of cars is not known, the train nose subsource component is based on the assumption of an eight-car train (corresponding to longer cars), which yields slightly higher noise levels.

Analysts used assumed HSR operating speeds provided by the design team in the noise and vibration analyses. Table 4-7 shows a summary of the range of operating speeds for each project alternative in each subsection.

Table 4-7 Assumed HSR Operating Speeds

Location	Geographic Extent	Range of HSR Operating Speeds (mph)
Alternative 1		
San Jose Diridon Station Approach	Scott Boulevard to San Jose Diridon Station	50 – 110
San Jose Diridon Station Approach	San Jose Diridon Station to Tamien Station	50 – 95
Monterey Corridor	Tamien Station to Communications Hill Boulevard	95 – 110
Monterey Corridor	Communications Hill Boulevard to Kittery Court	125 – 130
Morgan Hill and Gilroy	Kittery Court to Cox Avenue	125 – 175
Morgan Hill and Gilroy	Cox Avenue to Casa de Fruta	80 – 220
Morgan Hill and Gilroy	Casa de Fruta to Pacheco	200
Pacheco Pass	Pacheco to Henry Miller Road	200
San Joaquin Valley	Henry Miller Road to Carlucci Road	220
Alternative 2		
San Jose Diridon Station Approach	Scott Boulevard to San Jose Diridon Station	50 – 110
San Jose Diridon Station Approach	San Jose Diridon Station to Tamien Station	50 – 95
Monterey Corridor	Tamien Station to Communications Hill Boulevard	95 – 110

Location	Geographic Extent	Range of HSR Operating Speeds (mph)
Monterey Corridor	Communications Hill Boulevard to Kittery Court	125 – 185
Morgan Hill and Gilroy	Kittery Court to Cox Avenue	100 – 195
Morgan Hill and Gilroy	Cox Avenue to Casa de Fruta	80 – 220
Morgan Hill and Gilroy	Casa de Fruta to Pacheco	200
Pacheco Pass	Pacheco to Henry Miller Road	200
San Joaquin Valley	Henry Miller Road to Carlucci Road	220
Alternative 3		
San Jose Diridon Station Approach	Scott Boulevard to San Jose Diridon Station	50 – 110
San Jose Diridon Station Approach	San Jose Diridon Station to Tamien Station	50 – 95
Monterey Corridor	Tamien Station to Communications Hill Boulevard	95 – 110
Monterey Corridor	Communications Hill Boulevard to Kittery Court	125 – 130
Morgan Hill and Gilroy	Kittery Court to Cox Avenue	125 – 175
Morgan Hill and Gilroy	Cox Avenue to Casa de Fruta	180 – 220
Morgan Hill and Gilroy	Casa de Fruta to Pacheco	200
Pacheco Pass	Pacheco to Henry Miller Road	200
San Joaquin Valley	Henry Miller Road to Carlucci Road	220
Alternative 4		
San Jose Diridon Station Approach[1]	Scott Boulevard to San Jose Diridon Station	15 – 110
San Jose Diridon Station Approach[1]	San Jose Diridon Station to Tamien Station	20 – 110
Monterey Corridor[1]	Tamien Station to Communications Hill Boulevard	90 – 110
Monterey Corridor[1]	Communications Hill Boulevard to Kittery Court	110
Morgan Hill and Gilroy[1]	Kittery Court to Cox Avenue	110
Morgan Hill and Gilroy[1]	Cox Avenue to Downtown Gilroy	110
Morgan Hill and Gilroy[1]	Downtown Gilroy to Casa de Fruta	1–0 - 200
Morgan Hill and Gilroy	Casa de Fruta to Pacheco	200
Pacheco Pass	Pacheco to Henry Miller Road	200
San Joaquin Valley	Henry Miller Road to Carlucci Road	220

Source: Authority 2019c
HSR = high-speed rail
mph = miles per hour
[1] In this location Caltrain would use the same tracks as HSR with Alternative 4 and operate at the same speeds.

The predictions account for the proposed operations schedule, ground propagation attenuation effects, cross-sectional geometry of the guideway and superstructure (e.g., elevated guideway), and shielding provided by existing noise barriers and intervening rows of buildings. Analysts assumed all tracks were ballast-and-tie construction with concrete ties, except in tunnels where concrete slab track would be used. The project includes sections of track on embankment with the top-of-rail height approximately 10 to 15 feet above adjacent ground. Many sections of track would be on aerial structures with the top-of-rail height approximately 50 feet above grade and a maximum height of approximately 85 feet above grade. The aerial structure guideway would incorporate a solid parapet on both outer edges approximately 3 feet higher than the top-of-rail. In many locations, the parapet would provide significant acoustical shielding from the propulsion and wheel-rail noise subsources, reducing sound levels. The noise predictions assume that the parapet would be included for all aerial structure sections of track. Alternative 4 would include blended HSR service with Caltrain on at-grade tracks.

Figure 4-6 illustrates the projected 24-hour noise levels from project operations versus distance at train speeds of 220 mph, 150 mph, and 110 mph. The data for the 220 mph and 150 mph speeds are representative of a typical embankment section of track between San Jose and Gilroy. The data for 110 mph are representative of a typical at-grade section of track between San Jose and Gilroy. The figure shows that L_{dn} from HSR operating at 220 mph is typically from 5 to 8 dB higher than when HSR is operating at 150 mph. The figure further illustrates how the noise levels from project operations would attenuate to typical L_{dn} at various distances from the track.

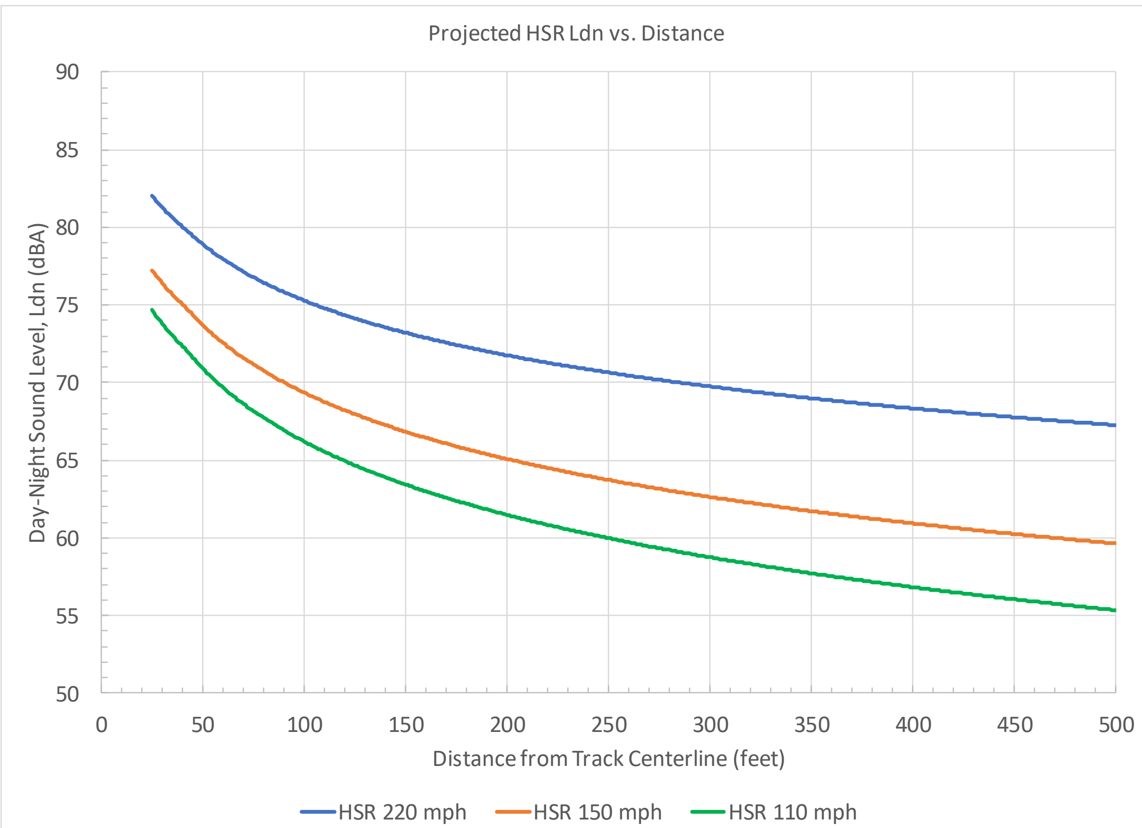

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Figure 4-6 Projected HSR 24-Hour Noise Levels versus Distance for Typical Embankment Track Section without Shielding Effects

Adjustments were made to predicted noise levels to account for increases in localized noise because of special trackwork, such as crossovers or turnouts. Alternatives 1, 2, and 3 would use special trackwork, such as moveable-point frogs, to avoid significant gaps in the rail running surface. Any insulated joints would be low-impact joints. Therefore, any increases in localized noise because of special trackwork with Alternatives 1, 2, and 3 are expected to be small and would not change overall effects on sensitive receptors. Alternative 4 would use the same type of special trackwork as currently exists in the corridor. All special trackwork frogs in the Project Section for Alternative 4 were assumed to be standard frogs.

Other Rail Traffic

The noise analyses for the 2029 and 2040 conditions include noise-level changes associated with future Caltrain operations between San Jose and Gilroy. The Caltrain Peninsula Corridor Electrification Project (PCEP) will replace approximately 75 percent of the current train fleet, which currently consists of diesel locomotive-hauled coaches, with EMU trains between San Francisco and Tamien Station in San Jose by 2029, and 100 percent by 2040. The PCEP will also increase service to six Caltrain trains per peak hour north of Tamien. An environmental impact analysis for the PCEP was prepared in 2014. The details of the analysis are contained in the *Caltrain Peninsula Corridor Electrification Project Noise and Vibration Technical Report* (Wilson Ihrig 2014). The changes to Caltrain service will change the existing noise environment in the RSA; therefore, the PCEP is included as part of these analyses.

Under Alternatives 1, 2, and 3, Caltrain operations between Tamien and Gilroy would use only diesel locomotive-hauled coaches. Under Alternative 4, however, the blended HSR service would require that all Caltrain tracks from San Jose to Gilroy be upgraded to operate both HSR and Caltrain PCEP up to 110 mph. Therefore, under Alternative 4, Caltrain would operate EMU trains from San Jose to Gilroy, and the total Caltrain daily trips would increase from 6 to 8 trains per day.

Similar to the wayside noise projections for HSR, the noise predictions for Caltrain operations were based on the source reference levels and account for the proposed operations schedule, ground effect, cross-sectional geometries, the existing shielding of noise barriers, and intervening rows of buildings where applicable.

Existing freight operations were also included in the analysis, and future freight operations were included in the cumulative noise analysis. Freight operations occur mainly during the nighttime. Noise from freight operations was modeled based on FTA methods. Future freight operations in the future conditions 2029 and 2040 were determined based on growth factors and were used in the cumulative noise impact analysis. Freight train speeds were assumed to match existing speeds between San Jose and Gilroy.

Other passenger train services in the RSA were incorporated into the analyses, including the Altamont Corridor Express train, Amtrak Capital Corridor, and Coast Starlight passenger train service. Two planned new passenger services—the Coast Daylight and the Transportation Agency for Monterey County Salinas Rail Extension—were included in the future cumulative analyses as well as the Bay Area Rapid Transit (BART) Silicon Valley Santa Clara Extension. Caltrain accounts for the majority of the existing rail traffic along most of the Project Section, followed by ACE, freight, and Amtrak Coast Starlight (up to two trains per day). Other passenger train speeds were assumed to match existing speeds in the RSA. Table 4-8 shows the existing daily train operations, Table 4-9 shows the projected daily 2029 train operations, and Table 4-10 shows the projected daily 2040 train operations in the Project Section.

Table 4-8 Existing (2017) Passenger and Freight Train Operations

System	Period	Total Daily Trains (Both Directions) per Segment				
		Lawrence – Santa Clara	Santa Clara – Diridon	Diridon – Tamien	Tamien – Gilroy	South of Gilroy
Caltrain	Daytime[1]	77	77	33	4	0
	Nighttime[2]	15	15	7	2	0
	Peak hour[3]	10	10	4	2	0
	Total	**92**	**92**	**40**	**6**	**0**

System	Period	Total Daily Trains (Both Directions) per Segment				
		Lawrence – Santa Clara	Santa Clara – Diridon	Diridon – Tamien	Tamien – Gilroy	South of Gilroy
ACE / Amtrak Capitol Corridor	Daytime[1]	0	20	8	0	0
	Nighttime[2]	0	2	0	0	0
	Peak hour[3]	0	4	2	0	0
	Total	**0**	**22**	**8**	**0**	**0**
Coast Starlight	Daytime[1]	0	2	2	2	2
	Nighttime[2]	0	0	0	0	0
	Peak hour[3]	0	2	2	2	2
	Total	**0**	**2**	**2**	**2**	**2**
Freight	Daytime[1]	0	0	0	0	0
	Nighttime[2]	2	9	4	4	4
	Peak hour[3]	2	2	2	2	2
	Total	**2**	**9**	**4**	**4**	**4**
Total Trains		**94**	**125**	**54**	**12**	**6**

ACE = Altamont Corridor Express
[1] Daytime is defined as between 7:00 a.m. and 10:00 p.m.
[2] Nighttime is defined as between 10:00 p.m. and 7:00 a.m.
[3] Approximate

Table 4-9 Assumed 2029 Passenger and Freight Train Operations

System	Period	Total Daily Trains (Both Directions) per Segment				
		Lawrence – Santa Clara	Santa Clara – Diridon	Diridon – Tamien	Tamien – Gilroy	South of Gilroy
Caltrain[4]	Daytime[1]	100	100	49	4[5]	0
	Nighttime[2]	14	14	5	2-4[5]	0
	Peak hour[3]	12	12	4	2-4[5]	0
	Total	**114**	**114**	**54**	**6-8[5]**	**0**
ACE / Amtrak Capitol Corridor	Daytime[1]	0	40	40	0	0
	Nighttime[2]	0	2	2	0	0
	Peak hour[3]	0	14	14	0	0
	Total	**0**	**42**	**42**	**0**	**0**
Coast Starlight	Daytime[1]	0	2	2	2	2
	Nighttime[2]	0	0	0	0	0
	Peak hour[3]	0	2	2	2	2
	Total	**0**	**2**	**2**	**2**	**2**
Freight	Daytime[1]	0	0	0	0	0
	Nighttime[2]	3	15	7	7	7
	Peak hour[3]	2	2	2	2	2
	Total	**3**	**15**	**7**	**7**	**7**

System	Period	Total Daily Trains (Both Directions) per Segment				
		Lawrence – Santa Clara	Santa Clara – Diridon	Diridon – Tamien	Tamien – Gilroy	South of Gilroy
Coast Daylight	Daytime[1]	0	0	2	2	2
	Nighttime[2]	0	0	0	0	0
	Peak hour[3]	0	0	1	1	1
	Total	**0**	**0**	**2**	**2**	**2**
TAMC Salinas Rail Extension	Daytime[1]	0	0	8	8	8
	Nighttime[2]	0	0	0	0	0
	Peak hour[3]	0	0	1	1	1
	Total	**0**	**0**	**8**	**8**	**8**
BART SVSX	Daytime[1]	0	265	0	0	0
	Nighttime[2]	0	50	0	0	0
	Peak hour[3]	0	20	0	0	0
	Total	**0**	**315**	**0**	**0**	**0**
Total Trains		**117**	**488**	**115**	**25-27**	**19**

ACE = Altamont Corridor Express
BART = Bay Area Rapid Transit
SVSX = Silicon Valley Santa Clara Extension
TAMC = Transportation Agency for Monterey County
[1] Daytime is defined as between 7:00 a.m. and 10:00 p.m.
[2] Nighttime is defined as between 10:00 p.m. and 7:00 a.m.
[3] Approximate
[4] In 2029 under Alternatives 1, 2, and 3 Caltrain operations north of Tamien will be a mix of 75% EMU trains and 25% diesel locomotive-hauled trains, and Caltrain operations south of Tamien will be 100% diesel locomotive-hauled trains. Under Alternative 4 Caltrain operations will be 100% EMU trains.
[5] Under Alternatives 1, 2, and 3 there would be six Caltrain operations between Tamien and Gilroy. Under Alternative 4 there would be 8 Caltrain operations between Tamien and Gilroy.

Table 4-10 Assumed 2040 Passenger and Freight Train Operations

System	Period	Total Daily Trains (Both Directions) per Segment				
		Lawrence – Santa Clara	Santa Clara – Diridon	Diridon – Tamien	Tamien – Gilroy	South of Gilroy
Caltrain[4]	Daytime[1]	100	100	47	4[5]	0
	Nighttime[2]	14	14	5	2-4[5]	0
	Peak hour[3]	12	12	4	2-4[5]	0
	Total	**114**	**114**	**52**	**6-8[5]**	**0**
ACE / Amtrak Capitol Corridor	Daytime[1]	0	48	20	0	0
	Nighttime[2]	0	2	0	0	0
	Peak hour[3]	0	14	6	0	0
	Total	**0**	**50**	**20**	**0**	**0**
Coast Starlight	Daytime[1]	0	2	2	2	2
	Nighttime[2]	0	0	0	0	0
	Peak hour[3]	0	2	2	2	2
	Total	**0**	**2**	**2**	**2**	**2**

System	Period	Total Daily Trains (Both Directions) per Segment				
		Lawrence – Santa Clara	Santa Clara – Diridon	Diridon – Tamien	Tamien – Gilroy	South of Gilroy
Freight	Daytime[1]	0	0	0	0	0
	Nighttime[2]	5	23	10	10	10
	Peak hour[3]	2	2	2	2	2
	Total	**5**	**23**	**10**	**10**	**10**
Coast Daylight	Daytime[1]	0	0	4	4	4
	Nighttime[2]	0	0	0	0	0
	Peak hour[3]	0	0	1	1	1
	Total	**0**	**0**	**4**	**4**	**4**
TAMC Salinas Rail Extension	Daytime[1]	0	0	12	12	12
	Nighttime[2]	0	0	0	0	0
	Peak hour[3]	0	0	1	1	1
	Total	**0**	**0**	**12**	**12**	**12**
BART SVSX	Daytime[1]	0	265	0	0	0
	Nighttime[2]	0	50	0	0	0
	Peak hour[3]	0	20	0	0	0
	Total	**0**	**315**	**0**	**0**	**0**
Total Trains		**119**	**504**	**100**	**34-36**	**28**

ACE = Altamont Corridor Express
BART = Bay Area Rapid Transit
SVSX = Silicon Valley Santa Clara Extension
TAMC = Transportation Agency for Monterey County
[1] Daytime is defined as between 7:00 a.m. and 10:00 p.m.
[2] Nighttime is defined as between 10:00 p.m. and 7:00 a.m.
[3] Approximate
[4] In 2040 Caltrain operations north of Tamien would be 100% EMU trains. Caltrain operations south of Tamien would be 100% diesel locomotive-hauled trains.
[5] Under Alternatives 1, 2, and 3 there would be six Caltrain operations between Tamien and Gilroy. Under Alternative 4 there would be 8 Caltrain operations between Tamien and Gilroy.

Horn Noise

Future HSR tracks would predominately follow existing rail tracks between San Jose and Gilroy. These existing rail tracks include numerous at-grade crossings where Caltrain, freight, and other passenger service trains are currently required to sound their warning horns. Additionally, trains currently sound horns while approaching Caltrain passenger station platforms. Table 4-11 shows all the locations in the Project Section where trains currently sound warning horns. The table also shows the locations where Caltrain, freight, and other passenger trains would sound horns in the future with the project alternatives. An *X* in the table indicates that those trains do sound horns in those locations.

Under Alternatives 1, 2, and 3, HSR trains would not sound horns at any at-grade crossings in the RSA because the HSR tracks would be grade separated. Under Alternative 4, HSR trains would sound horns as they approach at-grade crossings and Caltrain passenger stations.

To assess noise levels associated with the at-grade crossings and horn-sounding locations for each project alternative, the noise predictions include a horn noise model. The horn noise model was based on the FRA horn noise model (FRA 2000) and field noise measurements. Analysts applied the model to receptors within 0.25 mile of each at-grade crossing and passenger station location where horns must be sounded. Noise measurements in the RSA and in the adjacent San Francisco to San Jose Project Section indicate that the maximum sound level from Caltrain and other passenger trains are 96 dBA at a distance of 100 feet from the track. This is consistent with the minimum horn sound level allowable by FRA regulations to provide adequate warning of the train approach and is used by existing Caltrain locomotives and future Caltrain EMUs with PCEP.

The noise prediction model for freight train horns was based on a maximum sound level of 107 dBA at 100 feet from the track. This assumption is based on field measurement data by FRA showing that this is the average horn noise level from freight trains (FRA 2018). The noise prediction model for HSR train horns assumes a maximum sound level of 96 dBA at 100 feet from the track, consistent with Caltrain and FRA regulations. Crossing bells near existing at-grade crossings were included in the noise measurement program, and were modeled based on the methods in the FTA guidance manual (FTA 2018).

The mounting height location of train horns is also an important input to the noise modeling results, because the horn height affects the amount of ground attenuation and shielding provided by noise barriers. The height of the horns on existing Caltrain locomotives is modeled at 16 feet above-top-of-rail (ATOR). Future Caltrain EMUs will incorporate a lower mounted horn height of 3 feet ATOR. Horns on all freight trains and other passenger trains, including Amtrak and Ace, are located at a height of 16 feet ATOR. Future HSR trains will have horns mounted at a height of 7 feet ATOR.

Table 4-11 Grade Crossings and Horn-Sounding Locations

Grade Crossing / Station	Existing Horn	Future Caltrain / Freight Horn				Future HSR Horn			
		Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Santa Clara Station[1]	X	X	X	X	X				X
College Park Station[1]	X	X	X	X	X				X
San Jose Diridon Station[1]	X	X	X	X	X				X
Auzerais Avenue (at Caltrain)	X	X	X	X	X				X
Auzerais Avenue (at HSR)									
West Virginia Street (at Caltrain)	X	X	X	X	X				X
West Virginia Street (at HSR)									
Tamien Station[1]	X	X	X	X	X				X
Capitol Station[1]	X	X	X	X	X				X
Skyway Drive	X	X		X	X				X
Branham Lane	X	X		X	X				X
Chynoweth Avenue	X	X		X	X				X
Blossom Hill Station[1]	X	X	X	X	X				X
Blanchard Road	X	X		X	X				X

Grade Crossing / Station	Existing Horn	Future Caltrain / Freight Horn				Future HSR Horn			
		Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Emado Avenue	X	X		X	X				X
(Private)	X	X		X	X				X
Palm Avenue	X	X		X	X				X
Live Oak Avenue	X	X		X	X				X
Tilton Avenue	X	X		X	X				X
East Main Avenue	X	X		X	X				X
Morgan Hill Station[1]	X	X	X	X	X				X
Dunne Avenue	X	X		X	X				X
San Pedro Avenue	X	X		X	X				X
Tennant Avenue	X	X		X	X				X
East Middle Avenue	X	X		X	X				X
San Martin Station[1]	X	X	X	X	X				X
San Martin Avenue	X	X		X	X				X
Church Avenue	X	X		X	X				X
Masten Avenue	X	X		X	X				X
Rucker Avenue	X	X		X	X				X
Buena Vista Avenue	X	X		X	X				X
Cohansey Avenue	X	X		X	X				X
(Private)	X	X		X	X				X
Las Animas Avenue	X	X		X	X				X
Leavesley Road	X	X		X	X				X
Casey Street	X	X		X	X				X
Ioof Avenue	X	X		X	X				X
Lewis Street	X	X		X	X				X
Martin Street	X	X		X	X				X
Sixth Street	X	X		X	X				X
Seventh Street / Old Gilroy Street	X	X		X	X				X
Gilroy Station[1]	X	X	X	X	X				X
10th Street	X	X		X	X				X
Luchessa Avenue (Thomas)	X	X		X	X				X

Grade Crossing / Station	Existing Horn	Future Caltrain / Freight Horn				Future HSR Horn			
		Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Bloomfield Avenue (at Freight)	X			X	X				X
Bloomfield Avenue (at HSR)									
(Private)	X	X		X	X				X

Source: Authority 2019c
HSR = high-speed rail
Alt = alternative
[1] Caltrain trains, other passenger trains, and freight trains sound horns at existing Caltrain stations in addition to sounding horns approaching at-grade crossings.

Annoyance from Rapid Onset of HSR Passbys

There is considerable evidence that increased annoyance is likely to occur for train noise events with high travel speeds (rapid onset rates) (FRA 2012). A rapid rise of sound level can result in a startle effect, particularly for a noise-sensitive receptor near the tracks. Analysts assessed the potential for annoyance from rapid onset based on HSR train speed and distance of the receptor from the track. Figure 4-5 on page 4-8 illustrates the relationship of speed and distance to locations where the onset rate for project operations may cause a startle effect.

Other Noise Sources

Station Noise

Analysts assessed noise impacts associated with the planned HSR stations in San Jose and Gilroy at each nearby noise-sensitive receptor by following the method for detailed noise analysis for HSR train operations summarized in Section 5.2 of the FRA guidance manual (FRA 2012) and the method for a general noise assessment for parking facilities summarized in Section 4.4 of the FTA guidance manual (FTA 2018).

The dominant noise source at the stations would be HSR train movements. The station noise analysis includes noise measurements at representative clusters of receptors near the stations, noise modeling to determine existing ambient noise conditions, and predictions of future noise conditions. The noise predictions at these receptors are based on the project operations noise levels, incorporating the type of train equipment to be used, train schedules, train consists (number of cars), speed profiles (including through trains), and track elevation.

Analysts used the station plan layouts and number of planned parking spaces to predict the noise exposure from the parking facilities at nearby noise-sensitive receptors. The FTA guidance manual (FTA 2018) Section 4.4 reference SEL of 92 dBA corresponding to 1,000 cars in a peak activity hour was used to predict the additional noise from the parking lots at each of the HSR stations.

Analysts tabulated the predicted noise levels from HSR trains at the stations and from the parking facilities along with the existing ambient noise exposures at the identified receptors or clusters of receptors. Levels of impact (no impact, moderate impact, or severe impact) were determined by comparing the existing and projected noise exposure based on the impact criteria described in Section 4.1.3.

Maintenance Facility Noise

Noise sources at the MOWF near Gilroy are expected to include daily inspections, pre-departure cleaning and testing, quarterly inspections, and train storage activities. Analysts used the method in Section 4.4 of the FTA guidance manual (FTA 2018) to predict noise exposure from the maintenance facility. A reference SEL of 118 dBA corresponding to 20 train movements in a peak activity hour was used to predict noise from the facility. The planned MOWF layouts and number of movements per day were used to calculate noise exposure at nearby noise-sensitive receptors. The predicted noise levels from the MOWF were combined with the project operations noise predictions and compared to the impact criteria described in Section 4.1.3.

Vehicle Traffic Noise

In addition to noise from project operations, noise from changes in traffic volume due to the project was considered for 2029 and 2040 conditions. Analysts assessed the anticipated increases in noise levels resulting from increased traffic volumes near the HSR stations and maintenance facilities. Total daily traffic volumes for roadway segments near the HSR stations and maintenance facilities were calculated for each project alternative and were compared to existing traffic volumes.

Analysts used the following methods to determine locations with the potential for noise impacts from traffic:

- Where major roads would undergo changes due to the project alternatives, traffic growth factors for road segments were calculated to assess locations where the change in traffic volume would increase noise levels. Increases with and without the project were calculated separately.
- Traffic growth factors for road segments near HSR stations and MOWFs were calculated to assess locations where the change in traffic volume would increase noise levels. Increases with and without the project were calculated.
- For each project alternative, roadway segments were identified where the growth factors indicated a potential increase in noise of 3 dB or greater, which represents a noticeable increase in noise level.
- At locations where the growth factors for a project alternative resulted in a 3 dB or greater increase in noise, for instance, a doubling of traffic, an analysis was conducted to determine what portion of the increase in traffic volume would be related to the alternative.

Daily traffic volumes for these roadway segments were used to calculate traffic growth factors to assess the potential change in noise levels for each project alternative. Analysts calculated the potential noise level increase for each roadway segment by comparing the future traffic volume with the project alternatives to the existing volume and the future volume without the alternatives. The comparison to existing traffic volume is consistent with the FRA approach to assessing operations noise impacts. The increases with the alternatives over the projected future volumes without the alternatives are caused by the project. Increases in future traffic volumes without the project alternatives over the existing traffic volumes would be due to other growth factors not related to HSR.

The potential change in noise level for each roadway segment is calculated as follows:

$$\Delta = 10 * Log\left(\frac{a}{b}\right)$$

where:

Δ	=	Change in noise level (dBA) due to the project alternatives
a	=	Future average daily traffic (ADT) traffic volume with project alternatives
b	=	Existing ADT traffic volume *or* Future ADT traffic volume without project alternatives

Traction Power Substation Noise

In addition to the noise generated by project operations, impacts may be caused by some of the electrical traction power substations (TPSS) and facilities. TPSSs would be located at approximately 30-mile intervals and would include two 115/50 kV or 230/50 kV single-phase transformers at 60 megavolt amperes (MVA). The traction power switching stations would be required midway between the TPSSs and would include two (10 to 60 MVA) transformers. Traction power paralleling stations would be required at approximately 5-mile intervals between the traction power switching stations and the TPSSs. Each traction power paralleling station would include one or two (10 to 60 MVA) transformers.

The FRA does not have its own analysis techniques because these facilities are not unique to high-speed systems, and they reference the FTA method. Thus, FTA reference levels were used to calculate the total project noise level at the receivers identified within the screening distances of 250 feet for facilities with no intervening buildings and 150 feet for the configurations where intervening buildings would shield traction power facilities (TPF) noise from noise sensitive receptors. The FTA reference SEL for substations is 99 dBA at 50 feet, which equates to an L_{dn} of 70 dBA at 50 feet (assuming continuous 24-hour usage).

Benchmark Tests to Validate HSR Noise Prediction Model

The Authority developed a protocol to validate HSR noise models for accurate HSR noise predictions and consistency among the multiple project sections. The *Benchmark Tests for Calibration of CAHST Noise Models* (May 26, 2010) (Authority and FRA 2010b) establishes a series of test cases and input parameters that practitioners use to validate individual noise models. The purpose is to make sure that the HSR noise models used by practitioners for each of the project sections throughout California agree and achieve consistent prediction results.

The test cases established by the Authority include calculations at two speeds (100 mph and 200 mph) for receptors at multiple distances and elevations for the project on typical embankment and aerial guideway locations. Input parameters include train vehicle type, length of train, number of trains during daytime and nighttime, as well as specific geometrical track configurations.

The results of the benchmark tests are shown in Table 4-12 and Table 4-13. The results agree with the HSR benchmark noise prediction model results and are consistent with the Authority's established noise model.

Table 4-12 Benchmark Noise Model Results at 100 mph

Results and Model Input Parameters Using VHS Electric (100 mph)							Reference Results			Modeled Results			Difference		
Test Case #	Receptor Height (feet)	Floor of Building	Receptor to Near Track CL Distance (feet)	Source Ground Height (feet)	Barrier Height (feet)	Barrier to Near Track CL Distance (feet)	L_{dn} (dBA)	Peak $L_{eq}(h)$ (dBA)	L_{max} (dBA)	L_{dn} (dBA)	Peak $L_{eq}(h)$ (dBA)	L_{max} (dBA)	L_{dn} (dBA)	Peak $L_{eq}(h)$ (dBA)	L_{max} (dBA)
Case # 1	5	1st	100	4	4	6	69.3	69.4	86.7	69.3	69.4	86.7	0.0	0.0	0.0
	5	1st	200	4	4	6	64.9	65.0	79.2	64.9	65.0	79.2	0.0	0.0	0.0
	5	1st	400	4	4	6	60.4	60.5	71.7	60.4	60.5	71.7	0.0	0.0	0.0
	25	3rd	100	4	4	6	70.2	70.3	87.6	70.2	70.3	87.6	0.0	0.0	0.0
	25	3rd	200	4	4	6	66.3	66.5	80.7	66.3	66.5	80.7	0.0	0.0	0.0
	25	3rd	400	4	4	6	62.4	62.5	73.7	62.4	62.5	73.7	0.0	0.0	0.0
Case # 2	5	1st	100	4	12	21.5	68.2	68.3	87.4	68.2	68.3	87.4	0.0	0.0	0.0
	5	1st	200	4	12	21.5	64.7	64.8	80.4	64.7	64.8	80.4	0.0	0.0	0.0
	25	3rd	100	4	12	21.5	70.3	70.4	88.4	70.3	70.4	88.4	0.0	0.0	0.0
	25	3rd	200	4	12	21.5	66.3	66.4	81.9	66.3	66.4	81.9	0.0	0.0	0.0
Case # 3	5	1st	200	60	63	15.5	66.2	66.4	83.5	66.2	66.4	83.5	0.0	0.0	0.0
	25	3rd	200	60	63	15.5	67.8	67.9	83.5	67.8	67.9	83.5	0.0	0.0	0.0
Case # 4	5	1st	200	60	67	15.5	61.0	61.1	78.7	61.0	61.1	78.7	0.0	0.0	0.0
	25	3rd	200	60	67	15.5	65.3	65.5	83.0	65.3	65.5	83.0	0.0	0.0	0.0

mph = miles per hour
VHS = very-high speed
dBA = A-weighted decibel
$L_{eq}(h)$ = hourly equivalent sound level
L_{max} = maximum sound level
L_{dn} = day-night sound level

Table 4-13 Benchmark Noise Model Results at 200 mph

Results and Model Input Parameters Using VHS Electric (100 mph)							Reference Results			Modeled Results			Difference		
Test Case #	Receptor Height (ft)	Floor of Building	Receptor to Near Track CL Distance (feet)	Source Ground Height (feet)	Barrier Height (feet)	Barrier to Near Track CL Distance (feet)	L_{dn} (dBA)	Peak $L_{eq}(h)$ (dBA)	L_{max} (dBA)	L_{dn} (dBA)	Peak $L_{eq}(h)$ (dBA)	L_{max} (dBA)	L_{dn} (dBA)	Peak $L_{eq}(h)$ (dBA)	L_{max} (dBA)
Case # 1	5	1st	100	4	4	6	74.0	74.2	89.3	74.0	74.2	89.3	0.0	0.0	0.0
	5	1st	200	4	4	6	70.3	70.4	84.2	70.3	70.4	84.2	0.0	0.0	0.0
	5	1st	400	4	4	6	66.6	66.7	78.3	66.6	66.7	78.3	0.0	0.0	0.0
	25	3rd	100	4	4	6	74.6	74.7	90.0	74.6	74.7	90.0	0.0	0.0	0.0
	25	3rd	200	4	4	6	71.0	71.2	85.4	71.0	71.2	85.4	0.0	0.0	0.0
	25	3rd	400	4	4	6	67.5	67.6	80.1	67.5	67.6	80.1	0.0	0.0	0.0
Case # 2	5	1st	100	4	12	21.5	71.3	71.4	89.8	71.3	71.4	89.8	0.0	0.0	0.0
	5	1st	200	4	12	21.5	68.3	68.5	82.7	68.3	68.5	82.7	0.0	0.0	0.0
	25	3rd	100	4	12	21.5	73.9	74.0	89.2	73.9	74.0	89.1	0.0	0.0	0.0
	25	3rd	200	4	12	21.5	69.6	69.7	84.2	69.6	69.7	84.2	0.0	0.0	0.0
Case # 3	5	1st	200	60	63	15.5	68.7	68.8	85.8	68.7	68.8	85.8	0.0	0.0	0.0
	25	3rd	200	60	63	15.5	70.0	70.1	85.8	70.0	70.1	85.8	0.0	0.0	0.0
Case # 4	5	1st	200	60	67	15.5	65.2	65.4	81.0	65.2	65.4	81.0	0.0	0.0	0.0
	25	3rd	200	60	67	15.5	67.8	67.9	85.4	67.8	67.9	85.4	0.0	0.0	0.0

mph = miles per hour
VHS = very-high speed
dBA = A-weighted decibel
$L_{eq}(h)$ = hourly equivalent sound level
L_{max} = maximum sound level
L_{dn} = day-night sound level

4.2 Vibration

4.2.1 Descriptors

Ground vibration is an oscillatory motion of the soil with respect to the equilibrium position and can be quantified in terms of displacement, velocity, or acceleration. Vibration can be described by its peak or root-mean-square (RMS) amplitudes. The RMS amplitude is useful for assessing human annoyance, while peak vibration is most often used for assessing the potential for damage to building structures. Building damage is often discussed in terms of peak velocity, or peak particle velocity (PPV). Construction vibration is assessed in terms of PPV.

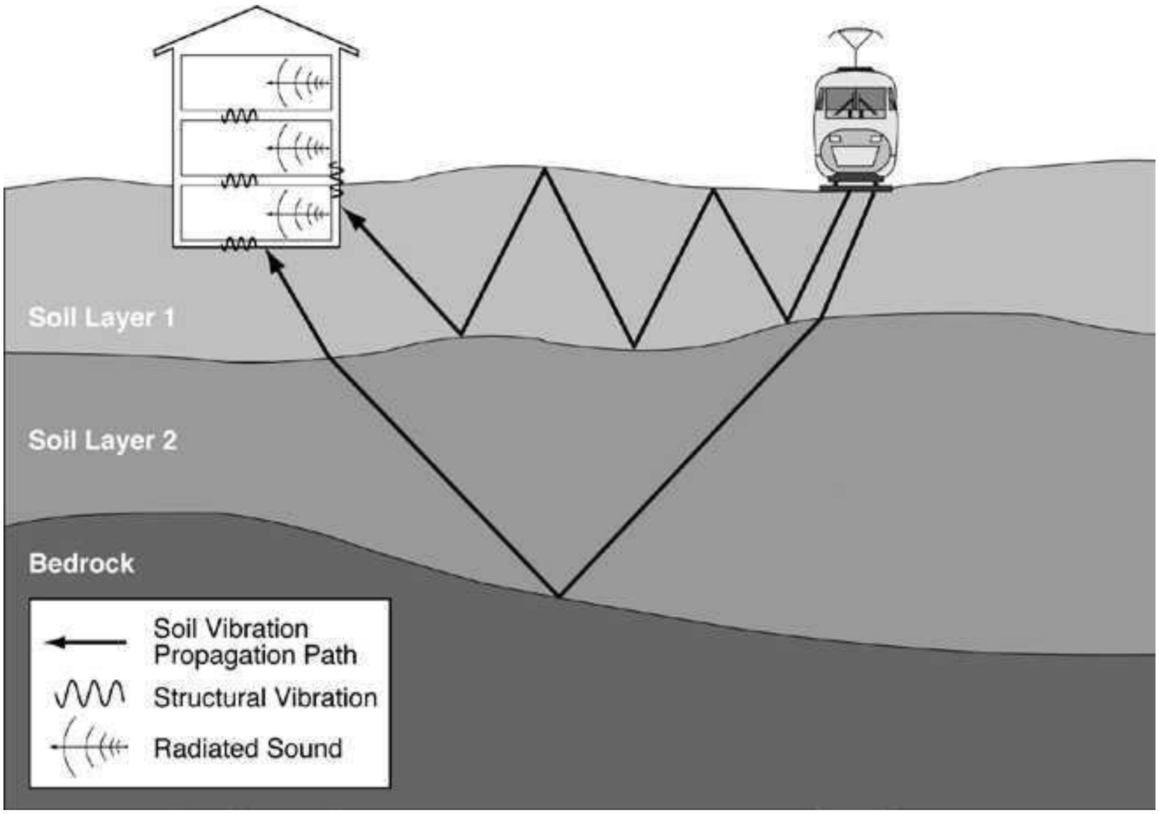
Although vibration velocity can be quantified in units of inches per second, it is common to use the velocity level to quantify vibration to cover the wide range of magnitudes that can be encountered. The vibration is expressed in terms of the velocity level (L_v) in decibel units, defined as:

$$Lv = 20 * Log(\frac{v}{v_{ref}})$$

Where, “v” is the RMS velocity amplitude and “v_{ref}” is the reference velocity amplitude (1 micro-inch per second [µin/sec]). Thus, the descriptor used to assess ground-borne vibration is L_v in vibration decibels (VdB). Like noise, VdB is related to a reference quantity; in this case, 1 micro-inch per second. Vibration is a function of the frequency of motion measured in Hz. Ground vibration of concern for transportation sources generally spans from 4 to 160 Hz. The overall vibration is the combined energy of ground motion at all frequencies, and this overall vibration level is used in this analysis.

Vibration attenuates as a function of the distance between the source and the receptor because of geometric spreading and inherent damping in the soil that absorbs energy of the ground motion. Ground-borne vibration from rapid transit systems is caused by dynamic forces at the wheel/rail interface. It is influenced by many factors, which include the rail and wheel roughness, out-of-round wheel conditions, the mass and stiffness of the rail vehicle truck and its suspension components, the mass and stiffness characteristics of the track support system, and the local soil conditions.

Vibration transmitted through the transit structure, such as at-grade ballast and tie track, radiates energy into the adjacent soil in the form of different types of waves that propagate through the various soil and rock strata to the foundation of nearby buildings. Buildings respond differently to ground vibration depending on the type of foundation, the mass of the building, and the building interaction with the soil. Once inside the building, vibration propagates throughout the building with some attenuation with distance from the foundation, but often with amplification due to floor resonances. The basic concepts for rail system-generated ground vibration are illustrated on Figure 4-7.



Source: FRA 2012

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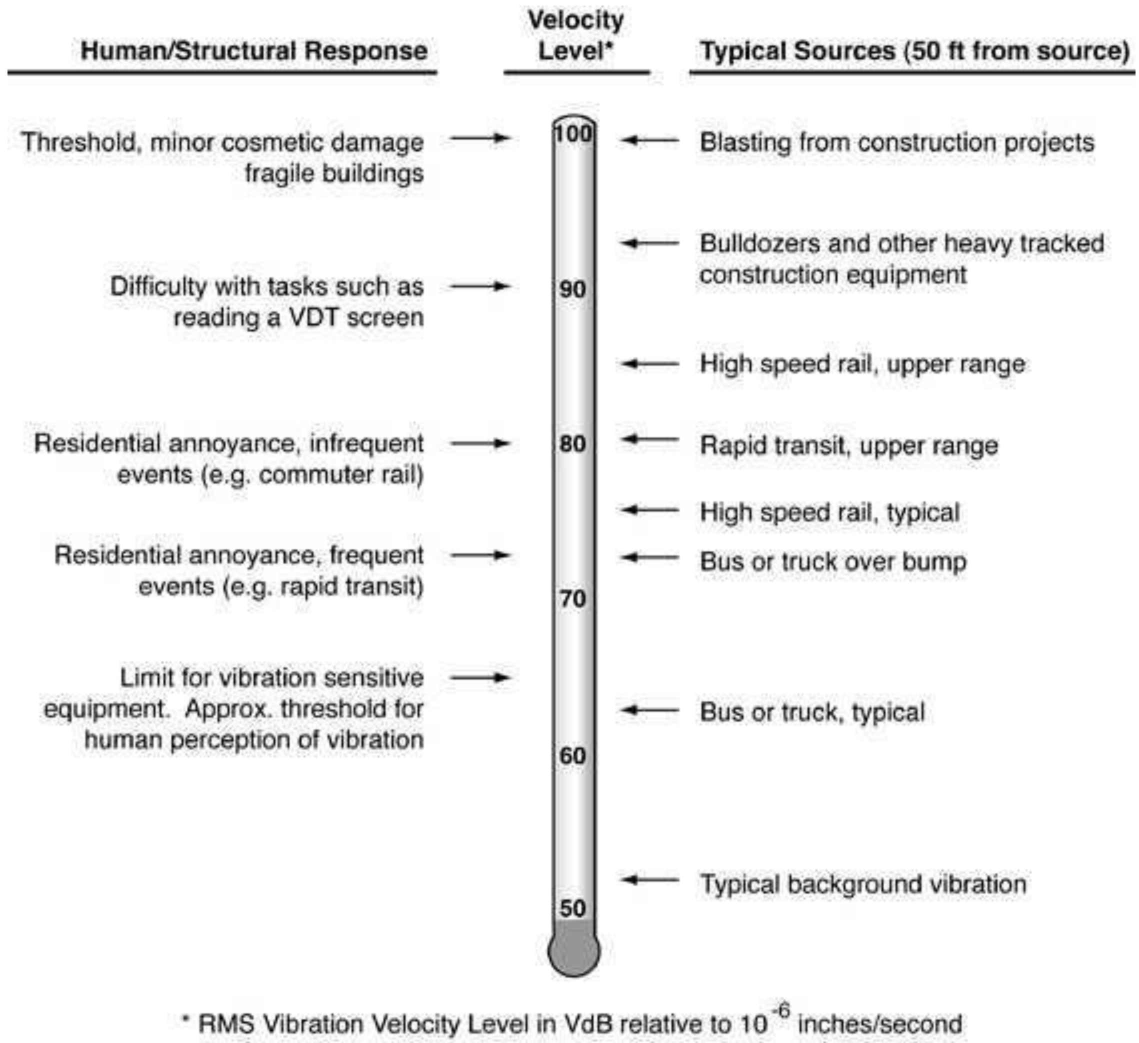
Figure 4-7 Propagation of Ground-Borne Vibration into Buildings

Figure 4-8 illustrates the typical levels of human response and, at much higher levels, the structural response to ground-borne vibration. The figure shows that the threshold of human perception is about 65 VdB, while the threshold for cosmetic damage is about 100 VdB. However, the threshold for building damage is directly related to the condition of the structure. It is very rare that transportation-generated ground vibration approaches building damage levels.

Ground-borne noise is a secondary phenomenon of ground-borne vibration. When a building structure vibrates, noise is radiated into the interior of the building. Typically, this low- frequency sound would be perceived as a low rumble. The magnitude of the sound depends on the frequency characteristic of the vibration and the manner in which the room surfaces in the building radiate sound. Ground-borne noise is quantified by the A-weighted sound level inside the building.



Source: FRA 2012

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Figure 4-8 Typical Levels of Ground-Borne Vibration and Response to Vibration

4.2.2 Resource Study Area

The vibration RSA extends 275 feet from the project alternatives' centerlines, which is narrower than the noise RSA. This distance is consistent with the FRA screening procedures and was established to identify where vibration impacts from HSR might occur. Table 4-14 shows the FRA-recommended screening distances for vibration assessments of various land use types. To include all potentially affected areas along the project extent, the highest speed and frequent event categories were used to establish screening distances.

Table 4-14 FRA-Recommended Screening Distances for Vibration Assessments

Land Use	Train Frequency[1]	Screening Distance (feet from centerline) Train Speed[2] 100 to 200 mph	200 to 300 mph
Residential	Frequent	220	275
	Infrequent	100	140
Institutional	Frequent	160	220
	Infrequent	70	100

Source: FRA 2012
mph = miles per hour
[1] Frequent = more than 70 passbys per day; Infrequent = fewer than 70 passbys per day
[2] Screening distances are not provided for speeds of less than 100 mph, as train speeds would typically exceed 100 mph.

4.2.3 Impact Criteria

4.2.3.1 Construction

The construction vibration assessment is based on the FRA guidance manual (FRA 2012). To avoid temporary annoyances to building occupants or interference with vibration-sensitive equipment inside special-use buildings during construction, FRA recommends using the long-term operations vibration criteria for a general assessment. These are discussed in Section 4.2.3.2, Operations.

Table 4-15 shows the FRA guideline for vibration damage criteria from construction activity. The table provides PPV limits for four building categories. Analysts used a crest factor of 4 (representing a PPV–RMS difference of 12 VdB) to calculate the approximate RMS vibration velocity limits in VdB from the PPV limits. These limits were used to identify areas that should be addressed during engineering design of the project alternatives.

Table 4-15 Construction Vibration Damage Criteria

Building Category	PPV (in/sec)	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: FRA 2012
PPV= peak particle velocity
in/sec = inches per second
L_v = velocity level
RMS = root-mean squared
VdB = vibration decibels
μin/sec = microinch per second
[1] RMS VdB re: 1 μin/sec

4.2.3.2 Operations

Vibration impact levels are determined by the receptor land-use category and the daily number of the vibration events. The limits are based on the maximum RMS vibration level. The impact level also depends on the type of analysis being conducted (i.e., ground-borne vibration or ground-borne noise).

The FRA provides guidelines to assess the human response to different levels of ground-borne noise and vibration as shown in Table 4-16. Ground-borne noise and vibration levels represent the vibration during a train passby (RMS vibration level of an event). The guidelines provide additional criteria for special-use buildings that are sensitive to ground-borne noise and vibration as shown in Table 4-17.

The criteria in Table 4-16 and Table 4-17 apply only to occupied spaces in potentially affected buildings (i.e., receptors). The number of daily train events are considered in determining which criterion to apply. HSR service would provide more than 70 trains per day, which would be characterized as frequent events. Ground-borne vibration is assessed at the building façade. Ground-borne noise is assessed inside buildings.

In most cases, for at-grade or aerial train operations, the airborne noise would be substantially louder than the ground-borne noise, and ground-borne noise is not perceived separately from the airborne noise. Therefore, the analysis focused on airborne noise to assess at-grade or aerial portions; ground-borne noise was used to assess tunnels.

Table 4-16 Ground-Borne Vibration and Ground-Borne Noise Impact Criteria for General Assessment

Land Use Category	GBV Impact Levels (VdB re: 1 µin/sec)			GBN Impact Levels (dB re: 20 µPa)		
	Frequent Events[1]	Occasional Events[2]	Infrequent Events[3]	Frequent Events[1]	Occasional Events[2]	Infrequent Events[3]
Category 1: Buildings where vibration would interfere with interior operations.	65 VdB[4]	65 VdB[4]	65 VdB[4]	N/A[5]	N/A[5]	N/A[5]
Category 2: Residences and buildings where people normally sleep.	72 VdB	75 VdB	80 VdB	35 dBA	38 dBA	43 dBA
Category 3: Institutional land uses with primarily daytime use.	75 VdB	78 VdB	83 VdB	40 dBA	43 dBA	48 dBA

Source: FRA 2012
GBV = ground-borne vibration
GBN = ground-borne noise
VdB = vibration decibels
µin/sec = microinch per second
dB = decibel
µPa = micro-Pascal
dBA = A-weighted decibel
N/A = not applicable
[1] *Frequent Events* is defined as more than 70 vibration events of the same kind per day.
[2] *Occasional Events* is defined as between 30 and 70 vibration events of the same kind per day.
[3] *Infrequent Events* is defined as fewer than 30 vibration events of the same kind per day.
[4] This criterion limit is based on levels that are acceptable for most moderately sensitive equipment such as optical microscopes. Vibration-sensitive manufacturing or research requires detailed evaluation to define the acceptable vibration levels. Ensuring lower vibration levels in a building often requires special design of the HVAC systems and stiffened or vibration-isolated floors.
[5] Vibration-sensitive equipment is not sensitive to ground-borne noise.

Table 4-17 Ground-Borne Vibration and Ground-Borne Noise Impact Criteria for Special Buildings

Land Use Category	GBV Impact Levels (VdB re: 1 µin/sec)		GBN Impact Levels (dB re: 20 µPa)	
	Frequent Events[1]	Infrequent Events[2]	Frequent Events[1]	Infrequent Events[2]
Concert halls	65 VdB	65 VdB	25 dBA	25 dBA
TV studios	65 VdB	65 VdB	25 dBA	25 dBA
Recording studios	65 VdB	65 VdB	25 dBA	25 dBA
Auditoriums	72 VdB	80 VdB	30 dBA	38 dBA
Theaters	72 VdB	80 VdB	35 dBA	43 dBA

Source: FRA 2012
[1] *Frequent Events* is defined as more than 70 vibration events per day.
[2] *Occasional or Infrequent Events* is defined as fewer than 70 vibration events per day.
GBV = ground-borne vibration
GBN = ground-borne noise
VdB = vibration decibels
µin/sec = microinch per second
dB = decibel
µPa = micro-Pascal
dBA = A-weighted decibel

Analysts applied additional vibration impact criteria where the project would be located in an existing rail corridor from San Jose to Gilroy. When there are existing substantial sources of vibration, such as trains, at locations affected by the project, the existing vibration levels were factored into the assessment. The FRA provides guidance on how to apply the vibration impact criteria based on the existing vibration conditions. The existing rail corridor is first defined by how many trains are on it per day. The following scenarios summarize the FRA guidance and a flow chart graphically summarizes the evaluation process (Figure 4-9):

- **Infrequently used rail corridor** (fewer than five trains per day):
  - Compare the vibration levels from the project to the vibration criteria in Table 4-16 and Table 4-17. If the vibration levels from the project exceed the criteria in Table 4-16 and Table 4-17, the project would have a vibration impact.
- **Moderately used rail corridor** (5 to 12 trains per day):
  - If the existing train vibration levels exceed the criteria in Table 4-16 and Table 4-17 and the project vibration levels are at least 5 VdB lower than the existing levels, the project would not have a vibration impact.
  - If the existing train vibration levels exceed the criteria in Table 4-16 and Table 4-17 and the project vibration levels are within 5 VdB of the existing levels, then compare the vibration levels from the project to the vibration criteria in Table 4-16 and Table 4-17.
  - If the existing train vibration levels do not exceed the criteria in Table 4-16 and Table 4-17, then compare the vibration levels from the project to the vibration criteria in Table 4-16 and Table 4-17. If the vibration levels from the project exceed the criteria in Table 4-16 and Table 4-17, the project would have a vibration impact.
- **Heavily used rail corridor** (more than 12 trains per day):
  - If the existing train vibration levels exceed the criteria in Table 4-16 and Table 4-17 and the project would cause a substantial increase in the total number of trains per day, the project would have a vibration impact. (A substantial increase is defined as approximately doubling the total number of trains per day.)

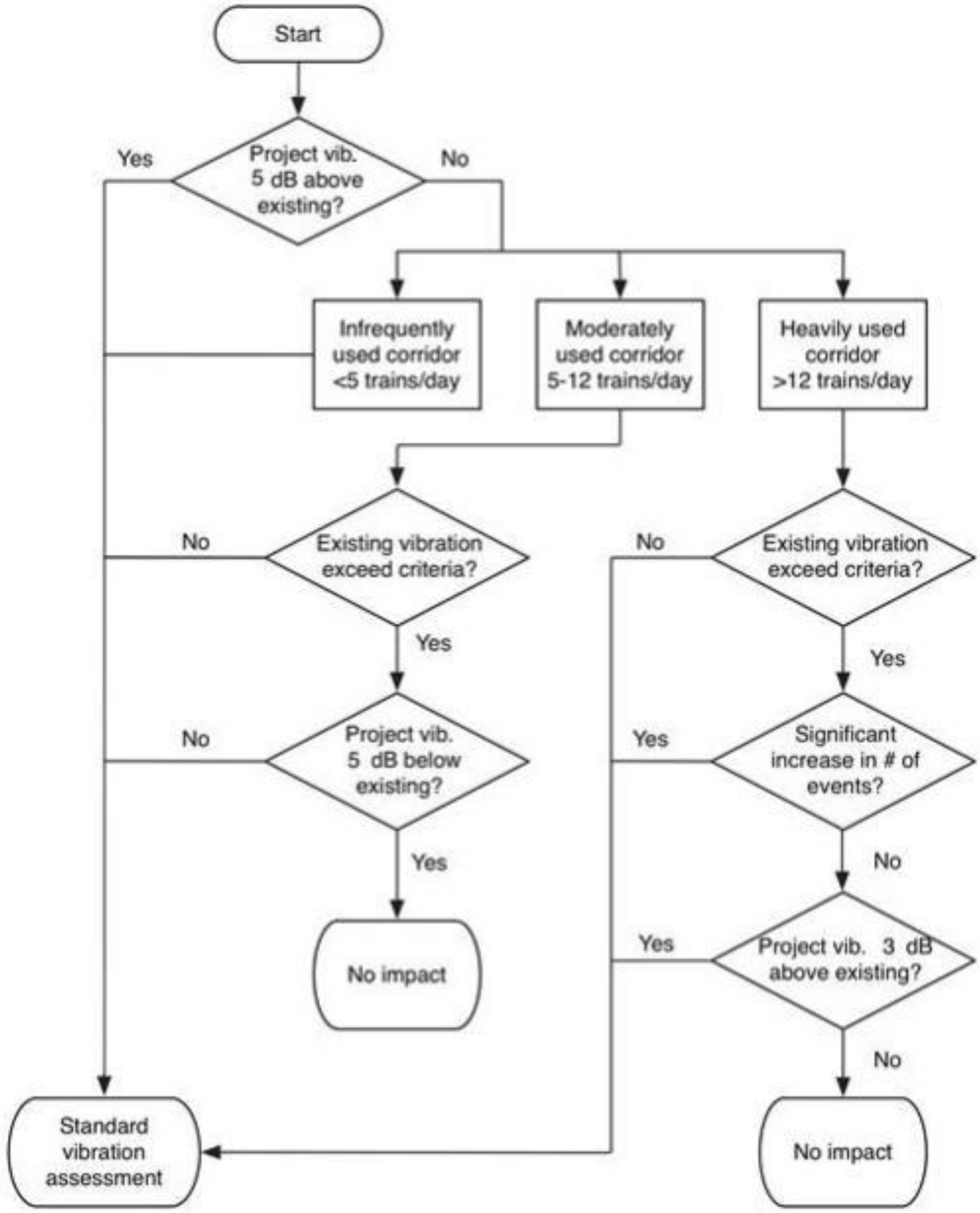
  - If there is not a substantial increase in the number of vibration events per day, the existing train vibration levels exceed the criteria in Table 4-16 and Table 4-17, and the project vibration levels are 3 VdB greater than the existing levels, the project would have a vibration impact.
  - If the vibration levels from the project are 5 VdB greater than the existing levels, then the existing source can be ignored, and the vibration levels from the project should be compared to the criteria in Table 4-16 and Table 4-17. If the vibration levels from the project exceed the criteria in Table 4-16 and Table 4-17, the project would have a vibration impact.

- **Moving existing tracks:**
  - Existing vibration can be substantial when an HSR project would share an existing rail right-of-way and shift the location of existing tracks. The relocated track can result in lower vibration levels from the existing trains at some locations and higher vibration levels at other locations.
  - If the vibration levels from the relocated existing trains would create higher levels, then the vibration levels from the relocated existing trains and from the project must be compared to the criteria in Table 4-16 and Table 4-17.
  - If the existing vibration levels prior to relocating the track did not exceed the criteria in Table 4-16 and Table 4-17, then the vibration levels from the relocated track must be compared to the criteria in Table 4-16 and Table 4-17. If the vibration levels from either the relocated existing trains or from the project exceed the criteria in Table 4-16 and Table 4-17, the project would have a vibration impact.
  - If the existing vibration levels prior to shifting the track exceeded the criteria in Table 4-16 and Table 4-17 and the vibration levels from the relocated track would increase by more than 3 VdB, then the project would have a vibration impact.

The vibration levels from the new project vibration source must also be compared separately to the criteria in Table 4-16 and Table 4-17.

The RSA includes portions of all of the previously noted situations because of the number of Caltrain, freight, and other passenger trains that travel the existing corridor daily. The corridor from Scott Boulevard to West Alma Avenue in San Jose is a heavily used rail corridor with a segment of new rail corridor between Diridon Station and Tamien outside the existing rail right-of-way (Alternatives 1, 2, 3, and 4). From West Alma Avenue in San Jose to 10th Street in Gilroy, the project would follow the existing rail right-of-way, in a moderately used rail corridor (Alternatives 1, 2, 3, and 4). The Morgan Hill Bypass would introduce a new rail corridor (Alternatives 1 and 3). The alignment through downtown Gilroy from 10th Street to the Santa Clara County line is an infrequently used rail corridor (Alternatives 1, 2, and 4). The alignment located east of Gilroy is a new rail corridor (Alternative 3). The corridor from south of the Santa Clara County line through Pacheco Pass and the San Joaquin Valley is a new rail corridor (Alternatives 1, 2, 3, and 4).

In addition to the criteria provided for general assessment purposes, FRA has established criteria in terms of 1/3-octave band frequency spectra for use in detailed analyses. Figure 4-10 illustrates the application of these criteria and Table 4-18 shows descriptions of the criteria. The VC-A through VC-E curves are used for special equipment that is very sensitive to vibration. Four vibration-sensitive facilities with sensitive equipment were identified in the vibration RSA.



Source: FRA 2012; FTA 2018

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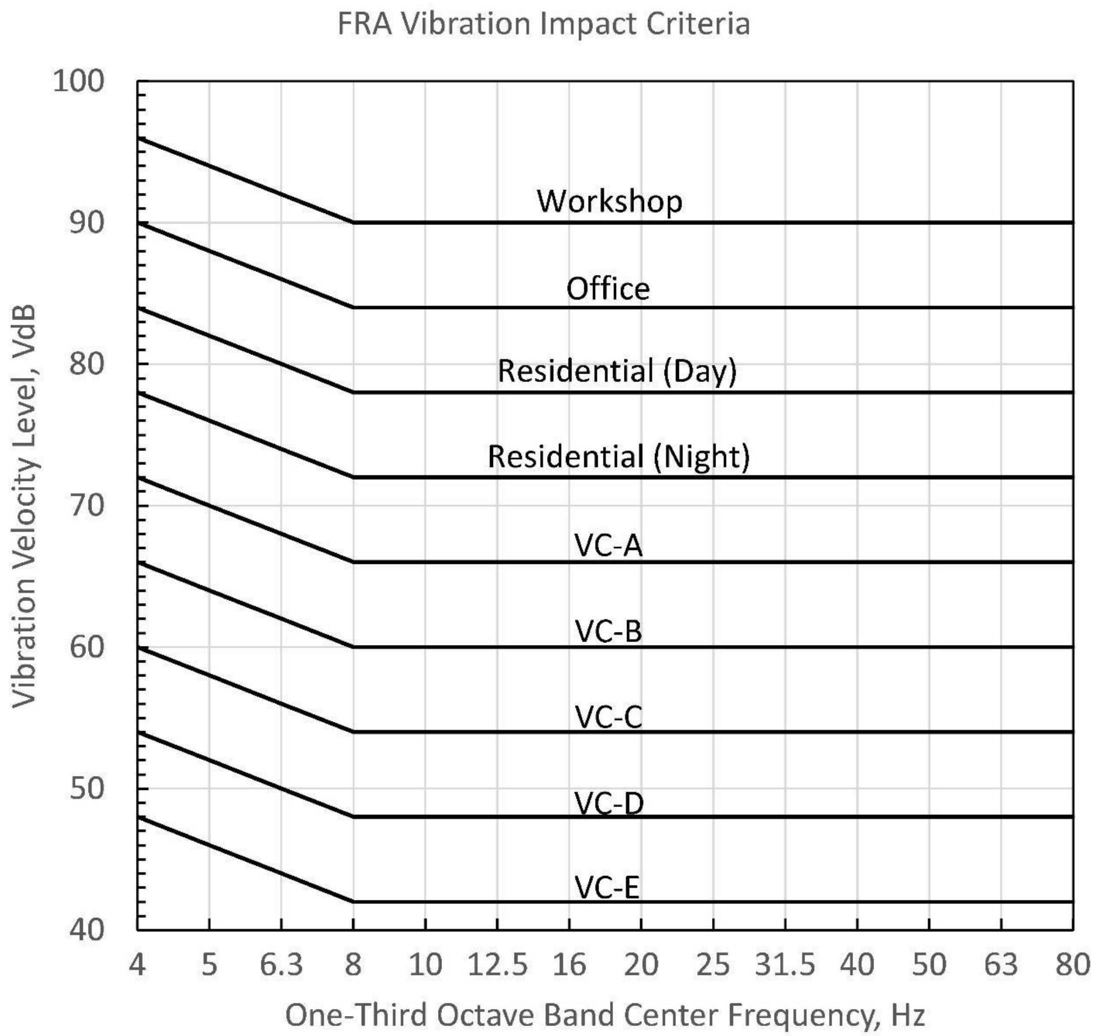
Figure 4-9 FRA Vibration Impact Criteria Flowchart



Source: FRA 2012

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Figure 4-10 FRA Criteria for Detailed Vibration Analysis

Table 4-18 Interpretation of Vibration Criteria for Detailed Analysis

Criterion Curve	Maximum Vibration Level (VdB re: 1 µin/sec)[1]	Description of Use
Workshop	90	Distinctly perceptible vibration. Appropriate to workshops and non-sensitive areas.
Office	84	Perceptible vibration. Appropriate to offices and non-sensitive areas.
Residential Day	78	Barely perceptible vibration. Adequate for computer equipment and low-power optical microscopes (up to ×20).
Residential night, operating rooms	72	Vibration not perceptible, but ground-borne noise may be audible inside quiet rooms. Suitable for medium-power optical microscopes (×100) and other equipment of low sensitivity.
VC-A	66	Adequate for medium- to high-power optical microscopes (×400), microbalances, optical balances, and similar specialized equipment.
VC-B	60	Adequate for high-power optical microscopes (×1,000), inspection and lithography equipment to 3-micron line widths.
VC-C	54	Appropriate for most lithography and inspection equipment to 1-micron detail size.
VC-D	48	Suitable in most instances for the most demanding equipment, including electron microscopes operating to the limits of their capability.
VC-E	42	The most demanding criterion for extremely vibration-sensitive equipment.

Source: FRA 2012
[1] As measured in 1/3 octave-bands over the frequency range of 8-100 Hz.
VC = vibration criteria
VdB = vibration decibels
µin/sec = microinch per second

4.2.4 Methods for Establishing Existing Vibration Levels

Locations for measuring the existing ground vibration levels in the RSA encompass the variable conditions along the HSR alignment. The primary source of existing ground vibration in the RSA is Caltrain operations and to a lesser degree other passenger rail and infrequent freight trains. Analysts selected measurement sites by project alternative to measure the overall ground vibration level due to train passbys as well as the spectral (frequency content of the ground vibration) components of the passby vibration, which are influenced by the local soil conditions and input forces unique to different types of trains. The selection of the vibration measurement sites was also based on a preliminary vibration analysis conducted for the project in 2011 (Authority 2011), which was based on the FRA General Assessment method as described in Section 8.2 of the FRA guidance manual (FRA 2012). The selection of measurement sites for this work prioritized those areas with higher potential for vibration impact.

Because Caltrain train vibration is the dominant existing source of ground vibration in most areas, the vibration survey focused on obtaining ground vibration measurements during Caltrain passbys. Vibration was measured for sensitive receptors at typical setback distances from the nearest track. For each site, train vibration was typically measured at two distances from the rail alignment simultaneously.

The ambient vibration survey establishes the existing overall vibration levels throughout the corridor. The variation in measured vibration levels from Caltrain trains in the RSA is due to the varying speed and the variability in the soil vibration attenuation characteristics. These factors were used in the selection of field vibration propagation testing locations which for the detailed analysis.

Section 4.2.5.2, Operations Vibration, provides details about the vibration propagation measurement procedure.

4.2.5 Prediction Methods

4.2.5.1 Construction Vibration

Analysts assessed construction vibration impacts in accordance with the method described in Chapter 10 of the FRA guidance manual (FRA 2012) for quantitative construction vibration assessments. HSR construction activity scenarios were developed to estimate construction vibration quantitatively, comparing the predicted ground-borne vibration amplitudes with appropriate construction stage impact criteria. Quantitative construction vibration analysis was conducted where there was a potential for pile driving, vibratory compaction, demolition, or excavation near vibration-sensitive structures. Criteria for annoyance (Tables 4-16 and 4-17) and damage (Table 4-15) were applied to determine impacts from construction vibration. Analysts used the following information to assess the construction vibration:

- Vibration source levels from equipment expected to be used by contractors.
- Estimated site layouts of equipment along the right-of-way.
- Distance from the construction operations to nearby vibration-sensitive receptors.

4.2.5.2 Operations Vibration

The FRA guidance manual (FRA 2012) provides three levels of analysis: screening, general assessment, and detailed analysis. The screening analysis was used to determine the RSA for conducting the detailed analysis of operations vibration. For this analysis, analysts evaluated residential locations within 275 feet and institutional locations within 220 feet of the alternatives' centerlines.

The FRA criteria for assessing ground-borne vibration from shared corridors require that the levels resulting from the relocated existing tracks be compared to the existing vibration levels. Thus, analysts prepared separate analyses to predict ground-borne vibration from project operations and from existing and future Caltrain operations.

The FRA prediction method is based on an empirical modeling approach. The basis of the empirical model is the assumption that vibration generated by a train rolling on steel rail and its propagation through the surrounding geologic strata (soil and rock) and into buildings can be separated into independent elements. Each of the vibration elements can be quantified separately by measurements conducted in the field. The individual elements are combined to predict ground-borne noise and vibration inside occupied buildings, which are vibration-sensitive and adjacent to the rail alignment. Adjustments are made to the prediction model to account for other factors such as train speed and track and superstructure effects.

The prediction model for ground-borne vibration employs the following equation:

$$Lv = FDL + LSR + AF$$

where:

Lv	=	projected vibration velocity level in a specific building: VdB
FDL	=	force density level: dB re: 1 lb/ft$^{1/2}$
LSR	=	line source response: dB re: 10^{-6} (inch/sec)/(lb/ft$^{1/2}$)
AF	=	adjustment factor for track and structure: dB (relative level)

All of the model parameters are determined in terms of their 1/3-octave band frequency content. The overall vibration level at a specific building is the combination of the individual 1/3-octave band levels determined by an “energy sum” over all the bands. The energy sum, calculated by summing the energy in all 1/3-octave bands, results in a single-number level (also in decibels: VdB) accounting for the vibration energy in all of the 1/3-octave bands within the overall frequency range of interest. The FRA general assessment vibration criteria are based on the overall vibration level. The FRA detailed assessment criteria are based on the individual 1/3-octave band levels.

Each projection of ground-borne vibration begins with the force density level (FDL), which represents an excitation force caused by the wheels of a train rolling on the rail. As each train has several wheels rolling simultaneously, the prediction model incorporates this input as an incoherent line of vibration forces generated by the dynamic interaction of the rail vehicle and the rail and the track support system. This analysis uses the FDL indicated for the Pendolino train as the most representative FDL for the technology envisioned for the statewide HSR system because it is also a high-speed EMU vehicle.

The FDLs used in the vibration analyses are illustrated on Figure 4-11. The Pendolino FDL used to predict HSR vibration levels is shown at a reference speed of 150 mph. The FDL of Caltrain locomotives is also illustrated on Figure 4-11 at a reference speed of 50 mph. The Caltrain FDL was calculated from field measurements of existing trains in the Project Section and the San Francisco to San Jose Project Section. The figure shows that even at very different speeds, the HSR and Caltrain FDLs are similar below 31.5 Hz. The Caltrain FDL shows a peak at 100 Hz that is more than 10 dB greater than the HSR FDL, which would result in higher vibration levels in the 100 Hz 1/3-octave band.

The reference HSR Pendolino FDL is from a system where high-speed passenger trains were operating on their own dedicated tracks, with smooth rail in good condition. The HSR trains in the Project Section would operate on tracks that are shared with both Caltrain and freight trains, which increases the likelihood that the rail roughness could increase with time and potentially lead to increased vibration levels. To account for this, an added engineering factor of 5 VdB was added to the HSR vibration predictions where blended service would occur under Alternative 4. The FDL of the Caltrain system (locomotives and coaches) was empirically derived from train passby measurements and the impact testing performed at multiple sites throughout the Project Section and in the San Francisco to San Jose Project Section. The future Caltrain rolling stock will be EMU vehicles (no locomotive). The FTA guidelines provide an FDL for commuter rail; however, this assumes the use of a locomotive. Consideration was given to other previously measured FDLs that might approximate an FDL for an EMU, including FDL for heavy rail transit vehicles. However, none was found to be completely satisfactory. Consistent with the *Caltrain Peninsula Corridor Electrification Project Noise and Vibration Technical Report* (Wilson Ihrig 2014), the FDL for the existing Caltrain was selected with the assumption that the EMU would be no greater than the existing FDL.

Figure 4-11 illustrates the FDL spectra used in the vibration prediction model for HSR and Caltrain. The FDLs for HSR and Caltrain were adjusted for speed using the following formula.

$$20 * Log(S/_{Sref})$$

where:

S	=	operations speed (mph)
S_{ref}	=	speed reference (mph)

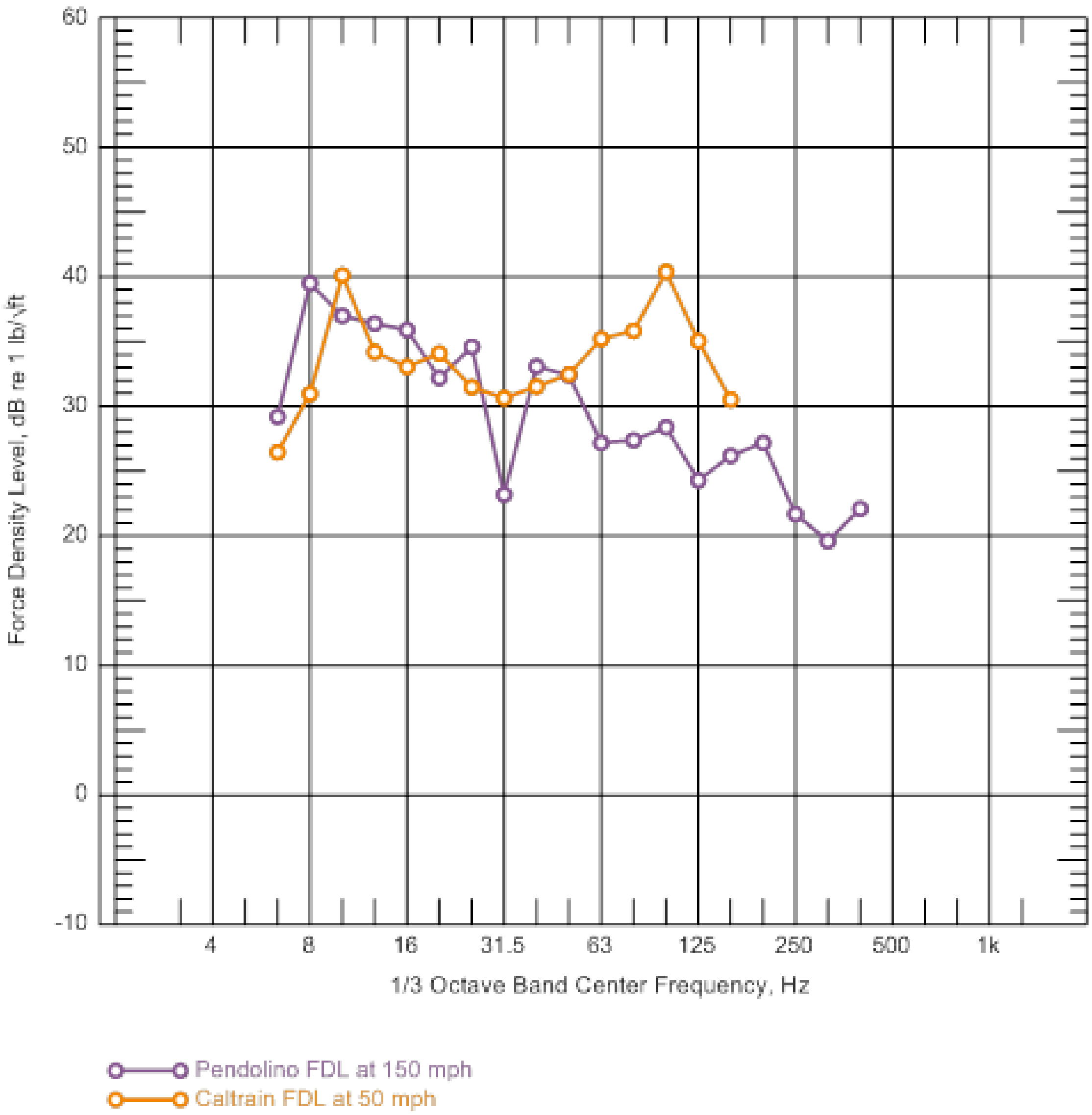

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Figure 4-11 Force Density Level Spectra Used in the Vibration Analysis

The second element in the FRA model is the line source response (LSR). The LSR quantifies the effect of soil conditions at a receptor location relative to the FDL. The LSR represents the response of the local soil strata to vibration and the attenuation of vibration energy due to its propagation through the surrounding soil. The LSR characterizes the vibration velocity response at a single location on the surface of the ground due to incoherent forces distributed over the length of a train (i.e., a finite line source). LSR as used in this analysis refers to the response of a free ground surface and not to the response of a built structure, such as a floor in a building. However, the response of an individual building can be measured if there are only a limited number of buildings potentially affected. This analysis addresses impacts on hundreds of buildings, making that approach impractical.

The LSR for a soil region is found by imparting a vertical force on the ground surface or bottom of a borehole for a subsurface alignment, measuring that force with a load cell or strain gage and simultaneously measuring the vertical vibration velocity of the ground surface at several distances from the impact location. This procedure, described in the FRA guidance manual (FRA 2012), provides a set of point source responses (also referred to as transfer mobility), from which an LSR can be constructed.

The LSR is added to the FDL to obtain the ground surface vibration velocity levels in the absence of buildings. Analysts obtained the various LSRs used in the vibration analyses from numerous site measurements conducted in the field using the procedure described in the FRA guidance manual.

The normal procedure for obtaining transfer mobility data is to impact the ground at several locations and measure the ground surface velocity at various distances from the point of impact. For surface alignments, analysts used a pneumatic, force-instrumented hammer to generate impact forces. The pneumatic hammer consists of a 27-pound cylindrical mass guided by a 4-inch diameter tube with pneumatic assist to both raise the hammer and drive the hammer downward onto a load cell. Approximately 20 to 30 impacts are recorded at each surface position.

For subway alignments, boreholes were drilled and a force-instrumented transducer was attached to the end of a drill string. The impacts delivered to the bottom of the borehole were obtained with a standard, 130-pound driller's slide hammer. Force input from the hammer and geophone responses are recorded simultaneously for 40 to 50 impacts at each testing depth. A graphic representation of the surface test is illustrated on Figure 4-12 and the borehole test is illustrated on Figure 4-13.

Transfer mobility data collected by the vibration testing were then fit with polynomial functions of distance using least squares regression. The point source responses that are derived from the curve fitting were then numerically integrated over a length of 600 feet (to approximate the train length) to obtain the following mathematical function for the line source response with distance:

$$LSR(d) = A + B * Log(d) + C * Log^2(d)$$

where:

A, B, C	=	polynomial coefficients
d	=	perpendicular and horizontal distance from track centerline (feet)

Because ground-borne noise and vibration are typically not substantial at distances of more than 250 feet from the tracks, a 600-foot train length provides a reasonable approximation to the length of train that would affect ground-borne vibration.

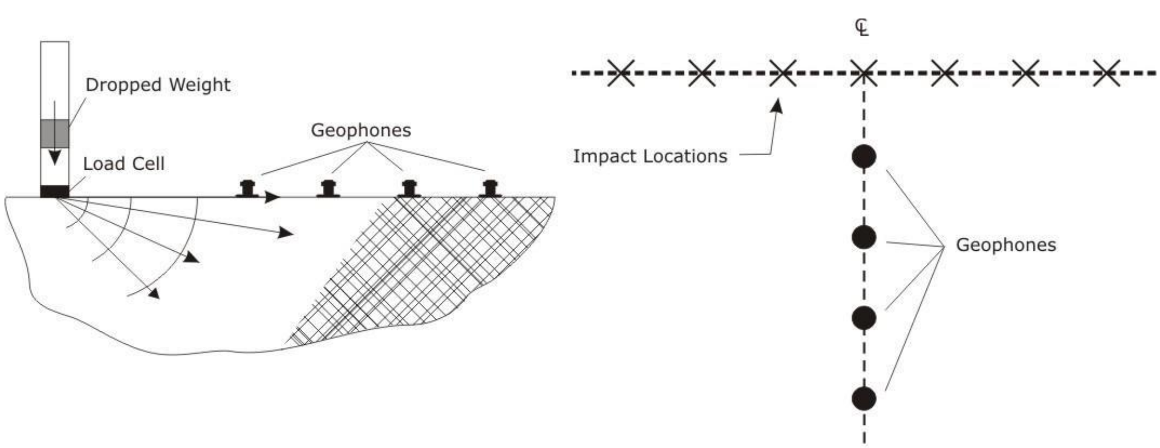

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Figure 4-12 Surface Vibration Propagation Test (cross section)

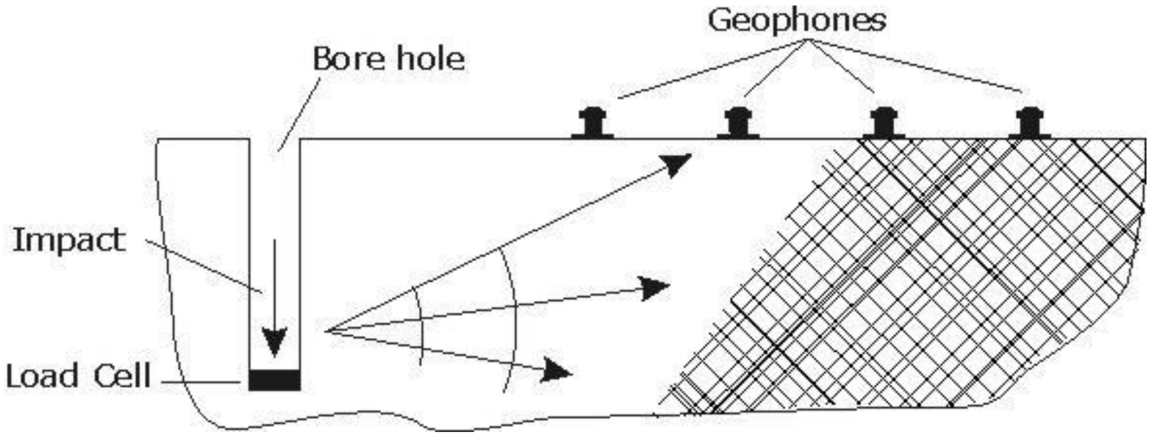

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Figure 4-13 Borehole Vibration Propagation Test (cross section)

To predict levels of ground-borne noise and vibration for project conditions different from those on which the FDL is based, analysts applied the adjustment factors specified in the FRA guidance manual (FRA 2012) to account for the effects of train speed and the specific alignment structures (e.g., at grade, embankment, aerial, and tunnel geometry). Vibration levels from HSR on an aerial structure are assumed 10 VdB less than vibration from at-grade or embankment sections of track based on Table 8-2 of the FRA guidance manual.

Ground-borne noise is generated when the surfaces of interior building elements such as floors, walls, and ceilings vibrate because of ground-borne vibration from trains. Ground-borne noise is commonly described as the "rumble" from a subway train. The prediction of such noise is directly related to the prediction of vibration inside a building.

The final step in the ground-borne noise and vibration prediction procedure is the prediction of interior noise levels in occupied building spaces due to acoustic radiation caused by the room's vibrating elements. The following equation from Section 9.3.2 of the FRA guidance manual shows the relationship between ground-borne vibration and ground-borne noise:

$$L_A = L_v + K_{rad} + K_{A-wt}$$

where:

L_A	=	A-weighted sound level in 1/3 octave band (dBA re: 20 µPa)
L_v	=	RMS vibration velocity level in 1/3 octave band (VdB re: 1 µin/sec)
K_{rad}	=	adjustment to convert from vibration to sound pressure level and account for average acoustical absorption inside room (typically -5 dB for residential rooms)
$K_{A\text{-}wt}$	=	A-weighting adjustment in each 1/3 octave-band

Ground-borne noise is computed on a 1/3 octave-band basis. The 1/3 octave-band noise levels are A-weighted and combined to obtain an overall A-weighted noise level. The A-weighted ground-borne noise level is evaluated with respect to the FRA ground-borne noise criteria.

Where trains change tracks or cross over other tracks, wheel impacts at regular crossovers (conventional rail-bound manganese frogs) or special trackwork produce an increase in vibration relative to standard track and thus would require an adjustment factor to account for the ground vibration levels in the immediate vicinity of a track crossover or turnout. Adjustments were made to predicted vibration levels to account for increases in localized vibration due to special trackwork, such as crossovers or turnouts.

Alternatives 1, 2, and 3 would use special trackwork without significant gaps in the rail running surface, such as moveable-point frogs. Moveable-point frogs reduce noise and vibration because the wing rail closes the gap at the frog, reducing the impact as the wheel crosses it. Any insulated joints would be low-impact type joints. Therefore, any increases in localized vibration because of special trackwork are expected to be small and would not change overall effects on sensitive receptors.

Under Alternative 4, HSR trains would operate in blended service on the Caltrain tracks between San Jose and Gilroy and would use the same type of special trackwork currently in use in the corridor. All special trackwork frogs under Alternative 4 are assumed to be standard frogs. Wheel impacts at turnouts and crossovers with standard frogs were assumed to cause localized increases in vibration of up to 10 VdB within 50 feet, then decreasing with distance from the frogs.

5 EXISTING CONDITIONS AND EFFECTS ANALYSIS

This chapter presents the existing noise and vibration environment and existing measurement results. This chapter also provides the results of the noise and vibration impact assessments for construction and operations.

5.1 Noise

5.1.1 Existing Noise Environment

This section summarizes the noise measurement results and describes the noise-sensitive land uses in the RSA. Section 5.1.1.2, Noise Measurement and Modeling, summarizes the existing noise model used to identify the existing ambient noise conditions at all noise-sensitive receptors in the RSA.

5.1.1.1 Noise Measurement Results

A total of 65 measurements of ambient noise were conducted in the noise and vibration RSA. Measurements of ambient noise were conducted at 11 locations in the San Jose Diridon Approach Subsection between Scott Boulevard and West Alma Avenue, 10 locations in the Monterey Corridor Subsection between West Alma Avenue and Bernal Way, 36 locations in the Morgan Hill and Gilroy Subsection between Bernal Way and State Route (SR) 152, 2 locations in the Pacheco Pass Subsection between SR 152 and Interstate (I-) 5, and 6 locations in the San Joaquin Valley Subsection between I-5 and Carlucci Road. The long-term measurement locations are illustrated on Figures 5-1 through 5-5. Photographs of the noise measurement sites are provided in Appendix A.

The noise monitors were located at or near noise-sensitive locations. At some sites the noise measurement microphones were located in the back, front, or side yards of residences. At other sites, the microphones were mounted to utility poles near noise-sensitive locations. At all sites, the microphones were positioned in accordance with FRA guidance relative to both the dominant ambient noise sources and the noise-sensitive locations.

Figure 5-1 Noise and Vibration Measurement Locations

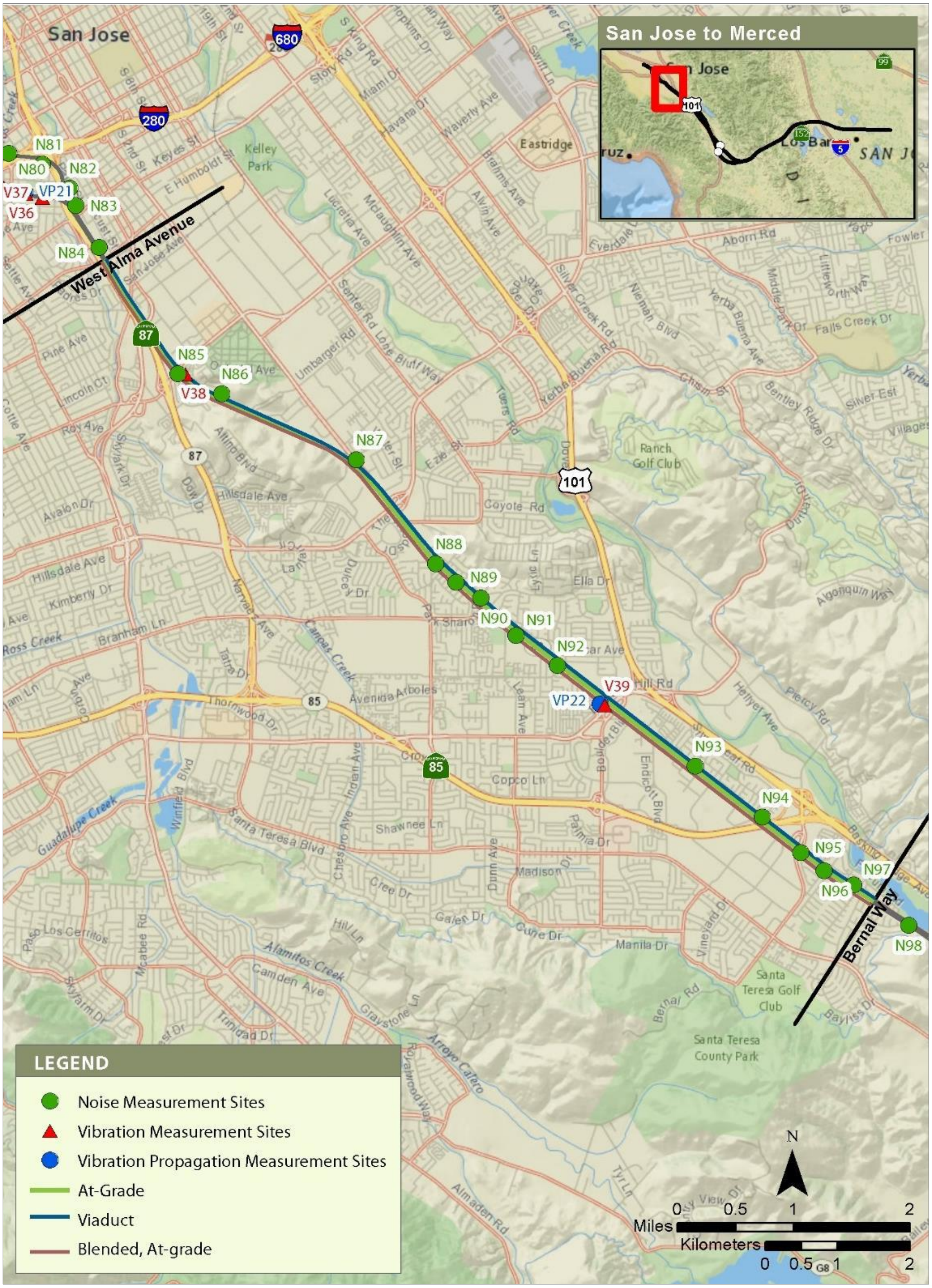

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Figure 5-2 Noise and Vibration Measurement Locations

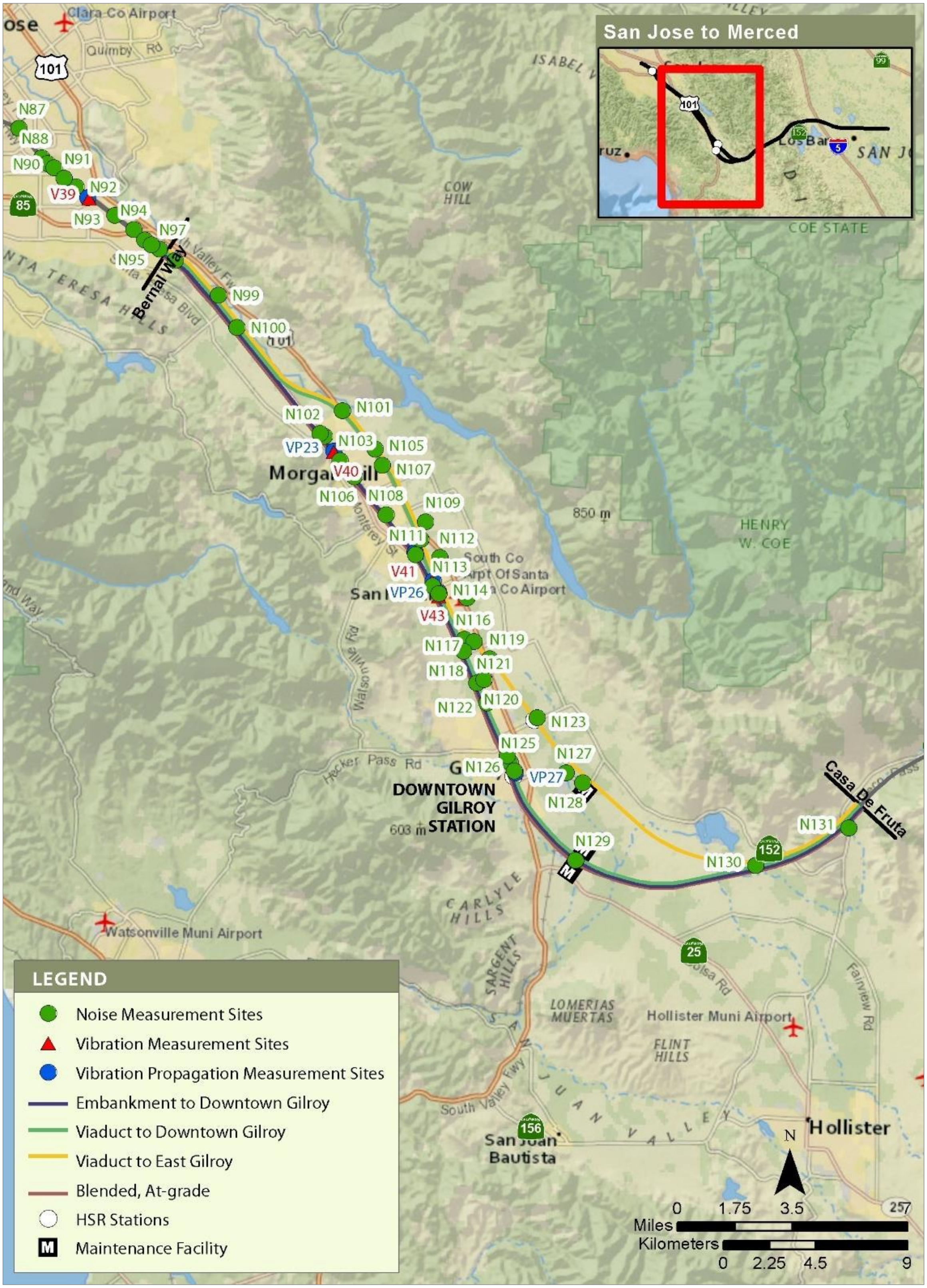

Figure 5-3 Noise and Vibration Measurement Locations

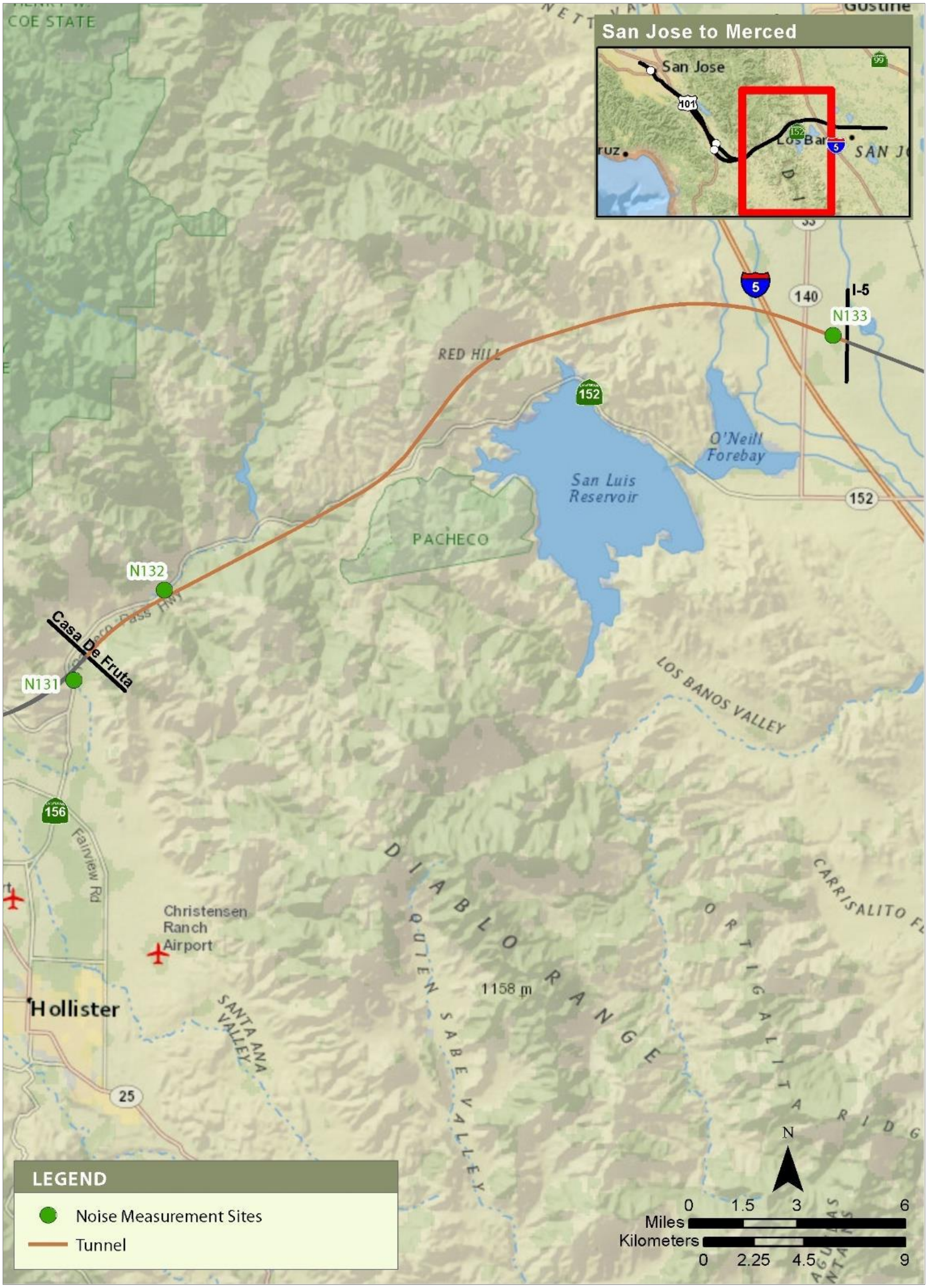

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Figure 5-4 Noise and Vibration Measurement Locations

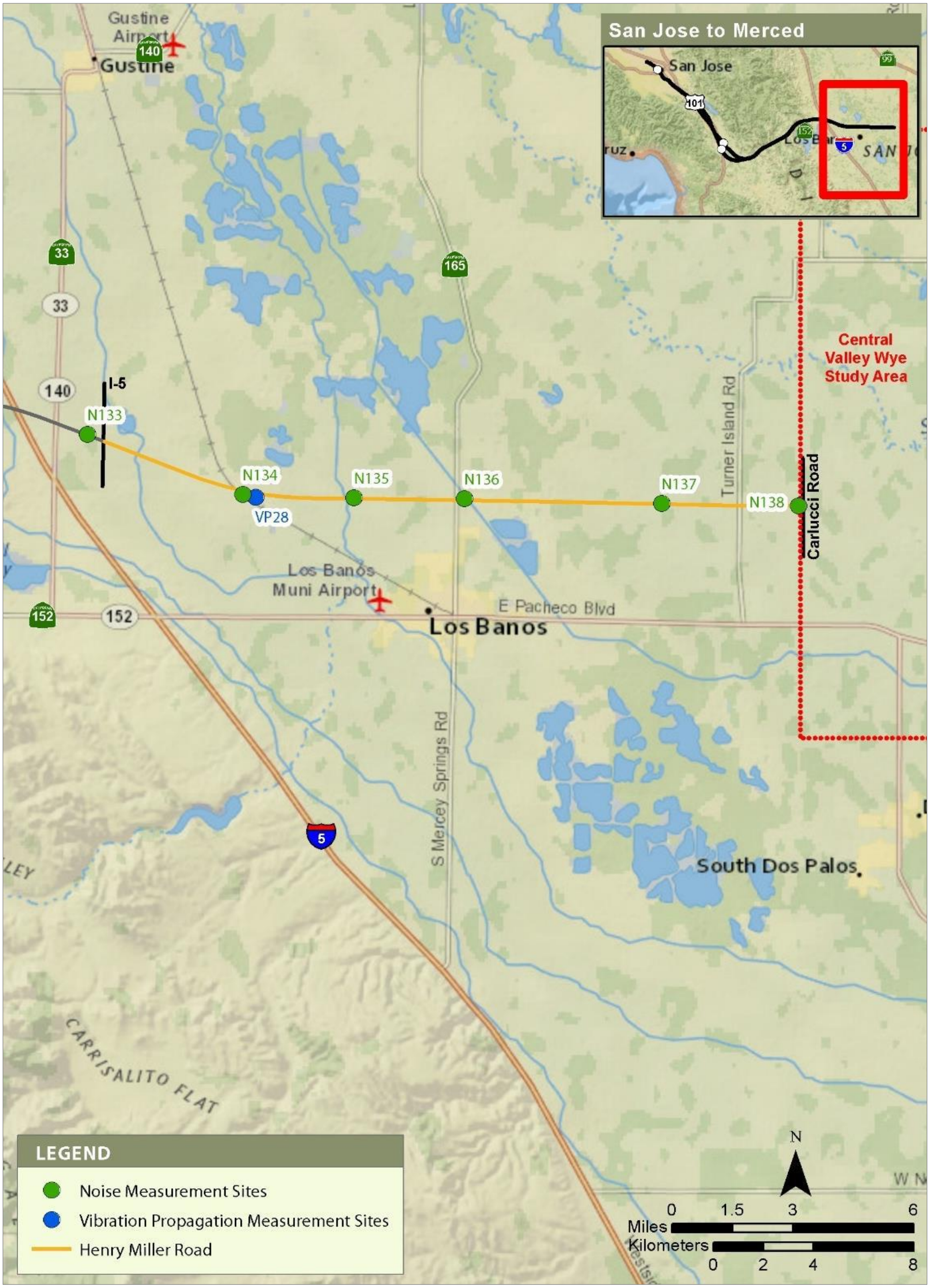

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Figure 5-5 Noise and Vibration Measurement Locations

The major noise sources for much of the project are trains in the existing rail corridor. In some locations, the project alternatives would deviate from the existing rail corridors and pass through rural areas. In some areas, the project alternatives would follow major highways where the existing noise environment is dominated by traffic noise. Noise monitors were located near noise-sensitive receptors and near existing major noise sources, such as roadways or rail lines. The noise measurement results shown in Table 5-1 represent the actual measured sound levels at the noise monitor locations. The results of the existing noise measurement program were used to validate the existing noise spreadsheet model developed by Wilson Ihrig to better predict existing noise levels at all noise-sensitive locations throughout the RSA. The existing noise spreadsheet model was used to identify the ambient existing noise levels at the exterior façade of building locations for residential land uses and at the nearest point of use for nonresidential noise-sensitive sites.

Commercial and industrial uses are the largest developed component in the northern portion of the San Jose Diridon Station Approach Subsection, with increasing residential use south of West Alma Avenue. South of San Jose Diridon Station, the alignment would pass through primarily residential areas but also some areas of commercial and industrial use to a point just north of Morgan Hill (near Kirby Avenue). In downtown Gilroy, dense urban commercial and residential uses are on both sides of the alignment. South and east of Gilroy, the primary land use is agricultural, interspersed with small rural communities and scattered residences on large acreages. The land uses east of Gilroy are predominantly agricultural and open space, with limited residential development and a commercial outlets center near Leavesley Road. The land use through the Pacheco Pass Subsection, where the alignment would pass through a new 13.5-mile tunnel, is open space and rangeland. Where the alignment would exit the tunnel in the eastern portion of the Pacheco Pass Subsection and then crosses I-5, residential and local commercial uses in the community of Santa Nella are located south of the alignment. The land uses in the San Joaquin Valley Subsection, along Henry Miller Road, are primarily agricultural (with supporting structures such as silos and barns) with scattered residences.

The noise measurement results are organized by subsection in Table 5-1. Table 5-1 shows the results of the ambient noise measurements conducted in 2010 by Parsons Transportation Group and ambient noise measurements conducted in 2009, 2010, 2013, 2016, and 2017 by Wilson Ihrig. Noise measurements conducted by Parsons Transportation Group are included in the *San Jose to Merced Section Noise and Vibration Technical Report* (Authority 2011). Noise measurements conducted by Wilson Ihrig in 2009 and 2010 are included in the *San Francisco to San Jose Section Noise and Vibration Technical Report* (Authority and FRA 2010a). Noise measurements conducted by Wilson Ihrig in 2013 are included in the *Caltrain Peninsula Corridor Electrification Project Noise and Vibration Technical Report* (Wilson Ihrig 2014). Noise measurements conducted by Wilson Ihrig in 2016 and 2017 are included in this assessment. Appendix B provides plots of the ambient noise measurement results.

Table 5-1 Ambient Noise Measurement Results

Site	Location	Land Use	Date Deployed	Average L_{dn}[1] (dBA)	Loudest Hour L_{eq} (dBA)
San Jose Diridon Station Approach Subsection					
N76[2]	2079 Main Street, San Jose, CA	Residential	5/3/2016	63	65
N77[2]	1315 De Altura Commons, San Jose, CA	Residential	10/16/2009	65	64
N78[2]	726 Emory Street, San Jose, CA	Residential	3/5/2010	64	65
N79	(adjacent to) 109 Laurel Grove Avenue, San Jose, CA	Residential	5/10/2016	67	70
N80	421 Illinois Avenue, San Jose, CA	Residential	10/12/2010	68	69

Site	Location	Land Use	Date Deployed	Average L_{dn}[1] (dBA)	Loudest Hour L_{eq} (dBA)
N81	663 Delmas Avenue, San Jose, CA	Residential	5/6/2016	61	63
N82	827 Harliss Avenue, San Jose, CA	Residential	10/12/2010	63	62
N83	(adjacent to) 974 McLellan Avenue, San Jose, CA	Residential	5/17/2016	66	63
N84	1197 Lick Avenue, San Jose, CA	Residential	11/11/2014	77	77
N139	782 Auzerais Avenue, San Jose, CA	Residential	5/20/2013	82	81
N140	748 Illinois Avenue, San Jose, CA	Residential	5/20/2013	71	68
Monterey Corridor Subsection					
N85	2320 Canoas Garden Avenue (Lot 608), San Jose, CA	Residential	10/11/2010	67	67
N86	Communications Hill Drive, San Jose, CA	Residential	5/17/2016	61	62
N87	3200 Monterey Road, Clarion Inn, San Jose, CA	Residential	5/17/2016	79	77
N88	4406 Pinon Place, San Jose, CA	Residential	10/13/2010	67	66
N89	23 Park Groton Place, San Jose, CA	Residential	10/12/2010	68	63
N90	4635 Rotherhaven Way, San Jose, CA	Residential	5/12/2016	77	77
N91	510 Saddle Brook Drive (Lot A), San Jose, CA	Residential	5/12/2016	67	67
N92	5272 Waterfall Court, San Jose, CA	Residential	10/19/2010	67	66
N93	60 Foxwell Place, San Jose, CA	Residential	5/10/2016	74	75
N94	5919 Southwind Drive, San Jose, CA	Residential	10/13/2010	73	76
Morgan Hill and Gilroy Subsection					
Along Monterey Road through Downtown Gilroy					
N95	6908 Sessions Drive, San Jose, CA	Residential	10/13/2010	59	58
N96	6998 Sessions Drive, San Jose, CA	Residential	5/10/2016	72	72
N97	7307 Urshan Way San Jose, CA	Residential	10/14/2010	60	58
N98	7465 Pegasus Court San Jose, CA	Residential	1/17/2011	61	59
N99	8470 Monterey Road, San Jose, CA	Residential	1/18/2011	61	62
N100	586 Monterey Road, Morgan Hill, CA	Residential	5/10/2016	81	81
N101	(adjacent to) 19271 Saffron Drive, Morgan Hill, CA	Residential	5/9/2016	73	76
N103	19260 Monterey Road, Morgan Hill, CA	Residential	10/18/2010	71	71
N104	157 Bender Circle, Morgan Hill, CA	Residential	5/3/2016	68	69
N106	95 E Central Avenue, Morgan Hill, CA	Residential	10/18/2010	66	66
N108	16250 Railroad Avenue, Morgan Hill, CA	Residential	6/22/2010	68	68

Site	Location	Land Use	Date Deployed	Average L_{dn}[1] (dBA)	Loudest Hour L_{eq} (dBA)
N111	14542 Crowner Avenue, San Martin, CA	Residential	5/12/2016	62	66
N113	13455 Monterey Road, San Martin, CA	Residential	10/19/2010	69	69
N114	13150 Depot Road, San Martin, CA	Residential	5/3/2016	64	67
N115	12675 Sycamore Avenue, San Martin, CA	Residential	5/9/2016	67	66
N118	110 Jacob Way, Gilroy, CA	Residential	6/22/2010	74	70
N120	325 Denio Avenue, Gilroy, CA	Residential	10/21/2010	56	56
N121	25 Denio Avenue, Gilroy, CA	Residential	10/20/2010	68	68
N122	70 Cohansey Avenue, Gilroy, CA	Residential	10/20/2010	60	61
N124	(adjacent to) 120 Sarafina Way, Gilroy, CA	Residential	5/9/2016	68	70
N125	111 Martin Street, Gilroy, CA	Residential	10/20/2010	58	65
N126	7250 Alexander Street, Gilroy, CA	Residential	2/14/2017	59	64
N129	1230 Bloomfield, Gilroy, CA	Residential	5/3/2016	71	74
N130	8247 Lovers Lane, Hollister, CA	Residential	5/6/2016	61	66
US 101 through Morgan Hill					
N102	(adjacent to) 19490 Vista De Lomas, Morgan Hill, CA	Residential	5/9/2016	69	67
N105	17905 Condit, Morgan Hill, CA	Residential	5/13/2016	66	68
N107	877 English Walnut Court, Morgan Hill, CA	Residential	10/19/2010	69	69
N109	15450 Murphy Avenue, Morgan Hill, CA	Residential	10/18/2010	57	60
N110	14916 Llagas Avenue, Morgan Hill, CA	Residential	12/19/2016	70	68
N112	14150 Murphy Avenue, San Martin, CA	Residential	10/18/2010	62	62
East Gilroy					
N116	11460 Rothe Avenue, Gilroy, CA	Residential	10/20/2010	56	59
N117	405 Lena Avenue, Gilroy, CA	Residential	10/21/2010	62	58
N119	695 Rucker Avenue, Gilroy, CA	Residential	5/6/2016	68	69
N123	8415 Marcella Avenue, Gilroy, CA	Residential	12/19/2016	66	65
N127	6780 Holsclaw Road, Gilroy, CA	Residential	5/6/2016	67	66
N128	1975 CA-152, Gilroy, CA	Residential	2/14/2017	82	79
Pacheco Pass Subsection					
N131	210 Walnut Avenue, Hollister, CA	Residential	11/17/2010	58	54
N132	Pacheco Pass Highway	Residential	5/13/2016	82	79

Site	Location	Land Use	Date Deployed	Average L_{dn}[1] (dBA)	Loudest Hour L_{eq} (dBA)
San Joaquin Valley Subsection					
N133	28263 Fahey Road, Los Banos, CA	Residential	5/20/2016	65	67
N134	(adjacent to) 24334 Henry Miller Avenue, Los Banos, CA	Residential	5/20/2016	74	72
N135	(adjacent to) 21534 Henry Miller Avenue, Los Banos, CA	Residential	5/20/2016	79	79
N136	(adjacent to) 18827 Henry Miller Road, Los Banos, CA	Residential	5/20/2016	73	72
N137	13893 Henry Miller Road, Los Banos, CA	Residential	11/15/2010	65	67
N138	12051 Carlucci Road, Los Banos, CA	Residential	5/20/2016	67	71

Sources: Authority 2011; Authority and FRA 2010a; Wilson Ihrig 2014
dBA = A-weighted decibel
L_{dn} = day-night sound level
SR = State Route
[1] The L_{dn} was calculated from the average hourly L_{eq} values collected over the entire measurement period.
[2] Includes existing noise from nearby airport

San Jose Diridon Station Approach Subsection

In San Jose, the noise RSA follows the Caltrain right-of-way through moderately dense urban areas with mixed land use. North of San Jose Diridon Station, the land use on the east side of the existing rail alignment is primarily industrial, while the western side is mainly residential. The closest residences are approximately 30 to 50 feet from the existing railway. Bellarmine College Preparatory School campus is on the western side of the RSA. The closest Bellarmine school buildings are more than 350 feet from the existing railway line.[8] At San Jose Diridon Station, there are multifamily buildings along the entire west side of San Jose Diridon Station facing the existing tracks and platforms. Templo La Hermosa church is on the eastern side of the station, beyond the parking lots approximately 550 feet from the station.

South of San Jose Diridon Station, land uses in the noise RSA include transportation rights-of-way associated with I-280 and SR 87, residential neighborhoods, and some commercial/industrial areas. The San Jose Fire Department Bureau of Field Operations campus is located just south of San Jose Diridon Station on the east side of the RSA. Gardner Elementary School is located approximately 275 feet south of I-280 on the south side of the RSA.

Existing noise in this portion of the RSA is dominated by a number of daily rail operations that share the alignment (Table 4-8). This alignment is a heavily used rail corridor with 92 daily weekday Caltrain passenger trains currently operating between San Francisco and San Jose Diridon Station. Forty daily Caltrain trains operate through to Tamien Station. Approximately two to nine freight trains run along the route per day. Fourteen Capital Corridor and eight ACE trains run along the alignment daily between De La Cruz Boulevard and San Jose Diridon Station. ACE trains continue to travel south to Tamien Station to access the layover facility. Amtrak Coast Starlight trains pass through the section twice daily. Santa Clara VTA light rail trains run along the center of SR 87. Other noise sources include traffic on I-880, SR 87, I-280, local roads, as well as aircraft activities associated with Norman Y Mineta San Jose International Airport.

[8] Outdoor sports fields associated with Bellarmine are adjacent to the existing railway, but are not considered noise-sensitive uses by the FRA guidance manual (FRA 2012).

Ambient noise conditions were characterized at eleven locations: N76 to N84 and N139 and 140. The ambient L_{dn} in the San Jose Diridon Station Approach Subsection ranged from 61 dBA to 82 dBA, depending on the location.

Monterey Corridor Subsection

South of West Alma Avenue, the noise RSA extends along SR 87 until south of Almaden Expressway, where it turns east toward Monterey Road following the Union Pacific Railroad (UPRR) right-of-way. Land uses along the Monterey Corridor Subsection include primarily single-family residential neighborhoods and some commercial/industrial areas. Toward the southern end of the subsection, land uses include scattered single-family homes and farms.

The closest residence is approximately 30 feet from the existing railway line, near Skyway Drive, where backyards of single-family homes abut the right-of-way. An Elk's Lodge on West Alma Avenue is approximately 180 feet from SR 87 on the west side of the RSA. A recording studio is on the east side of the RSA, although it is approximately 350 feet from the existing railway and behind some intervening commercial buildings. The School of the Blues music school is on Monterey Road, approximately 190 feet from the existing railway line. Other institutional land uses include Edenvale Branch Library and four places of worship.

Sources of existing noise include traffic on SR 87, Monterey Road (near Capitol Caltrain Station), SR 85, and local roads, as well as the existing rail traffic. South of Tamien Station the daily rail traffic consists of six Caltrain passenger trains, two Amtrak passenger trains, and approximately four freight trains per day. VTA light rail trains also run along the center of SR 87.

Ambient noise conditions were characterized at 10 locations: N85 to N94. The ambient L_{dn} in the Monterey Corridor Subsection ranged from 61 dBA to 79 dBA, depending on the location.

Morgan Hill and Gilroy Subsection

In this subsection, the noise RSA diverges to follow the different horizontal alignments. It is best characterized by separate discussion of the portion of the RSA along Monterey Road through downtown Gilroy, the portion of the RSA adjacent to U.S. Highway (US) 101 through Morgan Hill, and the portion of the RSA through east Gilroy.

Along Monterey Road through Downtown Gilroy

The noise RSA extends along the single UPRR track from Bernal Way into downtown Gilroy. It continues past the Gilroy Caltrain Station, along UPRR south of downtown, and then turns east toward the Pacheco Pass Highway near Bloomfield Avenue. Land uses include farms with scattered single-family homes, and residential neighborhoods and commercial areas in Morgan Hill and San Martin. The closest residences to the existing railway line are a row of single-family homes approximately 40 feet away, where backyards abut the right-of-way, between Bernal Way and Metcalf Road. Three hotels are within 200 feet of the existing railway line. The closest school is approximately 145 feet from the existing railway line. The closest place of worship is approximately 150 feet from the existing railway line. In downtown Morgan Hill, the Morgan Hill Community Center outdoor amphitheater is approximately 500 feet from the existing railway line and the South Valley Civic Theatre and Community Playhouse is more than 600 feet from the railway line.

In the downtown Gilroy area, land uses include a mix of residential neighborhoods and commercial/industrial areas. South of downtown, land uses include farms with scattered single-family homes. The closest residential building to the existing railway line is approximately 50 feet from UPRR track on Monterey Road and Lewis Street. The closest school is Gilroy Preparatory School, which is approximately 145 feet from the existing railway line. Pintello Comedy Theater is approximately 365 feet from the existing railway line and the District Theater Live Music Venue is 50 feet from the railway line.

Sources of existing noise include traffic on Monterey Road and local roads, as well as the rail traffic along UPRR consisting of six Caltrain passenger trains, two Amtrak passenger trains, and approximately four freight trains per day. Caltrain trains stop at the existing Gilroy station, which is a terminal station. Amtrak and freight trains continue to operate south of Gilroy. Farming and industrial activities south of Metcalf Road also contribute to existing noise levels, as do aircraft activities associated with South County Airport and Frazier Lake Airpark

Ambient noise conditions were characterized at 24 locations in the portion of the RSA along Monterey Road through downtown Gilroy: N95 to N101, N103, N104, N106, N108, N111, N113 to 115, N118, N120 to N122, N124 to N126, N129, and N130. The ambient L_{dn} along this portion of the Morgan Hill and Gilroy Subsection ranged from 56 dBA to 81 dBA, depending on the location.

Adjacent to US 101 through Morgan Hill

Land uses include farms with scattered single-family homes, and residential neighborhoods and commercial areas in Morgan Hill near El Camino Real/US 101.

For most of this noise RSA, the noise environment is dominated by US 101 and local street traffic. At connection points on both ends, some receptors are exposed to the rail traffic along UPRR (six Caltrain passenger trains, two Amtrak passenger trains, and approximately four freight trains per day). Farming activities south of Morgan Hill also contribute to existing noise levels.

Ambient noise conditions were characterized at six locations: N102, N105, N107, N109, N110, and N112. The ambient L_{dn} along this portion of the Morgan Hill and Gilroy Subsection ranged from 57 dBA to 70 dBA, depending on the location.

East Gilroy

Land uses include farms with scattered single-family homes. For most of this RSA, the noise environment is dominated by rural traffic. At the connection point, some receptors are exposed to the rail traffic along UPRR (six Caltrain passenger trains, two Amtrak passenger trains, and approximately four freight trains per day). Other noise sources include aircraft activities associated with Frazier Lake Airpark and farming activities.

Ambient noise conditions were characterized at six locations: N116, N117, N119, N123, N127, and N128. The ambient L_{dn} along this portion of the Morgan Hill and Gilroy Subsection ranged from 56 dBA to 82 dBA, depending on the location.

Pacheco Pass Subsection

Land uses in this subsection are quite different from the rest of the project extent. There are some sparsely scattered single-family homes, but much of the subsection is not inhabited. The RSA passes through two portions of the Cottonwood Creek Wildlife Area.

For most of this RSA, the noise environment is dominated by SR 152 and rural traffic. The majority of the alignment in this subsection is in a tunnel. Ambient noise conditions were characterized at two locations where the alignment is above grade: N131 and N132. The ambient L_{dn} along this subsection ranged from 58 dBA to 82 dBA, depending on the location.

San Joaquin Valley Subsection

The RSA passes Santa Nella Road/I-5 then follows Henry Miller Road to Carlucci Road. Land uses include farms with scattered single-family homes and one elementary school.

For most of the San Joaquin Valley Section, there are no existing rail noise sources and the noise environment is dominated by rural traffic. In Volta, a freight railroad line crosses the RSA. One single-family residence is within 200 feet of the freight railway line. Sources of existing noise include traffic along Henry Miller Road and other local roadways as well as farming activities.

Ambient noise conditions were characterized at six locations: N133 to N138. The ambient L_{dn} along this subsection ranged from 65 dBA to 79 dBA, depending on the location.

5.1.1.2 Noise Measurement and Modeling Discussion

To validate the existing noise model, the existing noise spreadsheet model results were calculated at the exact locations of the noise monitors. In some instances, the noise monitors were closer to existing noise sources such as roadways and rail lines than the noise-sensitive buildings themselves. Once the existing noise model was validated for existing conditions by showing close agreement with the measurement results (as shown in Table 5-2), the existing noise model was then used to predict ambient noise levels at all sensitive receptors, typically building facades, in the project extent.

Table 5-2 shows the results of the comparison of the existing noise model and the measured noise levels at the measurement locations. The comparison indicates that the existing noise model is in close agreement with the field noise measurement data. The data were within 3 dB at all but one measurement location (N137). Site N137 was located along Henry Miller Road in the San Joaquin Valley Subsection. Four noise measurement sites were along Henry Miller Road. The existing noise model for receptors in that area incorporated the measurement results from all four sites. Some variation of measured noise levels along Henry Miller Road was due to daily fluctuations in traffic, as would be expected.

Table 5-2 Comparison of Existing Noise Model Results to Existing Measurement Results

Site	Measured Average L_{dn}[1] (dBA)	Modeled L_{dn} (dBA)	Difference[2]
San Jose Diridon Station Approach Subsection			
N76	63	62	(1)
N77	65	68	3
N78	64	65	1
N79	67	70	3
N80	68	69	1
N81	61	62	1
N82	63	62	(1)
N83	66	64	(2)
N84	77	74	(3)
N139	82	80	(2)
N140	71	71	0
Monterey Corridor Subsection			
N85	67	67	2
N86	61	58	(2)
N87	79	79	0
N88	67	68	1
N89	68	68	0
N90	77	75	(2)
N91	67	69	2
N92	67	67	0
N93	74	74	0
N94	73	72	(1)

Site	Measured Average L_{dn}[1] (dBA)	Modeled L_{dn} (dBA)	Difference[2]
Morgan Hill and Gilroy Subsection			
Along Monterey Road through Downtown Gilroy			
N95	59	61	2
N96	72	70	(2)
N97	60	58	(2)
N98	61	59	(1)
N99	61	61	0
N100	81	81	0
N101	73	72	(1)
N103	71	72	1
N104	68	70	2
N106	66	66	0
N108	68	67	1
N111	62	62	0
N113	69	71	2
N114	64	67	3
N115	67	69	2
N118	74	74	0
N120	56	59	3
N121	68	66	(2)
N122	60	59	(1)
N124	68	67	(1)
N125	58	61	3
N126	59	61	2
N129	71	71	0
N130	61	62	1
Along Monterey Road through Downtown Gilroy			
N102	69	69	0
N105	66	66	0
N107	69	71	2
N109	57	58	1
N110	70	70	0
N112	62	61	(1)

Site	Measured Average L_{dn}[1] (dBA)	Modeled L_{dn} (dBA)	Difference[2]
East Gilroy			
N116	56	57	0
N117	62	62	0
N119	68	67	(1)
N123	66	66	0
N127	67	64	(3)
N128	82	80	(2)
Pacheco Pass Subsection			
N131	58	59	1
N132	82	82	0
San Joaquin Valley Subsection			
N133	65	65	0
N134	74	74	0
N135	79	76	(3)
N136	73	74	1
N137	65	70	5
N138	67	65	(2)

(Parentheses) indicate negative values
dBA = A-weighted decibel
L_{dn} = day-night sound level
[1] The L_{dn} was calculated from the average hourly L_{eq} values collected over the entire measurement period.
[2] The difference is the measured level minus the modeled level at each location.

5.1.2 Noise Impact Assessment

Noise impacts were assessed according to the criteria described in Section 4.1.3 and the method, data, and assumptions described in Section 4.1.4, Methods for Establishing Existing Noise Levels, and Section 4.1.5, Prediction Methods.

5.1.2.1 Construction Noise Impacts

Temporary noise and vibration impacts would result from activities associated with the construction of new tracks and stations, utility relocation, grading, excavation, track work, demolition, and installation of systems components. Impacts may occur in residential areas and at other noise-sensitive land uses within several hundred feet of the alignment. The potential for noise impacts would be greatest near pavement breaking and close to any nighttime construction work. Construction noise varies with the process used, layout of the sites, and the type and condition of the equipment used. The noisiest pieces of equipment determine the maximum sound levels from construction activities.

The alternatives incorporate project features (IAMFs) to avoid or minimize potential effects from construction and operations. NV-IAMF#1: Noise and Vibration would require the contractor to prepare and submit to the Authority prior to construction a noise and vibration technical memorandum documenting how the FTA and FRA guidelines for minimizing construction noise and vibration impacts would be employed when work is conducted within 1,000 feet of sensitive receptors. Typical construction practices in the FRA guidance manual (FRA 2012) for minimizing construction noise and vibration impacts include the following:

- Build 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 where possible.
- Build walled enclosures around especially noisy activities or around clusters of noisy equipment.
- Combine noisy operations so they occur in the same period.
- Phase demolition, earthmoving, and ground-impacting operations so they do not occur in the same period.
- Avoid impact pile driving where possible in noise- and vibration-sensitive areas.

Application of the FRA and FTA guidelines would minimize temporary construction effects on sensitive receptors. However, there is still the potential for adverse effects from construction noise for sensitive receptors located close to construction activity.

Table 5-3 shows data on noise emissions of construction equipment. It includes average values of the L_{max} for various pieces of typical construction equipment at a distance of 50 feet. The data are from Table 10-1 of the FRA guidance manual.

Table 5-3 Construction Equipment Noise Emission Levels

Equipment	Typical Noise Level at 50 feet from Source (dBA)
Auger drill rig[1]	85
Backhoe	80
Compactor	82
Concrete mixer	85
Crane, mobile	83
Dozer	85
Drill rig truck[1]	84
Drum mixer[1]	80
Excavator[1]	85
Man lift[1]	85
Generator	82
Grader	85
Loader	80
Pickup truck[1]	55
Pile driver (impact)	101
Pile driver (vibratory)	95
Pump	77
Roller	85
Scraper	85
Truck	84
Vacuum street sweeper[1]	80

Equipment	Typical Noise Level at 50 feet from Source (dBA)
Vacuum excavator (vac-truck)[1]	85
Helicopter at 200 feet altitude[2]	84-89[2] (overflight) 89[2] (hovering)

Sources: FRA 2012; FHWA 2006;
dBA = A-weighted decibel
[1] Reference level from FHWA Roadway Construction Noise Model (FHWA 2006).
[2] SEL based on expected noise emissions from construction helicopters (Wilson Ihrig 2009).

Predicting construction noise requires a construction scenario of the equipment that would likely be used and average utilization factors. Utilization factors represent the percentage of time the equipment would be expected to be operating during each phase. Analysts used the typical noise levels for various pieces of equipment to calculate the L_{eq} at various distances from a construction site. Additional noise level data and utilization factor data were obtained from the FHWA *Roadway Construction Noise Model* (FHWA 2006).

Analysts identified five typical types of construction activities that would be used for project construction for analysis. Table 5-4 shows the results of the analysis. For each typical planned construction activity, including the PG&E network upgrades construction, the expected noisiest pieces of equipment are listed. For this level of detail, analysts assumed that all pieces of equipment would be located at the center of the construction site. The projection for the PG&E upgrades includes noise generated by helicopter overflights and hovering at the network tower installation location. The total 8-hour L_{eq} was calculated by incorporating the typical maximum sound levels of each piece of equipment and the utilization factor. For each construction activity type, the projections were adjusted to calculate the distance at which the L_{eq} would reach the criteria shown in Table 5-4.

The criteria are based on land use, with the most stringent category being for residential locations. For typical track construction scenarios, the residential nighttime 8-hour L_{eq} criterion of 70 dBA would potentially be exceeded up to 374 feet from the clear and grub construction activity, and as far away as 774 feet from the concrete pour aerial structure activity. These distances would be applicable to all four project alternatives because the same construction scenarios would apply to all of the alternatives. Concrete pour aerial structure activity would not apply to Alternative 4 between San Jose and Gilroy.

For the PG&E upgrade construction scenarios, the residential nighttime 8-hour L_{eq} criterion of 70 dBA would be exceeded up to 158 feet from the haul material construction activity and as far away as 522 feet from the conductor installation construction activity. These distances would be applicable to all four project alternatives because the same construction scenarios apply to all four alternatives. The Skyway Drive Variants A and B result in no measurable differences in noise impacts on sensitive receptors associated with Alternative 2.

Table 5-4 Construction Activity Noise Levels

Construction Activity	Equipment Type	Total 8-Hour Leq (dBA) at 50 feet	Distance to 70 dBA[1] Residential Nighttime Criterion (feet)	Distance to 80 dBA[1] Residential Daytime Criterion (feet)	Distance to 85 dBA[1] Commercial Criterion (feet)	Distance to 90 dBA[1] Industrial Criterion (feet)
Track Construction						
Clear and grub	Dump truck, water truck, rubber tired dozer, loader, crane	87	374	118	66	37

Construction Activity	Equipment Type	Total 8-Hour Leq (dBA) at 50 feet	Distance to 70 dBA[1] Residential Nighttime Criterion (feet)	Distance to 80 dBA[1] Residential Daytime Criterion (feet)	Distance to 85 dBA[1] Commercial Criterion (feet)	Distance to 90 dBA[1] Industrial Criterion (feet)
Grading	Scraper, grader, crushing equipment, dump truck, rubber tired dozer, excavator, loader, water truck	90	515	163	92	51
Concrete pour aerial structure	Transit mix truck, crane, drill rig, dump truck, flatbed truck, loader, forklift, pump, water truck	94	774	245	138	77
Ballast compaction	Loader, crushing equipment, water truck, dump truck	89	425	134	76	42
Track installation	Crushing equipment, plate compactor, dump truck, grader, scraper, water truck	91	585	185	104	59
PG&E Network Upgrades Construction						
Site preparation	Backhoe, small bulldozer, truck with trailer, water truck, light-duty pickup truck, sweeper/scrubber, plate compactor, motor grader	87	362	114	64	36
Auger holes	Water truck, pickup truck, line truck with auger attachment	82	202	64	36	20
Haul material	Line truck with trailer	80	158	50	28	16
Tower installation	Crane, helicopter, vacuum trailer, rough terrain forklift, pump, bucket truck	90	483	153	86	48
Conductor installation	Line truck with reel, pickup trucks, line truck with bucket/crane, line truck with conductor puller, line truck with conductor tensioner, helicopter, cement and mortar mixer, dump truck	90	522	165	93	52

L_{eq} = equivalent sound level
dBA = A-weighted decibel
[1] Distances for this analysis assume that all pieces of equipment are located at the center of the construction site.

Table 5-5 shows key differences among the alternatives that would affect how construction noise affects the communities. Areas with embankments could include retaining structures, and embankment and at-grade could include vibratory compaction. The right-of-way blended areas might also require a greater amount of nighttime work to minimize service disruptions.

Table 5-5 Differences Among Alternatives

Subsection	Alt. 1	Alt. 2	Alt. 3	Alt. 4
San Joaquin Valley	Aerial/embankment			
Pacheco Pass	Mostly tunnel			
Morgan Hill and Gilroy	Aerial	Embankment/at grade	Far east aerial would avoid downtown Gilroy and Morgan Hill	At grade, right-of-way blended
Monterey Corridor	Aerial	Embankment	Aerial	At grade, right-of-way blended
San Jose Diridon Station Approach	Aerial/interchange touchdown at I-880	Aerial/interchange Touchdown at Scott	Same as Alt 2	At grade, right-of-way blended

I = Interstate

For the Morgan Hill and Gilroy Subsection, construction of the viaduct structure (Alternative 1 and 2) would have a larger criterion distance than the embankment and at-grade track options (Alternatives 2 and 4, respectively) because of height of the structure and the concrete pumps. For the Monterey Corridor Subsection and the San Jose Diridon Approach Subsection, the aerial viaduct (Alternatives 1 and 2) similarly would have a larger criterion distance than Alternatives 2 and 4. Nighttime construction could be required for Alternative 4 to minimize disruption of existing passenger rail services.

5.1.2.2 Operations Noise Impacts

This section describes the projected noise impacts related to HSR train operations, activities near the HSR stations, and conceptual operations at maintenance facility locations for the 2029 and 2040 conditions.[9]

As discussed in Section 4.1.3, the FRA noise impact criteria are based on a comparison of future projected noise levels to existing noise levels. Where the project alternatives would cause existing noise sources to change, such as by shifting an existing rail alignment, those changes become part of the projected noise levels.

Additionally, when a noise source in the RSA is known to be changing either with or without the project alternatives, that change in future noise is included in the future projections as well. The assumption for this project is that the Caltrain PCEP will happen regardless of the HSR project. Therefore, either with or without the project alternatives, the future noise levels in part of the RSA will change. To quantify the effect of the project alternatives, the future noise levels at all noise-sensitive receptors were calculated both with and without the project alternatives and compared to the existing levels.

This analysis evaluates the No Project Alternative and the project alternatives in 2029 and 2040. Under the 2029 and 2040 No Project conditions, changes in noise levels would be associated with the Caltrain PCEP and the increased operations of other adjacent passenger and freight

[9] A qualitative noise impact analysis of the Interim 2025 Plus Project condition (an initial operating section of HSR service between San Jose Diridon Station to the Central Valley prior to commencement of service on the entire Phase 1 system in 2029), was also evaluated. The Interim 2025 Plus Project condition would include significantly fewer daily HSR trains than the 2029 Plus Project condition, and as a result, associated operations noise impacts would be substantially less under the Interim 2025 Plus Project condition than the 2029 Plus Project condition. Therefore, this analysis does not further address the Interim 2025 Plus Project condition.

railroads. Because the Caltrain PCEP would upgrade the existing diesel locomotives with new, quieter EMU trains, which would reduce noise levels, it is anticipated that any noise impacts under the No Project conditions would be associated with increased operations of non-Caltrain passenger rail and freight rail service in the existing rail corridor. The 2029 and 2040 Plus Project condition evaluates changes in noise associated with implementation of the Caltrain PCEP and the HSR project. The 2029 and 2040 Plus Project cumulative conditions evaluates changes in noise levels associated with project operations, in addition to implementation of the Caltrain PCEP and increased operations of passenger and freight railroads in the corridor.

Table 5-6 shows the results of the 2029 No Project and 2029 Plus Project noise impact assessment. In all cases the noise impact is determined from the increase in noise over the existing condition. Alternative 1 would result in 47 severe impacts and 310 moderate impacts, Alternative 2 would result in 38 severe impacts and 599 moderate impacts,[10] Alternative 3 would result in 34 severe impacts and 227 moderate impacts, and Alternative 4 would result 190 severe impacts and 1,001 moderate impacts. Alternative 4 would have the most severe and moderate operations noise impacts, followed by Alternative 2, Alternative 1, and Alternative 3.

Noise impacts, before mitigation, associated with the DDV (which applies only to Alternative 4 in the San Jose Diridon Station Approach Subsection) and the TDV (which applies to all alternatives within the Morgan Hill and Gilroy, Pacheco Pass, and San Joaquin Valley Subsections) are shown in parentheses in Table 5-6. In some cases, receptors that would not have moderate or severe noise impacts with the preliminary design would have moderate or severe impacts with the DDV and TDV. In some cases, receptors that would have moderate noise impacts with the preliminary design would have severe impacts with the DDV and TDV. With the DDV and TDV, Alternative 1 would result in 51 severe impacts and 313 moderate impacts, Alternative 2 would result in 43 severe impacts and 601 moderate impacts,[11] Alternative 3 would result in 37 severe impacts and 233 moderate impacts, and Alternative 4 would result 197 severe impacts and 1,004 moderate impacts.

The difference in operations noise impacts among the four alternatives is predominately a result of the vertical and horizontal profile of each alternative. The greatest difference among the alternatives would occur in the Morgan Hill and Gilroy Subsection. Many Alternative 4 noise impacts would be from the HSR train horns in the Project Section. Alternative 2 would have a longer embankment profile than Alternatives 1 and 3, which are both predominately on aerial structures. Although the aerial structures of Alternatives 1 and 3 would be much higher in the air (which can sometimes lead to higher sound levels because of less ground attenuation), the design of the aerial structures includes a 3-foot-high parapet wall that functions as a short noise barrier. This parapet wall would reduce the noise levels from the propulsion and wheel-rail subsources under Alternatives 1 and 3, resulting in fewer noise impacts compared to Alternative 2. The horizontal alignment near Gilroy further differentiates the noise and vibration impacts among the four project alternatives. Alternatives 1 and 2 would extend through downtown Gilroy, while Alternative 3 would extend east of Gilroy through rural agricultural lands that are sparsely populated and have fewer sensitive receptors.

[10] The Skyway Drive Variants A and B under Alternative 2 would result in no measurable differences in noise impacts on sensitive receptors.

[11] The Skyway Drive Variants A and B under Alternative 2 would result in no measurable differences in noise impacts on sensitive receptors.

Table 5-6 Summary of 2029 No Project and 2029 Plus Project Noise Impacts

Subsection	Land Use Category[1]	No Project		Alternative 1		Alternative 2		Alternative 3		Alternative 4	
		Mod	Sev	Mod	Sev	Mod	Sev	Mod	Sev	Mod	Sev
San Jose Diridon Station Approach	2	0	0	1	3	11	0	11	0	84 (85)[2]	38
	1, 3	0	0	0	0	0	0	0	0	0	0
Monterey Corridor	2	0	0	61	4	25	4	61	4	252	17
	1, 3	0	0	0	0	0	0	0	0	0	0
Morgan Hill and Gilroy	2	0	0	158 (162)	14 (16)	473 (477)	8 (11)	66 (73)	4 (5)	574 (577)	109 (114)
	1, 3	0	0	1	0	1 (0)	0	0	0	2	0
Pacheco Pass	2	0	0	9 (10)	1	9 (10)	1	9 (10)	1	9 (10)	1
	1, 3	0	0	0	0	0	0	0	0	0	0
San Joaquin Valley	2	0	0	80 (78)	25 (27)	80 (78)	25 (27)	80 (78)	25 (27)	80 (78)	25 (27)
	1, 3	0	0	0	0	0	0	0	0	0	0
Total	2	**0**	**0**	**309 (312)**	**47 (51)**	**598 (601)**	**38 (43)**	**227 (233)**	**34 (37)**	**999 (1,002)**	**190 (197)**
	1, 3	**0**	**0**	**1**	**0**	**1 (0)**	**0**	**0**	**0**	**2**	**0**

Mod = Moderate
Sev = Severe
[1] FRA Land Use Categories are summarized in Table 4-3. Land Use Category 1 = areas where quiet is an essential element to the land use; Category 2 = Residential; Category 3 = Institutional use and passive-use parks.
[2] Impacts associated with the design variants are shown in parentheses. The DDV affects Alternative 4 within the San Jose Diridon Station Approach Subsection; the remaining noise impacts are associated with the TDV.

A cumulative noise impact assessment was also conducted for both the 2029 No Project and 2029 Plus Project conditions. In all cases the noise impact is determined from the increase in cumulative noise over the existing condition. The cumulative analysis assumes that the Caltrain PCEP will be implemented and that the increase in other passenger and freight operations in 2029 (shown in Table 4-9) would occur. Table 5-7 shows the 2029 No Project and Plus Project cumulative noise impact assessment results. The results indicate that under the 2029 No Project cumulative condition there would be 9 severe noise impacts and 841 moderate noise impacts caused by increases in other, non-HSR train operations. Under the 2029 Plus Project cumulative condition there would be 71 severe noise impacts and 1,620 moderate impacts under Alternative 1; 200 severe impacts and 1,426 moderate impacts under Alternative 2; 48 severe impacts and 1,306 moderate impacts under Alternative 3; and 475 severe noise impacts and 1,500 moderate impacts under Alternative 4. Future 2027 CNEL airport noise contours for San Jose International Airport (2010) have also been used to evaluate the cumulative condition.

Noise impacts associated with the DDV and TDV are shown in parentheses in Table 5-7. Under the 2029 Plus Project cumulative condition with the DDV and TDV, there would be 75 sensitive receptors that would experience severe impacts and 1,623 sensitive receptors that would experience moderate impacts under Alternative 1; 205 severe impacts and 1,427 moderate impacts under Alternative 2; 51 severe impacts and 1,312 moderate impacts under Alternative 3; and 501 severe impacts and 1,496 moderate impacts under Alternative 4.

Table 5-7 Summary of 2029 No Project and Plus Project Cumulative Noise Impacts

Subsection	Land Use Category[1]	No Project		Alternative 1		Alternative 2		Alternative 3		Alternative 4	
		Mod	Sev	Mod	Sev	Mod	Sev	Mod	Sev	Mod	Sev
San Jose Diridon Station Approach	2	191	1	193	11	228	1	228	1	152 (143)[2]	50 (70)
	1, 3	5	0	1	0	1	0	1	0	3 (5)	0
Monterey Corridor	2	279	4	388	16	214	12	388	16	397	83
	1, 3	0	0	1	0	1	0	1	0	0	0
Morgan Hill and Gilroy	2	365	4	947 (951)	17 (19)	890 (893)	161 (164)	598 (605)	5 (6)	857 (861)	315 (319)
	1, 3	1	0	1	1	3 (2)	0	1	0	2	1
Pacheco Pass	2	0	0	9 (10)	1	9 (10)	1	9 (10)	1	9 (10)	1
	1, 3	0	0	0	0	0	0	0	0	0	0
San Joaquin Valley	2	0	0	80 (78)	25 (27)	80 (78)	25 (27)	80 (78)	25 (27)	80 (78)	25 (27)
	1, 3	0	0	0	0	0	0	0	0	0	0
Total	**2**	**835**	**9**	**1,617 (1,620)**	**70 (74)**	**1,421 (1,423)**	**200 (205)**	**1,303 (1,309)**	**48 (51)**	**1,495 (1,489)**	**474 (500)**
	1, 3	**6**	**0**	**3**	**1**	**5 (4)**	**0**	**3**	**0**	**5 (7)**	**1**

Mod = Moderate
Sev = Severe
[1] FRA Land Use Categories are summarized in Table 4-3. Land Use Category 1 = areas where quiet is an essential element to the land use; Category 2 = Residential; Category 3 = Institutional use and passive-use parks.
[2] Impacts associated with the design variants are shown in parentheses. The DDV affects Alternative 4 within the San Jose Diridon Station Approach Subsection; the remaining noise impacts are associated with the TDV.

Table 5-8 shows the results of the 2040 No Project and 2040 Plus Project condition noise impact assessment. In all cases the noise impact is determined from the increase in noise over the existing condition. Alternative 1 would result in 337 severe impacts and 1,200 moderate impacts; Alternative 2 would result in 755 severe impacts and 1,844 moderate impacts; Alternative 3 would result in 222 severe impacts and 834 moderate impacts; and Alternative 4 would result in 1,212 severe impacts and 1,666 moderate impacts. The results of the 2040 Plus Project noise impact assessment indicate more noise impacts than the 2029 Plus Project noise impact assessment results due to significantly more HSR train operations in 2040. Many Alternative 4 noise impacts would result from the HSR train horns in the Project Section. The existing noise from non-project elements was unchanged, such as the airports and local roads.

Noise impacts associated with the DDV and TDV are shown in parentheses in Table 5-8. Under the 2040 Plus Project condition with the DDV and TDV, there would be 347 sensitive receptors that would experience severe impacts and 1,195 sensitive receptors that would experience moderate impacts under Alternative 1; 766 severe impacts and 1,838 moderate impacts under Alternative 2; 233 severe impacts and 845 moderate impacts under Alternative 3; and 1,224 severe impacts and 1,658 moderate impacts under Alternative 4.

Table 5-8 Summary of 2040 No Project and 2040 Plus Project Noise Impacts

Subsection	Land Use Category[1]	No Project		Alternative 1		Alternative 2		Alternative 3		Alternative 4	
		Mod	Mod	Mod	Sev	Mod	Sev	Mod	Sev	Mod	Sev
San Jose Diridon Station Approach	2	0	0	117	20	73	0	73	0	218	136
	1, 3	0	0	1	0	0	0	0	0	3	0
Monterey Corridor	2	0	0	225	46	326	46	225	46	264	293
	1, 3	0	0	1	0	1	0	1	0	3	0
Morgan Hill and Gilroy	2	0	0	815 (812)[2]	160 (167)	1,399 (1,395)	598 (606)	498 (511)	65 (73)	1,133 (1,127)	671 (680)
	1, 3	0	0	4	0	8	0	0	0	8	1
Pacheco Pass	2	0	0	4	10 (11)	4	10 (11)	4	10 (11)	4	10 (11)
	1, 3	0	0	0	0	0	0	0	0	0	0
San Joaquin Valley	2	0	0	32 (30)	101 (103)	32 (30)	101 (103)	32 (30)	101 (103)	32 (30)	101 (103)
	1, 3	0	0	1	0	1	0	1	0	1	0
Total	**2**	**0**	**0**	**1,193 (1,188)**	**337 (347)**	**1,834 (1,828)**	**755 (766)**	**832 (843)**	**222 (233)**	**1,651 (1,643)**	**1,211 (1,223)**
	1, 3	**0**	**0**	**7**	**0**	**10**	**0**	**2**	**0**	**15**	**1**

Mod = Moderate
Sev = Severe
[1] FRA Land Use Categories are summarized in Table 4-3. Land Use Category 1 = areas where quiet is an essential element to the land use; Category 2 = Residential; Category 3 = Institutional use and passive-use parks.
[2] Impacts associated with the design variants are shown in parentheses. The DDV affects Alternative 4 within the San Jose Diridon Station Approach Subsection; the remaining noise impacts are associated with the TDV.

The 2040 Plus Project noise impact locations for each project alternative are illustrated on Figures 5-6 through 5-25. For the San Jose Diridon Station Approach, Monterey Corridor, and Morgan Hill and Gilroy Subsections, the noise impact locations for Alternative 1 with and without the DDV and TDV are illustrated on Figures 5-6 through 5-9. For the Pacheco Pass and San Joaquin Valley Subsections with and without the DDV and TDV, the noise impact locations are the same for the four project alternatives and are illustrated on Figures 5-10 through 5-13. Noise impact locations for Alternative 2 with and without the DDV and TDV in the San Jose Diridon Station Approach, Monterey Corridor, and Morgan Hill and Gilroy Subsections are illustrated on Figures 5-14 through 5-17; noise impact locations for Alternative 3 with and without the DDV and TDV are illustrated on Figures 5-18 through 5-21; and noise impact locations for Alternative 4 with and without the DDV and TDV are illustrated on Figures 5-22 through 5-25. Each red dot indicates a cluster of receptors predicted to have severe impacts and each yellow dot indicates a cluster of receptors predicted to have moderate impacts for the 2040 Plus Project condition.

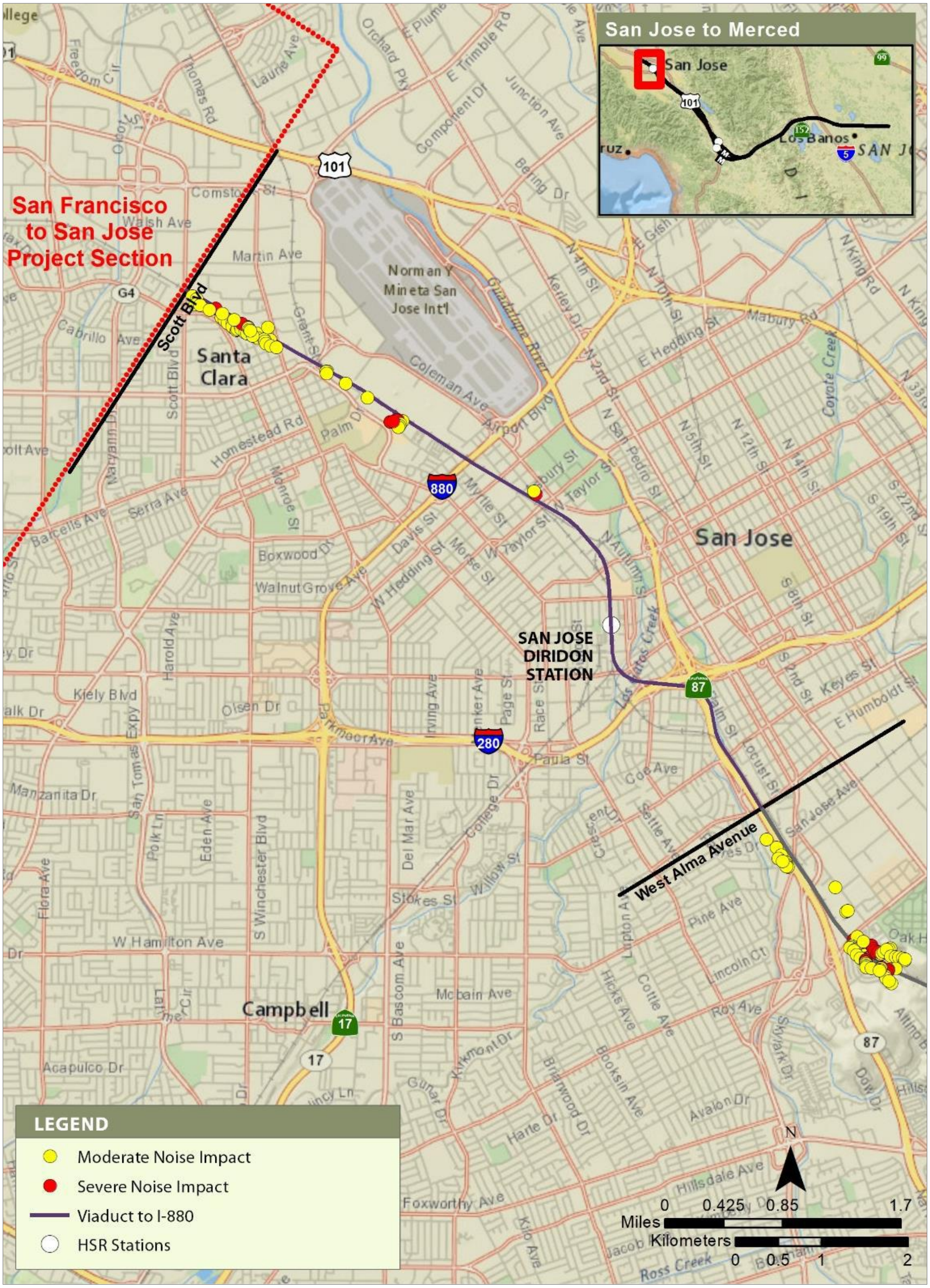

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Figure 5-6 2040 Plus Project Noise Impacts—Alternative 1

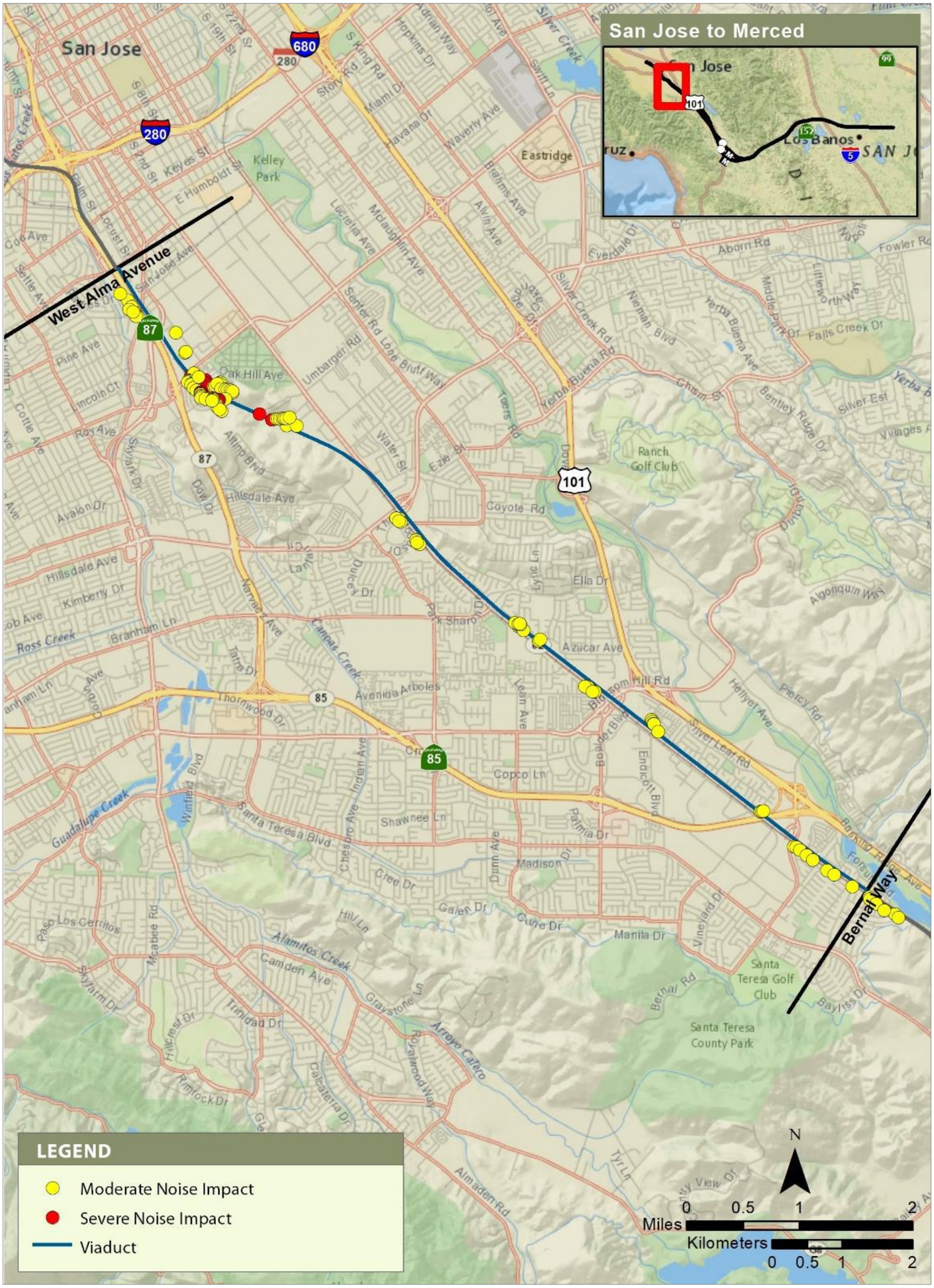

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Figure 5-7 2040 Plus Project Noise Impacts—Alternative 1

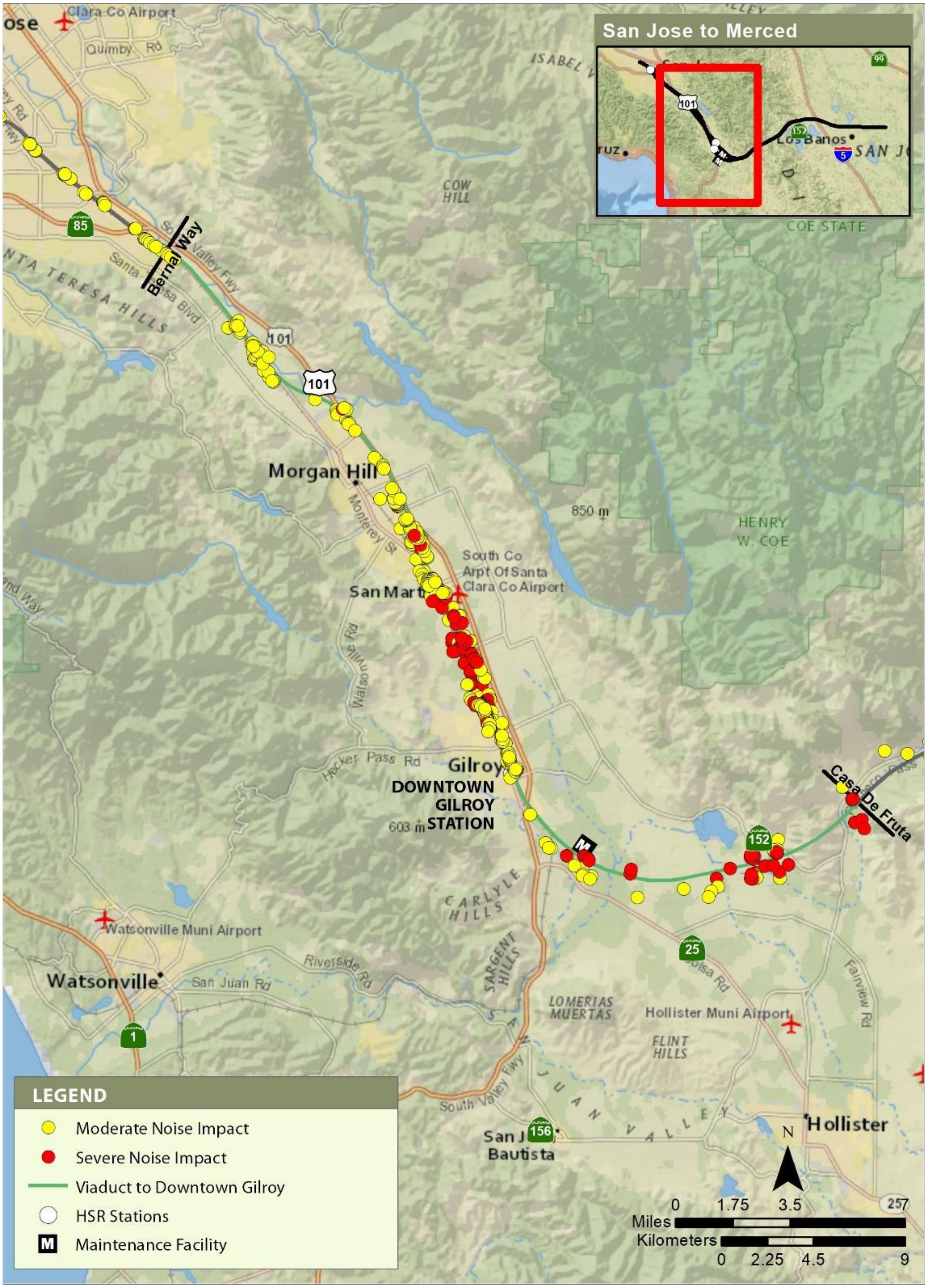

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Figure 5-8 2040 Plus Project Noise Impacts—Alternative 1 without the Tunnel Design Variant

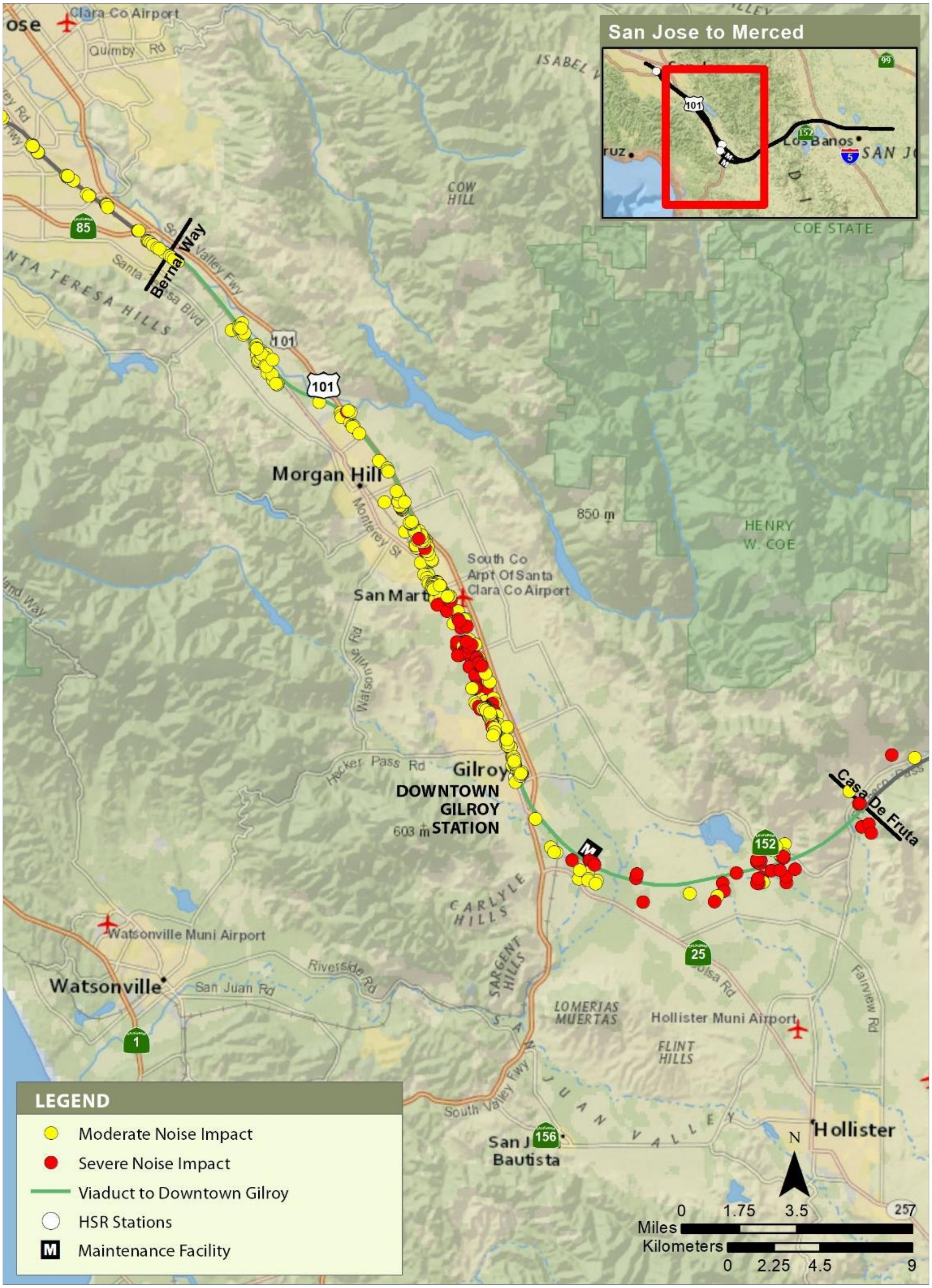

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Figure 5-9 2040 Plus Project Noise Impacts—Alternative 1 with the Tunnel Design Variant

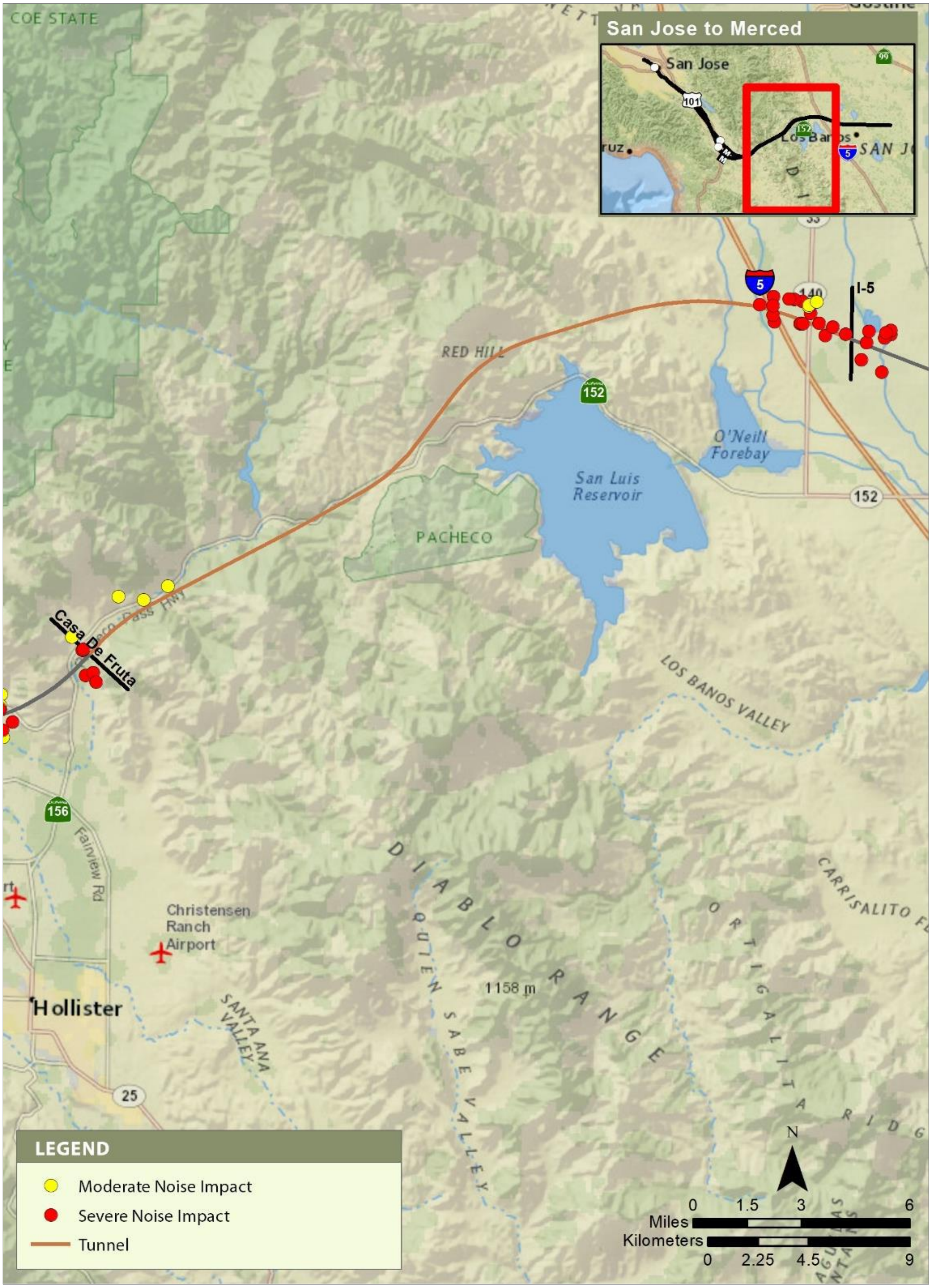

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Figure 5-10 2040 Plus Project Noise Impacts—Alternatives 1, 2, 3, and 4 without the Tunnel Design Variant

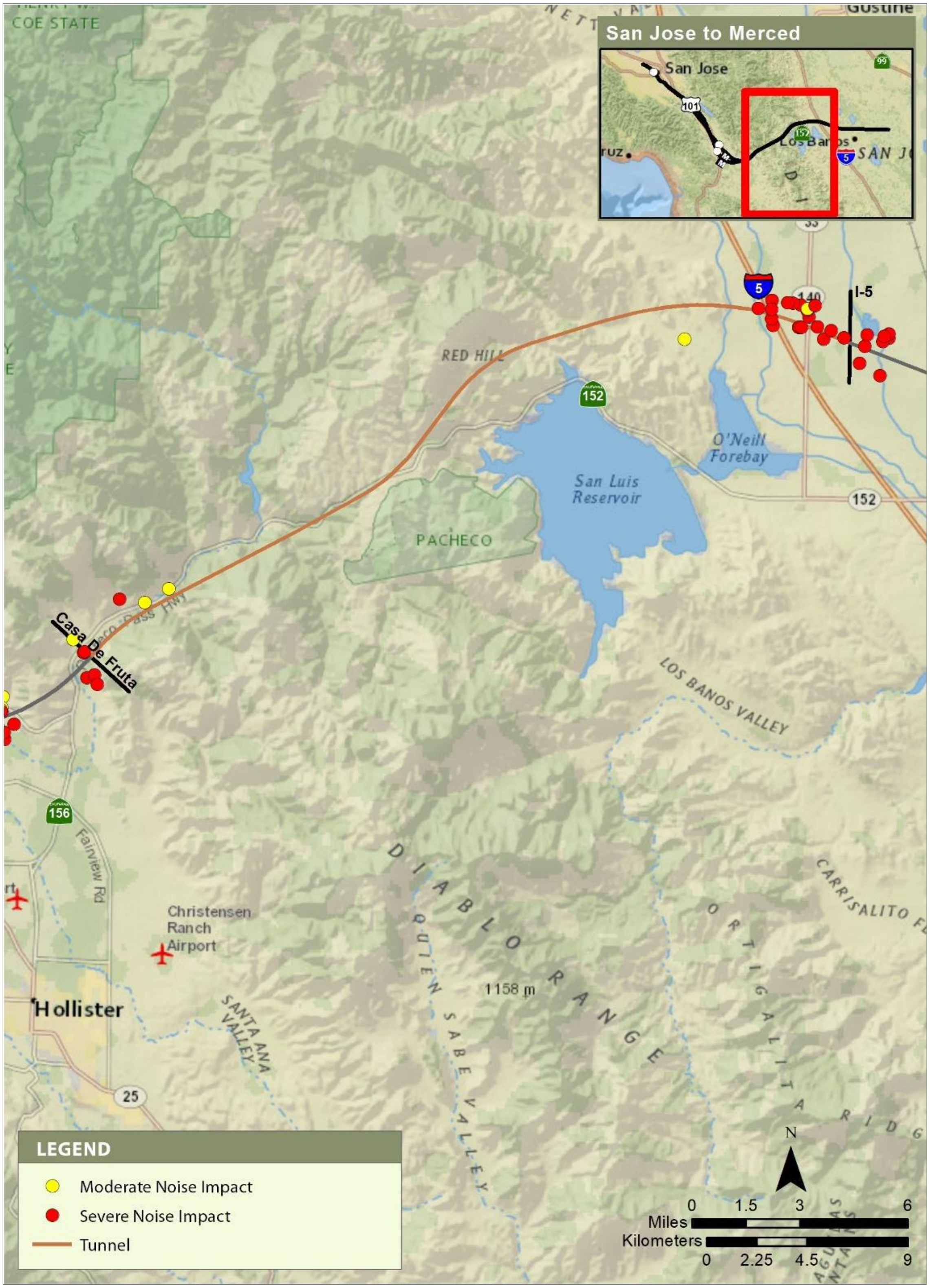

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Figure 5-11 2040 Plus Project Noise Impacts—Alternatives 1, 2, 3, and 4 with the Tunnel Design Variant

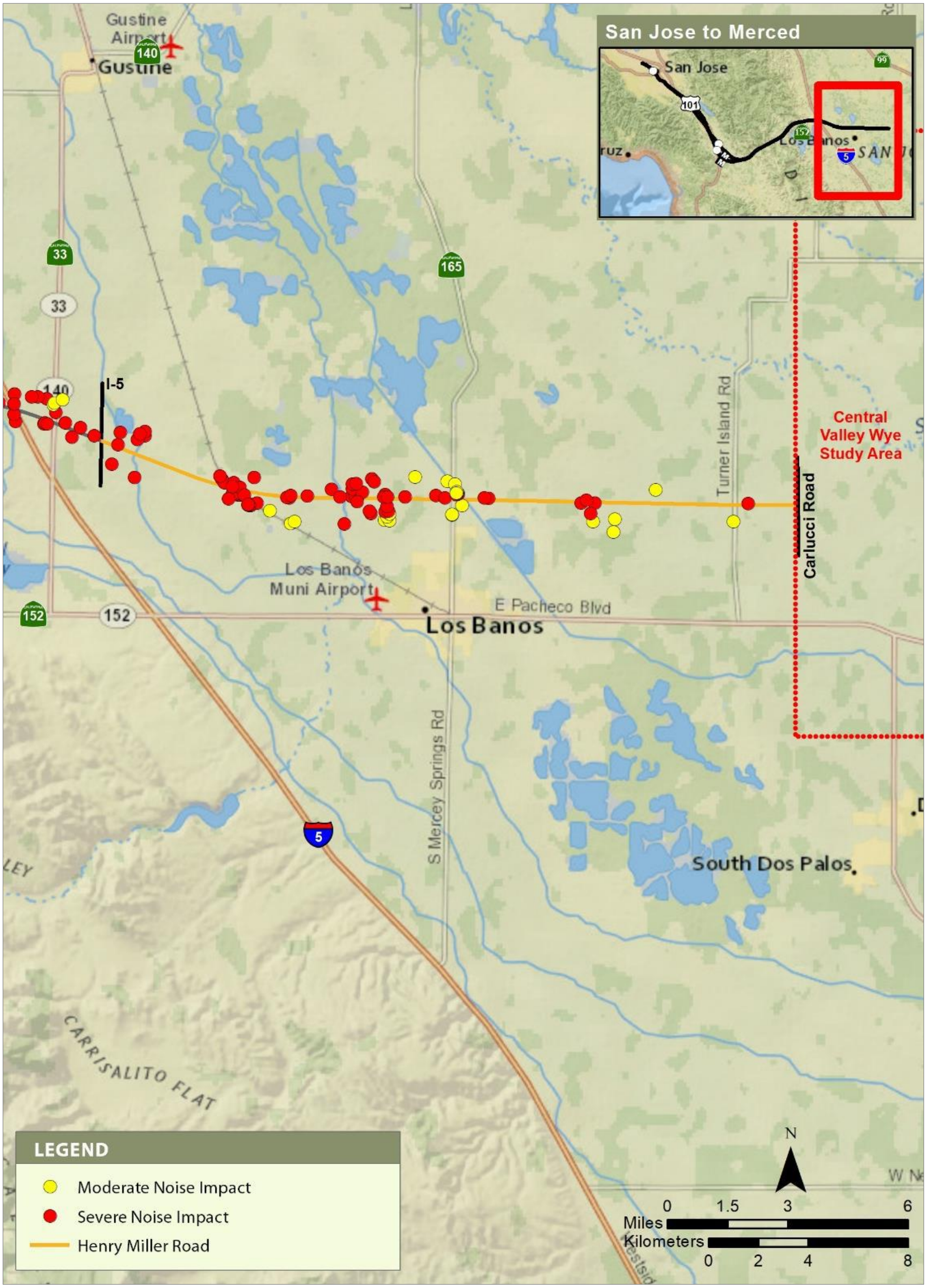

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Figure 5-12 2040 Plus Project Noise Impacts—Alternatives 1, 2, 3, and 4 without the Tunnel Design Variant

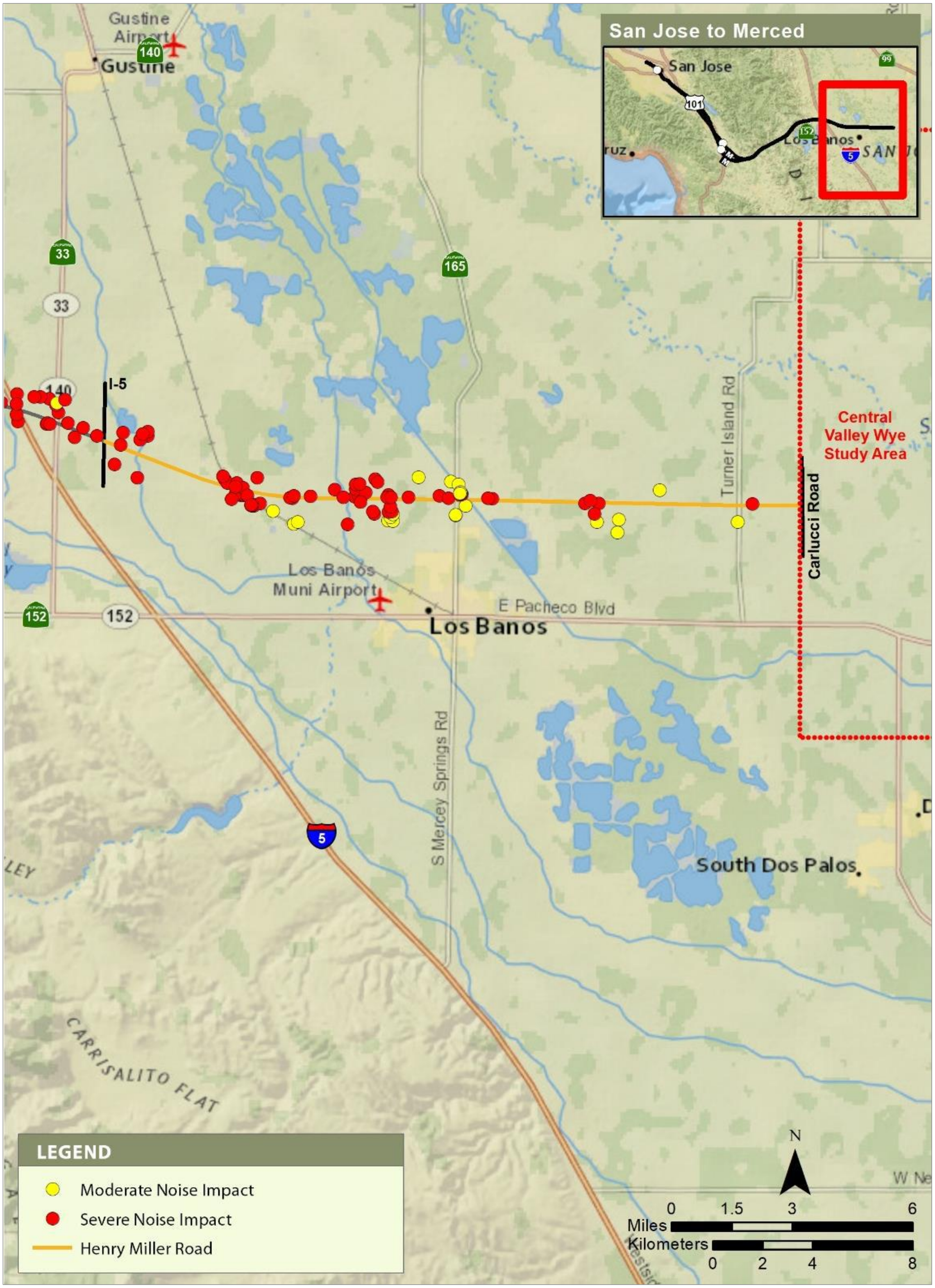

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Figure 5-13 2040 Plus Project Noise Impacts—Alternatives 1, 2, 3, and 4 with the Tunnel Design Variant

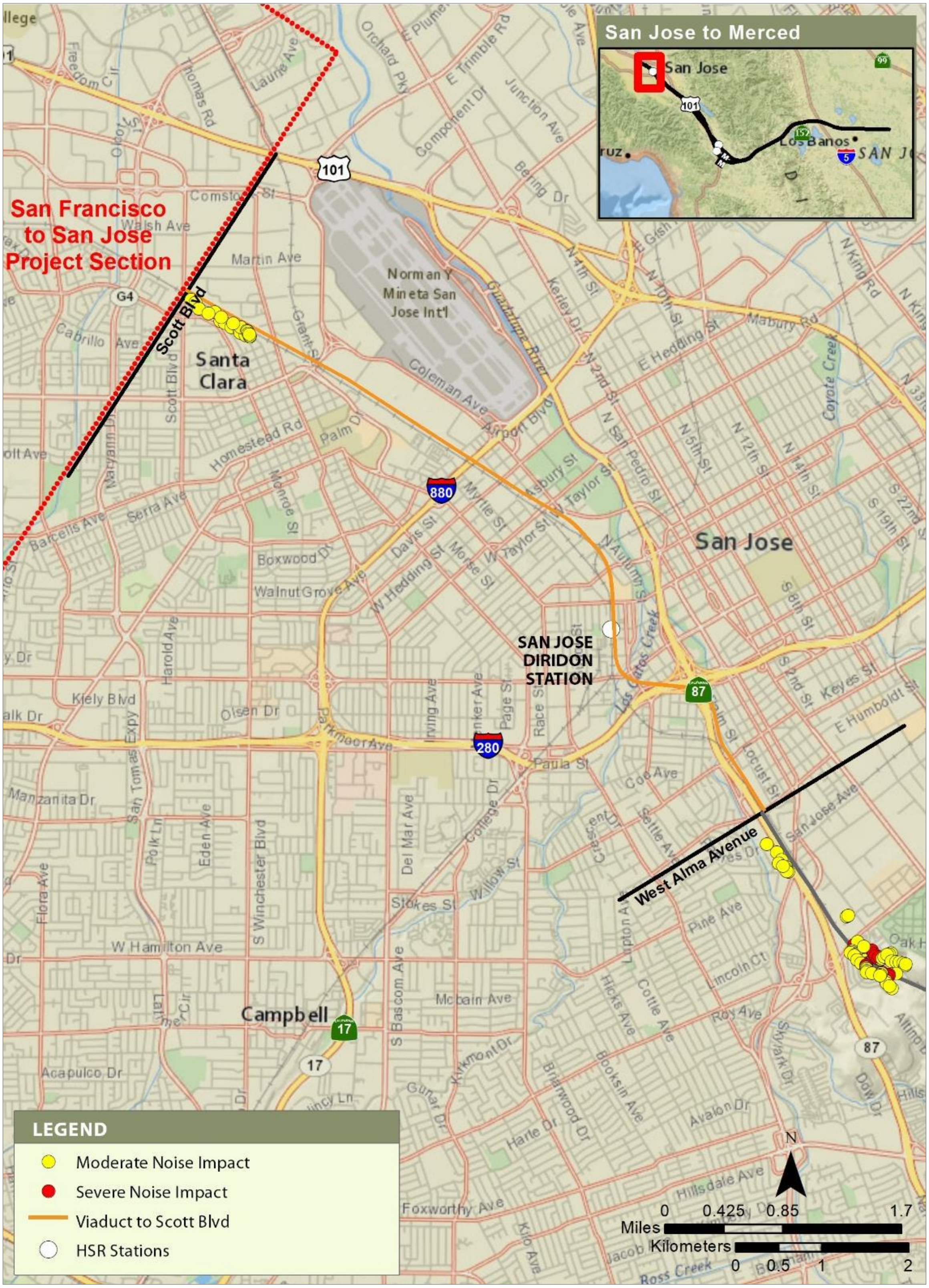

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Figure 5-14 2040 Plus Project Noise Impacts—Alternative 2

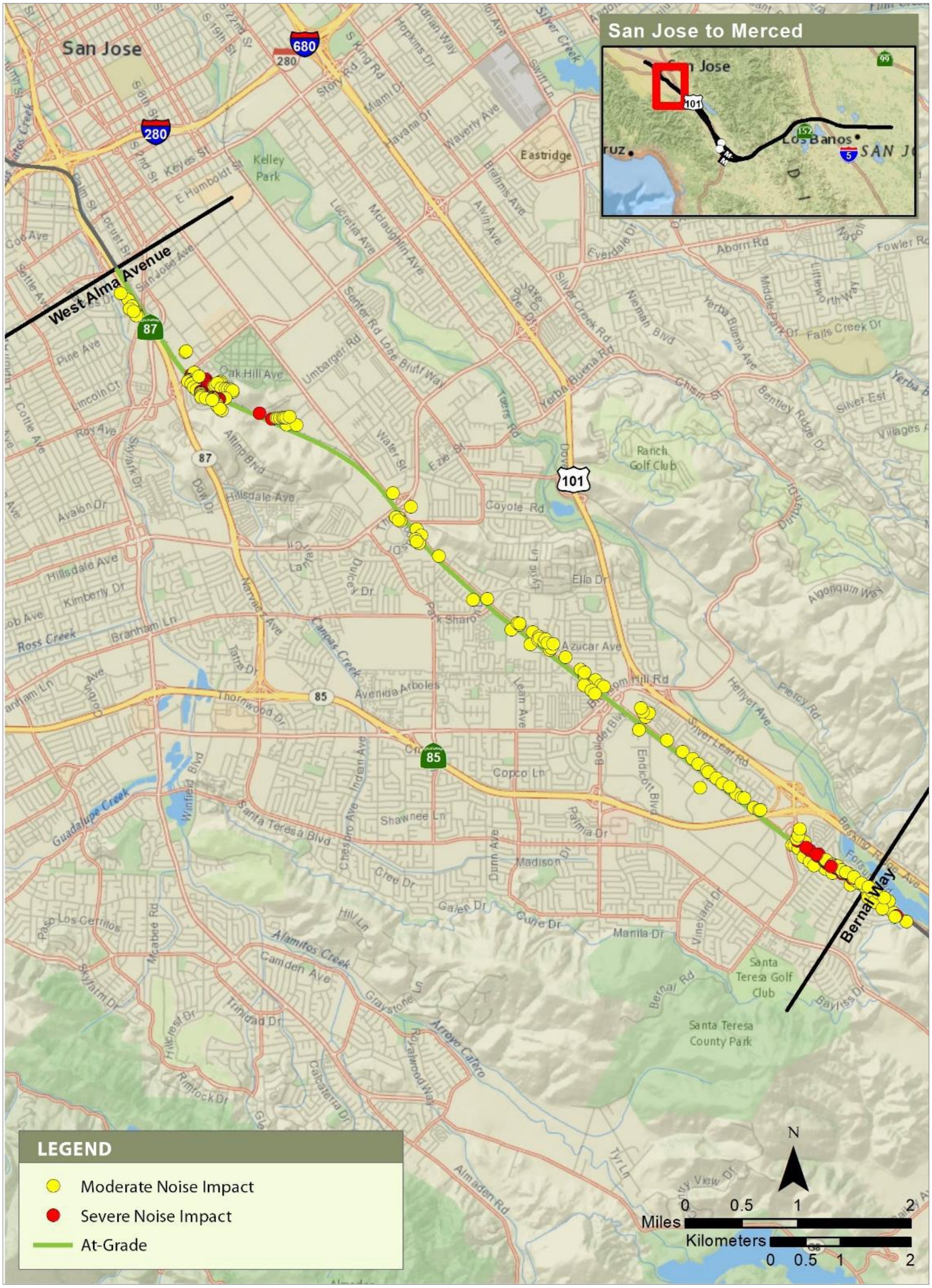

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Figure 5-15 2040 Plus Project Noise Impacts—Alternative 2

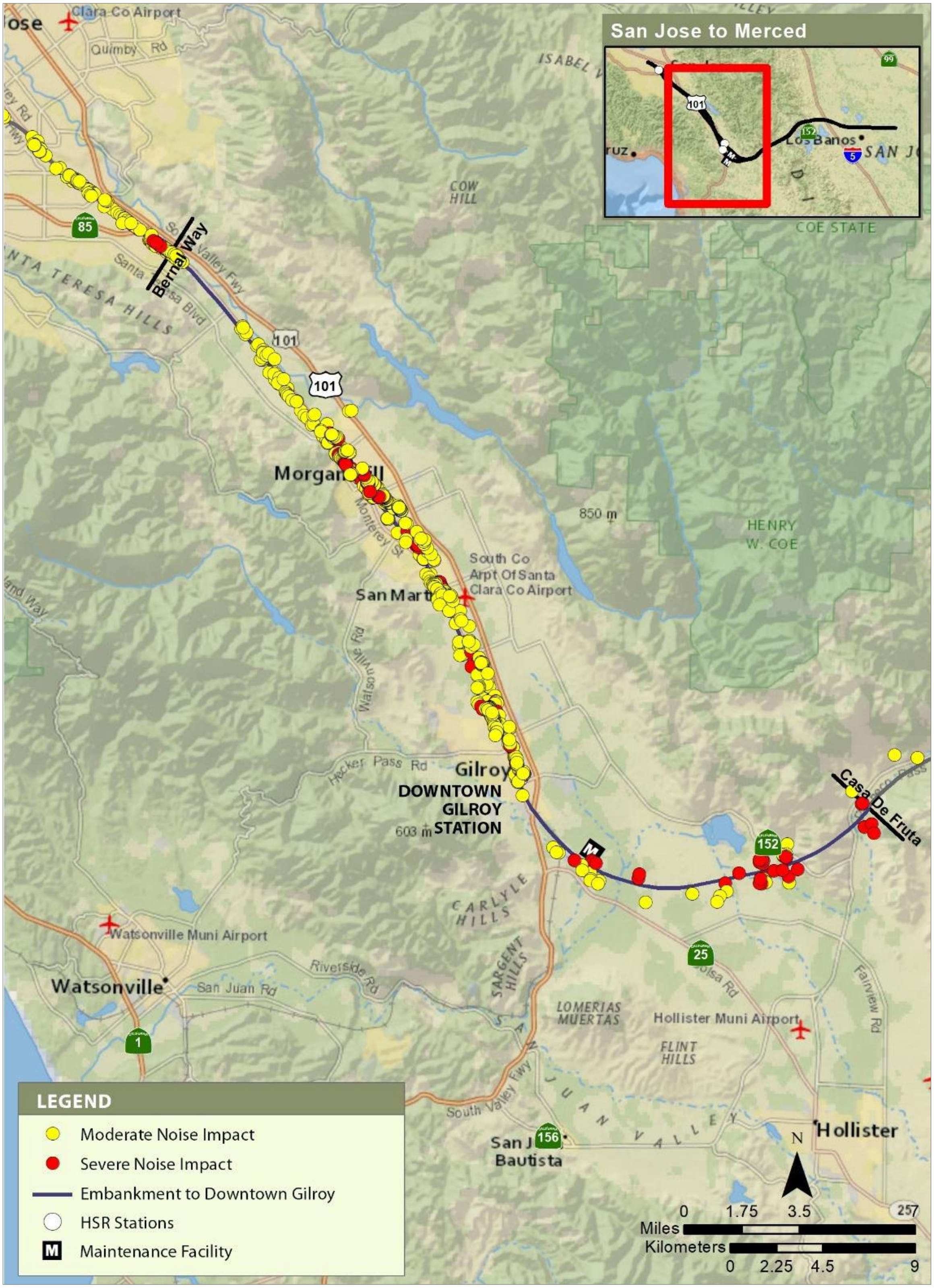

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Figure 5-16 2040 Plus Project Noise Impacts—Alternative 2 without the Tunnel Design Variant

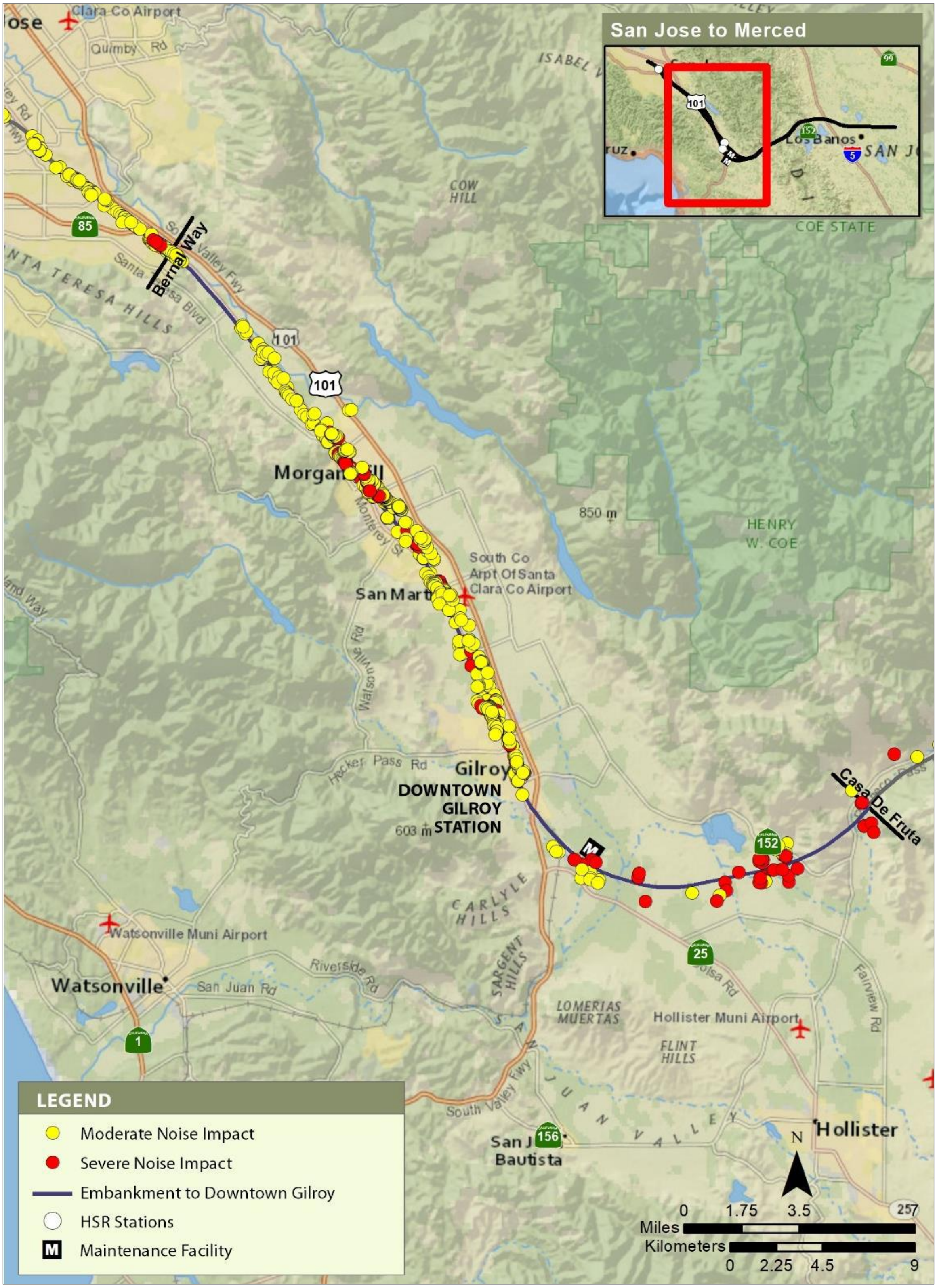

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Figure 5-17 2040 Plus Project Noise Impacts—Alternative 2 with the Tunnel Design Variant

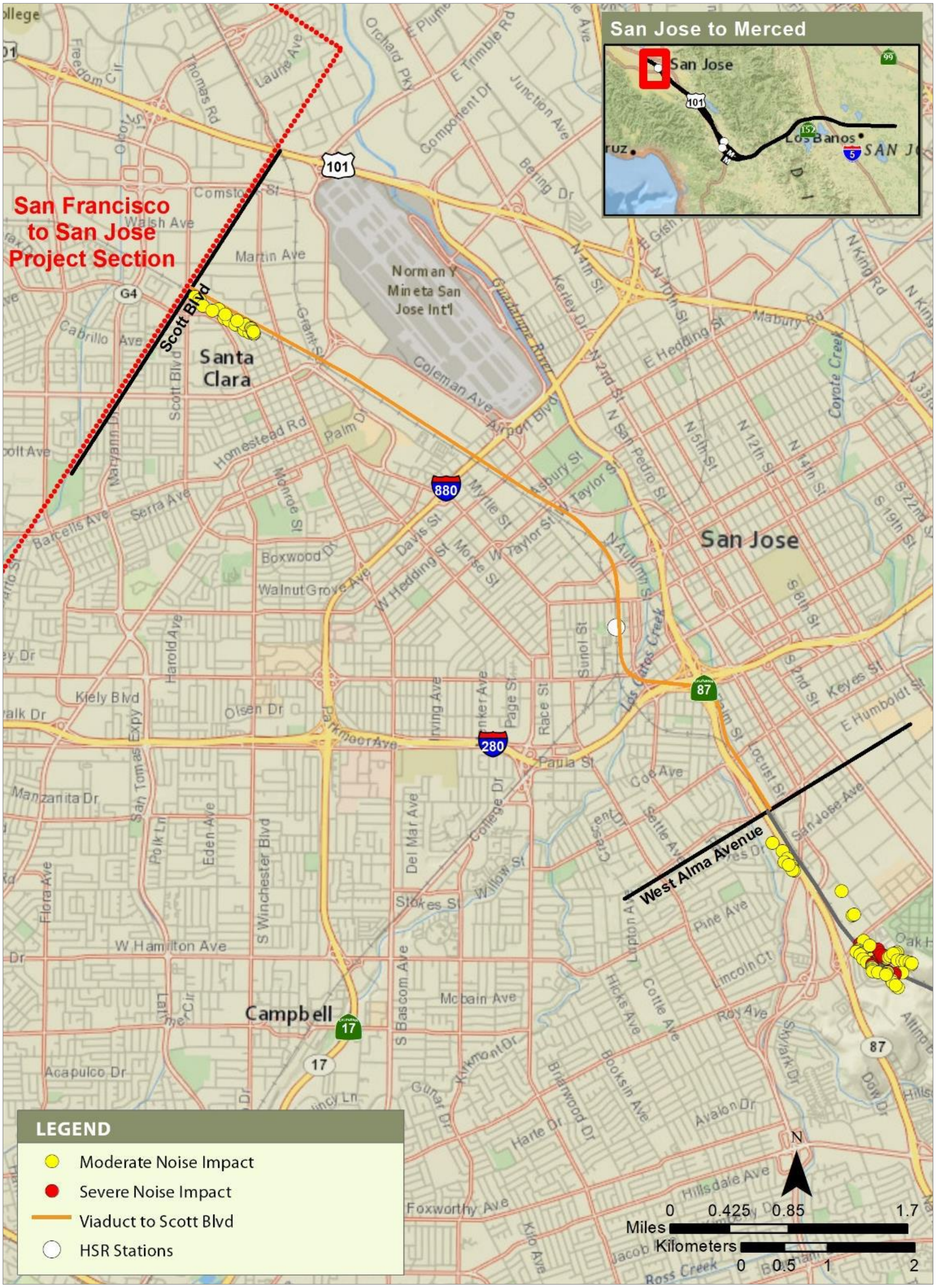

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Figure 5-18 2040 Plus Project Noise Impacts—Alternative 3

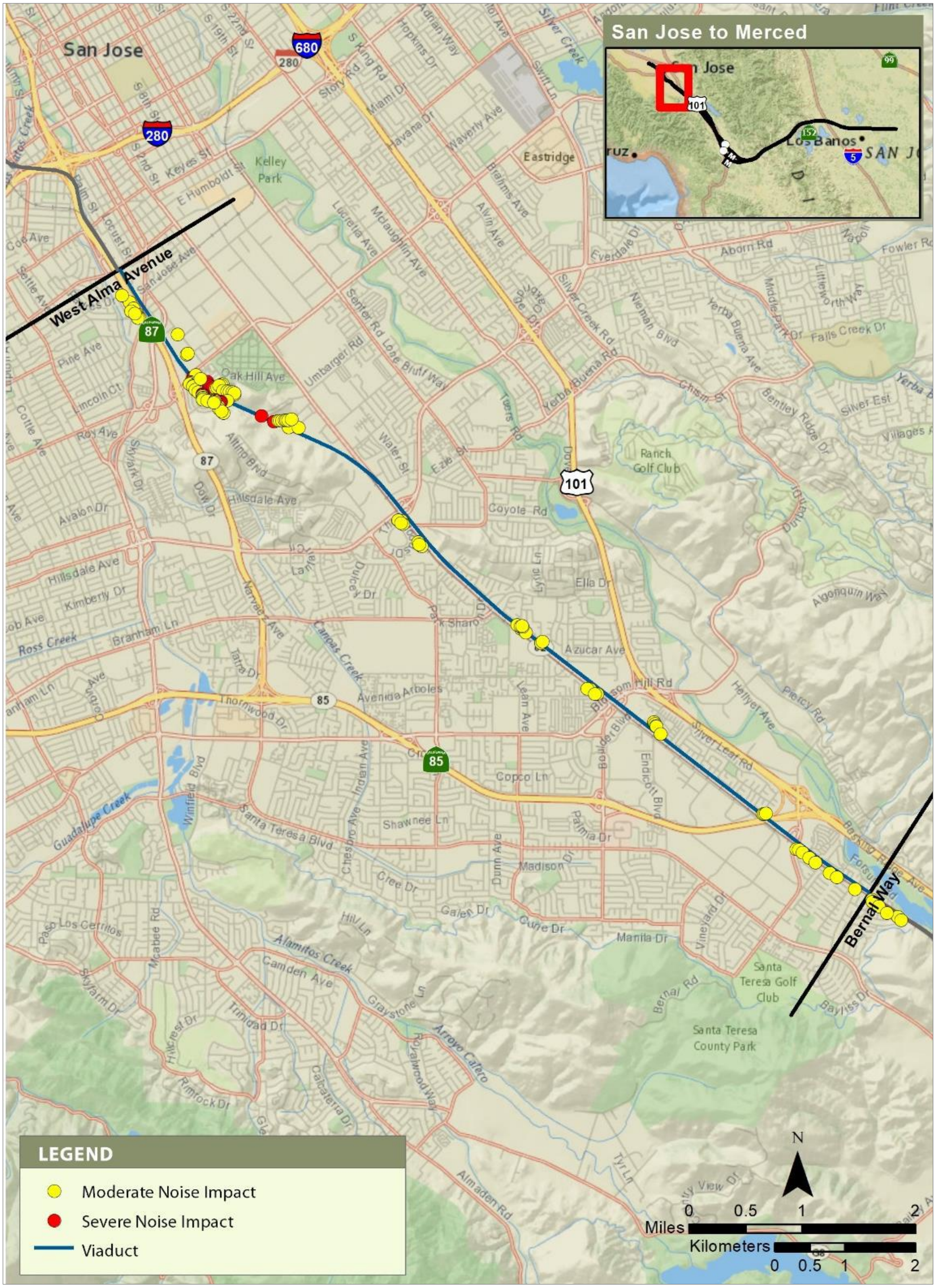

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Figure 5-19 2040 Plus Project Noise Impacts—Alternative 3

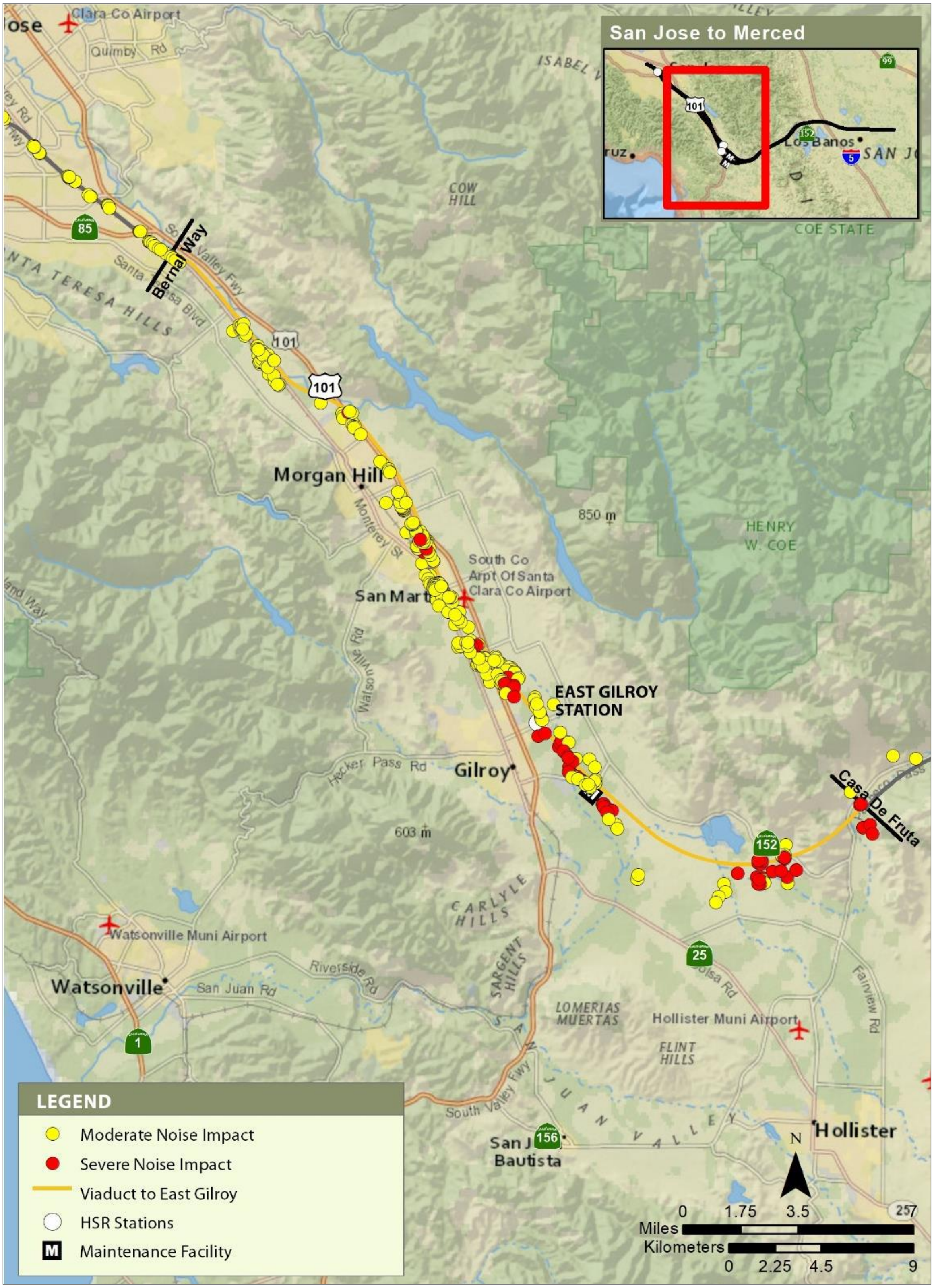

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Figure 5-20 2040 Plus Project Noise Impacts—Alternative 3 without the Tunnel Design Variant

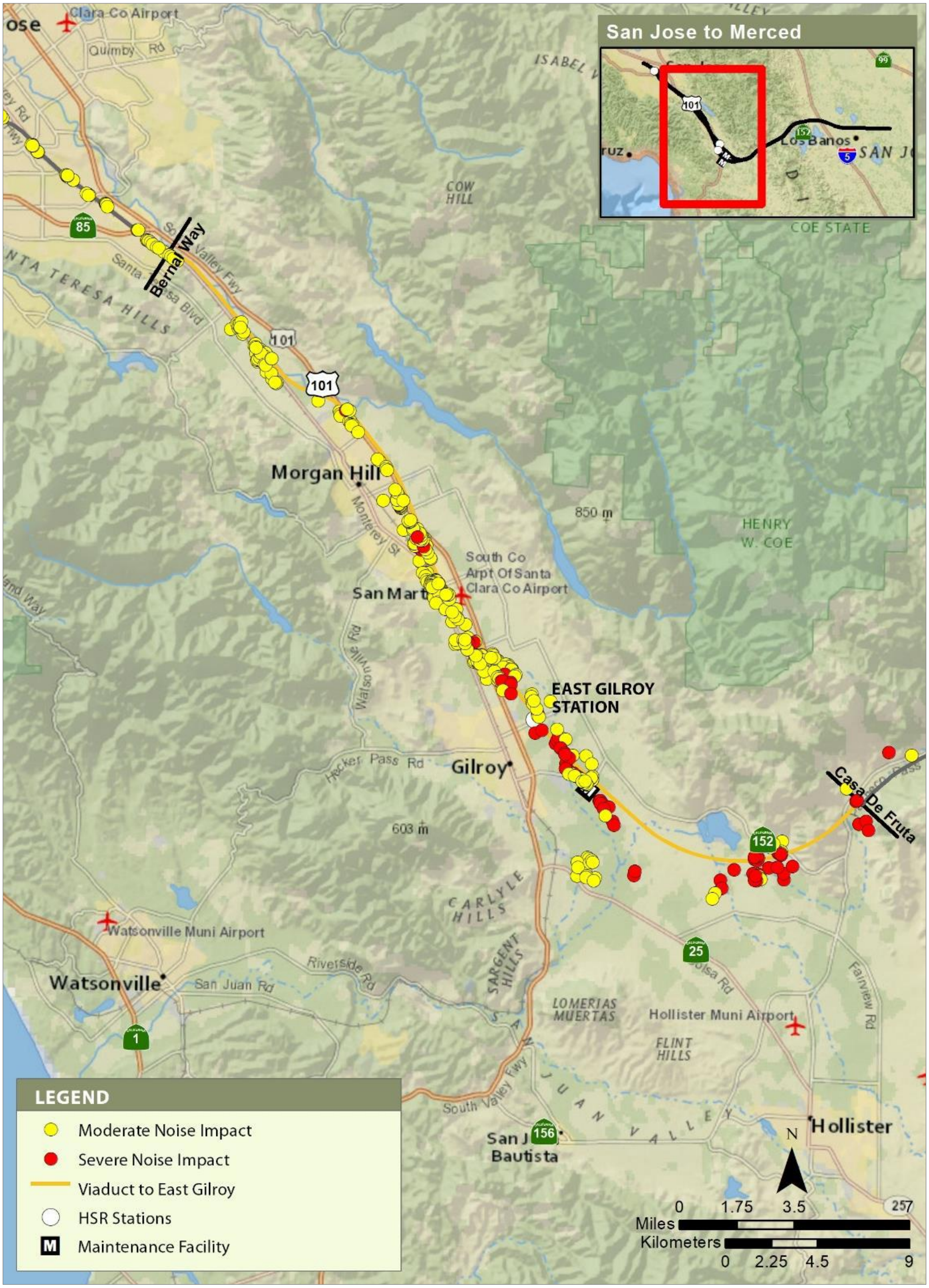

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Figure 5-21 2040 Plus Project Noise Impacts—Alternative 3 with the Tunnel Design Variant

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Figure 5-22 2040 Plus Project Noise Impacts—Alternative 4

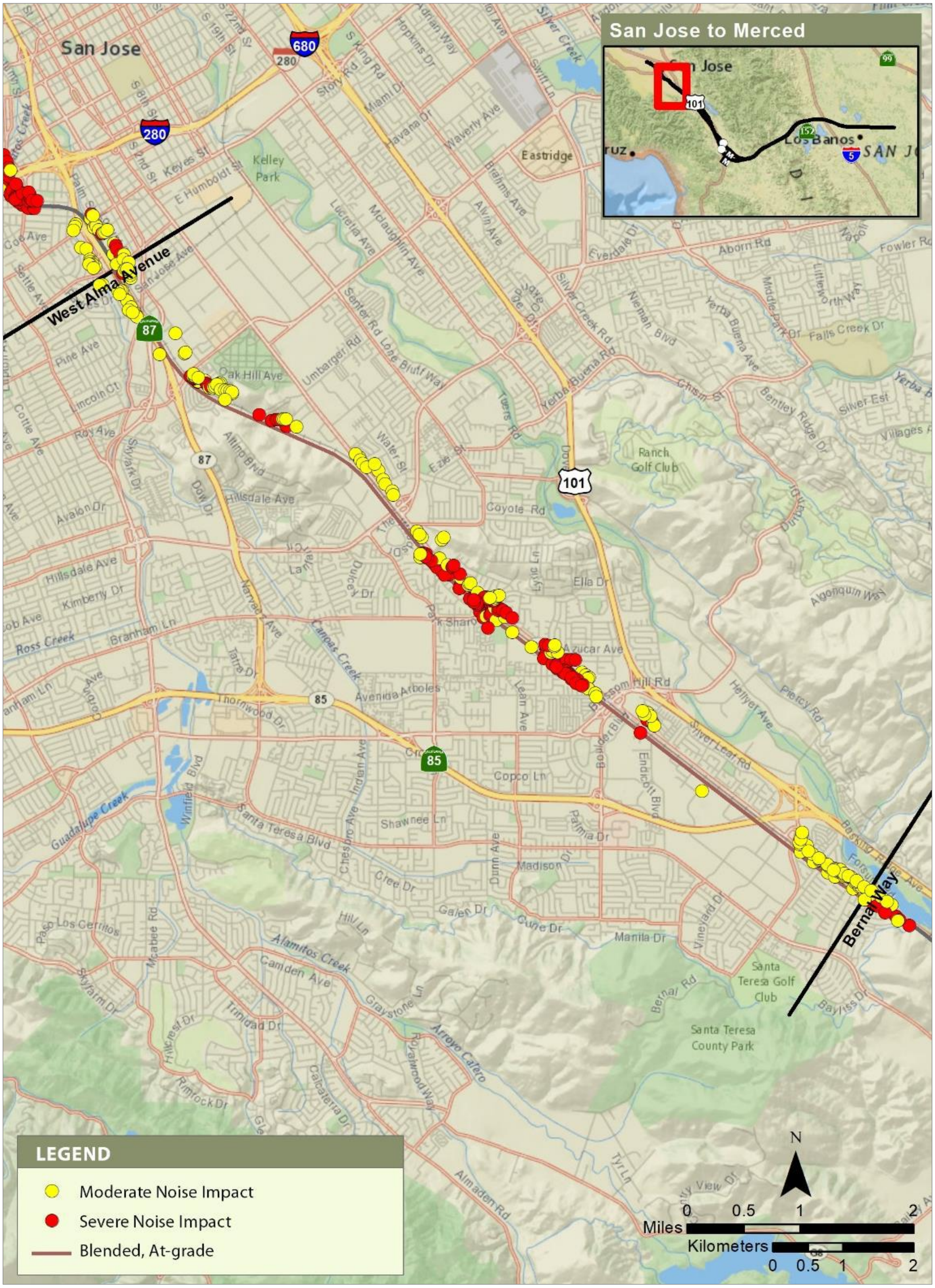

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Figure 5-23 2040 Plus Project Noise Impacts—Alternative 4

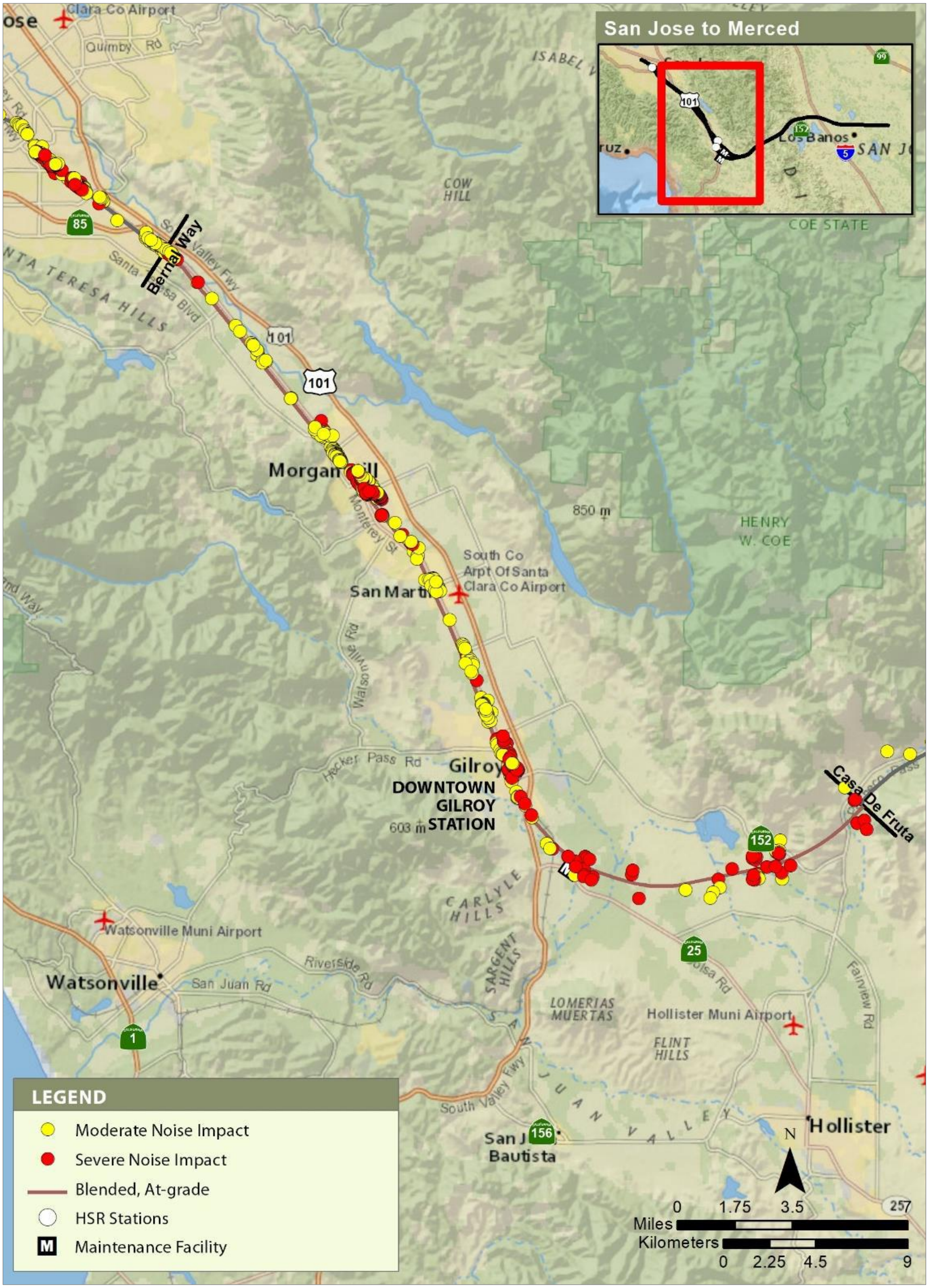

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Figure 5-24 2040 Plus Project Noise Impacts—Alternative 4 without the Tunnel Design Variant

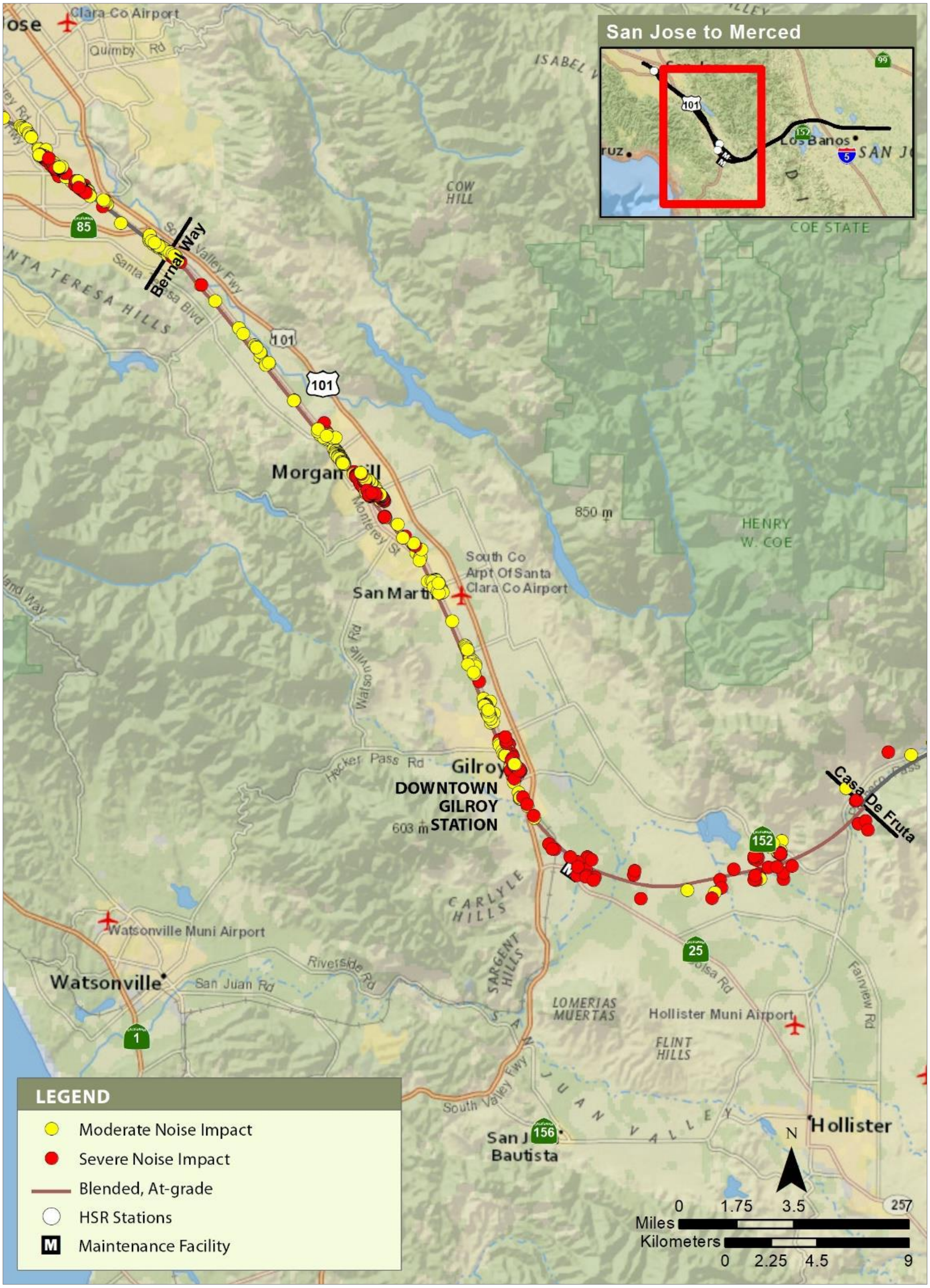

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Figure 5-25 2040 Plus Project Noise Impacts—Alternative 4 with the Tunnel Design Variant

Analysts also conducted a cumulative noise impact assessment for both the 2040 No Project and 2040 Plus Project conditions. The cumulative analysis assumes that the Caltrain PCEP will be implemented and that the increase in other 2040 passenger and freight operations (shown in Table 4-10) would occur. Table 5-9 shows the 2040 No Project and 2040 Plus Project cumulative noise impact assessment results. Under the 2040 No Project cumulative condition there would be 291 severe noise impacts and 1,506 moderate noise impacts caused by increases in other, non-HSR train operations. Under the 2040 Plus Project cumulative condition there would be 879 severe noise impacts and 2,556 moderate impacts under Alternative 1, 1,237 severe impacts and 1,932 moderate impacts under Alternative 2, 647 severe impacts and 2,357 moderate impacts under Alternative 3, and 1,589 severe impacts and 1,933 moderate impacts under Alternative 4. The results of the cumulative noise impact assessment for the 2040 No Project and 2040 Plus Project conditions indicate that there would be substantially more noise impacts in 2040 compared to 2029 because of the increase in other non-HSR train operations. Future 2027 CNEL airport noise contours for San Jose International Airport (2010) have also been used to evaluate the cumulative condition.

Noise impacts associated with the DDV and TDV are shown in parentheses in Table 5-9. Under the 2040 Plus Project cumulative condition with the DDV and TDV, there would be 890 sensitive receptors that would experience severe impacts and 2,550 sensitive receptors that would experience moderate impacts under Alternative 1; 1,249 severe impacts and 1,925 moderate impacts under Alternative 2; 658 severe impacts and 2,361 moderate impacts under Alternative 3; and 1,601 severe impacts and 1,928 moderate impacts under Alternative 4.

Table 5-9 Summary of 2040 No Project and Plus Project Cumulative Noise Impacts

Subsection	Land Use Category[1]	No Project Cumulative		Plus Project Cumulative							
				Alternative 1		Alternative 2		Alternative 3		Alternative 4	
		Mod	Sev	Mod	Sev	Mod	Sev	Mod	Sev	Mod	Sev
San Jose Diridon Station Approach	2	268	13	308	81	363	12	363	12	472 (475)[2]	174
	1, 3	3	0	0	1	0	0	0	0	4	0
Monterey Corridor	2	454	110	540	253	447	159	540	253	339	410
	1, 3	0	0	1	0	1	0	1	0	5	0
Morgan Hill and Gilroy	2	780	168	1,667 (1,663)	432 (440)	1,078 (1,073)	953 (962)	1,415 (1,421)	271 (279)	1,065 (1,059)	891 (900)
	1, 3	1	0	3	1	6	2	1	0	11	3
Pacheco Pass	2	0	0	4	10 (11)	4	10 (11)	4	10 (11)	4	10 (11)
	1, 3	0	0	0	0	0	0	0	0	0	0
San Joaquin Valley	2	0	0	32 (30)	101 (103)	32 (30)	101 (103)	32 (30)	101 (103)	32 (30)	101 (103)
	1, 3	0	0	1	0	1	0	1	0	1	0
Total	**2**	**1,502**	**291**	**2,551 (2,545)**	**877 (888)**	**1,924 (1,917)**	**1,235 (1,247)**	**2,354 (2,358)**	**647 (658)**	**1,912 (1,907)**	**1,586 (1,598)**
	1, 3	**4**	**0**	**5**	**2**	**8**	**2**	**3**	**0**	**21**	**3**

[1] FRA Land Use Categories are summarized in Table 4-3. Land Use Category 1 = areas where quiet is an essential element to the land use; Category 2 = Residential; Category 3 = Institutional use and passive-use parks.
[2] Impacts associated with the design variants are shown in parentheses. The DDV affects Alternative 4 within the San Jose Diridon Station Approach Subsection; the remaining noise impacts are associated with the TDV.
Mod = Moderate
Sev = Severe

Implementation of the project alternatives would change the current practices regarding the sounding of train horns and crossing bells in the noise RSA. Alternatives 1, 2, and 3 would be grade separated and would not regularly sound warning horns between the San Jose and Gilroy HSR stations. However, one existing at-grade railway crossing at Bloomfield Avenue in Gilroy would be eliminated with Alternative 1, eliminating horn noise at that location. Alternative 2 would be predominately located on an embankment in or adjacent to the existing Caltrain/UPRR railway, which would necessitate the elimination of 33 existing at-grade crossings where trains currently sound warning horns. The elimination of at-grade crossings associated with Alternative 2 would produce a beneficial impact because of reduced noise exposure from horns and crossing bells. Existing trains would still sound horns at Caltrain stations with Alternative 2.

Alternative 4 would be located at grade at the same locations as the existing Caltrain and other passenger and freight operations. As a result, HSR trains under Alternative 4 would regularly sound warning horns at all at-grade crossings and Caltrain passenger stations.

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.

Tables 5-10 through 5-13 show a detailed breakdown of the 2040 Plus Project noise impact assessment results for each subsection. The subsections are divided into smaller areas by cross streets or other features. In each location, ranges of distance to the nearest HSR track and maximum HSR speed are shown. The ranges shown represent a composite of many receptors and are meant to provide the upper and lower limits of these values for each geographic location. In locations with noise impacts, the data represent the range for those affected receptors. In locations without noise impacts, the data are representative of the receptor with the largest projected noise level increase (typically the receptor located closest to the alignment).

The detailed impact tables provide ranges of existing noise levels, predicted future noise levels, and predicted increase in noise levels. The range of the impact criteria are also given for moderate and severe impacts in these areas. The numbers of moderate and severe noise impacts in each location are provided. In each area, the specific land uses of the projected noise impacts are included. Most of the noise impacts would occur at single-family residences; several multifamily residential buildings would also be affected. Results with the DDV and TDV are shown in parentheses where they are different than the results without the DDV and TDV.

Table 5-10 Detailed 2040 Plus Project Noise Impacts—Alternative 1

Location	Land Use Category	Distance to Near HSR Track (feet)[1]	Maximum HSR Speed (mph)	Existing Noise Level (dBA)	Future Noise Level[2]		Noise Impact Criteria		Number of Impacts	
					Predicted[3]	Increase[4]	Moderate	Severe	Moderate	Severe
San Jose Diridon Approach Subsection										
Scott Boulevard to Asbury Street	2	53 - 426	81 - 110	56 - 72	60 - 74	1.4 - 4.9	0.9 - 2.8	2.6 - 6.5	93 SF, 23 MF, 1 Hotel	16 SF, 4 MF
	3	111	110	68	72	4.0	3.0	6.3	1 Police Sta.	0
Asbury Street to San Jose Diridon Station	2	906	56	71	70	0.0	1.0	2.7	0	0
	3	503	55	61	70	0.0	4.4	8.7	0	0
San Jose Diridon Station to West Alma Avenue	2	883	95	58	59	0.7	2.4	5.8	0	0
	1, 3	265	95	68	59	0.1	2.9	6.2	0	0
Monterey Corridor Subsection										
West Alma Avenue to Daylight Way	2	44 - 719	95 - 122	52 - 68	56 - 72	1.9 - 11.4	1.2 - 4.2	3.2 - 8.8	131 SF, 35 MF	44 SF, 2 MF
	1, 3	104	110	66	70	3.7	3.3	6.9	1 Park	0
Daylight Way to Blossom Hill Road	2	70 - 318	125 - 130	57 - 64	60 - 66	1.5 - 3.4	1.5 - 2.6	3.8 - 6.2	35 SF, 10 MF	0
	3	1,258	125	60	63	0.6	4.7	9.1	0	0
Blossom Hill Road to Bernal Way	2	127 - 419	130	57 - 58	60 - 61	2.4 - 3.6	2.4 - 2.6	5.7 - 6.2	13 SF, 1 MF	0
	1, 3	663	130	64	61	0.5	3.6	7.4	0	0
Morgan Hill and Gilroy Subsection										
Bernal Way to Metcalf Road	2	124 - 281	125 - 130	57 - 60	61 - 62	2.1 - 3.8	2 - 2.6	5 - 6.2	105 SF	0
	3	-	-	-	-	-	-	-	0	0
Metcalf Road to Palm Avenue	2	52 - 1,175	157 - 175	61 - 79	63 - 79	0.2 - 2.8	0.2 - 1.9	1.5 - 4.7	42 SF, 2 Hotels	0
	3	1,479	125	67	64	0.3	3.2	6.7	0	0
Palm Avenue to Burnett Avenue	2	141 - 1,064	150 - 156	61 - 67	63 - 69	1.5 - 2.6	1.3 - 1.9	3.3 - 4.7	21 SF	0
	3	1,298	150	61	64	0.9	4.3	8.6	0	0

Location	Land Use Category	Distance to Near HSR Track (feet)[1]	Maximum HSR Speed (mph)	Existing Noise Level (dBA)	Future Noise Level[2]		Noise Impact Criteria		Number of Impacts	
					Predicted[3]	Increase[4]	Moderate	Severe	Moderate	Severe
Burnett Avenue to Tennant Avenue	2	41 - 2,931	150	55 - 67	60 - 69	1.4 - 5.9	1.2 - 3.3	3.2 - 7.3	68 SF, 2 MF, 1 Hotel	1 SF
	1, 3	406	150	54	61	4.7	6.9	12.1	0	0
Tennant Avenue to California Avenue	2	83 - 1,798	150	55 - 66	60 - 67	1.6 - 8.8	1.4 - 3.2	3.5 - 7.2	31 SF	4 SF
	3	868	150	60	64	2.3	4.7	9.1	0	0
California Avenue to Highland Avenue	2	140 - 1,311	150 - 220	54 - 71	58 - 73	1.3 - 10.3	1 - 3.5	2.7 - 7.6	67 SF, 9 MF	16 SF
	3	521	150	58	65	2.7	5.4	10.1	0	0
Highland Avenue to Buena Vista	2	109 - 1,766	207 - 220	56 - 78	61 - 79	1 - 10.6	0.2 - 2.9	1.6 - 6.6	18 SF	64 SF
	3	214	220	80	81	0.6	0.4	3.0	1 Place of Worship	0
Buena Vista Avenue to Leavesley Road	2	122 - 1,822	171 - 205	51 - 74	57 - 75	1.2 - 9.3	0.5 - 4.6	2.3 - 9.4	229 SF, 83 MF, 1 Hotel	41 SF, 9 MF
	3	223	190	59	66	7.2	5.0	9.6	1 Place of Worship	0
Leavesley Road to 10th Street	2	65 - 849	150	52 - 72	57 - 73	0.8 - 5.5	0.8 - 4.4	2.5 - 9.1	80 SF, 32 MF	0
	1, 3	110 - 148	150	63 - 75	65 - 76	1 - 1.7	0.4 - 1.6	2.2 - 4.1	2 Performing Arts Centers	0
10th Street to Santa Clara County Line	2	405 - 2,249 (405 - 2,796)[5]	150 - 200 (150 - 220)	55 - 62	59 – 66 (59 - 68)	2.7 - 11.3 (2.7 - 13.1)	1.8 - 3.2	4.5 - 7.1	10 SF, 1 Hotel	5 SF (6 SF)
	3	1,872	200 (220)	58	66 (68)	1.6 (2.3)	5.3	9.9	0	0
Santa Clara County Line to SR 152	2	123 - 3,632	200 (220)	45 - 66	59 – 73 (60 - 75)	1.9 - 22.2 (1.4 - 24.4)	1.3 - 7.8	3.5 - 13.9 (3.4 - 13.9)	13 SF (10 SF)	20 SF (26 SF)
	3	-	-	-	-	-	-	-	0	0

Location	Land Use Category	Distance to Near HSR Track (feet)[1]	Maximum HSR Speed (mph)	Existing Noise Level (dBA)	Future Noise Level[2]		Noise Impact Criteria		Number of Impacts	
					Predicted[3]	Increase[4]	Moderate	Severe	Moderate	Severe
Pacheco Pass Subsection										
Tunnel (2255+00 to 2340+00)[6]	2	-	-	-	-	-	-	-	0	0
	3	-	-	-	-	-	-	-	0	0
Aerial/Embankment (2340+00 to 3325+00)	2	1,038 - 3,530	200 (220)	50 - 68	60 – 70 (62 - 71)	1.4 - 11.7 (2.1 - 13.7)	1.1 - 5	3 - 10	3 SF, 1 Fire Dept. (2 SF, 1 Fire Dept.)	3 SF, 1 Hotel, 1 Campground (4 SF, 1 Hotel, 1 Campground)
	3	-	-	-	-	-	-	-	0	0
Tunnel (3325+00 to 4035+00)[6]	2	-	-	-	-	-	-	-	0	0
	3	-	-	-	-	-	-	-	0	0
Tunnel Portal to I-5	2	360 - 1,929 (360 - 4,979)	200 (220)	50 - 60	62 - 68 (57 - 69)	7 - 17.6 (6.7 - 19.2)	2 - 5	5 - 10	0 (1 SF)	5 SF
	3	6,330	200 (220)	47	68 (69)	8.5 (9.8)	10.8	17.1	0	0
San Joaquin Valley Subsection										
I-5 to San Waste Way	2	283 - 3,232	200 - 220 (220)	47 - 58	60 - 70 (61 - 72)	4.2 - 23 (5.2 - 24.8)	2.3 - 6.6	5.6 - 12.3	3 SF (1 SF)	23 SF (25 SF)
	3	-	-	-	-	-	-	-	0	0
San Waste Way to North Mercey Springs Road	2	114 - 3,485	220	53 - 70	58 - 75	2.9 - 15.3	1.1 - 3.8	2.8 - 8.2	16 SF	52 SF, 1 Campground
	3	1,131	220	67	72	2.2	3.1	6.5	0	0
North Mercey Springs Road to Carlucci Road	2	156 - 3,940	220	53 - 69	57 - 73	3.7 - 13.4	1.1 - 3.8	3 - 8.2	6 SF, 7 MF	4 SF, 20 MF, 1 Campground
	3	779	220	56	64	7.8	5.9	10.8	1 Park	0

Location	Land Use Category	Distance to Near HSR Track (feet)[1]	Maximum HSR Speed (mph)	Existing Noise Level (dBA)	Future Noise Level[2]		Noise Impact Criteria		Number of Impacts	
					Predicted[3]	Increase[4]	Moderate	Severe	Moderate	Severe
TOTAL	**2**								**1,193 (1,188)**	**337 (347)**
	1, 3								**7**	**0**

dBA = A-weighted decibel
MF = multifamily residential
mph = miles per hour
SF = single family residential
SR = State Route
Sta. = Station
[1] The ranges shown for the distances, speeds, and noise levels in this table are a composite of many receptors and are meant to provide the limits of these values for each geographic location. In locations with noise impacts, the data represent the range for those affected receptors. In locations without noise impacts, the data are representative of the receptor with the highest projected noise level increase (typically the receptor located closest to the alignment.)
[2] Noise levels for land use category 2 are based on L_{dn} and measured in dBA. Noise levels for land use categories 1 and 3 are based on L_{eq} and measured in dBA.
[3] Predicted future noise levels represent the total future predicted noise levels with the project alternatives.
[4] Increases in noise level represent the predicted increase in future noise levels with the project alternatives over the existing noise levels.
[5] Results associated with the TDV are shown in parentheses.
[6] Airborne noise was not assessed in this portion of the alignment where the alternative is in a tunnel.

Table 5-11 Detailed 2040 Plus Project Noise Impacts—Alternative 2

Location	Land Use Category	Distance to Near HSR Track (feet)[1]	Maximum HSR Speed (mph)	Existing Noise Level (dBA)	Future Noise Level[2]		Noise Impact Criteria		Number of Impacts	
					Predicted[3]	Increase[4]	Moderate	Severe	Moderate	Severe
San Jose Diridon Approach Subsection										
Scott Boulevard to Asbury Street	2	80 - 304	110	59 - 68	61 - 70	1.3 - 2.9	1.2 - 2.2	3.2 - 5.3	68 SF, 5 MF	0
	3	689	63	64	64	0.0	3.7	7.6	0	0
Asbury Street to San Jose Diridon Station	2	906	56	71	70	0.0	1.0	2.7	0	0
	3	503	55	61	60	0.0	4.4	8.7	0	0
San Jose Diridon Station to West Alma Avenue	2	883	95	58	59	0.6	2.4	5.8	0	0
	1, 3	230	50	73	73	0.0	1.9	5.3	0	0

Location	Land Use Category	Distance to Near HSR Track (feet)[1]	Maximum HSR Speed (mph)	Existing Noise Level (dBA)	Future Noise Level[2]		Noise Impact Criteria		Number of Impacts	
					Predicted[3]	Increase[4]	Moderate	Severe	Moderate	Severe
Monterey Corridor Subsection										
West Alma Avenue to Daylight Way	2	44 - 695	95 - 122	52 - 68	56 - 72	2.1 - 11.3	1.2 - 4.2	3.2 - 8.8	130 SF, 35 MF	44 SF, 2 MF
	1, 3	104	110	66	69	3.5	3.3	6.9	1 Park	0
Daylight Way to Blossom Hill Road	2	116 - 540	125 - 130	57 - 74	60 - 75	0.9 - 5.1	0.6 - 2.6	2.3 - 6.2	27 SF, 46 MF, 1 Hotel	0
	3	265	125	73	73	0.4	1.9	5.3	0	0
Blossom Hill Road to Bernal Way	2	116 - 668	130	57 - 69	60 - 70	1.4 - 3.3	1.1 - 2.6	2.9 - 6.2	79 SF, 8 MF	0
	1, 3	275	130	67	69	1.4	3.1	6.5	0	0
Morgan Hill and Gilroy Subsection										
Bernal Way to Metcalf Road	2	99 - 633	100 - 185	57 - 68	61 - 73	1.9 - 7.6	1.1 - 2.6	3 - 6.2	198 SF, 6 MF	52 SF, 12 MF
	3	-	-	-	-	-	-	-	0	0
Metcalf Road to Palm Avenue	2	120 - 796	168 - 190	62 - 75	65 - 77	1 - 2.5	0.4 - 1.7	2.2 - 4.3	18 SF, 2 Hotel	0
	3	189	100	81	81	0.0	0.3	2.6	0	0
Palm Avenue to Tilton Avenue	2	106 - 1,059	190	60 - 75	63 - 77	1.5 - 4.7	0.4 - 2.1	2.2 - 5.2	36 SF, 1 MF, 1 Hotel	0
	3	722	190	65	66	1.1	3.4	7.1	0	0
Tilton Avenue to Tennant Avenue	2	101 - 5,486	185 - 195	51 - 71	56 - 74	1.6 - 10.2	0.9 - 4.6	2.6 - 9.4	304 SF, 131 MF, 1 Hotel	225 SF, 79 MF
	1, 3	111 - 586	185 - 195	64 - 74	67 -70	1.9 - 3.9	1.4 - 3.3	3.5 - 6.9	1 Historic Bldg., 2 Courthouses, 1 Micro, 1 Amphitheater	0
Tennant Avenue to California Avenue	2	82 - 1,725	185 - 185	55 - 69	60 - 74	1.8 - 11.8	1.1 - 3.2	2.9 - 7.2	26 SF, 101 MF	6 SF, 100 MF
	3	749	185	61	63	2.4	4.5	8.8	0	0
California Avenue to Highland Avenue	2	145 - 1,311	185 - 210	54 - 71	58 - 73	1.6 - 7.1	1 - 3.5	2.7 - 7.6	61 SF, 8 MF	16 SF
	3	145	185	66	70	4.4	3.3	6.9	1 Place of Worship	0

Location	Land Use Category	Distance to Near HSR Track (feet)[1]	Maximum HSR Speed (mph)	Existing Noise Level (dBA)	Future Noise Level[2]		Noise Impact Criteria		Number of Impacts	
					Predicted[3]	Increase[4]	Moderate	Severe	Moderate	Severe
Highland Avenue to Buena Vista	2	109 - 1,569	207 - 220	56 - 78	59 - 79	0.6 - 8.2	0.2 - 2.9	1.6 - 6.6	50 SF	18 SF
	3	214	220	80	80	0.3	0.4	3.0	0	0
Buena Vista Avenue to Leavesley Road	2	122 - 1,822	171 - 201	51 - 74	57 - 75	1 - 8.4	0.5 - 4.6	2.3 - 9.4	245 SF, 88 MF, 1 Hotel	24 SF, 4 MF
	3	223	190	59	67	7.8	5.0	9.6	1 Place of Worship	0
Leavesley Road to 10th Street	2	65 - 874	150	52 - 68	58 - 72	1.5 - 7.2	1.2 - 4.4	3.1 - 9.1	65 SF, 31 MF	31 SF, 5 MF
	1, 3	110	150	63	67	3.9	1.6	4.1	1 Performing Arts Center	0
10th Street to Santa Clara County Line	2	335 - 2,249 (335 - 2,796)[5]	150 - 200 (150 - 220)	55 - 67	59 - 69	1.4 - 11.4 (1.4 - 13.4)	1.2 - 3.2	3.2 - 7.1	12 SF (11 SF)	6 SF (8 SF)
	3	1,872	200 (220)	58	60	1.6 (2.3)	5.3	9.9	0	0
Santa Clara County Line to SR 152	2	123 - 3,632	200 (220)	45 - 66	59 - 73 (60 - 75)	1.9 - 22.2 (1.4 - 24.4)	1.3 - 7.8	3.5 - 13.9 (3.4 - 13.9)	13 SF (10 SF)	20 SF (26 SF)
	3	-	-	-	-	-	-	-	0	0

Location	Land Use Category	Distance to Near HSR Track (feet)[1]	Maximum HSR Speed (mph)	Existing Noise Level (dBA)	Future Noise Level[2]		Noise Impact Criteria		Number of Impacts	
					Predicted[3]	Increase[4]	Moderate	Severe	Moderate	Severe
Pacheco Pass Subsection										
Tunnel (2255+00 to 2340+00)[6]	2	-	-	-	-	-	-	-	0	0
	3	-	-	-	-	-	-	-	0	0
Aerial/Embankment (2340+00 to 3325+00)	2	1,038 - 3,530	200 (220)	50 - 68	60 - 70 (62 - 71)	1.4 - 11.7 (2.1 - 13.7)	1.1 - 5	3 - 10	3 SF, 1 Fire Dept. (2 SF, 1 Fire Dept.)	3 SF, 1 Hotel, 1 Campground (4 SF, 1 Hotel, 1 Campground)
	3	-	-	-	-	-	-	-	0	0
Tunnel (3325+00 to 4035+00)[6]	2	-	-	-	-	-	-	-	0	0
	3	-	-	-	-	-	-	-	0	0
Tunnel Portal to I-5	2	360 - 1,929	200 (220)	50 - 60	62 - 68 (57 - 69)	7 - 17.6 (6.7 - 19.2)	2 - 5	5 - 10	0 (1 SF)	5 SF
	3	6,330	200 (220)	47	55 (57)	8.5 (9.8)	10.8	17.1	0	0
San Joaquin Valley Subsection										
I-5 to San Waste Way	2	283 - 3,232	200 - 220 (220)	47 - 58	60 - 70 (61 - 72)	4.2 - 23 (5.2 - 24.8)	2.3 - 6.6	5.6 - 12.3	3 SF (1 SF)	23 SF (25 SF)
	3	-	-	-	-	-	-	-	0	0
San Waste Way to North Mercey Springs Road	2	114 - 3,485	220	53 - 70	58 - 75	2.9 - 15.3	1.1 - 3.8	2.8 - 8.2	16 SF	52 SF, 1 Campground
	3	1,131	220	67	69	2.2	3.1	6.5	0	0
North Mercey Springs Road to Carlucci Road	2	156 - 3,940	220	53 - 69	57 - 73	3.7 - 13.4	1.1 - 3.8	3 - 8.2	6 SF, 7 MF	4 SF, 20 MF, 1 Campground
	3	779	220	56	64	7.8	5.9	10.8	1 Park	0

Location	Land Use Category	Distance to Near HSR Track (feet)[1]	Maximum HSR Speed (mph)	Existing Noise Level (dBA)	Future Noise Level[2]		Noise Impact Criteria		Number of Impacts	
					Predicted[3]	Increase[4]	Moderate	Severe	Moderate	Severe
Total	**2**								**1,834 (1,828)**	**755 (766)**
	1, 3								**10**	**0**

dBA = A-weighted decibel
MF = multifamily residential
Micro = microelectronics facility
mph = miles per hour
SF = single family residential
SR = State Route
[1] The ranges shown for the distances, speeds, and noise levels in this table are a composite of many receptors and are meant to provide the limits of these values for each geographic location. In locations with noise impacts, the data represent the range for those affected receptors. In locations without noise impacts, the data are representative of the receptor with the highest projected noise level increase (typically the receptor located closest to the alignment.)
[2] Noise levels for land use category 2 are based on L_{dn} and measured in dBA. Noise levels for land use categories 1 and 3 are based on L_{eq} and measured in dBA.
[3] Predicted future noise levels represent the total future predicted noise levels with the project alternatives.
[4] Increases in noise level represent the predicted increase in future noise levels with the project alternatives over the existing noise levels.
[5] Results associated with the TDV are shown in parentheses.
[6] Airborne noise was not assessed in this portion of the alignment where the alternative is in a tunnel.

Table 5-12 Detailed 2040 Plus Project Noise Impacts—Alternative 3

Location	Land Use Category	Distance to Near HSR Track (feet)[1]	Maximum HSR Speed (mph)	Existing Noise Level (dBA)	Future Noise Level[2]		Noise Impact Criteria		Number of Impacts	
					Predicted[3]	Increase[4]	Moderate	Severe	Moderate	Severe
San Jose Diridon Approach Subsection										
Scott Boulevard to Asbury Street	2	80 - 304	110	59 - 68	61 - 70	1.3 - 2.9	1.2 - 2.2	3.2 - 5.3	68 SF, 5 MF	0
	3	689	63	64	64	0.0	3.7	7.6	0	0
Asbury Street to San Jose Diridon Station	2	906	56	71	70	0.0	1.0	2.7	0	0
	3	503	55	61	60	0.0	4.4	8.7	0	0
San Jose Diridon Station to West Alma Avenue	2	883	95	58	59	0.7	2.4	5.8	0	0
	1, 3	265	95	68	69	0.1	2.9	6.2	0	0

Location	Land Use Category	Distance to Near HSR Track (feet)[1]	Maximum HSR Speed (mph)	Existing Noise Level (dBA)	Future Noise Level[2]		Noise Impact Criteria		Number of Impacts	
					Predicted[3]	Increase[4]	Moderate	Severe	Moderate	Severe
Monterey Corridor Subsection										
West Alma Avenue to Daylight Way	2	44 - 719	95 - 122	52 - 68	56 - 72	1.9 - 11.4	1.2 - 4.2	3.2 - 8.8	131 SF, 35 MF	44 SF, 2 MF
	1, 3	104	110	66	70	3.7	3.3	6.9	1 Park	0
Daylight Way to Blossom Hill Road	2	70 - 318	125 - 130	57 - 64	60 - 66	1.5 - 3.4	1.5 - 2.6	3.8 - 6.2	35 SF, 10 MF	0
	3	1,258	125	60	60	0.6	4.7	9.1	0	0
Blossom Hill Road to Bernal Way	2	127 - 419	130	57 - 58	60 - 61	2.4 - 3.6	2.4 - 2.6	5.7 - 6.2	13 SF, 1 MF	0
	3	663	130	64	65	0.5	3.6	7.4	0	0
Morgan Hill and Gilroy Subsection										
Bernal Way to Metcalf Road	2	124 - 281	125 - 130	57 - 60	61 - 62	2.1 - 3.8	2 - 2.6	5 - 6.2	105 SF	0
	3	-	-	-	-	-	-	-	0	0
Metcalf Road to Palm Avenue	2	52 - 1,175	157 - 175	61 - 79	63 - 79	0.2 - 2.8	0.2 - 1.9	1.5 - 4.7	43 SF, 2 Hotels	0
	3	1,479	125	67	67	0.3	3.2	6.7	0	0
Palm Avenue to Burnett Avenue	2	141 - 1,064	150 - 156	61 - 67	63 - 69	1.5 - 2.6	1.3 - 1.9	3.3 - 4.7	22 SF	0
	3	1,298	150	61	62	0.9	4.3	8.6	0	0
Burnett Avenue to Tennant Avenue	2	41 - 2,931	150	55 - 69	60 - 70	1.1 - 5.9	1.1 - 3.3	2.9 - 7.3	70 SF, 2 MF, 1 Hotel	1 SF
	1, 3	406	150	54	59	4.7	6.9	12.1	0	0
Tennant Avenue to California Avenue	2	83 - 1,798	150	55 - 66	60 - 67	1.6 - 8.8	1.4 - 3.2	3.5 - 7.2	31 SF	6 SF
	3	868	150	60	62	2.3	4.7	9.1	0	0
California Avenue to Highland Avenue	2	140 - 1,311	150 - 179	54 - 71	58 - 72	1.2 - 6.2	1 - 3.5	2.7 - 7.6	83 SF, 9 MF	0
	3	521	150	58	60	2.7	5.4	10.1	0	0
Highland Avenue to Buena Vista	2	119 - 2,136	180 - 187	56 - 78	59 - 79	0.3 - 11.3	0.2 - 2.9	1.6 - 6.6	79 SF	8 SF
	3	489	185	68	69	0.9	3.0	6.4	0	0
	2	311 - 4,040	188 - 213	56 - 67	59 - 69	1.4 - 7.3	1.2 - 2.9	3.2 - 6.6	15 SF	6 SF

Location	Land Use Category	Distance to Near HSR Track (feet)[1]	Maximum HSR Speed (mph)	Existing Noise Level (dBA)	Future Noise Level[2]		Noise Impact Criteria		Number of Impacts	
					Predicted[3]	Increase[4]	Moderate	Severe	Moderate	Severe
Buena Vista Avenue to Leavesley Road	1, 3	1,145	198	67	67	0.7	3.2	6.7	0	0
Leavesley Road to Bloomfield Avenue	2	158 - 2,868	204 - 220 (219 - 220)	58 - 74 (55 - 74)[5]	61 - 75 (58 - 76)	1.1 - 13.7 (1.0 - 13.7)	0.5 - 2.4 (0.5 - 3.2)	2.3 - 5.8 (2.3 - 7.1)	22 SF (34 SF)	26 SF (28 SF)
	1, 3	332	216 (220)	73	74	1.4 (1.5)	1.8	5.3	0	0
Bloomfield Avenue to SR 152	2	487 - 6,650	200 (220)	45 - 66	58 - 68 (59 - 69)	2 - 12.8 (1.5 - 14.6)	1.3 - 7.8	3.5 - 13.9 (3.4 - 13.9)	14 SF (15 SF)	18 SF (24 SF)
	3	-	-	-	-	-	-	-	0	0
Pacheco Pass Subsection										
Tunnel (2255+00 to 2340+00)[6]	2	-	-	-	-	-	-	-	0	0
	3	-	-	-	-	-	-	-	0	0
Aerial/Embankment (2340+00 to 3325+00)	2	1,038 - 3,530	200 (220)	50 - 68	60 - 70 (62 - 71)	1.4 - 11.7 (2.1 - 13.7)	1.1 - 5	3 - 10	3 SF, 1 Fire Dept. (2 SF, 1 Fire Dept.)	3 SF, 1 Hotel, 1 Campground (4 SF, 1 Hotel, 1 Campground)
	3	-	-	-	-	-	-	-	0	0
Tunnel (3325+00 to 4035+00)[6]	2	-	-	-	-	-	-	-	0	0
	3	-	-	-	-	-	-	-	0	0
Tunnel Portal to I-5	2	360 - 1,929 (360 - 4,979)	200 (220)	50 - 60	62 - 68 (57 - 69)	7 - 17.6 (6.7 - 19.2)	2 - 5	5 - 10	0 (1 SF)	5 SF
	3	6,330	200 (220)	47	55 (57)	8.5 (9.8)	10.8	17.1	0	0

Location	Land Use Category	Distance to Near HSR Track (feet)[1]	Maximum HSR Speed (mph)	Existing Noise Level (dBA)	Future Noise Level[2]		Noise Impact Criteria		Number of Impacts	
					Predicted[3]	Increase[4]	Moderate	Severe	Moderate	Severe
San Joaquin Valley Subsection										
I-5 to San Waste Way	2	283 – 3,232	200 - 220 (220)	47 - 58	60 - 70 (61 - 72)	4.2 - 23 (5.2 - 24.8)	2.3 - 6.6	5.6 - 12.3	3 SF (1 SF)	23 SF (25 SF)
	3	-	-	-	-	-	-	-	0	0
San Waste Way to North Mercey Springs Road	2	114 - 3,485	220	53 - 70	58 - 75	2.9 - 15.3	1.1 - 3.8	2.8 - 8.2	16 SF	52 SF, 1 Campground
	3	1,131	220	67	69	2.2	3.1	6.5	0	0
North Mercey Springs Road to Carlucci Road	2	156 - 3,940	220	53 - 69	57 - 73	3.7 - 13.4	1.1 - 3.8	3 - 8.2	6 SF, 7 MF	4 SF, 20 MF, 1 Campground
	3	779	220	56	64	7.8	5.9	10.8	1 Park	0
Total	**2**								**832 (843)**	**222 (233)**
	1, 3								**2**	**0**

dBA = A-weighted decibel
MF = multifamily residential
mph = miles per hour
SF = single family residential
[1] The ranges shown for the distances, speeds, and noise levels in this table are a composite of many receptors and are meant to provide the limits of these values for each geographic location. In locations with noise impacts, the data represent the range for those affected receptors. In locations without noise impacts, the data are representative of the receptor with the highest projected noise level increase (typically the receptor located closest to the alignment.)
[2] Noise levels for land use category 2 are based on L_{dn} and measured in dBA. Noise levels for land use categories 1 and 3 are based on L_{eq} and measured in dBA.
[3] Predicted future noise levels represent the total future predicted noise levels with the project alternatives.
[4] Increases in noise level represent the predicted increase in future noise levels with the project alternatives over the existing noise levels.
[5] Results associated with the TDV are shown in parentheses.
[6] Airborne noise was not assessed in this portion of the alignment where the alternative is in a tunnel.

Table 5-13 Detailed 2040 Plus Project Noise Impacts—Alternative 4

Location	Land Use Category	Distance to Near HSR Track (feet)[1]	Maximum HSR Speed (mph)	Existing Noise Level (dBA)	Future Noise Level[2]		Noise Impact Criteria		Number of Impacts	
					Predicted[3]	Increase[4]	Moderate	Severe	Moderate	Severe
San Jose Diridon Approach Subsection										
Scott Boulevard to Asbury Street	2	53 - 420	41 - 79	61 - 77	65 - 78	0.7 - 5.0	0.3 - 1.9	2 - 4.7	7 SF, 7 MF	4 MF, 1 Hotel
	3	111	79	72	73	1.8	2.3	5.5	0	0
Asbury Street to San Jose Diridon Station	2	174 - 612	15 - 40	58 - 71	61 - 72	1.1 - 2.9	1 - 2.4	2.6 - 5.8	3 SF, 6 MF	0
	3	488	17	61	61	0.5	4.4	8.7	0	0
San Jose Diridon Station to West Alma Avenue	2	25 - 973	18 - 90	56 - 76	60 - 82	1.6 - 10 (1.6 - 10.2)[5]	0.3 - 2.9	2.1 - 6.6	180 SF, 15 MF	98 SF, 33 MF
	1, 3	165 - 481	20 - 83	64 - 68	66 - 72	1.8 - 4.0 (1.9 - 3.9)	1.5 - 3.0	3.9 – 6.4	1 Park, 1 School, 1 Performing Arts Center	0
Monterey Corridor Subsection										
West Alma Avenue to Daylight Way	2	70 - 1,065	90 - 110	52 - 70	57 - 75	0.5 - 9	1 - 4.0	2.8 - 8.6	83 SF, 31 MF	27 SF, 27 MF
	1, 3	90	110	66	69	3.4 (3.5)	3.3	6.9	1 Park	0
Daylight Way to Blossom Hill Road	2	28 - 989	110	57 - 76	61 - 77	0.5 - 10	0.3 - 2.6	2.1 - 6.2	76 SF, 54 MF, 1 Fire Dept., 4 Hotels	199 SF, 36 MF
	3	149 - 220	110	67 - 74	71 - 76	1.7 - 3.9	1.3 - 3	5.0 - 6.4	1 Library, 1 Park	0
Blossom Hill Road to Bernal Way	2	177 - 732	110	57 - 69	60 - 73	2.7 - 5.1	1.1 - 2.6	2.9 - 6.2	12 SF, 3 MF	4 MF
	1, 3	522	110	64	68	3.4	3.6	7.4	0	0
Morgan Hill and Gilroy Subsection										
Bernal Way to Metcalf Road	2	35 - 706	110	57 - 68	60 - 71	1.5 - 10.8	1.1 - 2.6	3 - 6.2	165 SF, 18 MF	49 SF
	3	-	-	-	-	-	-	-	0	0
Metcalf Road to Palm Avenue	2	68 - 302	110	67 - 79	68 - 79	0.3 - 3.6	0.2 - 1.3	1.5 - 3.3	11 SF, 1 Hotel	2 SF
	3	210	110	76	76	0.1	1.0	4.8	0	0

Location	Land Use Category	Distance to Near HSR Track (feet)[1]	Maximum HSR Speed (mph)	Existing Noise Level (dBA)	Future Noise Level[2]		Noise Impact Criteria		Number of Impacts	
					Predicted[3]	Increase[4]	Moderate	Severe	Moderate	Severe
Palm Avenue to Tilton Avenue	2	108 - 1,143	110	60 - 78	67 - 78	0.4 - 6.9	0.2 - 2.1	1.9 - 5.2	9 SF	1 SF, 1 MF
	3	639	110	63	66	2.7	3.9	7.8	0	0
Tilton Avenue to Tennant Avenue	2	20 - 1,119	110	51 - 75	56 - 80	0.5 - 10.9	0.4 - 4.6	2.2 - 9.4	223 SF, 67 MF, 2 Hotels	158 SF, 107 MF
	1, 3	289 - 508	110	66 - 71	69 - 74	3.2 - 3.4	1.4 - 3.1	3.5 - 6.5	1 Historic Bldg., 2 Places of Worship, 1 Amphitheater	0
Tennant Avenue to California Avenue	2	25 - 713	110	56 - 73	61 - 80	1.2 - 7.7	0.7 - 2.9	2.4 - 6.6	11 SF, 100 MF	17 SF, 100 MF
	3	1,721	110	60	60	0.3	4.7	9.1	0	0
California Avenue to Highland Avenue	2	152 - 1,006	110	54 - 72	58 - 73	1 - 5.7	0.8 - 3.5	2.5 - 7.6	49 SF, 3 MF	0
	3	227	110	66	68	2.3	3.3	6.9	0	0
Highland Avenue to Buena Vista	2	80 - 592	110	60 - 78	63 - 79	0.4 - 4.3	0.2 - 2.1	1.6 - 5.2	16 SF	3 SF
	3	138	110	80	80	0.1	0.4	3.0	0	0
Buena Vista Avenue to Leavesley Road	2	134 - 606	110	53 - 74	57 - 76	1.1 - 5.5	0.5 - 3.8	2.3 - 8.2	210 SF, 6 MF, 1 Hotel	1 SF
	3	364	110	59	62	2.7	5.0	9.6	0	0
Leavesley Road to 10th Street	2	71 - 925	110 - 117	51 - 75	61 - 78	0.8 - 10.8	0.4 - 4.6	2.2 - 9.4	60 SF, 9 MF, 2 Hotels	104 SF, 89 MF
	1, 3	61 - 674	110 - 113	58 - 74	64 - 78	3.5 - 6.0	0.5 - 5.2	2.3 - 9.8	2 Schools, 1 Banquet Hall, 1 Performing Arts Center	1 Performing Arts Center
10th Street to Santa Clara County Line	2	176 - 2,630	118 - 200 (217 - 220)	55 - 70	61 - 74 (62 - 74)	1.1 - 14.7 (1.1 - 15.6)	1 - 3.2	2.7 - 7.1	156 SF, 1 MF, 1 Hotel (153 SF, 1 MF, 1 Hotel)	16 SF, 2 Hotels (19 SF, 2 Hotels)
	3	1,584	200 (220)	58	61 (62)	3.0 (3.8)	5.3	9.9	0	0

Location	Land Use Category	Distance to Near HSR Track (feet)[1]	Maximum HSR Speed (mph)	Existing Noise Level (dBA)	Future Noise Level[2]		Noise Impact Criteria		Number of Impacts	
					Predicted[3]	Increase[4]	Moderate	Severe	Moderate	Severe
Santa Clara County Line to SR 152	2	205 - 3,632	200 (220)	45 - 66	59 - 71 (60 - 73)	1.9 - 22.2 (1.4 - 24.4)	1.3 - 7.8	3.5 - 13.9 (3.4 - 13.9)	12 SF (9 SF)	21 SF (27 SF)
	3	-	-	-	-	-	-	-	0	0
Pacheco Pass Subsection										
Tunnel (2255+00 to 2340+00)[6]	2	-	-	-	-	-	-	-	0	0
	3	-	-	-	-	-	-	-	0	0
Aerial/Embankment (2340+00 to 3325+00)	2	1,038 - 3,530	200 (220)	50 - 68	60 – 70 (62 - 71)	1.4 - 11.7 (2.1 - 13.7)	1.1 - 5	3 - 10	3 SF, 1 Fire Dept. (2 SF, 1 Fire Dept.)	3 SF, 1 Hotel, 1 Campground (4 SF, 1 Hotel, 1 Campground)
	3	-	-	-	-	-	-	-	0	0
Tunnel (3325+00 to 4035+00)[6]	2	-	-	-	-	-	-	-	0	0
	3	-	-	-	-	-	-	-	0	0
Tunnel Portal to I-5	2	360 - 1,929 (360 - 4,979)	200 (220)	50 - 60	62 - 68 (57 - 69)	7 - 17.6 (6.7 - 19.2)	2 - 5	5 - 10	0 (1 SF)	5 SF
	3	6,330	200 (220)	47	55 (57)	8.5 (9.8)	10.8	17.1	0	0
I-5 to San Waste Way	2	283 - 3,232	200 - 220 (220)	47 - 58	60 - 70 (61 - 72)	4.2 - 23 (5.2 - 24.8)	2.3 - 6.6	5.6 - 12.3	3 SF (1 SF)	23 SF (25 SF)
	3	-	-	-	-	-	-	-	0	0
San Waste Way to North Mercey Springs Road	2	114 - 3,485	220	53 - 70	58 - 75	2.9 - 15.3	1.1 - 3.8	2.8 - 8.2	16 SF	52 SF, 1 Campground
	3	1,131	220	67	68	1.2	3.1	6.5	0	0

Location	Land Use Category	Distance to Near HSR Track (feet)[1]	Maximum HSR Speed (mph)	Existing Noise Level (dBA)	Future Noise Level[2]		Noise Impact Criteria		Number of Impacts	
					Predicted[3]	Increase[4]	Moderate	Severe	Moderate	Severe
North Mercey Springs Road to Carlucci Road	2	156 - 3,940	220	53 - 69	57 - 73	4.1 - 13.4	1.1 - 3.8	3 - 8.2	6 SF, 7 MF	4 SF, 20 MF, 1 Campground
	3	779	220	56	64	7.5	5.9	10.8	1 Park	0
Total	**2**								**1,651 (1,643)**	**1,211 (1,223)**
	1, 3								**15**	**1**

Bldg. = building
dBA = A-weighted decibel
MF = multifamily residential
mph = miles per hour
SF = single family residential
SR = State Route
[1] The ranges shown for the distances, speeds, and noise levels in this table are a composite of many receptors and are meant to provide the limits of these values for each geographic location. In locations with noise impacts, the data represent the range for those affected receptors. In locations without noise impacts, the data are representative of the receptor with the highest projected noise level increase (typically the receptor located closest to the alignment.)
[2] Noise levels for land use category 2 are based on L_{dn} and measured in dBA. Noise levels for land use categories 1 and 3 are based on L_{eq} and measured in dBA.
[3] Predicted future noise levels represent the total future predicted noise levels with the project alternatives.
[4] Increases in noise level represent the predicted increase in future noise levels with the project alternatives over the existing noise levels.
[5] Results associated with the DDV and TDV are shown in parentheses.
[6] Airborne noise was not assessed in this portion of the alignment where the alternative is in a tunnel.

Annoyance from Onset of HSR Passbys

Operations of the project would result in a sudden increase in noise for receivers along the alignment because of the rapid approach of an HSR train and a quick onset rate. Onset rate is the average rate of change of increasing sound pressure level measured in decibels per second (dB/sec) during a single noise event. The rapid approach of an HSR train is accompanied by a sudden increase in noise for a receiver near the tracks. As described in Section 4.1.3.2, Operations, startle effects are likely to occur in humans as onset rates approach 30 dB/sec when there is no advance warning of train approach.

Trains for all project alternatives would reach maximum speeds of 220 mph in certain portions of the alignments with dedicated track. As illustrated on Figure 4-5, the onset rate of 30 dB/second would be experienced by receptors within 46 feet of the train when the train is operating at 220 mph and within 23 feet when the train is operating at 110 mph. For speeds between 110 mph and 220 mph, the onset rate of 30 dB/second would be experienced at distances between 23 and 46 feet from the train. For speeds less than 110 mph, the onset rate of 30 dB/second would be experienced at distances of less than 23 feet from the train.

The project's dedicated right-of-way would be a minimum of 85 feet wide. In addition, the dedicated segments are usually on viaduct or embankments instead of at-grade, which introduces additional vertical distance separation from sensitive receptors. As the distance for the startle effect for humans is 46 feet, it is expected that the distance in which startle effects would occur would be within the dedicated right-of-way. This would apply to Alternative 1 south of I-880, Alternatives 2 and 3 south of Scott Boulevard, and Alternative 4 south of Gilroy.

Under Alternative 1, blended operations would occur between Scott Boulevard and I-880 but the right-of-way is sufficiently wide that there are no noise-sensitive receptors within 23 feet of the planned track alignments.

Under Alternative 4, blended operations would occur between Scott Boulevard in Santa Clara and San Jose and Gilroy, with speeds up to 110 mph; noise-sensitive receptors located within 23 feet of the alignment would experience an onset rate of 30 dB/second. Between Scott Boulevard and the San Jose Diridon Station, there is extensive daily train traffic along the Caltrain Corridor, including Caltrain (92 daily trains), ACE (8 daily trains), Capitol Corridor (14 daily trains), Amtrak (2 daily trains), and freight (9 daily trains). Between the San Jose Diridon Station and Tamien Station, a moderate amount of daily train traffic operates along the Caltrain Corridor including Caltrain (40 daily trains), ACE (8 daily trains), Amtrak (2 daily trains), and freight (4 daily trains). Between Tamien and Gilroy, there is limited existing daily train traffic along the Caltrain and UPRR corridors including Caltrain (6 daily trains), Amtrak (2 daily trains), and freight (4 daily trains). In these areas, trains operate up to 79 mph at present.

Passengers may be on Caltrain or HSR platforms closer than 23 feet from the tracks. However, there would be advance warning of trains approaching with announcements, horns, bells, and signage, so substantial, ongoing startle effects would not occur there with train passage. The same would be true at the at-grade crossings for vehicles, bicyclists, and pedestrians under Alternative 4.

Analysts reviewed the Alternative 4 alignment between Scott Boulevard in Santa Clara and Gilroy and found that in most areas (outside of stations and at-grade crossings) there would be more than 23 feet from the outermost track to sensitive noise receptors, and no startle effects would occur. Analysts identified one noise-sensitive receptor (a residence) within 23 feet of the

Alternative 4 tracks (receptors in properties not immediately adjacent to the railroad right-of-way would not be affected):[12]

- Morgan Hill and Gilroy Subsection
  - In Morgan Hill, one mobile home east of Wright Avenue west of the right-of-way south of Butterfield Boulevard, is within 23 feet of the proposed southbound track.

Operations of all four project alternatives would result in wayside noise near the tunnel portals in Pacheco Pass, which could startle nearby wayside receptors. As described in detail in Volume 2, Appendix 3.4-A, because the closest receptors to the tunnel portals are more than 1,000 feet away, wayside noise near the tunnel portals is not expected to cause an adverse effect on sensitive receptors.

Station Noise

The project includes the construction of two HSR stations – one passenger station would be located in San Jose adjacent to the existing San Jose Diridon Station and the other would be located in Gilroy. The San Jose Diridon Station would be the same for all four alternatives. Two station location options have been identified in Gilroy—a Downtown Gilroy Station located adjacent to the existing Gilroy Caltrain Station would be used for Alternatives 1, 2, and 4, while an East Gilroy Station would be constructed in agricultural lands east of Gilroy for Alternative 3.

The method used to assess noise impact from HSR stations is summarized in Section 4.1.5.2, Operations Noise. The dominant noise source at receptors near the HSR stations would be assumed to be HSR train movements. This analysis also assessed additional noise from station parking facilities. Preliminary layouts of the parking facilities at the HSR stations were used to identify the location and total number of parking spaces at each station location options—San Jose Diridon Station, Downtown Gilroy Station, and East Gilroy Station.

The San Jose Diridon Station would be the same for Alternatives 1-3, with a variation for Alternative 4, and would remove and relocate approximately 226 parking spaces. The Downtown Gilroy Station would have four parking areas with approximately 1,710 spaces, and the East Gilroy Station would have two parking areas with approximately 1,520 spaces. The analysis assumed that on a typical day during the three peak morning hours and three peak afternoon hours all the parking spaces would be filled once and then vacated once. During the non-peak mid-day and evening hours, the analysis assumed that a percentage of the parking spaces corresponding to the ridership peaking factors (Authority 2008) would be filled and then vacated each hour.

A noise assessment following Section 4.4 of the FTA guidance manual (FTA 2018) was conducted using these inputs and the method in Section 4.1.5.2, Operations Noise, to calculate the total noise contribution from the parking facilities at the noise-sensitive receptors near the HSR stations. Near the San Jose Diridon Station, the largest L_{dn} contribution from the parking facilities at the nearby noise receptors would be 29 dBA. Near the Downtown Gilroy Station, the largest L_{dn} contribution from the parking facilities at the nearby noise receptors would be 40 dBA. Near the East Gilroy Station, the largest L_{dn} contribution from the parking facilities at the nearby noise receptors would be 28 dBA. The results of the station noise assessment indicate that the additional noise from parking facilities would be substantially lower than the projected L_{dn} from project operations. At all nearby receptors, the L_{dn} contribution from the parking facilities would be at least 18 dB less than project operations.

Maintenance Facility Noise

One MOWF would be located near Gilroy under each project alternative. There are two potential location options for the MOWF—a South Gilroy MOWF (located south of the Downtown Gilroy Station under Alternatives 1 and 2) and an East Gilroy MOWF (located south of the East Gilroy

[12] If residences are proposed for acquisition, they are not included in the profile of potentially affected areas, as residents would not be present during operations.

Station under Alternative 3). At both locations, the mainline HSR tracks would be directly adjacent to the MOWF and the HSR speeds would be approximately 200 mph. Therefore, the noise from project operations would dominate noise from occasional HSR train movements into and out of the MOWF.

Analysts used the methods to assess noise impacts from the proposed MOWFs summarized in Section 4.1.5.2, Operations Noise. Preliminary layouts of the two MOWFs were used to identify the approximate center of noise-producing activities at the facilities. A noise assessment following Section 4.4 of the FTA guidance manual was used to predict noise exposure from the MOWFs. The project operations schedule of train movements into and out of the MOWFs identified 24 planned HSR train movements during the daytime and 12 movements during the nighttime. The L_{dn} contribution from these MOWF train movements was then calculated at all nearby noise-sensitive receptors.

The closest identified receptor (single-family residence on Bolsa Road) to the South Gilroy MOWF is more than 1,500 feet away. The L_{dn} contribution from the South Gilroy MOWF at that nearest receptor would be 40 dBA, more than 20 dB less than the project operations contribution at that receptor. The nearest receptors (residences on Pacheco Pass Highway in the rural residential Old Gilroy neighborhood) to the East Gilroy MOWF would be approximately 800 feet away. In this neighborhood, the highest L_{dn} contribution from the East Gilroy MOWF would be 47 dBA, more than 20 dB less than the operations contribution at that receptor. The nearest receptors to the Alternative 4 South Gilroy MOWF are approximately 900 feet away. In this neighborhood, the highest L_{dn} contribution from the MOWF would be 45 dBA, more than 18 dB less than the operations contribution at that receptor. As a result, the additional noise from all of the MOWFs would not contribute to noise impacts of nearby sensitive receptors.

Vehicle Traffic Noise

In addition to noise from project train operations, noise from changes in vehicle traffic volume from the project was considered for 2029 and 2040 No Project and Plus Project conditions. The project would require the relocation of some local roads; however, traffic on local roads provides only a minor contribution to overall noise levels in the project extent. A number of existing at-grade crossings would be eliminated with Alternative 2 but these are not expected to result in increases in traffic volume. Monterey Road is the only major roadway that would be substantially reconfigured by the project, with the reduction of travel lanes from six to four lanes between approximately the Capitol Expressway and Blossom Hill Road.

Noise from changes in traffic volume due to the project was assessed following the method summarized in Section 4.1.5.2. The traffic noise analysis focused on roadway segments near the HSR stations, the MOWFs, and along Monterey Road where there would be permanent lane reductions. Daily traffic volumes for these select roadway segments were used to calculate traffic growth factors to assess the potential change in noise levels for each project alternative for 2029 and 2040.

Table 5-14 identifies the roadway segments assessed for Alternative 1 in 2029. It includes the existing total average daily traffic (ADT) volumes for each roadway segment, the 2029 No Project ADT, and the 2029 Plus Project ADT for Alternative 1. The potential noise increases over existing noise conditions and over the No Project Alternative are calculated. This assessment identifies that four roadway segments near San Jose Diridon Station have the potential for noise level increases greater than or equal to 3 dB compared to existing noise conditions. In all cases the noise impact is determined from the increase in noise over the existing condition. For context, in comparison with the No Project Alternative, two roadway segments have the potential for an increase of 3 dB. All other segments show increases of 2 dB or less over the No Project case.

Along Monterey Road, two segments have the potential for increases of 3 dB or greater compared to existing noise conditions. However, none of the segments would have an increase greater than 1 dB compared to the No Project Alternative. All comparisons to the No Project Alternative are for informational purposes only, and not a determinant of impact. None of the roadway segments near the Downtown Gilroy Station would have a noise level increase greater than 1 dB compared to existing noise conditions or the No Project Alternative. The largest increase in noise level for the east Gilroy roadway segments is 1 dB compared to existing noise conditions, with no increase compared to the No Project Alternative. Near the South Gilroy MOWF, one segment has the potential for a 3 dB increase compared to existing noise conditions and the No Project Alternative.

Table 5-14 Change in 2029 Traffic Noise Levels due to Project—Alternative 1

Segment	Roadway Segment Description	Existing ADT	No Project ADT	Plus Project ADT	Noise Increase Over Existing (dBA)	Noise Increase Over No Project (dBA) [1]
San Jose Diridon Station Approach Subsection						
San Jose Roadway Segments						
1	Julian between Stockton Avenue and Autumn Street	10,400	12,278	12,311	1	0
2	Autumn Street between Julian and Santa Clara	2,400	3,167	6,944	5	3
3	Stockton Avenue between Julian Street and The Alameda	7,317	14,389	14,872	3	0
4	The Alameda between Sunol Avenue and Delmas Avenue	16,861	24,889	26,639	2	0
5	Sunol Avenue between The Alameda and Park Avenue	3,522	4,167	4,739	1	1
6	Cahill Street between Santa Clara and San Fernando Street	2,056	4,611	6,478	5	1
7	Montgomery Street between Santa Clara Street and Park Avenue	4,428	4,056	7,361	2	3
8	Autumn Street between Santa Clara Street and Park Avenue	4,494	11,833	16,822	6	2
9	Park Avenue between Sunol Avenue and Montgomery Street	10,550	12,389	13,150	1	0
10	Montgomery Street between Park Avenue and San Carlos	20,328	21,278	22,083	0	0
11	San Carlos Street between Sunol Avenue and Montgomery Street	16,089	22,167	22,239	1	0
12	Bird Avenue between San Carlos Street and West Virginia Street	27,206	33,444	34,172	1	0
Monterey Corridor Subsection						
Monterey Road Roadway Segments						
1	Monterey Road between Capitol Expressway WB Ramps and Branham Lane	40,644	51,611	35,972	(1)	(2)
2	Skyway Drive between Monterey Road and Houndshaven Way	10,722	12,339	12,556	1	0

Segment	Roadway Segment Description	Existing ADT	No Project ADT	Plus Project ADT	Noise Increase Over Existing (dBA)	Noise Increase Over No Project (dBA) [1]
3	Houndshaven Way between Skyway Drive and Branham Lane	844	1,056	1,333	2	1
4	Branham Lane between Monterey Road and Houndshaven Way	11,178	12,833	12,972	1	0
5	Monterey Road between Branham Lane and Chynoweth Avenue	19,756	46,389	39,833	3	(1)
6[2]	Monterey Road between Chynoweth Avenue and Bernal Road	14,944	29,778	23,722	2	(1)
Morgan Hill and Gilroy Subsection						
Monterey Road Roadway Segments						
7	Bernal Road between Monterey Road and Santa Teresa Boulevard	13,117	15,389	16,278	1	0
8	Santa Teresa Boulevard between Bernal Road and Bailey Avenue	9,844	24,889	26,389	4	0
9	Hale Avenue between Baily Avenue and Llagas Road	10,661	15,222	15,389	2	0
10	Llagas Road between Hale Avenue and Old Monterey Road	4,022	6,111	6,111	2	0
11	Monterey Road between Bernal Road and Old Monterey Road	15,811	18,222	17,444	0	0
Downtown Gilroy Station Roadway Segments						
1	Leavesley Road between US 101 and Cameron Boulevard Extension	8,400	8,333	8,333	0	0
2	Leavesley Road between Monterey Road and US 101	24,689	26,444	27,028	0	0
3	Welburn Avenue between Church Street and Monterey Road	15,889	16,333	16,339	0	0
4	Monterey Road between Welburn Avenue and First Street	19,956	19,944	22,117	0	0
5	First Street between Church Street and Monterey Road	13,733	14,000	14,611	0	0
6	Monterey Road between First Street and 10th Street	8,606	8,722	11,422	1	1
7	Sixth Street between Monterey Road and US 101	6,689	6,833	7,611	1	0
8	10th Street between Monterey Road and US 101	19,672	19,889	23,778	1	1
9	Pacheco Pass Highway between US 101 and Cameron Boulevard	27,900	30,056	30,133	0	0

Segment	Roadway Segment Description	Existing ADT	No Project ADT	Plus Project ADT	Noise Increase Over Existing (dBA)	Noise Increase Over No Project (dBA) [1]
10	Monterey Road between [1]0th Street and Travel Park Circle	14,956	16,222	17,494	1	0
East Gilroy Roadway Segments						
1	Marcella Avenue between Buena Vista Avenue and Leavesley Road	417	528	528	1	0
2	Leavesley Road between Marcella Avenue and New Avenue	8,067	8,056	8,056	0	0
3	Leavesley Road between US 101 and Cameron Boulevard Extension	8,400	8,333	8,333	0	0
4	Leavesley Road between Monterey Road and US 101	24,689	26,444	27,028	0	0
5	Welburn Avenue between Church Street and Monterey Road	15,889	16,333	16,339	0	0
6	Monterey Road between Welburn Avenue and First Street	19,956	19,944	22,117	0	0
Gilroy MOWF Roadway Segments						
1	Frazier Lake Road south of Pacheco Pass Highway	4,317	4,889	N/A	N/A	N/A
2	Pacheco Pass Highway between US 101 and Frazier Lake Road	27,900	30,056	30,133	0	0
3	10th Street between Monterey Road and US 101	19,672	19,889	23,778	1	1
4	Alexander Street between Old Gilroy Street and 10th Street	3,233	3,333	6,417	3	3
5	Monterey Road between 10th Street and Travel Park Circle	14,956	16,222	17,494	1	0

(Parentheses) indicate negative values
ADT = average daily traffic
dBA = A-weighted decibel
MOWF = maintenance of way facility
[1] The noise increase over No Project data are presented only for reference purposes. The noise increase over existing is what determines impact.
[2] Monterey Road Roadway Segment number 6, Monterey Road between Chynoweth Avenue and Bernal Road, is in both the Monterey Corridor Subsection and the Morgan Hill and Gilroy Subsection.

Table 5-15 shows the roadway segments assessed for Alternative 2 in 2029. Four roadway segments near San Jose Diridon Station have the potential for noise level increases greater than or equal to 3 dB compared to existing noise conditions. In all cases the noise impact is determined from the increase in noise over the existing condition. For context, in comparison with the No Project Alternative, two roadway segments have the potential for an increase of 3 dB. All other segments show increases of 2 dB or less compared to No Project.

Along Monterey Road, two segments have the potential for increases of 3 dB or greater compared to existing noise conditions. However, none of the segments would have an increase greater than 1 dB compared to the No Project Alternative. None of the roadway segments near the Downtown Gilroy Station would have a noise level increase greater than 1 dB compared to existing noise conditions or the No Project Alternative. The largest increase in noise level for the east Gilroy roadway segments is 1 dB compared to existing noise conditions, with no increase compared to the No Project Alternative. Near the South Gilroy MOWF, one segment has the potential for a 3 dB increase compared to existing noise conditions and the No Project Alternative.

Table 5-15 Change in 2029 Traffic Noise Levels due to Project—Alternative 2

Segment	Roadway Segment Description	Existing ADT	No Project ADT	Plus Project ADT	Noise Increase Over Existing (dBA)	Noise Increase Over No Project (dBA) [1]
San Jose Diridon Station Approach Subsection						
San Jose Segments						
1	Julian between Stockton Avenue and Autumn Street	10,400	12,278	12,311	1	0
2	Autumn Street between Julian and Santa Clara	2,400	3,167	6,944	5	3
3	Stockton Avenue between Julian Street and The Alameda	7,317	14,389	14,872	3	0
4	The Alameda between Sunol Avenue and Delmas Avenue	16,861	24,889	26,639	2	0
5	Sunol Avenue between The Alameda and Park Avenue	3,522	4,167	4,739	1	1
6	Cahill Street between Santa Clara and San Fernando Street	2,056	4,611	6,478	5	1
7	Montgomery Street between Santa Clara Street and Park Avenue	4,428	4,056	7,361	2	3
8	Autumn Street between Santa Clara Street and Park Avenue	4,494	11,833	16,822	6	2
9	Park Avenue between Sunol Avenue and Montgomery Street	10,550	12,389	13,150	1	0
10	Montgomery Street between Park Avenue and San Carlos	20,328	21,278	22,083	0	0
11	San Carlos Street between Sunol Avenue and Montgomery Street	16,089	22,167	22,239	1	0
12	Bird Avenue between San Carlos Street and West Virginia Street	27,206	33,444	34,172	1	0
Monterey Corridor Subsection						
Monterey Road Segments						
1	Monterey Road between Capitol Expressway WB Ramps and Branham Lane	40,644	51,611	35,972	(1)	(2)
2	Skyway Drive between Monterey Road and Houndshaven Way	10,722	12,339	13,556	1	0

Segment	Roadway Segment Description	Existing ADT	No Project ADT	Plus Project ADT	Noise Increase Over Existing (dBA)	Noise Increase Over No Project (dBA)[1]
3	Houndshaven Way between Skyway Drive and Branham Lane	844	1,056	1,333	2	1
4	Branham Lane between Monterey Road and Houndshaven Way	11,178	12,833	12,972	1	0
5	Monterey Road between Branham Lane and Chynoweth Avenue	19,756	46,389	40,278	3	(1)
6[2]	Monterey Road between Chynoweth Avenue and Bernal Road	14,944	29,778	23,056	2	(1)
Morgan Hill and Gilroy Subsection						
Monterey Road Roadway Segments						
7	Bernal Road between Monterey Road and Santa Teresa Boulevard	13,117	15,389	16,278	1	0
8	Santa Teresa Boulevard between Bernal Road and Bailey Avenue	9,844	24,889	26,389	4	0
9	Hale Avenue between Baily Avenue and Llagas Road	10,661	15,222	15,389	2	0
10	Llagas Road between Hale Avenue and Old Monterey Road	4,022	6,111	6,111	2	0
11	Monterey Road between Bernal Road and Old Monterey Road	15,811	18,222	17,444	0	0
Downtown Gilroy Station Segments						
1	Leavesley Road between US 101 and Cameron Boulevard Extension	8,400	8,333	8,333	0	0
2	Leavesley Road between Monterey Road and US 101	24,689	26,444	27,028	0	0
3	Welburn Avenue between Church Street and Monterey Road	15,889	16,333	16,339	0	0
4	Monterey Road between Welburn Avenue and First Street	19,956	19,944	22,117	0	0
5	First Street between Church Street and Monterey Road	13,733	14,000	14,611	0	0
6	Monterey Road between First Street and 10th Street	8,606	8,722	11,422	1	1
7	Sixth Street between Monterey Road and US 101	6,689	6,833	7,611	1	0
8	10th Street between Monterey Road and US 101	19,672	19,889	23,778	1	1
9	Pacheco Pass Highway between US 101 and Cameron Boulevard	27,900	30,056	30,133	0	0

Segment	Roadway Segment Description	Existing ADT	No Project ADT	Plus Project ADT	Noise Increase Over Existing (dBA)	Noise Increase Over No Project (dBA) [1]
10	Monterey Road between 10th Street and Travel Park Circle	14,956	16,222	17,494	1	0
East Gilroy Segments						
1	Marcella Avenue between Buena Vista Avenue and Leavesley Road	417	528	528	1	0
2	Leavesley Road between Marcella Avenue and New Avenue	8,067	8,056	8,056	0	0
3	Leavesley Road between US 101 and Cameron Boulevard Extension	8,400	8,333	8,333	0	0
4	Leavesley Road between Monterey Road and US 101	24,689	26,444	27,028	0	0
5	Welburn Avenue between Church Street and Monterey Road	15,889	16,333	16,339	0	0
6	Monterey Road between Welburn Avenue and First Street	19,956	19,944	22,117	0	0
Gilroy MOWF Segments						
1	Frazier Lake Road south of Pacheco Pass Highway	4,317	4,889	N/A	N/A	N/A
2	Pacheco Pass Highway between US 101 and Frazier Lake Road	27,900	30,056	30,133	0	0
3	10th Street between Monterey Road and US 101	19,672	19,889	23,778	1	1
4	Alexander Street between Old Gilroy Street and 10th Street	3,233	3,333	6,417	3	3
5	Monterey Road between 10th Street and Travel Park Circle	14,956	16,222	17,494	1	0

(Parentheses) indicate negative values
ADT = average daily traffic
dBA = A-weighted decibel
MOWF = maintenance of way facility
[1] The noise increase over No Project data are presented only for reference purposes. The noise increase over existing is what determines impact.
[2] Monterey Road Roadway Segment number 6, Monterey Road between Chynoweth Avenue and Bernal Road, is in both the Monterey Corridor Subsection and the Morgan Hill and Gilroy Subsection.

Table 5-16 shows the roadway segments assessed for Alternative 3 in 2029. Four roadway segments near San Jose Diridon Station have the potential for noise level increases greater than or equal to 3 dB compared to existing noise conditions. Compared to the No Project Alternative, two roadway segments have the potential for an increase of 3 dB. All other segments show increases of 2 dB or less. Along Monterey Road, two segments have the potential for increases of 3 dB or greater compared to existing noise conditions. In all cases the noise impact is determined from the increase in noise over the existing condition. For context, none of the segments would have an increase greater than 1 dB compared to the No Project Alternative. None of the roadway segments near the Downtown Gilroy Station would have a noise level increase greater than 1 dB compared to existing noise conditions. No increase is anticipated compared to the No Project

Alternative. One roadway segment near east Gilroy has the potential for an increase of 2 dB compared to existing noise conditions. The largest increase compared to the No Project Alternative is 1 dB. Near the East Gilroy MOWF, no increase is anticipated compared to either the existing or the No Project Alternative.

Table 5-16 Change in 2029 Traffic Noise Levels due to Project—Alternative 3

Segment	Roadway Segment Description	Existing ADT	No Project ADT	Plus Project ADT	Noise Increase Over Existing (dBA)	Noise Increase Over No Project (dBA) [1]
San Jose Diridon Station Approach Subsection						
San Jose Segments						
1	Julian between Stockton Avenue and Autumn Street	10,400	12,278	12,311	1	0
2	Autumn Street between Julian and Santa Clara	2,400	3,167	6,944	5	3
3	Stockton Avenue between Julian Street and The Alameda	7,317	14,389	14,872	3	0
4	The Alameda between Sunol Avenue and Delmas Avenue	16,861	24,889	26,639	2	0
5	Sunol Avenue between The Alameda and Park Avenue	3,522	4,167	4,739	1	1
6	Cahill Street between Santa Clara and San Fernando Street	2,056	4,611	6,478	5	1
7	Montgomery Street between Santa Clara Street and Park Avenue	4,428	4,056	7,361	2	3
8	Autumn Street between Santa Clara Street and Park Avenue	4,494	11,833	16,822	6	2
9	Park Avenue between Sunol Avenue and Montgomery Street	10,550	12,389	13,150	1	0
10	Montgomery Street between Park Avenue and San Carlos	20,328	21,278	22,083	0	0
11	San Carlos Street between Sunol Avenue and Montgomery Street	16,089	22,167	22,239	1	0
12	Bird Avenue between San Carlos Street and West Virginia Street	27,206	33,444	34,172	1	0
Monterey Corridor Subsection						
Monterey Road Segments						
1	Monterey Road between Capitol Expressway WB Ramps and Branham Lane	40,644	51,611	35,972	(1)	(2)
2	Skyway Drive between Monterey Road and Houndshaven Way	10,722	12,339	12,556	1	0

Segment	Roadway Segment Description	Existing ADT	No Project ADT	Plus Project ADT	Noise Increase Over Existing (dBA)	Noise Increase Over No Project (dBA) [1]
3	Houndshaven Way between Skyway Drive and Branham Lane	844	1,056	1,333	2	1
4	Branham Lane between Monterey Road and Houndshaven Way	11,178	12,833	12,972	1	0
5	Monterey Road between Branham Lane and Chynoweth Avenue	19,756	46,389	39,833	3	(1)
6[2]	Monterey Road between Chynoweth Avenue and Bernal Road	14,944	29,778	23,722	2	(1)
Morgan Hill and Gilroy Subsection						
Monterey Road Roadway Segments						
7	Bernal Road between Monterey Road and Santa Teresa Boulevard	13,117	15,389	16,278	1	0
8	Santa Teresa Boulevard between Bernal Road and Bailey Avenue	9,844	24,889	26,389	4	0
9	Hale Avenue between Baily Avenue and Llagas Road	10,661	15,222	15,389	2	0
10	Llagas Road between Hale Avenue and Old Monterey Road	4,022	6,111	6,111	2	0
11	Monterey Road between Bernal Road and Old Monterey Road	15,811	18,222	17,444	0	0
Downtown Gilroy Station Segments						
1	Leavesley Road between US 101 and Cameron Boulevard Extension	8,400	8,333	9,144	0	0
2	Leavesley Road between Monterey Road and US 101	24,689	26,444	28,939	1	0
3	Welburn Avenue between Church Street and Monterey Road	15,889	16,333	16,506	0	0
4	Monterey Road between Welburn Avenue and First Street	19,956	19,944	20,317	0	0
5	First Street between Church Street and Monterey Road	13,733	14,000	14,561	0	0
6	Monterey Road between First Street and 10th Street	8,606	8,722	8,722	0	0
7	Sixth Street between Monterey Road and US 101	6,689	6,833	6,833	0	0
8	10th Street between Monterey Road and US 101	19,672	19,889	19,889	0	0
9	Pacheco Pass Highway between US 101 and Cameron Boulevard	27,900	30,056	30,000	0	0

Segment	Roadway Segment Description	Existing ADT	No Project ADT	Plus Project ADT	Noise Increase Over Existing (dBA)	Noise Increase Over No Project (dBA) [1]
10	Monterey Road between 10th Street and Travel Park Circle	14,956	16,222	16,222	0	0
East Gilroy Segments						
1	Marcella Avenue between Buena Avenue Road and Leavesley Road	417	528	739	2	1
2	Leavesley Road between Marcella Avenue and New Avenue	8,067	8,056	8,172	0	0
3	Leavesley Road between US 101 and Cameron Boulevard Extension	8,400	8,333	9,144	0	0
4	Leavesley Road between Monterey Road and US 101	24,689	26,444	28,939	1	0
5	Welburn Avenue between Church Street and Monterey Road	15,889	16,333	16,506	0	0
6	Monterey Road between Welburn Avenue and First Street	19,956	19,944	20,317	0	0
Gilroy MOWF Segments						
1	Frazier Lake Road south of Pacheco Pass Highway	4,317	4,889	N/A	N/A	N/A
2	Pacheco Pass Highway between US 101 and Frazier Lake Road	27,900	30,056	30,000	0	0
3	10th Street between Monterey Road and US 101	19,672	19,889	19,889	0	0
4	Alexander Street between Old Gilroy Street and 10th Street	3,233	3,333	3,333	0	0
5	Monterey Road between 10th Street and Travel Park Circle	14,956	16,222	16,222	0	0

(Parentheses) indicate negative values
[1] The noise increase over No Project data are presented only for reference purposes. The noise increase over existing is what determines impact.
[2] Monterey Road Roadway Segment number 6, Monterey Road between Chynoweth Avenue and Bernal Road, is in both the Monterey Corridor Subsection and the Morgan Hill and Gilroy Subsection.
ADT = average daily traffic
dBA = A-weighted decibel
MOWF = maintenance of way facility

Table 5-17 shows the roadway segments assessed for Alternative 4 in 2029. Three roadway segments near San Jose Diridon Station have the potential for noise level increases greater than or equal to 3 dB compared to existing noise conditions. Compared to the No Project Alternative, zero roadway segments have the potential for an increase greater than 1 dB. Along Monterey Road, three segments have the potential for increases of 3 dB or greater compared to existing noise conditions. In all cases the noise impact is determined from the increase in noise over the existing condition. For context, none of the segments would have an increase greater than 1 dB compared to the No Project Alternative. None of the roadway segments near the Downtown Gilroy Station would have a noise level increase greater than 2 dB compared to existing noise conditions or the No Project Alternative. The largest increase in noise level for the east Gilroy roadway segments is 1 dB compared to existing noise conditions, with no increase compared to the No Project Alternative. Near the South Gilroy MOWF, the largest increase in noise level compared to existing noise conditions or the No Project Alternative is 1 dB.

Table 5-17 Change in 2029 Traffic Noise Levels due to Project—Alternative 4

Segment	Roadway Segment Description	Existing ADT	No Project ADT	Plus Project ADT	Noise Increase Over Existing (dBA)	Noise Increase Over No Project (dBA) [1]
San Jose Diridon Station Approach Subsection						
San Jose Segments						
1	Julian between Stockton Avenue and Autumn Street	10,400	12,278	12,278	1	0
2	Autumn Street between Julian and Santa Clara	2,400	3,167	3,167	1	0
3	Stockton Avenue between Julian Street and The Alameda	7,317	14,389	14,411	3	0
4	The Alameda between Sunol Avenue and Delmas Avenue	16,861	24,889	26,100	2	0
5	Sunol Avenue between The Alameda and Park Avenue	3,522	4,167	4,167	1	0
6	Cahill Street between Santa Clara and San Fernando Street	2,056	4,611	6,433	5	1
7	Montgomery Street between Santa Clara Street and Park Avenue	4,428	4,056	4,056	0	0
8	Autumn Street between Santa Clara Street and Park Avenue	4,494	11,833	12,567	4	0
9	Park Avenue between Sunol Avenue and Montgomery Street	10,550	12,389	12,389	1	0
10	Montgomery Street between Park Avenue and San Carlos	20,328	21,278	21,278	0	0
11	San Carlos Street between Sunol Avenue and Montgomery Street	16,089	22,167	22,167	1	0
12	Bird Avenue between San Carlos Street and West Virginia Street	27,206	33,444	33,444	1	0
Monterey Corridor Subsection						
Monterey Road Segments						
1	Monterey Road between Capitol Expressway WB Ramps and Branham Lane	40,644	51,611	51,611	1	0
2	Skyway Drive between Monterey Road and Houndshaven Way	10,722	12,339	12,339	1	0

Segment	Roadway Segment Description	Existing ADT	No Project ADT	Plus Project ADT	Noise Increase Over Existing (dBA)	Noise Increase Over No Project (dBA) [1]
3	Houndshaven Way between Skyway Drive and Branham Lane	844	1,056	1,056	1	0
4	Branham Lane between Monterey Road and Houndshaven Way	11,178	12,833	12,833	1	0
5	Monterey Road between Branham Lane and Chynoweth Avenue	19,756	46,389	46,389	4	0
6[2]	Monterey Road between Chynoweth Avenue and Bernal Road	14,944	29,778	29,778	3	0
Morgan Hill and Gilroy Subsection						
Monterey Road Segments						
7	Bernal Road between Monterey Road and Santa Teresa Boulevard	13,117	15,389	15,389	1	0
8	Santa Teresa Boulevard between Bernal Road and Bailey Avenue	9,844	24,889	24,889	4	0
9	Hale Avenue between Baily Avenue and Llagas Road	10,661	15,222	15,222	2	0
10	Llagas Road between Hale Avenue and Old Monterey Road	4,022	6,111	6,111	2	0
11	Monterey Road between Bernal Road and Old Monterey Road	15,811	18,222	18,222	1	0
Downtown Gilroy Station Segments						
1	Leavesley Road between US 101 and Cameron Boulevard Extension	8,400	8,333	8,333	0	0
2	Leavesley Road between Monterey Road and US 101	24,689	26,444	26,444	0	0
3	Welburn Avenue between Church Street and Monterey Road	15,889	16,333	16,333	0	0
4	Monterey Road between Welburn Avenue and First Street	19,956	19,944	22,117	0	0
5	First Street between Church Street and Monterey Road	13,733	14,000	13,733	0	0
6	Monterey Road between First Street and 10th Street	8,606	8,722	9,472	0	0
7	Sixth Street between Monterey Road and US 101	6,689	6,833	10,867	2	2
8	10th Street between Monterey Road and US 101	19,672	19,889	23,111	1	1
9	Pacheco Pass Highway between US 101 and Cameron Boulevard	27,900	30,056	30,056	0	0

Segment	Roadway Segment Description	Existing ADT	No Project ADT	Plus Project ADT	Noise Increase Over Existing (dBA)	Noise Increase Over No Project (dBA) [1]
10	Monterey Road between 10th Street and Travel Park Circle	14,956	16,222	17,361	1	0
East Gilroy Segments						
1	Marcella Avenue between Buena Vista Avenue and Leavesley Road	417	528	528	1	0
2	Leavesley Road between Marcella Avenue and New Avenue	8,067	8,056	8,056	0	0
3	Leavesley Road between US 101 and Cameron Boulevard Extension	8,400	8,333	8,333	0	0
4	Leavesley Road between Monterey Road and US 101	24,689	26,444	26,444	0	0
5	Welburn Avenue between Church Street and Monterey Road	15,889	16,333	16,333	0	0
6	Monterey Road between Welburn Avenue and First Street	19,956	19,944	22,117	0	0
Gilroy MOWF Segments						
1	Frazier Lake Road south of Pacheco Pass Highway	4,317	4,889	4,889	0	0
2	Pacheco Pass Highway between US 101 and Frazier Lake Road	27,900	30,056	30,056	0	0
3	10th Street between Monterey Road and US 101	19,672	19,889	23,111	1	1
4	Alexander Street between Old Gilroy Street and 10th Street	3,233	3,333	4,206	1	1
5	Monterey Road between 10th Street and Travel Park Circle	14,956	16,222	17,361	1	0

ADT = average daily traffic
dBA = A-weighted decibel
MOWF = maintenance of way facility
[1] The noise increase over No Project data are presented only for reference purposes. The noise increase over existing is what determines impact.
[2] Monterey Road Roadway Segment number 6, Monterey Road between Chynoweth Avenue and Bernal Road, is in both the Monterey Corridor Subsection and the Morgan Hill and Gilroy Subsection.

Overall, there are relatively few roadway segments where the noise increases associated with the project alternatives in 2029 are anticipated to be greater than or equal to 3 dB. Most of those segments where increases greater than or equal to 3 dB are projected are near San Jose Diridon Station and some along the Monterey Road segment. The results of the traffic noise analysis for 2029 are similar for all project alternatives, and differ only near the MOWF near Gilroy.

Table 5-18 shows the roadway segments assessed for Alternative 1 in 2040. It includes the existing ADT volumes for each roadway segment, the 2040 No Project ADT, and the 2040 Plus Project ADT for Alternative 1. This assessment indicates that for Alternative 1 in 2040, five roadway segments near San Jose Diridon Station would have the potential for noise level increases greater than or equal to 3 dB compared to existing noise conditions. Compared to the

2040 No Project Alternative, one roadway segment has the potential for an increase of 3 dB. All other segments show increases of 1 dB or less. Along Monterey Road, six segments have the potential for increases of 3 dB or greater compared to existing noise conditions. However, none of the segments would have an increase greater than 1 dB compared to the No Project Alternative. None of the roadway segments near the Downtown Gilroy Station would have a noise level increase greater than 2 dB compared to existing noise conditions, or greater than 1 dB compared to the No Project Alternative. The largest increase in noise level for the east Gilroy roadway segments would be 2 dB compared to existing noise conditions, with no increase compared to the No Project Alternative. Near the South Gilroy MOWF one segment has the potential for a 3 dB increase compared to existing noise conditions and the No Project Alternative.

Table 5-18 Change in 2040 Traffic Noise Levels due to Project—Alternative 1

Segment	Roadway Segment Description	Existing ADT	No Project ADT	Plus Project ADT	Noise Increase Over Existing (dBA)	Noise Increase Over No Project (dBA) [1]
San Jose Diridon Station Approach Subsection						
San Jose Segments						
1	Julian between Stockton Avenue and Autumn Street	10,400	13,444	13,478	1	0
2	Autumn Street between Julian and Santa Clara	2,400	3,444	7,278	5	3
3	Stockton Avenue between Julian Street and The Alameda	7,317	18,833	19,311	4	0
4	The Alameda between Sunol Avenue and Delmas Avenue	16,861	23,056	32,006	3	1
5	Sunol Avenue between The Alameda and Park Avenue	3,522	4,667	5,239	2	1
6	Cahill Street between Santa Clara and San Fernando Street	2,056	5,722	7,217	5	1
7	Montgomery Street between Santa Clara Street and Park Avenue	4,428	5,667	7,100	2	1
8	Autumn Street between Santa Clara Street and Park Avenue	4,494	17,167	19,978	6	1
9	Park Avenue between Sunol Avenue and Montgomery Street	10,550	11,611	14,317	1	1
10	Montgomery Street between Park Avenue and San Carlos	20,328	25,611	29,683	2	1
11	San Carlos Street between Sunol Avenue and Montgomery Street	16,089	22,611	25,911	2	1
12	Bird Avenue between San Carlos Street and West Virginia Street	27,206	35,722	37,783	1	0

Segment	Roadway Segment Description	Existing ADT	No Project ADT	Plus Project ADT	Noise Increase Over Existing (dBA)	Noise Increase Over No Project (dBA) [1]
Monterey Corridor Subsection						
Monterey Road Segments						
1	Monterey Road between Capitol Expressway WB Ramps and Branham Lane	40,644	61,667	49,000	1	(1)
2	Skyway Drive between Monterey Road and Houndshaven Way	10,722	13,444	13,444	1	0
3	Houndshaven Way between Skyway Drive and Branham Lane	844	2,389	2,611	5	0
4	Branham Lane between Monterey Road and Houndshaven Way	11,178	20,667	20,944	3	0
5	Monterey Road between Branham Lane and Chynoweth Avenue	19,756	36,611	46,944	4	1
6[2]	Monterey Road between Chynoweth Avenue and Bernal Road	14,944	40,389	30,333	3	(1)
Morgan Hill and Gilroy Subsection						
Monterey Road Segments						
7	Bernal Road between Monterey Road and Santa Teresa Boulevard	13,117	16,722	17,722	1	0
8	Santa Teresa Boulevard between Bernal Road and Bailey Avenue	9,844	31,000	35,056	6	1
9	Hale Avenue between Baily Avenue and Llagas Road	10,661	17,944	18,722	2	0
10	Llagas Road between Hale Avenue and Old Monterey Road	4,022	7,278	7,278	3	0
11	Monterey Road between Bernal Road and Old Monterey Road	15,811	19,667	18,778	1	0
Downtown Gilroy Station Segments						
1	Leavesley Road between US 101 and Cameron Boulevard Extension	8,400	3,722	3,778	(3)	0
2	Leavesley Road between Monterey Road and US 101	24,689	27,389	27,850	1	0
3	Welburn Avenue between Church Street and Monterey Road	15,889	18,500	18,772	1	0
4	Monterey Road between Welburn Avenue and First Street	19,956	25,778	28,067	1	0
5	First Street between Church Street and Monterey Road	13,733	14,667	16,350	1	0

Segment	Roadway Segment Description	Existing ADT	No Project ADT	Plus Project ADT	Noise Increase Over Existing (dBA)	Noise Increase Over No Project (dBA) [1]
6	Monterey Road between First Street and 10th Street	8,606	11,500	14,156	2	1
7	Sixth Street between Monterey Road and US 101	6,689	7,444	8,000	1	0
8	10th Street between Monterey Road and US 101	19,672	20,167	24,117	1	1
9	Pacheco Pass Highway between US 101 and Cameron Boulevard	27,900	20,389	21,211	(1)	0
10	Monterey Road between 10th Street and Travel Park Circle	14,956	22,278	24,189	2	0
East Gilroy Segments						
1	Marcella Avenue between Buena Vista Avenue and Leavesley Road	417	611	611	2	0
2	Leavesley Road between Marcella Avenue and New Avenue	8,067	3,389	3,444	(4)	0
3	Leavesley Road between US 101 and Cameron Boulevard Extension	8,400	3,722	3,778	(3)	0
4	Leavesley Road between Monterey Road and US 101	24,689	27,389	27,850	1	0
5	Welburn between Church Street and Monterey Road	15,889	18,500	18,772	1	0
6	Monterey Road between Welburn Avenue and First Street	19,956	25,778	28,067	1	0
Gilroy MOWF Segments						
1	Frazier Lake Road south of Pacheco Pass Highway	4,317	5,167	N/A	N/A	N/A
2	Pacheco Pass Highway between US 101 and Frazier Lake Road	27,900	19,778	22,100	(1)	0
3	10th Street between Monterey Road and US 101	19,672	20,167	24,117	1	1
4	Alexander Street between Old Gilroy Street and 10th Street	3,233	3,889	6,961	3	3
5	Monterey Road between 10th Street and Travel Park Circle	14,956	22,278	24,189	2	0

(Parentheses) indicate negative values
ADT = average daily traffic
dBA = A-weighted decibel
MOWF = maintenance of way facility
[1] The noise increase over No Project data are presented only for reference purposes. The noise increase over existing is what determines impact.
[2] Monterey Road Roadway Segment number 6, Monterey Road between Chynoweth Avenue and Bernal Road, is in both the Monterey Corridor Subsection and the Morgan Hill and Gilroy Subsection.

Table 5-19 shows the roadway segments assessed for Alternative 2 in 2040. Five roadway segments near San Jose Diridon Station have the potential for noise level increases greater than or equal to 3 dB compared to existing noise conditions. Compared to the 2040 No Project Alternative, one roadway segment has the potential for an increase of 3 dB. All other segments show increases of 1 dB or less. Along Monterey Road, six segments have the potential for increases of 3 dB or greater compared to existing noise conditions. However, none of the segments would have an increase greater than 1 dB compared to the No Project Alternative. None of the roadway segments near the Downtown Gilroy Station would have a noise level increase greater than 2 dB compared to existing noise conditions, or greater than 1 dB compared to the No Project Alternative. The largest increase in noise level for the east Gilroy roadway segments is 2 dB compared to existing noise conditions, with no increase compared to the No Project Alternative. Near the South Gilroy MOWF, one segment has the potential for a 3 dB increase compared to existing noise conditions and the No Project Alternative.

Table 5-19 Change in 2040 Traffic Noise Levels due to Project—Alternative 2

Segment	Roadway Segment Description	Existing ADT	No Project ADT	Plus Project ADT	Noise Increase Over Existing (dBA)	Noise Increase Over No Project (dBA) [1]
San Jose Diridon Station Approach Subsection						
San Jose Segments						
1	Julian between Stockton Avenue and Autumn Street	10,400	13,444	13,478	1	0
2	Autumn Street between Julian and Santa Clara	2,400	3,444	7,278	5	3
3	Stockton Avenue between Julian Street and The Alameda	7,317	18,833	19,311	4	0
4	The Alameda between Sunol Avenue and Delmas Avenue	16,861	23,056	32,006	3	1
5	Sunol Avenue between The Alameda and Park Avenue	3,522	4,667	5,239	2	1
6	Cahill Street between Santa Clara and San Fernando Street	2,056	5,722	7,217	5	1
7	Montgomery Street between Santa Clara Street and Park Avenue	4,428	5,667	7,100	2	1
8	Autumn Street between Santa Clara Street and Park Avenue	4,494	17,167	19,978	6	1
9	Park Avenue between Sunol Avenue and Montgomery Street	10,550	11,611	14,317	1	1
10	Montgomery Street between Park Avenue and San Carlos	20,328	25,611	29,683	2	1
11	San Carlos Street between Sunol Avenue and Montgomery Street	16,089	22,611	25,911	2	1
12	Bird Avenue between San Carlos Street and West Virginia Street	27,206	35,722	37,783	1	0

Segment	Roadway Segment Description	Existing ADT	No Project ADT	Plus Project ADT	Noise Increase Over Existing (dBA)	Noise Increase Over No Project (dBA) [1]
Monterey Corridor Subsection						
Monterey Road Segments						
1	Monterey Road between Capitol Expressway WB Ramps and Branham Lane	40,644	61,667	49,000	1	(1)
2	Skyway Drive between Monterey Road and Houndshaven Way	10,722	13,444	17,833	2	1
3	Houndshaven Way between Skyway Drive and Branham Lane	844	2,389	2,611	5	0
4	Branham Lane between Monterey Road and Houndshaven Way	11,178	20,667	20,944	3	0
5	Monterey Road between Branham Lane and Chynoweth Avenue	19,756	36,611	46,944	4	1
6[2]	Monterey Road between Chynoweth Avenue and Bernal Road	14,944	40,389	30,556	3	(1)
Morgan Hill and Gilroy Subsection						
Monterey Road Segments						
7	Bernal Road between Monterey Road and Santa Teresa Boulevard	13,117	16,722	17,722	1	0
8	Santa Teresa Boulevard between Bernal Road and Bailey Avenue	9,844	31,000	35,056	6	1
9	Hale Avenue between Baily Avenue and Llagas Road	10,661	17,944	18,722	2	0
10	Llagas Road between Hale Avenue and Old Monterey Road	4,022	7,278	7,278	3	0
11	Monterey Road between Bernal Road and Old Monterey Road	15,811	19,667	18,778	1	0
Downtown Gilroy Station Segments						
1	Leavesley Road between US 101 and Cameron Boulevard Extension	8,400	3,722	3,778	(3)	0
2	Leavesley Road between Monterey Road and US 101	24,689	27,389	27,850	1	0
3	Welburn Avenue between Church Street and Monterey Road	15,889	18,500	18,772	1	0
4	Monterey Road between Welburn Avenue and First Street	19,956	25,778	28,067	1	0
5	First Street between Church Street and Monterey Road	13,733	14,667	16,350	1	0

Segment	Roadway Segment Description	Existing ADT	No Project ADT	Plus Project ADT	Noise Increase Over Existing (dBA)	Noise Increase Over No Project (dBA) [1]
6	Monterey Road between First Street and 10th Street	8,606	11,500	14,156	2	1
7	Sixth Street between Monterey Road and US 101	6,689	7,444	8,000	1	0
8	10th Street between Monterey Road and US 101	19,672	20,167	24,117	1	1
9	Pacheco Pass Highway between US 101 and Cameron Boulevard	27,900	20,389	21,211	(1)	0
10	Monterey Road between 10th Street and Travel Park Circle	14,956	22,278	24,189	2	0
East Gilroy Segments						
1	Marcella Avenue between Buena Vista Avenue and Leavesley Road	417	611	611	2	0
2	Leavesley Road between Marcella Avenue and New Avenue	8,067	3,389	3,444	(4)	0
3	Leavesley Road between US 101 and Cameron Boulevard Extension	8,400	3,722	3,778	(3)	0
4	Leavesley Road between Monterey Road and US 101	24,689	27,389	27,850	1	0
5	Welburn Avenue between Church Street and Monterey Road	15,889	18,500	18,772	1	0
6	Monterey Road between Welburn Avenue and First Street	19,956	25,778	28,067	1	0
Gilroy MOWF Segments						
1	Frazier Lake Road south of Pacheco Pass Highway	4,317	5,167	N/A	N/A	N/A
2	Pacheco Pass Highway between US 101 and Frazier Lake Road	27,900	19,778	22,100	(1)	0
3	10th Street between Monterey Road and US 101	19,672	20,167	24,117	1	1
4	Alexander Street between Old Gilroy Street and 10th Street	3,233	3,889	6,961	3	3
5	Monterey Road between 10th Street and Travel Park Circle	14,956	22,278	24,189	2	0

(Parentheses) indicate negative values
ADT = average daily traffic
dBA = A-weighted decibel
MOWF = maintenance of way facility
[1] The noise increase over No Project data are presented only for reference purposes. The noise increase over existing is what determines impact.
[2] Monterey Road Roadway Segment number 6, Monterey Road between Chynoweth Avenue and Bernal Road, is in both the Monterey Corridor Subsection and the Morgan Hill and Gilroy Subsection.

Table 5-20 shows the roadway segments assessed for Alternative 3 in 2040. Five roadway segments near San Jose Diridon Station have the potential for noise level increases greater than or equal to 3 dB compared to existing noise conditions. Compared to the 2040 No Project Alternative, one roadway segment has the potential for an increase of 3 dB. All other segments show increases of 1 dB or less. Along Monterey Road, five segments have the potential for increases of 3 dB or greater compared to existing noise conditions. However, none of the segments would have an increase greater than 1 dB compared to the No Project Alternative. None of the roadway segments near the Downtown Gilroy Station would have a noise level increase greater than 2 dB compared to existing noise conditions or greater than 1 dB compared to the No Project Alternative. One roadway segment near east Gilroy as the potential for an increase of 3 dB compared to existing noise conditions and an increase of 1 dB compared to the No Project Alternative. Near the East Gilroy MOWF, the largest increase compared to existing noise conditions is 2 dB and 1 dB compared to the No Project Alternative.

Table 5-20 Change in 2040 Traffic Noise Levels due to Project—Alternative 3

Segment	Roadway Segment Description	Existing ADT	No Project ADT	Plus Project ADT	Noise Increase Over Existing (dBA)	Noise Increase Over No Project (dBA) [1]
San Jose Diridon Station Approach Subsection						
San Jose Segments						
1	Julian between Stockton Avenue and Autumn Street	10,400	13,444	13,478	1	0
2	Autumn Street between Julian and Santa Clara	2,400	3,444	7,278	5	3
3	Stockton Avenue between Julian Street and The Alameda	7,317	18,833	19,311	4	0
4	The Alameda between Sunol Avenue and Delmas Avenue	16,861	23,056	32,006	3	1
5	Sunol Avenue between The Alameda and Park Avenue	3,522	4,667	5,239	2	1
6	Cahill Street between Santa Clara and San Fernando Street	2,056	5,722	7,217	5	1
7	Montgomery Street between Santa Clara Street and Park Avenue	4,428	5,667	7,100	2	1
8	Autumn Street between Santa Clara Street and Park Avenue	4,494	17,167	19,978	6	1
9	Park Avenue between Sunol Avenue and Montgomery Street	10,550	11,611	14,317	1	1
10	Montgomery Street between Park Avenue and San Carlos	20,328	25,611	29,683	2	1
11	San Carlos Street between Sunol Avenue and Montgomery Street	16,089	22,611	25,911	2	1
12	Bird Avenue between San Carlos Street and West Virginia Street	27,206	35,722	37,783	1	0

Segment	Roadway Segment Description	Existing ADT	No Project ADT	Plus Project ADT	Noise Increase Over Existing (dBA)	Noise Increase Over No Project (dBA) [1]
Monterey Corridor Subsection						
Monterey Road Segments						
1	Monterey Road between Capitol Expressway WB Ramps and Branham Lane	40,644	61,667	49,000	1	(1)
2	Skyway Drive between Monterey Road and Houndshaven Way	10,722	13,444	13,444	1	0
3	Houndshaven Way between Skyway Drive and Branham Lane	844	2,389	2,611	5	0
4	Branham Lane between Monterey Road and Houndshaven Way	11,178	20,667	20,944	3	0
5	Monterey Road between Branham Lane and Chynoweth Avenue	19,756	36,611	46,944	4	1
6[2]	Monterey Road between Chynoweth Avenue and Bernal Road	14,944	40,389	30,333	3	(1)
Morgan Hill and Gilroy Subsection						
Monterey Road Segments						
7	Bernal Road between Monterey Road and Santa Teresa Boulevard	13,117	16,722	17,722	1	0
8	Santa Teresa Boulevard between Bernal Road and Bailey Avenue	9,844	31,000	35,056	6	1
9	Hale Avenue between Baily Avenue and Llagas Road	10,661	17,944	18,722	2	0
10	Llagas Road between Hale Avenue and Old Monterey Road	4,022	7,278	7,278	3	0
11	Monterey Road between Bernal Road and Old Monterey Road	15,811	19,667	18,778	1	0
Downtown Gilroy Station Segments						
1	Leavesley Road between US 101 and Cameron Boulevard Extension	8,400	3,722	4,578	(3)	1
2	Leavesley Road between Monterey Road and US 101	24,689	27,389	29,583	1	0
3	Welburn Avenue between Church Street and Monterey Road	15,889	18,500	18,894	1	0
4	Monterey Road between Welburn Avenue and First Street	19,956	25,778	26,178	1	0
5	First Street between Church Street and Monterey Road	13,733	14,667	16,344	1	0

Segment	Roadway Segment Description	Existing ADT	No Project ADT	Plus Project ADT	Noise Increase Over Existing (dBA)	Noise Increase Over No Project (dBA) [1]
6	Monterey Road between First Street and 10th Street	8,606	11,500	11,506	1	0
7	Sixth Street between Monterey Road and US 101	6,689	7,444	7,511	1	0
8	10th Street between Monterey Road and US 101	19,672	20,167	21,400	0	0
9	Pacheco Pass Highway between US 101 and Cameron Boulevard	27,900	20,389	23,306	(1)	1
10	Monterey Road between 10th Street and Travel Park Circle	14,956	22,278	22,500	2	0
East Gilroy Segments						
1	Marcella Avenue between Buena Vista Avenue and Leavesley Road	417	611	822	3	1
2	Leavesley Road between Marcella Avenue and New Avenue	8,067	3,389	3,506	(4)	0
3	Leavesley Road between US 101 and Cameron Boulevard Extension	8,400	3,722	4,578	(3)	1
4	Leavesley Road between Monterey Road and US 101	24,689	27,389	29,583	1	0
5	Welburn Avenue between Church Street and Monterey Road	15,889	18,500	18,894	1	0
6	Monterey Road between Welburn Avenue and First Street	19,956	25,778	26,178	1	0
Gilroy MOWF Segments						
1	Frazier Lake Road south of Pacheco Pass Highway	4,317	5,167	N/A	N/A	N/A
2	Pacheco Pass Highway between US 101 and Frazier Lake Road	27,900	19,778	23,306	(1)	1
3	10th Street between Monterey Road and US 101	19,672	20,167	21,400	0	0
4	Alexander Street between Old Gilroy Street and 10th Street	3,233	3,889	3,889	1	0
5	Monterey Road between 10th Street and Travel Park Circle	14,956	22,278	22,500	2	0

(Parentheses) indicate negative values
ADT = average daily traffic
dBA = A-weighted decibel
MOWF = maintenance of way facility
[1] The noise increase over No Project data are presented only for reference purposes. The noise increase over existing is what determines impact.
[2] Monterey Road Roadway Segment number 6, Monterey Road between Chynoweth Avenue and Bernal Road, is in both the Monterey Corridor Subsection and the Morgan Hill and Gilroy Subsection.

Table 5-21 shows the roadway segments assessed for Alternative 4 in 2040. Four roadway segments near San Jose Diridon Station have the potential for noise level increases greater than or equal to 3 dB compared to existing noise conditions. Compared to the 2040 No Project Alternative, the largest increase is 2 dB, and all other segments show increases of 1 dB or less. Along Monterey Road, six segments have the potential for increases of 3 dB or greater compared to existing noise conditions. However, none of the segments would have an increase greater than 2 dB compared to the No Project Alternative. One roadway segment near the Downtown Gilroy Station would have a noise level increase greater than or equal to 3 dB compared to existing noise conditions, and compared to the No Project Alternative none would have increases greater than 2 dB. The largest increase in noise level for the east Gilroy roadway segments is 1 dB compared to existing noise conditions, with no increase compared to the No Project Alternative. Near the South Gilroy MOWF, one segment has the potential for an increase greater than 3 dB compared to existing noise conditions and the No Project Alternative.

Table 5-21 Change in 2040 Traffic Noise Levels due to Project—Alternative 4

Segment	Roadway Segment Description	Existing ADT	No Project ADT	Plus Project ADT	Noise Increase Over Existing (dBA)	Noise Increase Over No Project (dBA) [1]
San Jose Diridon Station Approach Subsection						
San Jose Segments						
1	Julian between Stockton Avenue and Autumn Street	10,400	13,444	13,444	1	0
2	Autumn Street between Julian and Santa Clara	2,400	3,444	3,444	2	0
3	Stockton Avenue between Julian Street and The Alameda	7,317	18,833	18,856	4	0
4	The Alameda between Sunol Avenue and Delmas Avenue	16,861	23,056	32,389	3	1
5	Sunol Avenue between The Alameda and Park Avenue	3,522	4,667	4,667	1	0
6	Cahill Street between Santa Clara and San Fernando Street	2,056	5,722	8,589	6	2
7	Montgomery Street between Santa Clara Street and Park Avenue	4,428	5,667	6,533	2	1
8	Autumn Street between Santa Clara Street and Park Avenue	4,494	17,167	18,456	6	0
9	Park Avenue between Sunol Avenue and Montgomery Street	10,550	11,611	13,722	1	1
10	Montgomery Street between Park Avenue and San Carlos	20,328	25,611	25,611	1	0
11	San Carlos Street between Sunol Avenue and Montgomery Street	16,089	22,611	25,833	2	1
12	Bird Avenue between San Carlos Street and West Virginia Street	27,206	35,722	35,722	1	0

Segment	Roadway Segment Description	Existing ADT	No Project ADT	Plus Project ADT	Noise Increase Over Existing (dBA)	Noise Increase Over No Project (dBA) [1]
Monterey Corridor Subsection						
Monterey Road Segments						
1	Monterey Road between Capitol Expressway WB Ramps and Branham Lane	40,644	61,667	61,667	2	0
2	Skyway Drive between Monterey Road and Houndshaven Way	10,722	13,444	13,444	1	0
3	Houndshaven Way between Skyway Drive and Branham Lane	844	2,389	2,389	5	0
4	Branham Lane between Monterey Road and Houndshaven Way	11,178	20,667	20,667	3	0
5	Monterey Road between Branham Lane and Chynoweth Avenue	19,756	36,611	55,722	5	2
6[2]	Monterey Road between Chynoweth Avenue and Bernal Road	14,944	40,389	40,389	4	0
Morgan Hill and Gilroy Subsection						
Monterey Road Segments						
7	Bernal Road between Monterey Road and Santa Teresa Boulevard	13,117	16,722	16,722	1	0
8	Santa Teresa Boulevard between Bernal Road and Bailey Avenue	9,844	31,000	31,000	5	0
9	Hale Avenue between Baily Avenue and Llagas Road	10,661	17,944	17,944	2	0
10	Llagas Road between Hale Avenue and Old Monterey Road	4,022	7,278	7,278	3	0
11	Monterey Road between Bernal Road and Old Monterey Road	15,811	19,667	19,667	1	0
Downtown Gilroy Station Segments						
1	Leavesley Road between US 101 and Cameron Boulevard Extension	8,400	3,722	3,722	(4)	0
2	Leavesley Road between Monterey Road and US 101	24,689	27,389	27,389	0	0
3	Welburn Avenue between Church Street and Monterey Road	15,889	18,500	18,500	1	0
4	Monterey Road between Welburn Avenue and First Street	19,956	25,778	28,067	1	0
5	First Street between Church Street and Monterey Road	13,733	14,667	15,778	1	0

Segment	Roadway Segment Description	Existing ADT	No Project ADT	Plus Project ADT	Noise Increase Over Existing (dBA)	Noise Increase Over No Project (dBA) [1]
6	Monterey Road between First Street and 10th Street	8,606	11,500	14,444	2	1
7	Sixth Street between Monterey Road and US 101	6,689	7,444	12,568	3	2
8	10th Street between Monterey Road and US 101	19,672	20,167	25,128	1	1
9	Pacheco Pass Highway between US 101 and Cameron Boulevard	27,900	20,389	20,389	(1)	0
10	Monterey Road between 10th Street and Travel Park Circle	14,956	22,278	24,511	2	0
East Gilroy Segments						
1	Marcella Avenue between Buena Vista Avenue and Leavesley Road	417	611	528	1	(1)
2	Leavesley Road between Marcella Avenue and New Avenue	8,067	3,389	3,389	(4)	0
3	Leavesley Road between US 101 and Cameron Boulevard Extension	8,400	3,722	3,722	(4)	0
4	Leavesley Road between Monterey Road and US 101	24,689	27,389	27,389	0	0
5	Welburn Avenue between Church Street and Monterey Road	15,889	18,500	18,500	1	0
6	Monterey Road between Welburn Avenue and First Street	19,956	25,778	28,067	1	0
Gilroy MOWF Segments						
1	Frazier Lake Road south of Pacheco Pass Highway	4,317	5,167	5,167	1	0
2	Pacheco Pass Highway between US 101 and Frazier Lake Road	27,900	19,778	20,389	(1)	0
3	10th Street between Monterey Road and US 101	19,672	20,167	25,128	1	1
4	Alexander Street between Old Gilroy Street and 10th Street	3,233	3,889	7,872	4	3
5	Monterey Road between 10th Street and Travel Park Circle	14,956	22,278	24,511	2	0

(Parentheses) indicate negative values
ADT = average daily traffic
dBA = A-weighted decibel
MOWF = maintenance of way facility
[1] The noise increase over No Project data are presented only for reference purposes. The noise increase over existing is what determines impact.
[2] Monterey Road Roadway Segment number 6, Monterey Road between Chynoweth Avenue and Bernal Road, is in both the Monterey Corridor Subsection and the Morgan Hill and Gilroy Subsection.

Overall, there are relatively few roadway segments where the increases in traffic associated with the project alternatives under the 2040 Plus Project Alternative are anticipated to be greater than or equal to 3 dB. Most of the segments where increases greater than or equal to 3 dB are projected are near San Jose Diridon Station and some along the Monterey Road segment. The results of the traffic noise analysis for 2040 are similar for all project alternatives, and differ only near the MOWF near Gilroy.

The traffic noise predictions have been made by comparing the existing traffic volumes to 2040 Plus Project volumes and by comparing the 2040 No Project volumes to the 2040 Plus Project volumes. The traffic volume predictions include growth factors unrelated to the project alternatives. In all cases the noise impact is determined from the increase in noise over the existing condition. As would be expected, the analysis shows greater potential increases in traffic noise compared to the existing noise conditions than when compared to the No Project Alternative.

Noise Effects on Livestock Animals

The project would extend through rural, agricultural, and open space lands in southern Santa Clara, San Benito, and Merced Counties. Livestock (cattle) are present in rangelands along the project alignments, particularly in the Pacheco Pass Subsection. Additionally, dairy is an important agricultural product in Merced County and confined animal agricultural operations are prevalent in the San Joaquin Valley.

Operations of the project would stress livestock animals by subjecting them to increased noise and vibration levels within 30 feet of the HSR right-of-way. The FRA guidance manual (FRA 2012) establishes an SEL of 100 dBA from a single train passby as the criteria for potential noise impacts on livestock. The criteria for potential effects are shown in Table 4-4. Analysts conducted a noise screening assessment to determine typical and maximum distances from the HSR tracks at which the limits may be exceeded. HSR passby SELs were calculated for various track types typical in the project: at-grade track, track on 10-foot-high embankment, and track on 50-foot-high viaduct. The projections were calculated for a HSR train traveling at a typical speed of 150 mph and at the maximum speed in the Project Section of 220 mph. For reference, a projection was also calculated for a HSR train sounding a warning horn. To provide conservative estimates, no shielding from intervening structures was assumed.

Table 5-22 shows the results of the screening assessment. For HSR track at grade and on embankment, the screening distances for potential effects on animals would be 15 feet from the track centerline for trains traveling at 110 mph, 25 feet from the track centerline for trains traveling at 150 mph, and 70 feet for trains traveling at 220 mph. At locations where the project would be on a 50-foot-high viaduct, the passby SEL of 100 dBA would not be surpassed beyond the edge of the aerial structure, approximately 15 feet from the track centerline. At locations where the HSR train would sound warning horns, the screening distance would be approximately 285 feet from the track centerline. For reference, screening distances have also been calculated and added to Table 5-22 for a Caltrain train and a freight train passby sounding warning horns. The screening distances are 62 feet and 290 feet, respectively.

According to the screening distance information provided in Table 5-19, livestock might be within the screening distance for an at-grade or 10-foot-high embankment HSR (i.e., within 70 feet of either side of the track centerline [for a total width of 140 feet]). Because fences control access to the right-of-way and the right-of-way would be a minimum of 85 feet wide, livestock would have to be within approximately 30 feet of the edge of the HSR right-of-way to experience noise effects above the recommended threshold. Where domestic animal operations are adjacent to the HSR right-of-way, adverse effects would occur within 30 feet of the HSR right-of-way because of passbys or within 285 feet of horn-sounding locations. These impacts will be temporary and of short duration.

As described in Appendix 3.12-E, High-Speed Rail Impacts on Confined Animal Agriculture Facilities, several confined animal agriculture facilities along the HSR alignment would be located within 100 feet of the centerline of the project alignment in the San Joaquin Valley subsection, and livestock animals within 30 feet of the right-of-way fence could be affected by train passbys. The figures in Appendix 3.12-E, show confined animal agriculture facilities that would be affected by the alternatives. Livestock may become habituated to train noise over time.

Alternatives 1, 2, and 3 would be grade separated on dedicated tracks and thus no horn sounding would be necessary at any at-grade crossings, and since HSR would operate on tracks that are physically separate from Caltrain, HSR trains would not sound horns at Caltrain stations. For these reasons no horn-sounding effects on livestock would occur. With Alternative 4, HSR would sound horns at at-grade crossings and Caltrain stations between San Jose and Gilroy. In urban areas of San Jose, Morgan Hill, and Gilroy and the developed area of San Martin and adjacent to the Caltrain stations, there is limited to no livestock areas. Thus, potential horn-sounding effects on livestock with Alternative 4 are limited to the rural area between San Jose and Morgan Hill (e.g., Coyote Valley) and the semi-rural area between San Martin and Gilroy. In these two areas, livestock would be sporadically within the screening distance for an HSR train sounding the warning horn at an at-grade crossing (i.e., within 285 feet of either side of the track centerlines) similar to how existing livestock is within the screening distances for existing Caltrain and freight sounding warning horn noise at at-grade crossings. Horn sounding in these areas would increase in frequency, but horn intensity would not increase over current levels.

At locations adjacent to existing rail right-of-way or busy highways where existing noise is already high, there would be no effects because livestock would be expected to be habituated to high noise levels.

Table 5-22 Screening Distances for Effects on Livestock

HSR Configuration	Speed (mph)	SEL[1] (dBA)	Distance from HSR Centerline (feet)
HSR on at-grade track	110	100	15
	150	100	25
	220	100	70
HSR on 10-foot-high embankment	150	100	25
	220	100	70
HSR on 50-foot high viaduct[2]	150	88	15
	220	94	15
HSR on at-grade track, sounding warning horn	110	100	285
Caltrain on at-grade track, sounding warning horn	79	100	62
Freight train on at-grade track, sounding warning horn	60	100	290

mph = miles per hour
SEL = sound exposure level
dBA = A-weighted decibel
[1] The SEL represents a receptor's cumulative noise exposure from an event normalized to a 1-second interval. This noise descriptor is used to assess effects on livestock.
[2] The aerial structure projections assume a parapet barrier on the edge of the aerial structure assumed to be 3 feet above the top-of-rail height. The distance from the track centerline where the SEL = 100 dBA is less than 15 feet.

Traction Power Facility Noise

Analysts identified potentially affected noise-sensitive receivers near traction power facilities using the screening distance of 250 feet for receivers with an unobstructed view to the facilities and 125 feet for those with intervening buildings. FTA reference levels were used to calculate the total project noise level at the receivers identified within the screening distance. For Alternative 4, within the Diridon Station Approach subsection, the HSR TPF would be co-located with the Caltrain facility (PS2 – Option 2), which was previously analyzed for the PCEP (Wilson Ihrig 2014), for which no noise sensitive receptors were identified within the screening distance.

Train operations noise levels were also calculated using the methods described in Section 4.1.5.2 to assess the total project noise levels considering ambient noise at the receivers and accounting for both changes from project operations and the new substation/facility noise source. The noise levels from ancillary facilities were estimated. The highest noise levels from ancillary facilities would be 63 L_{dn} dBA at 110 feet, but no TPF would generate noise impact due to the substation facility alone. Furthermore, in combination with the HSR train operations, the substation noise would not affect any new receptors not separately affected by the train operation impacts shown previously in Table 5-23. TPF combined with HSR train operations would generate noise impacts at several areas (7 receptors with Alternative 1, 1 receptor for Alternative 2, 9 receptors with Alternative 3, and 33 receptors for Alternative 4). Furthermore, this analysis is conservative because distances were based on the closest outer footprint of facility, and the specific distance to noise sources would be greater in many cases.

Table 5-23 Transfer Power Facility Noise Analysis Results

City (Subsection)	Facility[1] (Alternative)[1]	Near Receptor Address	Land Use Category[2]	Land Use	Receptor Distance to Ancillary Facility (feet)	Ambient L_{dn}	Substation Noise, L_{dn} (dBA)	Project with TPF				Number of Receivers	Noise Impact Thresholds		Noise Increase with Project and TPF			
								Alt 1	Alt 2	Alt 3	Alt 4		Moderate	Severe	Alt 1	Alt 2	Alt 3	Alt 4
San Jose (Monterey Corridor)	PS	5560 Lexington Avenue, SJ	2	MFR	110 (first row)	69.1	63	N	N	N	73.2	15	1.1	2.9	N/A	N/A	N/A	5.8
San Jose (Monterey Corridor)	PS	5560 Lexington Avenue, SJ	2	MFR	150 (further away)	69.1	60	N	N	N	73.2	15	1.1	2.9	N/A	N/A	N/A	5.7
Morgan Hill (Morgan Hill and Gilroy)	PS	17359 Walnut Grove Drive Morgan Hill	2	SFR	218	66.3	57	67.6	N	67.6	N	5	1.3	3.4	3.9	N/A	3.9	N/A
Morgan Hill (Morgan Hill and Gilroy)	PS	890 San Bernardo Lane	2	MFR	246	65.1	56	66.6	N	66.6	N	1	1.3	3.4	3.4	N/A	3.4	0.0
Gilroy (Morgan Hill and Gilroy)	SWS	Cohansey Avenue at Monterey Road	2	MFR	200	71.7	61	N	N	N	73.4	2	1.4	3.6	N/A	N/A	N/A	9.1

City (Subsection)	Facility[1] (Alternative)[1]	Near Receptor Address	Land Use Category[2]	Land Use	Receptor Distance to Ancillary Facility (feet)	Ambient L_{dn}	Substation Noise, L_{dn} (dBA)	Project with TPF				Number of Receivers	Noise Impact Thresholds		Noise Increase with Project and TPF			
								Alt 1	Alt 2	Alt 3	Alt 4		Moderate	Severe	Alt 1	Alt 2	Alt 3	Alt 4
Gilroy (Morgan Hill and Gilroy)	PS	Pacific Point School, 2220 Pacheco Pass Highway	1	school	100	70.2	64	N	N	71.6	N	1	0.8	2.5	N/A	N/A	3.3	N/A
Gilroy (Morgan Hill and Gilroy)	PS	2225 Pacheco Pass Highway	2	SFR	115	70.2	63	N	N	71.9	N	1	1.0	2.7	N/A	N/A	4.3	N/A
Gilroy (Morgan Hill and Gilroy)	PS	2160 Pacheco Pass Highway	2	SFR	95	75.3	64	TAKE				1	N/A	N/A	N/A			
Hollister (Morgan Hill and Gilroy)	PS	7968 Lover's Lane, Hollister	2	SFR	240	54.1	56	TAKE				1	N/A	N/A	N/A			
Gilroy (Morgan Hill and Gilroy)	TPSS Site 4 Gilroy	Residence near San Felipe Road at SR 152	2	SFR	175	69.6	59	70.3	70.3	70.3	70.3	1	1.1	2.8	3.5	3.5	3.5	3.5
Gilroy (Morgan Hill and Gilroy)	TPSS Site 4 Gilroy	Bloomfield Avenue at Nursery	2	MFR	187	61.2	58	TAKE*		N	TAKE*	2	N/A	N/A	N/A			

City (Subsection)	Facility[1] (Alternative)[1]	Near Receptor Address	Land Use Category[2]	Land Use	Receptor Distance to Ancillary Facility (feet)	Ambient L_{dn}	Substation Noise, L_{dn} (dBA)	Project with TPF				Number of Receivers	Noise Impact Thresholds		Noise Increase with Project and TPF			
								Alt 1	Alt 2	Alt 3	Alt 4		Moderate	Severe	Alt 1	Alt 2	Alt 3	Alt 4
Gilroy (Morgan Hill and Gilroy)	TPSS Site 4 Gilroy	Bloomfield Avenue at Nursery	2	SFR	170	61.2	58	TAKE*		N	TAKE*	1	N/A	N/A				

L_{dn} = day-night sound level, dBA
dBA = A-weighted decibel
TPF = traction power facility
PS = paralleling station
MFR = multifamily residence
N: Building not affected by TPF for this alternative
N/A = not applicable
SFR = single-family residence
SWS = switching station
TPSS = traction power supply station
SR = State Route
[1] Facilities not listed have no noise sensitive receivers within 250 feet of the facility.
[2] FRA land use categories are summarized in Table 3.4-5. Land Use Category 1 = areas where quiet is an essential element to the land use; Category 2 = Residential; Category 3 = Institutional use and passive-use parks.
Take: property would be acquired by the Authority; buildings not counted
* Take only affects Alternatives 1, 2, and 4.

5.2 Vibration

5.2.1 Existing Vibration Environment

This section summarizes the locations of existing vibration measurement sites and the results of vibration measurement. This section also describes the vibration-sensitive land uses and sources of existing vibration in the RSA.

5.2.1.1 Vibration Measurement Results and Discussion

Measurements of the existing vibration levels were conducted at 14 sites in the RSA. The locations of the vibration measurement sites are illustrated on Figures 5-1 through 5-5, and photographs of these sites are provided in Appendix A.

The existing vibration measurement results are shown in Table 5-24. At each site, ground-borne vibration levels were recorded at multiple distances, and the range of distances from the track centerline from where the vibration levels were measured are shown in Table 5-24. The results include the range of maximum overall ground-borne vibration levels for each type of train passby based on the distance from the track. The range in measured vibration levels corresponds directly to the accelerometer or geophone distance from the track. Higher vibration levels occur closer to the existing tracks and the vibration levels decrease with distance from the track.

The FRA notes that typical outdoor sources of perceptible ground-borne vibration are construction equipment, steel-wheeled trains, and traffic on rough roads. If the roadway is smooth, the vibration from traffic is rarely perceptible (FRA 2012). For most of the RSA, the dominant existing vibration sources are train traffic. In subsections where the vibration RSA diverges from existing railroad right-of-way, there are no significant sources of existing vibration. Traffic on roadways can cause some vibration, but because of the rubber tires on the vehicles, those vibration levels are typically low and isolated to locations close to roadways; vibration from traffic is only mentioned if the levels are comparable to 72 VdB. The vibration-sensitive land uses in the RSA are generally located where the vibration RSA is adjacent to existing rail rights-of-way and therefore, where existing ambient vibration measurements were conducted.

Table 5-24 Existing Vibration Measurement Locations

Site	Location	Date	Distance from Track (feet)	Overall Vibration Level (VdB)	Source
San Jose Diridon Station Approach Subsection					
V31	2075 Main Street, Santa Clara	10/20/2009	80 – 125	78 – 73	Caltrain
V32	890 Newhall Street, San Jose	7/1/2016	50 – 138	79 – 73	Caltrain
V33	855 McKendrie Street, San Jose	3/10/2010	70 – 195	77 – 70	Caltrain
			83 – 258	77 – 68	Amtrak
			100 – 270	73 – 64	Freight
V34	782 Auzerais Avenue, San Jose	5/29/2013	25 – 214	89 – 58	Caltrain
V35	704 Harrison Street, San Jose	7/1/2016	40 – 114	83 – 70	Caltrain
V36	Jerome Street & Willis Avenue, San Jose	7/28/2016	105 – 160	68 – 56	Caltrain
			45 – 150	74 – 59	Caltrain
			45 – 135	64 – 54	ACE

Site	Location	Date	Distance from Track (feet)	Overall Vibration Level (VdB)	Source
V37	Fuller Avenue & Delmas Avenue, San Jose	5/31/2016	40 – 139	73 – 58	Caltrain
			54 – 103	56 – 50	ACE
Monterey Corridor Subsection					
V38	Pomme Court & Olive Hill Drive, San Jose	6/01/2016	67 – 217	73 – 54	Caltrain
V39	Hayes Avenue & Endicott Boulevard, San Jose	5/17/2016	82 – 232	70 – 61	Caltrain
Morgan Hill and Gilroy Subsection					
V40	Old Monterey Road & Paloma Drive, Morgan Hill	5/18/2016	44 – 194	78 – 62	Caltrain
V41	East Middle Avenue & Crowner Avenue, San Martin	5/18/2016	66 – 166	76 – 65	Caltrain
V42	Depot Street & North Street, San Martin	7/21/2016	25 – 100	75 – 64	Caltrain
V43	Depot Street & South Street, San Martin	7/21/2016	25 – 100	75 – 67	Caltrain
V44	Railroad Street & Lewis Street, Gilroy	5/18/2016	50 – 150	71 – 56	Caltrain

VdB = vibration decibels

Figure 5-26 illustrates results of the existing vibration measurements. The overall ground-borne vibration velocity levels at each site at each measurement distance from the tracks are included. The various symbols in the figure identify the site and each type of train passby. For reference, the FRA residential vibration criterion of 72 VdB is also included, showing the range of distances at which existing train vibration currently exceeds the criterion. The measurements show that the vibration levels decrease with distance, which varies at each site as a function of distance from the track, the train type, and train speed. At most sites, the overall vibration levels exceeded the FRA residential criterion at locations less than 50 feet from the track and at some sites up to approximately 100 feet from the track, which is less than would typically be expected.

As discussed in Section 4.2.4, Methods for Establishing Existing Vibration Levels, vibration propagation measurements were conducted at 10 locations in the RSA to assist in the prediction of ground-borne vibration levels from project operations. The vibration propagation measurements shown in Table 5-25 are site-specific tests that quantify the efficiency of vibration propagation through the soil at specific locations. The results are used to conduct a detailed vibration analysis and predict future ground-borne vibration levels from project operations.

Surface vibration propagation tests were conducted at nine locations in the RSA. One borehole vibration propagation test was also conducted in the RSA during previous work in 2010. The LSR data from each propagation measurement site are plotted in Appendix C, which also provides LSR coefficients for each site.

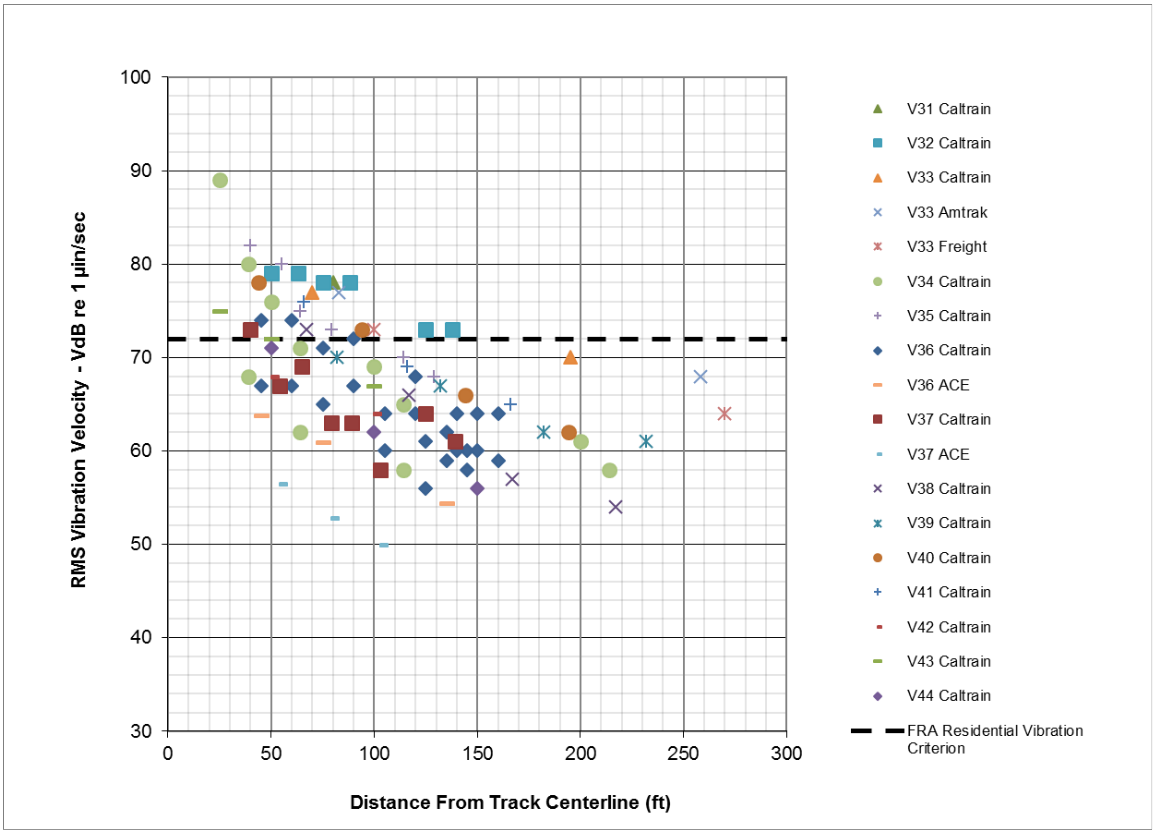

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Figure 5-26 Existing Vibration Measurement Levels

Table 5-25 Vibration Propagation Measurement Locations

Site	Location	Date	Test Type	Depth (feet)[1]
San Jose Diridon Station Approach				
VP19	Main Street & Washington Street, Santa Clara	3/25/2010	Borehole	50, 60, 70
VP20	855 McKendrie Street, San Jose	3/10/2010	Surface	0
VP21	Jerome Street & Willis Avenue, San Jose	7/28/2016	Surface	0
Monterey Corridor Subsection				
VP22	Hayes Avenue & Endicott Boulevard, San Jose	5/17/2016	Surface	0
Morgan Hill and Gilroy				
VP23	Old Monterey Road & Paloma Drive, Morgan Hill	5/18/2016	Surface	0
VP24	Seymour Avenue & East Middle Avenue, San Martin	7/22/2016	Surface	0
VP25	Depot Street & North Avenue, San Martin	7/21/2016	Surface	0
VP26	Depot Street & Spring Street, San Martin	5/18/2016	Surface	0
VP27	Alexander Street & East Eighth Street, Gilroy	5/19/2016	Surface	0

Site	Location	Date	Test Type	Depth (feet)[1]
San Joaquin Valley				
VP28	Volta Road & Henry Miller Road, Los Banos	5/24/2016	Surface	0

[1] At site VP19, vibration propagation was measured at multiple borehole depths.
[2] No vibration propagation measurements were conducted in the Pacheco Pass Subsection because no sensitive receptors are near the project.

San Jose Diridon Station Approach Subsection

In San Jose, the vibration RSA follows the Caltrain right-of-way through moderately dense urban areas with mixed land use. North of San Jose Diridon Station, the land use on the east side of the existing rail alignment is primarily industrial, while the western side is mainly residential. The closest residence is approximately 50 feet from the existing railway line. Bellarmine College Preparatory School campus is on the western side of the vibration RSA. At San Jose Diridon Station, there are multifamily buildings along the entire west side of San Jose Diridon Station facing the existing tracks and platforms. Templo La Hermosa church is on the eastern side of the station, beyond the parking lots approximately 550 feet from the station.

South of San Jose Diridon Station, the vibration RSA follows I-280 and SR 87. Land uses include residential neighborhoods and some commercial/industrial areas. The San Jose Fire Department Bureau of Field Operations campus is located just south of San Jose Diridon Station on the east side of the RSA. Gardner Elementary School is located approximately 275 feet south of I-280 on the south side of the RSA.

Existing vibration in this portion of the RSA is dominated by a number of daily rail operations that share the alignment (Table 4-8). This alignment is a heavily used rail corridor with 92 daily weekday Caltrain passenger trains currently operating between San Francisco and San Jose Diridon Station. Forty daily Caltrain trains operate through to Tamien Station. Approximately two to nine freight trains run along the route per day. Fourteen Capital Corridor and eight ACE trains run along the alignment daily between De La Cruz Boulevard and San Jose Diridon Station. ACE trains continue to travel south to Tamien Station to access the layover facility. Amtrak Coast Starlight trains pass through the section twice daily. Santa Clara VTA light rail trains run along the center of SR 87.

Vibration from Caltrain trains was measured at three sites north of San Jose Diridon Station. Overall ground-borne vibration levels from Caltrain measured at the closest positions ranged from 79 VdB (at 50 feet) to 77 VdB (at 80 feet) from the tracks. The vibration levels from Amtrak trains measured at V33 were similar to Caltrain trains. Vibration levels from freight train operations measured at V33 ranged from 73 VdB (at 100 feet) to 64 VdB (at 270 feet).

Vibration from Caltrain trains was measured at three sites south of San Jose Diridon Station. Overall vibration levels from Caltrain at the closest positions ranged from 83 VdB (at 40 feet) to 68 VdB (at 105 feet). Vibration levels from ACE trains at V36 were lower than Caltrain trains.

Monterey Corridor Subsection

South of West Alma Avenue, the vibration RSA extends along SR 87 until south of Almaden Expressway where it turns east toward Monterey Road following the UPRR right-of-way. Land uses along the Monterey Corridor Subsection include primarily single-family residential neighborhoods and some commercial/industrial areas. Toward the southern end of the subsection, land uses include scattered single-family homes and farms.

The closest residence is approximately 30 feet from the existing railway line, near Skyway Drive, where backyards of single-family homes abut the right-of-way. An Elk's Lodge on West Alma Avenue is approximately 180 feet from SR 87 on the west side of the RSA. A recording studio is on the east side of the RSA, although it is approximately 350 feet from the existing railway and behind some intervening commercial buildings. The School of the Blues music school is located on Monterey Road, approximately 190 feet from the existing railway line. Other institutional land uses include Edenvale Branch Library and four places of worship.

Sources of existing vibration include traffic on SR 87 and Monterey Road, as well as the existing rail traffic along UPRR. South of Tamien station the daily rail traffic consists of six Caltrain passenger trains, two Amtrak trains, and approximately four freight trains per day. VTA light rail also run along the center of SR 87.

Vibration from Caltrain trains was measured at site V38. Overall vibration levels from Caltrain ranged from 73 VdB (at 67 feet) to 54 VdB (at 217) feet from the tracks. Vibration from Caltrain trains was also measured at site V39. Overall vibration levels ranged from 70 VdB (at 82 feet) to 61 VdB (at 232) feet from the tracks.

Morgan Hill and Gilroy Subsection

Along Monterey Road through Downtown Gilroy

The vibration RSA extends along the single UPRR track from Bernal Way into downtown Gilroy. It continues past the existing Gilroy Caltrain Station, along UPRR south of downtown, and then turns east toward the Pacheco Pass Highway near Bloomfield Avenue. Land uses include farms with scattered single-family homes, and residential neighborhoods and commercial areas in Morgan Hill and San Martin. The closest residences to the existing railway line are a row of single-family homes approximately 40 feet away, where backyards abut the right-of-way, between Bernal Way and Metcalf Road. Three hotels are within 200 feet of the existing railway line. The closest school is approximately 145 feet from the existing railway line. The closest place of worship is located approximately 150 feet from the existing railway line. In downtown Morgan Hill, the Morgan Hill Community Center outdoor amphitheater is approximately 500 feet from the existing railway line and the South Valley Civic Theatre and Community Playhouse is more than 600 feet from the railway line.

In the downtown area, land uses include a mix of residential neighborhoods and commercial/industrial areas. South of downtown, land uses include farms with scattered single-family homes. The closest residential building to the existing railway line is approximately 50 feet from UPRR track on Monterey Road and Lewis Street. The closest school is Gilroy Preparatory School, which is approximately 145 feet from the existing railway line. Pintello Comedy Theater is approximately 365 feet from the existing railway line and the District Theater Live Music Venue is 50 feet from the railway line.

Sources of existing vibration include existing rail traffic along UPRR (six Caltrain passenger trains, two Amtrak passenger trains, and approximately four freight trains per day). Caltrain trains stop at the existing Gilroy station, which is where Caltrain service terminates. Amtrak and freight trains continue to operate south of Gilroy. Low level vibration occurs from traffic on Monterey Road.

Vibrations from Caltrain trains were measured at five sites from Morgan Hill to Gilroy. Overall ground-borne vibration levels from Caltrain measured at the closest positions ranged from 78 VdB (at 44 feet) to 71 VdB (at 50 feet) from the tracks. Levels at the farthest measured distances ranged from 67 VdB (at 100 feet) to 56 VdB (at 150 feet).

Adjacent to US 101 through Morgan Hill

Land uses include farms with scattered single-family homes, and residential neighborhoods and commercial areas in Morgan Hill near El Camino Real/US 101. For most of this RSA, there are no existing rail vibration sources and the existing low-level vibration environment is primarily traffic on US 101 and local streets. At connection points on both ends, some receptors are exposed to the existing rail traffic along UPRR (Caltrain passenger trains, two Amtrak passenger trains, and approximately four freight trains per day).

East Gilroy

Land uses include farms with scattered single-family homes. For most of this RSA, there are no existing rail vibration sources and the existing low-level vibration environment is primarily traffic on rural streets. At the connection point, some receptors are exposed to the existing rail traffic along UPRR (Caltrain passenger trains, two Amtrak passenger trains, and approximately four freight trains per day).

Pacheco Pass Subsection

For most of this RSA, there are no existing rail vibration sources and the existing low-level vibration environment is primarily traffic on SR 152 and rural streets. The land uses in this subsection are quite different from the rest of the project. There are some sparsely scattered single-family homes, but much of the subsection is not inhabited. The RSA passes through two portions of the Cottonwood Creek Wildlife Area, which is not considered vibration sensitive because it is an outdoor land use. Vibration impact criteria have not been established for animals. Therefore, no vibration propagation measurements were conducted in the Pacheco Pass Subsection.

San Joaquin Valley Subsection

The vibration RSA passes Santa Nella Road/I-5 then follows Henry Miller Road to Carlucci Road. Land uses include farms with scattered single-family homes and one elementary school. For most of the San Joaquin Valley Section, there are no existing rail vibration sources and the existing low-level vibration environment is primarily traffic on rural streets. In Volta, a freight railroad line crosses the RSA. One single-family residence is within 200 feet of the existing freight railway line and in the RSA.

5.2.2 Vibration Impact Assessment

Vibration impacts were assessed according to the criteria described in Section 4.2.3 and the method, data, and assumptions described in Section 4.2.4 and Section 4.2.5, Prediction Methods.

5.2.2.1 Construction Vibration Impacts

Construction of project alternatives would require the use of equipment that would generate temporary ground-borne vibration during the construction period, with up to 2 years of continuous construction activity anticipated at any one location. The effects from construction-related vibration would be similar under all project alternatives.

Construction vibration would result in human annoyance and building damage. Human annoyance occurs when construction vibration rises above the threshold of human perception for extended periods. A threshold of 80 VdB was used to evaluate nighttime annoyance for infrequent events at residential land use, which would typically be applied to most project construction work. For sources such as pile driving, vibratory compaction and ongoing demolition work with jackhammers or hoe-rams, the frequent event criterion of 72 VdB is more appropriate. Nighttime annoyance would potentially occur as far out as 300 feet from pile- driving activities, 140 feet from vibratory compaction and 50 feet from short-duration, transient events. These activities could occur on any of the alternatives, but more likely to occur on Alternative 4.

Building damage occurs when construction activities produce waves in the ground that are strong enough to cause cosmetic or structural damage. Of the vibration-sensitive buildings along the project corridor that have been considered, the most sensitive are lightweight (wood-framed) buildings with plaster interior wall finishes, as shown in Table 4-15 for Type III structures. The potential for vibration impacts would occur near pile driving, vibratory compaction, demolition, or excavation activities near vibration-sensitive structures (building damage) or vibration-sensitive use (annoyance). Pile driving very close to buildings (within 50 feet) would be anticipated to exceed the threshold of 0.2 inch per second (in/sec) PPV and cause building damage at Type III, as shown in Table 5-26. Pile driving would only occur at limited worksites, such as the MOWF building foundations, bridge retrofit structures, and some aerial structure foundation support for any of the alternatives.

Construction of bored tunnels in the Pacheco Pass Subsection would require the use of a TBM). Ground-borne TBM vibration is often imperceptible to humans at distances greater than 100 feet and comparable to vibration from train operations. The vibration from the TBM would vary with the diameter of the tunnel being constructed; a bigger TBM would create greater vibration than a smaller TBM. At slant distances (measured along a direct line from the TBM to a receptor of interest) less than 100 feet, the likelihood of perceptibility increases, and overall vibration levels might be expected range of 72 VdB to 80 VdB. In this range, a person in an occupied building would be aware of the vibration from the TBM, but because the TBM would be moving through the tunnel, the vibration may only last for approximately a day. At the residential building nearest to the alignment in Pacheco Pass, on Whiskey Flat Road, the tunnel depth would greater than 200 feet. At that distance, TBM vibration would be less than 64 VdB, which would not be perceptible.

Table 5-26 Construction Equipment Vibration Impact Distances (feet)

Construction Equipment	Source Vibration at 25 feet		Buffer Distances[1] and Thresholds (feet)				
	Peak Particle Velocity (PPV in/sec)	Vibration Level, L_v	Bldg. Damage (Type I) 0.5 in/sec PPV	Bldg. Damage (Type II) 0.3 in/sec PPV	Bldg. Damage (Type III) 0.2 in/sec PPV	Annoyance (Infrequent Events) 80 VdB	Annoyance (Frequent Events) 72 VdB
Impact pile driver	0.644	104	30	42	55	159	296
Vibratory pile driver	0.17	93	12	17	22	66	122
Vibratory compactor	0.21	94	14	20	26	76	140
Loaded trucks	0.076	86	7	10	13	38	71
Jackhammer	0.035	79	4	6	8	23	42
Small bulldozer	0.003	58	1	1	2	4	8
TBM	0.144	91	11	15	20	59	109

Sources: FRA 2012;
In/sec = inches per second
L_v = velocity level
VdB = velocity decibels
[1] Buffer distances calculated to the ground at the edge of structures.
Type I – Reinforced-concrete, no plaster.
Type II – Engineered concrete and masonry, no plaster
Type III – Nonengineered timber and masonry
Infrequent – less than 30 vibration events per day
Frequent – more than 70 vibration events per day

Construction key differences are discussed in Section 5.1.2.1. For the Morgan Hill and Gilroy Subsection, construction of the viaduct structure (Alternative 1 and 2) with cast-in drilled-hole piles would generally have a shorter criterion distance than the embankment and at-grade track options (Alternatives 2 and 4, respectively) because vibratory compaction would not be as widespread. For the Monterey Corridor and the San Jose Diridon Approach Subsections, the aerial viaduct (Alternatives 1 and 2) similarly would have a shorter criterion distance than Alternatives 2 and 4. Nighttime construction could be required for Alternative 4 to minimize disruption with existing passenger rail services.

5.2.2.2 Operations Vibration Impacts

This section describes the predicted vibration impacts from project operations, which are due to annoyance. The vibration propagation measurement results were combined with the FDL data illustrated on Figure 4-10 for HSR trains and Caltrain trains, as described in Section 4.2.5.2. Figure 5-27 illustrates the projections of maximum overall ground-borne vibration levels from HSR operations for each of the vibration propagation measurement sites assuming HSR would operate on embankment at 220 mph. The figure also includes the FRA residential vibration criterion of 72 VdB as a reference. Figure 5-28 illustrates the sample projections of maximum overall ground-borne vibration levels from HSR operations at 110 mph on blended, at-grade track for each of the vibration propagation measurement sites (excluding site VP28, where HSR would operate on dedicated tracks).

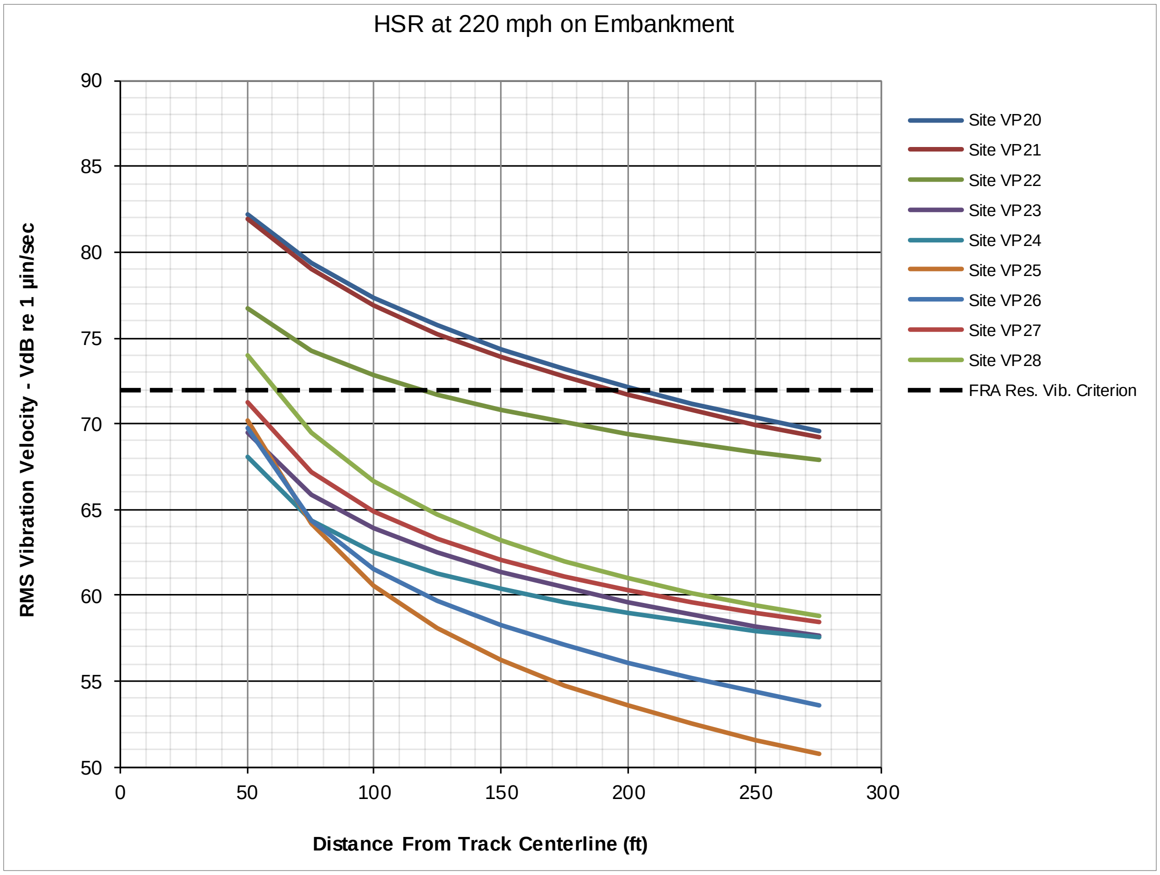

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Figure 5-27 Projected HSR Vibration Levels

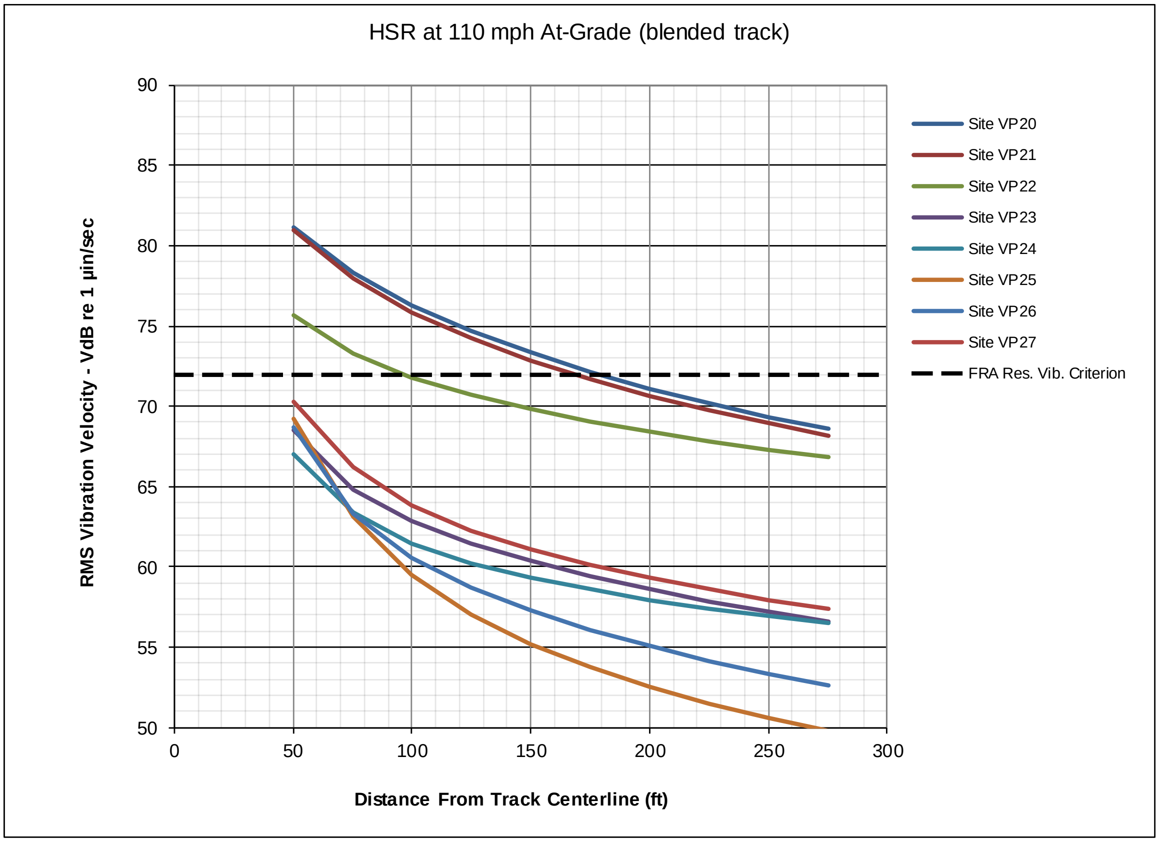

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Figure 5-28 Projected HSR Vibration Levels

The plots show the variation in vibration propagation throughout the RSA. The projections at the lower curves indicate much greater attenuation of vibration levels with distance compared to the higher curves. The most efficient propagation would be near McKendrie Street and near Jerome Street & Willis Avenue in San Jose. Locations in the RSA would experience different vibration levels for a train moving at the same speed because the ground conditions affect the vibration levels. At both sites, the projections for a 220-mph HSR train on embankment would be above the impact criterion within 200 feet of the track. The projections for these two sites for a 110 mph HSR train on blended at-grade track would be above the impact criterion within 170 feet of the track.

Figure 5-29 illustrates predicted HSR vibration levels at site VP22 for comparison with Caltrain vibration levels. The plot shows the vibration projections at this sample site for HSR on embankment at 220 mph and at 110 mph on blended at-grade track, in addition to projections of a Caltrain train at 79 mph (the maximum speed of Caltrain trains in the RSA with Alternatives 1, 2, and 3). As described in Section 4.2.5.2, vibration levels typically increase with increasing speed. However, even at 79 mph, the overall vibration level from a Caltrain passby is expected to be higher than from an HSR train traveling at 220 mph.

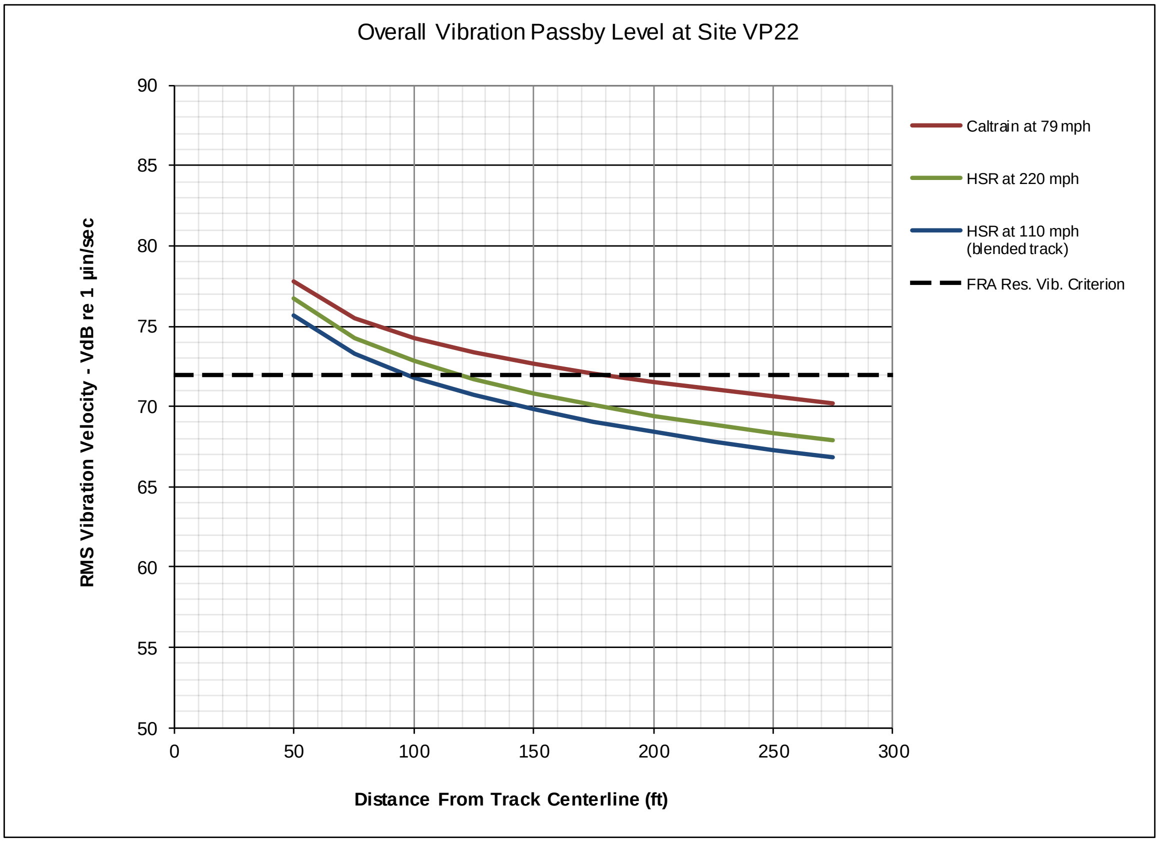

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Figure 5-29 Comparison of Projected HSR and Caltrain Vibration Levels

Potential vibration impacts from project operations were assessed according to the criteria described in Section 4.2.3.2. In the subsections of the vibration RSA with existing rail operations, analysts calculated the existing vibration levels and future project levels at vibration receptors. The modeled vibration levels for existing sources and shifted existing sources were calculated based on the measurement data and method discussed previously in Section 4.2.5.2. HSR vibration levels were predicted at each vibration-sensitive receptor or cluster of receptors for the project alternatives. In areas with existing train operations, the modeled existing vibration levels were compared to the modeled future project vibration levels from HSR operations and shifted existing train operations (where applicable).

The vibration impact criteria summarized in Section 4.2.3.2 are based on a maximum level of vibration from a train passby. This differs from the noise impact criteria, which are based on time-weighted metrics that account for the level of an event as well as the number of events in a specific period. Because the vibration impact criteria are based on single train passby events, a cumulative analysis was not necessary.

The vibration impact assessment was conducted for 2040.[13] HSR project operations would be fewer per day in 2029 than in 2040, but the maximum operating speeds would be the same, so

[13] A qualitative vibration impact analysis of the Interim 2025 Plus Project condition (an initial operating section of HSR service between San Jose Diridon Station to the Central Valley prior to commencement of service on the entire Phase 1 system in 2029), was also evaluated. The Interim 2025 Plus Project condition would include significantly fewer daily HSR trains than the 2029 Plus Project condition, which would be operated at the same train speeds. The vibration conditions

the maximum vibration levels would be the same for both 2029 and 2040 Plus Project conditions. Thus, the vibration impact assessment was conducted for only the 2040 Plus Project condition. Under the No Project Alternative, the Caltrain PCEP is assumed to use EMU vehicles in place of the current diesel locomotive-hauled coaches. The vibration analysis for the Caltrain PCEP assumed that the EMU vehicle would generate vibration similar to the existing vehicle (Wilson Ihrig 2014). Thus, no new vibration impacts are assumed associated with PCEP.

Table 5-27 summarizes the results of the vibration impact assessment (annoyance) by project alternative. Alternative 1 would result in 81 vibration impacts, Alternative 2 would result in 143 vibration impacts, Alternative 3 would result in 140 vibration impacts, and Alternative 4 would results in 1,203 vibration impacts. The majority of these vibration impacts would occur in the Monterey Corridor Subsection, with the remaining vibration impacts occurring in the San Jose Diridon Station Approach and Morgan Hill and Gilroy Subsections. There would be no building damage impacts from project operations.

These vibration impacts are caused by both HSR train operations and also in some cases by Caltrain operations. Where the HSR project causes Caltrain and freight tracks to be shifted closer to vibration-sensitive buildings the train operations on those closer tracks are treated as project vibration sources and compared to the impact criteria. Under Alternative 4, the project also causes Caltrain trains to operate at increased maximum speeds to accommodate blended service, and those Caltrain operations at higher speeds are treated as project vibration sources and compared to impact criteria.

Analysts also analyzed the DDV and TDV design effect on vibration effects. The vibration analysis indicated no change to the vibration impact assessment for the alternatives with the DDV and TDV. This is because the minor shifts in alignment and speed cause minor change in vibration levels.

Table 5-27 2029 and 2040 Plus Project Potential Vibration Impacts

Subsection	Number of Vibration Impacts				
	Land Use Category[1]	Alternative 1	Alternative 2	Alternative 3	Alternative 4
San Jose Diridon Station Approach	2	19	78	78	201
	1, 3	0	0	0	2
Monterey Corridor	2	62	63	62	581
	1, 3	0	0	0	2
Morgan Hill and Gilroy	2	0	1	0	416
	1, 3	0	1	0	1
Pacheco Pass	2	0	0	0	0
	1, 3	0	0	0	0
San Joaquin Valley	2	0	0	0	0
	1, 3	0	0	0	0
Total	**2**	**81**	**142**	**140**	**1,198**
	1, 3	**0**	**1**	**0**	**5**

[1] FRA Land Use Categories are summarized in Table 3.4-9. Land Use Category 1 = Areas where vibration would interfere with operations; Category 2 = Residential; Category 3 = Institutional use.

from HSR operations would be the same for the 2025 and 2029 conditions. Therefore, the vibration impacts of the Interim 2025 Plus Project condition are not further addressed in this analysis.

The potential vibration impact locations for each project alternative are illustrated on Figures 5-30 through 5-39. Figures 5-30 and 5-31 show the Alternative 1 vibration impact locations, Figures 5-32 through 5-34 show the Alternative 2 vibration impact locations, Figures 5-35 and 5-36 show the Alternative 3 locations, and figures 5-37 through 5-39 show the Alternative 4 vibration impact locations. Each red dot indicates a cluster of receptors predicted to have a potential vibration impact.

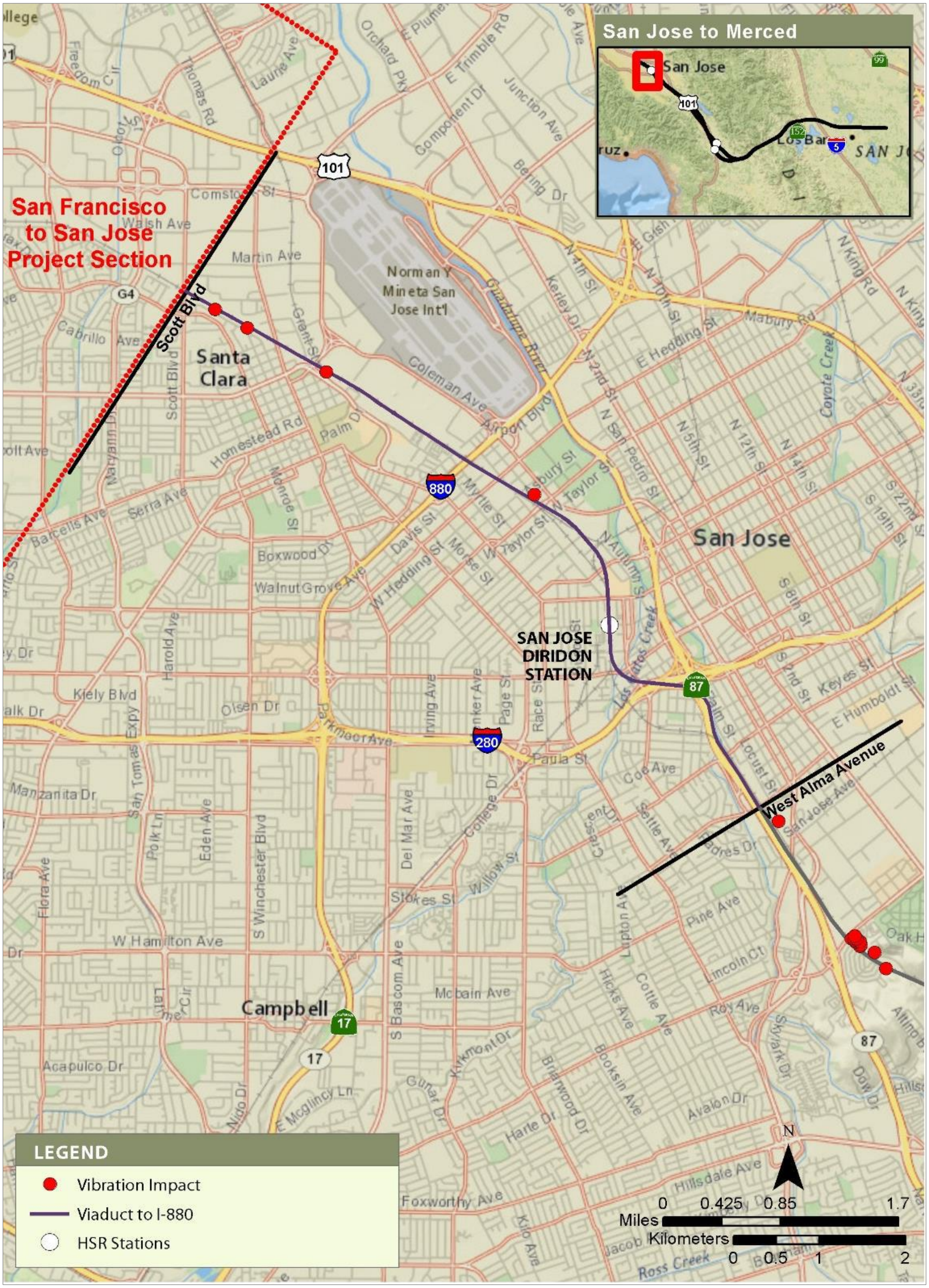

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Figure 5-30 2029 and 2040 Plus Project Vibration Impacts—Alternative 1

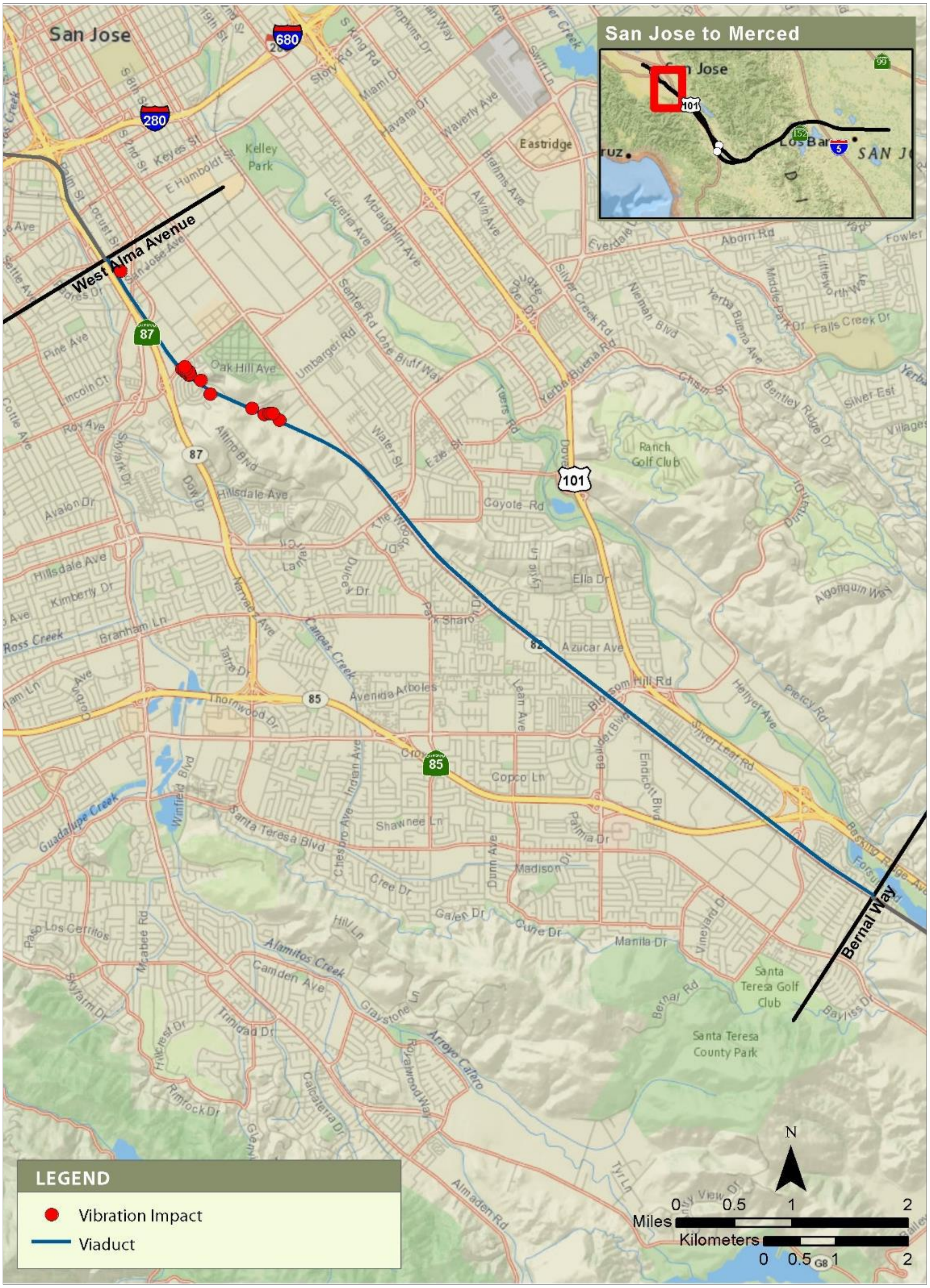

Figure 5-31 2029 and 2040 Plus Project Vibration Impacts—Alternative 1

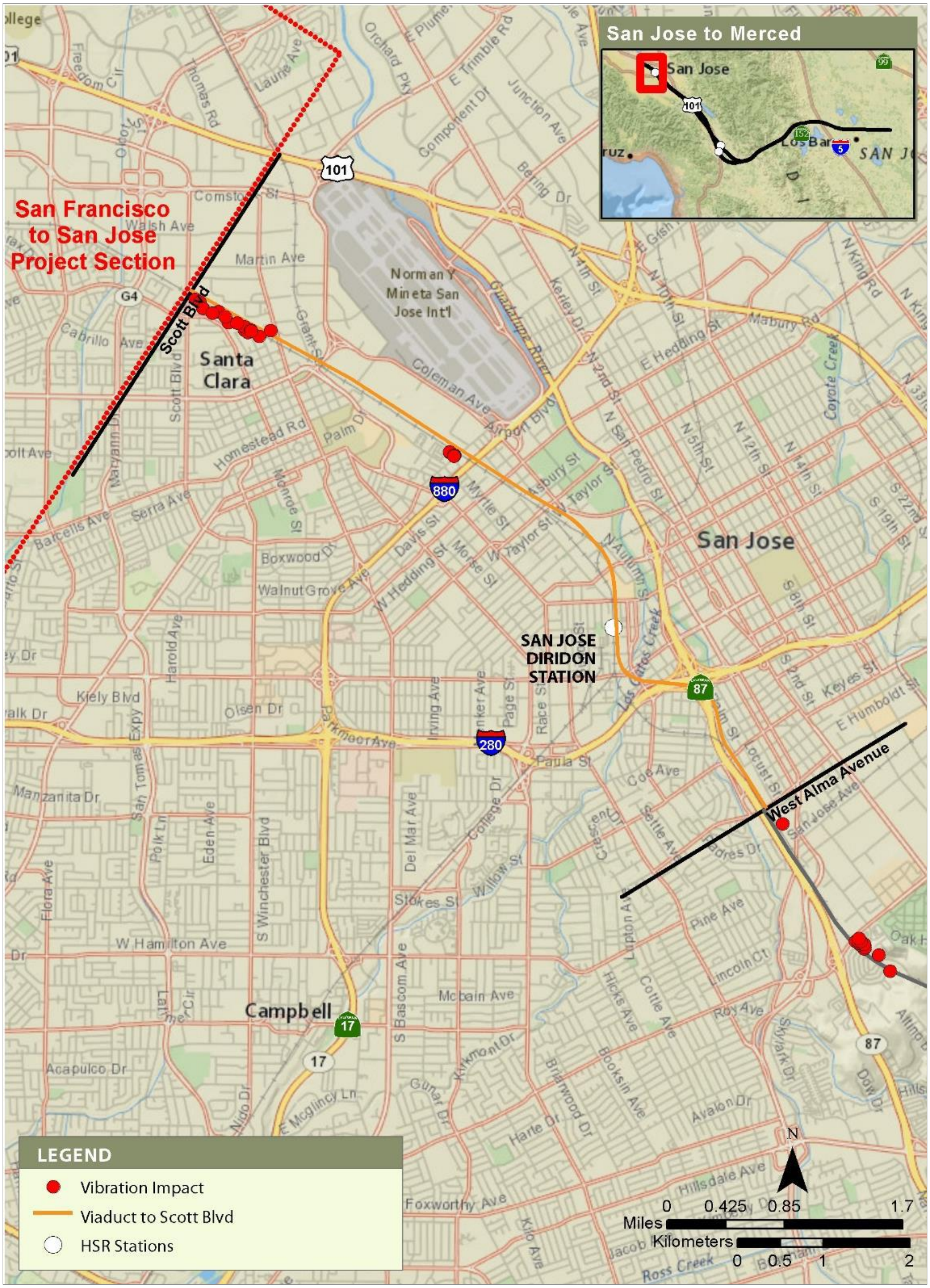

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Figure 5-32 2029 and 2040 Plus Project Vibration Impacts—Alternative 2

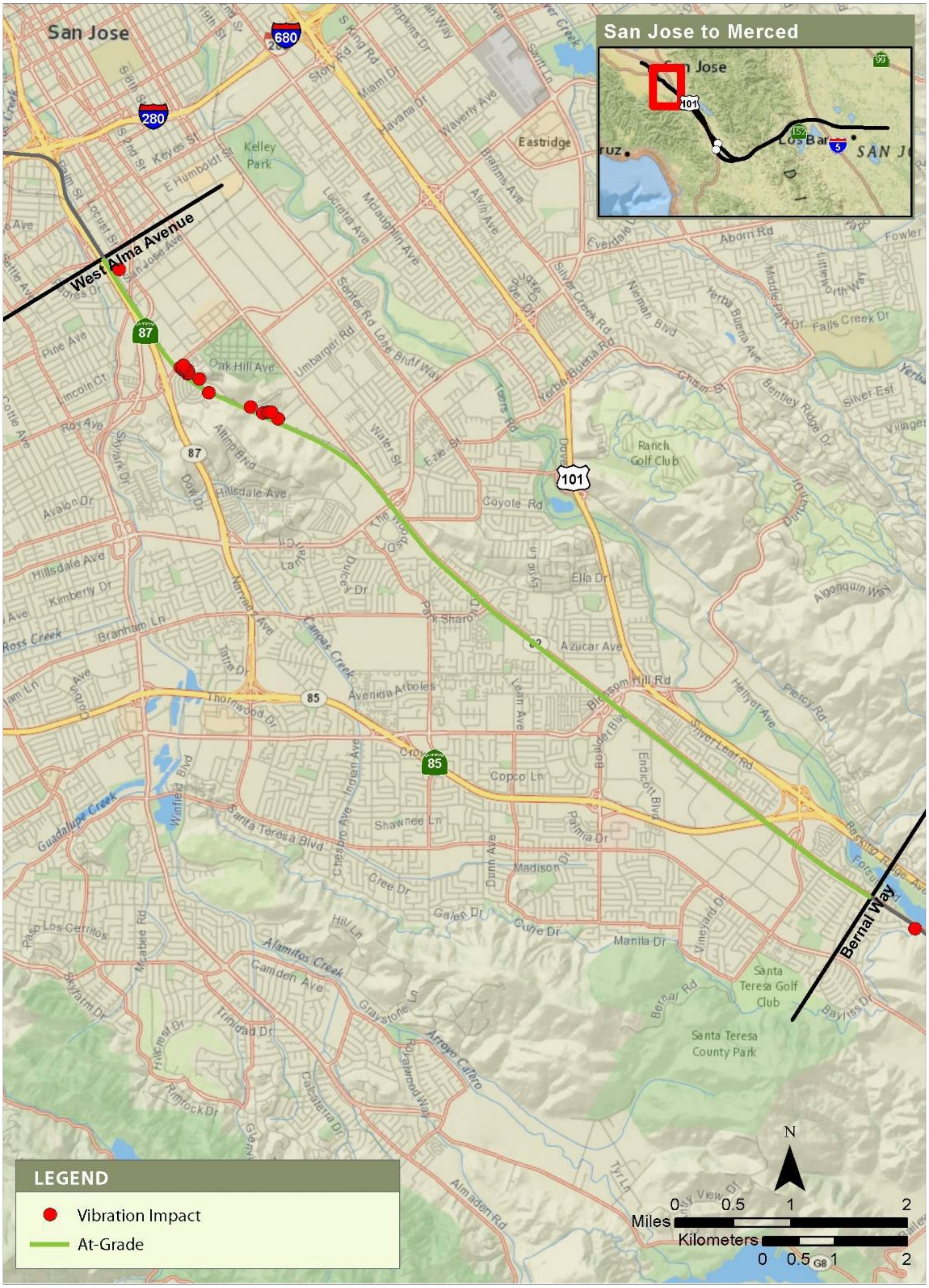

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Figure 5-33 2029 and 2040 Plus Project Vibration Impacts—Alternative 2

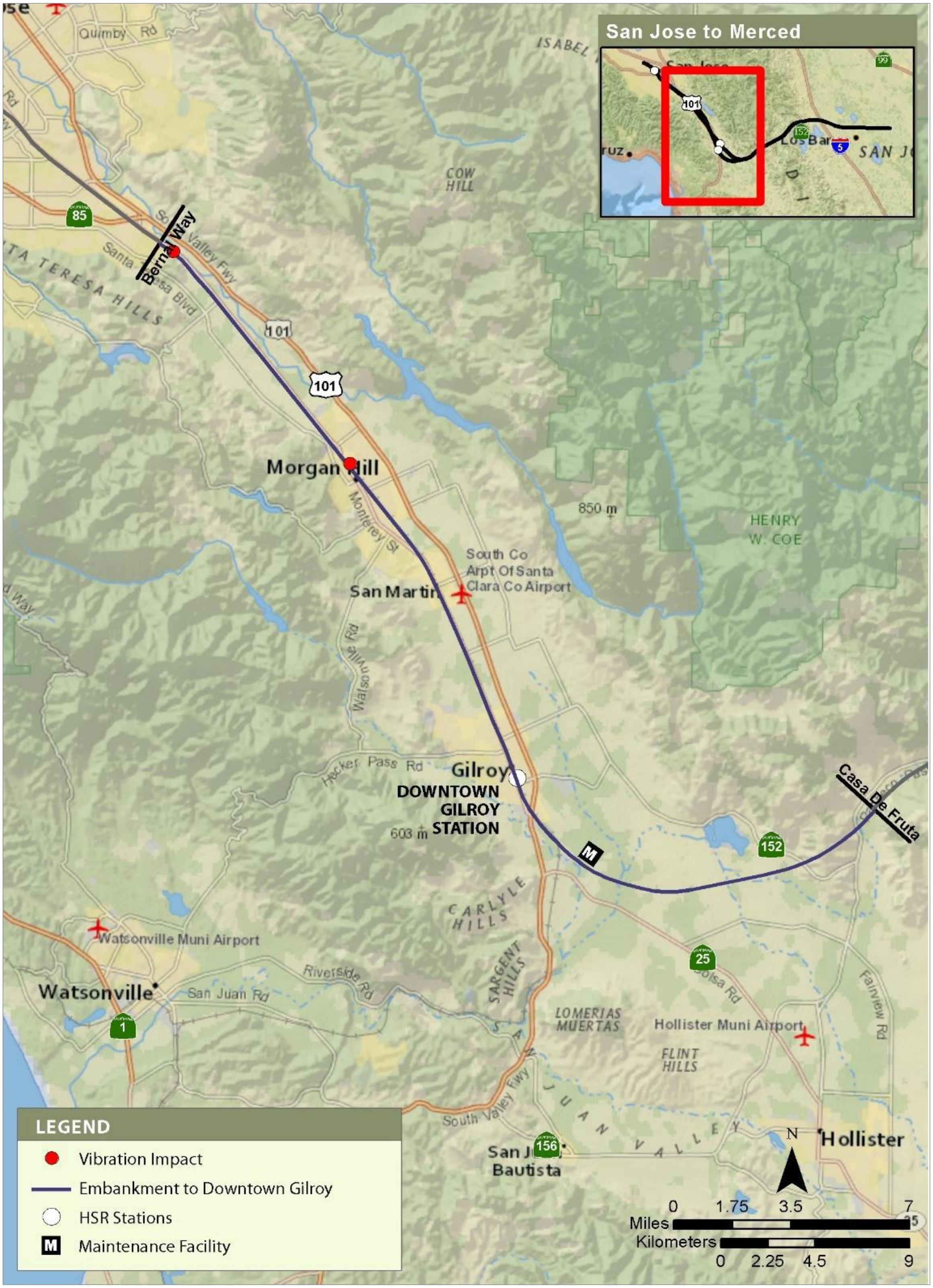

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Figure 5-34 2029 and 2040 Plus Project Vibration Impacts—Alternative 2

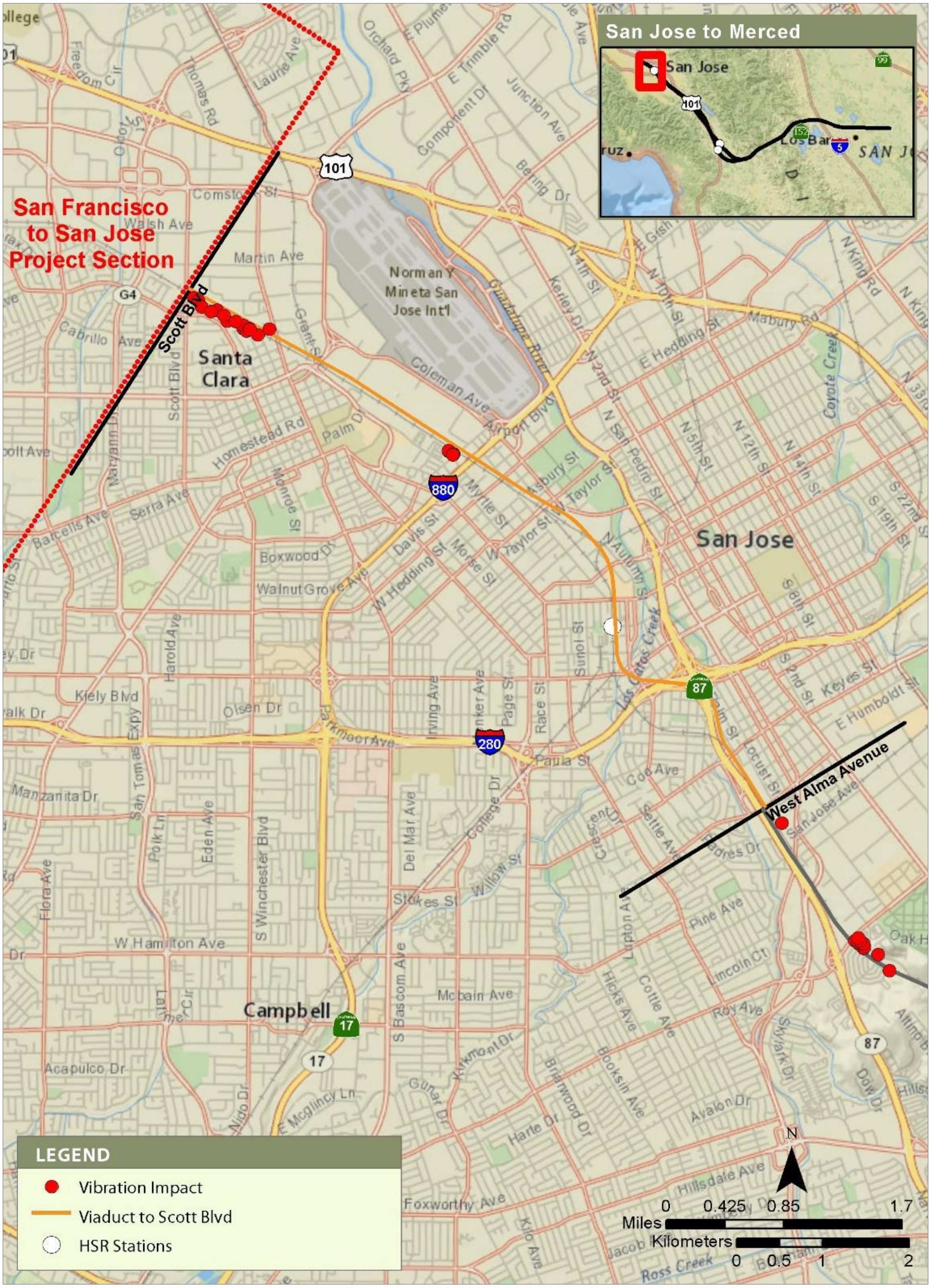

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Figure 5-35 2029 and 2040 Plus Project Vibration Impacts—Alternative 3

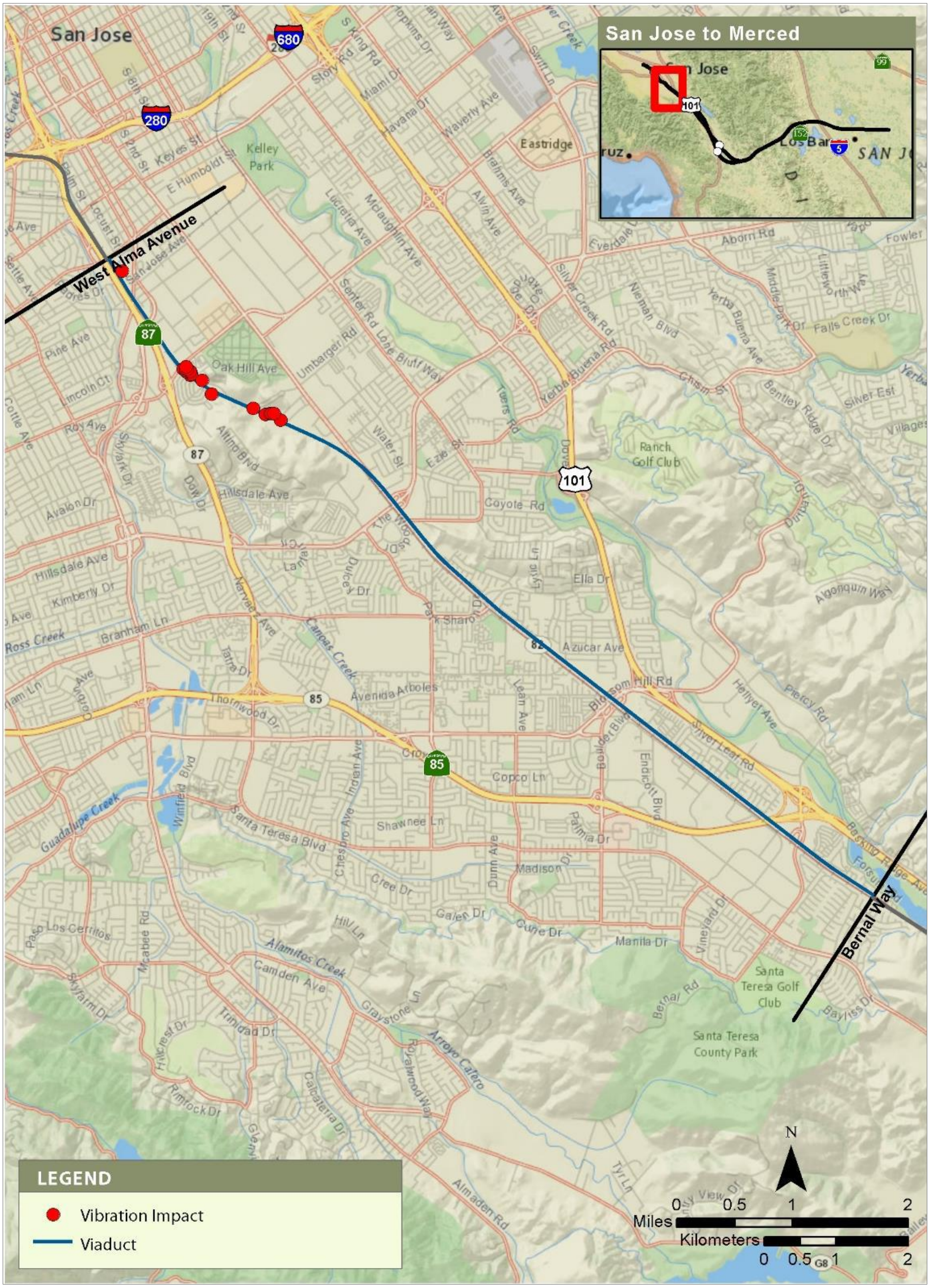

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Figure 5-36 2029 and 2040 Plus Project Vibration Impacts—Alternative 3

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Figure 5-37 2029 and 2040 Plus Project Vibration Impacts—Alternative 4

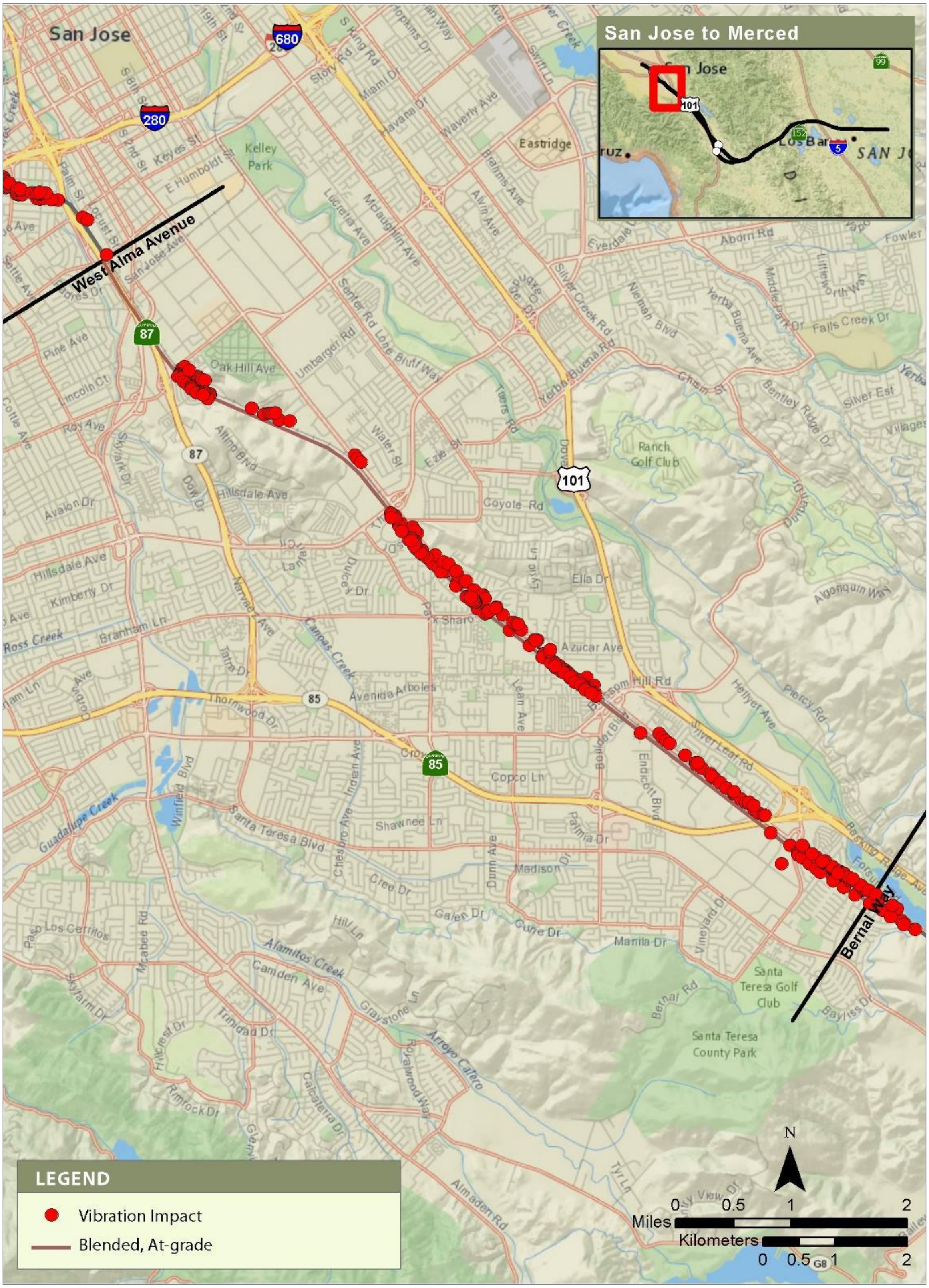

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Figure 5-38 2029 and 2040 Plus Project Vibration Impacts—Alternative 4

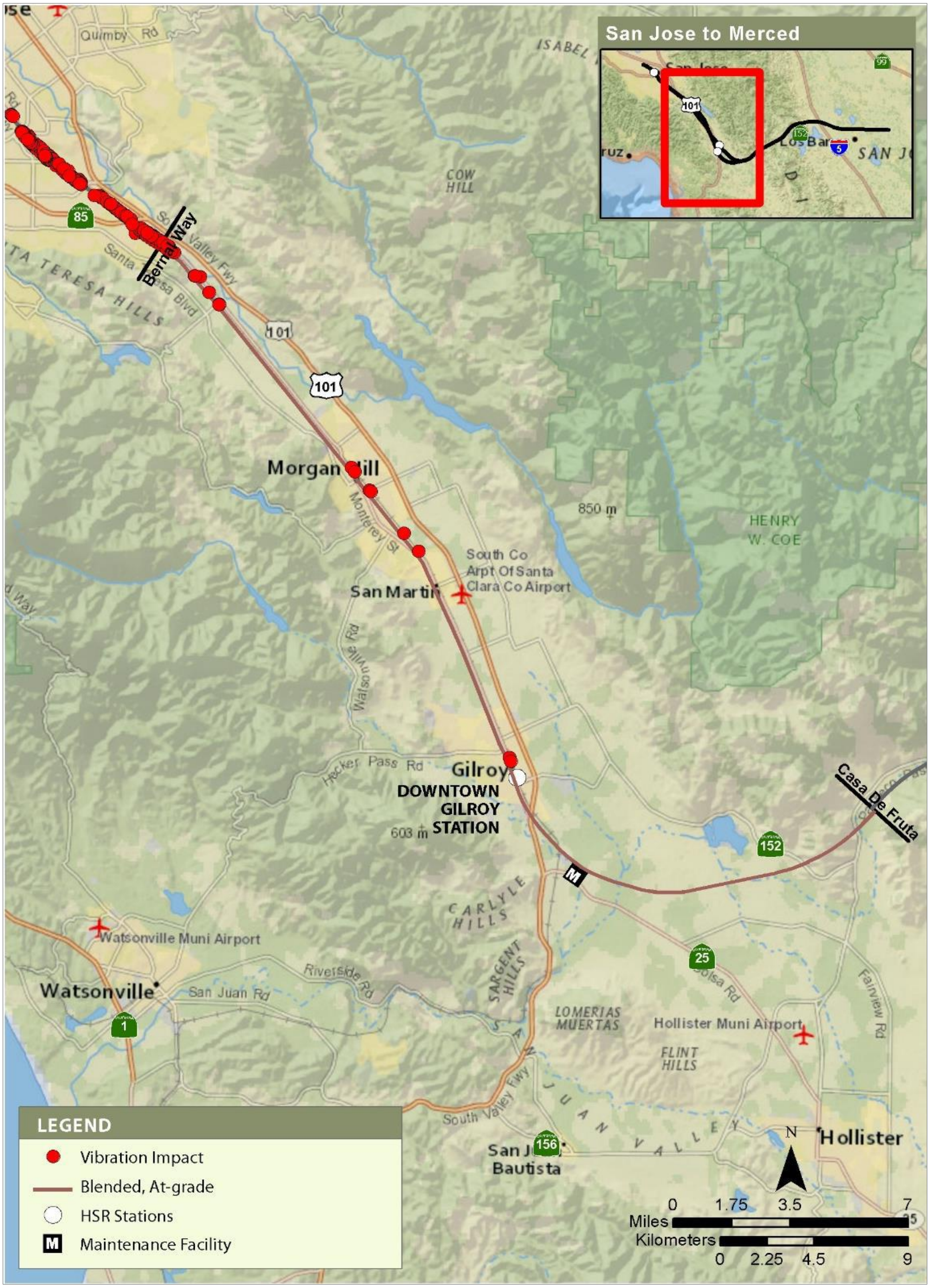

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Figure 5-39 2029 and 2040 Plus Project Vibration Impacts—Alternative 4

Tables 5-28 through 5-31 show the vibration impact assessment results by project alternative, subsection, and segments in each subsection. The distance to the nearest vibration-sensitive receptor is shown, along with the maximum speed of HSR trains in the area. The type of existing corridor, as defined in Section 4.2.3, is listed for each location. As discussed in Section 4.2.3, the type of existing rail corridor and the existing maximum vibration levels influence the impact assessment.

The detailed vibration impact assessment results tables include the range of maximum existing vibration velocity levels that the vibration receptors are currently exposed to in each location. In the San Jose Diridon Station Approach and Monterey Corridor Subsections, there are many vibration-sensitive locations where the existing levels exceed the residential criterion of 72 VdB. Caltrain trains are the dominant existing rail source of vibration in the RSA, because Caltrain speeds exceed those of freight trains and vibration levels increase with speed. Caltrain trains create similar ground-borne vibration levels to those from HSR trains in the RSA, even though the maximum speeds are generally slower. The tables also include the range of maximum future Caltrain vibration levels. In some areas, the project alternatives would cause the existing tracks to be shifted. The analysis accounts for where the existing vibration rail sources would be shifted closer to sensitive locations.

The range of maximum vibration levels from HSR trains is provided for each location. Throughout most of the RSA the projected vibration levels from HSR trains would be below the impact criterion and typically lower than the slower Caltrain trains. Much of Alternatives 1 and 3 would be on viaduct, and vibration levels from HSR trains on aerial structure are assumed 10 VdB lower than HSR at grade or on embankments. Even though the HSR train speeds are much higher than conventional-speed commuter rail such as Caltrain, the ground-borne vibration levels are often comparable or lower. This is likely because of the relatively low input forces from the HSR trains (the FDL). To operate trains at very high speeds, the rails and wheels typically have to be in very good condition, resulting in lower vibration levels.

Four category 1 vibration-sensitive facilities were identified near the project and potential impacts at each are described in subsequent paragraphs. The FRA general assessment impact criterion of 65 VdB for Category 1 vibration-sensitive facilities was used to assess potential impacts at these buildings because it is not known what specific equipment are located in the buildings, or where any sensitive equipment is located in the buildings. Analysts used the general assessment criterion to provide a conservative assessment of potential impact. Though the specific vibration-sensitive equipment at these facilities is not known, the projected maximum 1/3-octave band vibration levels are provided for reference.

The Great Oaks Research Park would be located approximately 180 feet from the nearest HSR track in the Monterey Corridor Subsection for Alternative 4, and approximately 250 feet from the nearest HSR track for Alternatives 1, 2, and 3. The maximum projected vibration levels from HSR trains at the Great Oaks Research Park would be approximately 52 VdB with Alternatives 1 and 3, 64 VdB with Alternative 2, and 69 VdB with Alternative 4; therefore, a vibration impact is predicted under Alternative 4. With Alternatives 1 and 3, the maximum 1/3-octave band vibration level is predicted to be approximately 47 VdB. With Alternative 2, the maximum 1/3-octave band vibration level is predicted to be approximately 58 VdB. With Alternative 4, the maximum vibration in any 1/3-octave band is predicted to be approximately 63 VdB.

Two vibration-sensitive facilities were identified in the Morgan Hill and Gilroy Subsection for Alternatives 2 and 4—Paramit Manufacturing and the Butterfield Professional Center—both between Tilton Avenue and Tennant Avenue. The Paramit Manufacturing building would be approximately 215 feet from the nearest HSR track for Alternative 2 and approximately 320 feet from the nearest HSR track for Alternative 4. The maximum projected vibration levels from HSR trains would be approximately 56 VdB; therefore, no vibration impact is predicted. The maximum 1/3-octave band vibration level is predicted to be approximately 49 VdB. The Butterfield Professional Center is located approximately 75 feet from the nearest HSR track with Alternative 2 and approximately 150 feet from the nearest HSR track with Alternative 4. The maximum projected vibration levels from HSR trains would be 60 VdB for Alternative 4 and 65 VdB for Alternative 2; therefore, a vibration impact is predicted at the Butterfield facility under Alternative 2. The maximum 1/3-octave band vibration level is predicted to be approximately 59 VdB.

The St. Louise Regional Hospital would be more than 1,000 feet from the nearest HSR track in Alternative 3. The maximum projected vibration levels would be less than 50 VdB; therefore, no vibration impact is predicted.

Tables 5-28 through 5-31 also show the number of vibration impacts in each segment of each subsection. With Alternative 1, 15 single-family residences and 4 multifamily residential buildings[14] have the potential for vibration impacts and in the San Jose Diridon Station Approach Subsection between Scott Boulevard to Asbury Street. In the Monterey Corridor Subsection, there are 38 single-family residences and 24 multifamily residential buildings with the potential for vibration impacts between West Alma Avenue and Daylight Way.

Alternative 2 differs in profile and track configuration from Alternative 1 in the San Jose Station Approach Subsection. In this subsection there would be potential vibration impacts at 73 single-family residences and 5 multifamily buildings. All of these impacts would be between Scott Boulevard and Asbury Street. In the Monterey Corridor and the Morgan Hill and Gilroy Subsections, the alignment for Alternative 2 would be largely on embankment. In the Monterey Corridor Subsection, there are 39 single-family residences and 24 multifamily residential buildings with the potential for vibration impacts between West Alma Avenue and Daylight Way. In the Morgan Hill and Gilroy Subsection, there is 1 single-family residence with the potential for vibration impact between Bernal Way and Metcalf Road. Potential vibration impacts are also predicted at the Butterfield Professional Center between Tilton Avenue and Tennant Avenue.

The projected vibration impacts for Alternative 3 are the same as Alternative 2 in the San Jose Diridon Station Approach Subsection—73 single-family residences and 5 multifamily buildings. In the Monterey Corridor Subsection the projected impacts are the same as Alternative 1—38 single-family residences and 24 multifamily residential buildings between West Alma Avenue and Daylight Way.

With Alternative 4, HSR trains would operate between San Jose and Gilroy on tracks that are shared with Caltrain, other passenger trains, and freight trains, which would cause increased vibration levels compared to other alternatives. In the San Jose Station Approach Subsection, there would be potential vibration impacts at 144 single-family residences, 56 multifamily residential buildings, 1 institutional building, and 1 place of worship, and 1 hotel. In the Monterey Corridor Subsection, potential vibration impacts are predicted at 479 single-family residences, 97 multifamily residential buildings, 1 Fire Dept., 4 hotels, 1 Place of Worship, and at the Great Oaks Research Park. In the Morgan Hill and Gilroy Subsection, potential vibration impacts are predicted at 297 single-family residences, 119 multifamily residential buildings, and 1 hospital. The greater number of vibration impacts under Alternative 4 are due to both HSR trains operating on blended tracks that are typically at-grade and due to increased speeds of Caltrain trains for Alternative 4.

In the areas categorized as a heavily used rail corridor in the San Jose Diridon Station Approach Subsection, many of the receptors currently experience vibration levels greater than the criterion of 72 VdB. The project alternatives would more than double the number of train passby events per day, therefore causing vibration impacts from the project alternatives. The predicted vibration impacts in the subsections characterized as a moderately used rail corridor are primarily caused by HSR trains on embankment that exceed the vibration impact criterion or by shifted existing rail sources that exceed the criteria, though HSR train vibration does exceed the criterion at some locations.

In the Pacheco Pass Subsection, the alignment would largely be in a tunnel. The tunnel depth would vary depending upon the terrain elevation. Near the closest sensitive buildings, the tunnel would be more than 200 feet deep and 1,000 feet away horizontally. At these large distances and depths, ground-borne vibration would be well below the impact criteria. Similarly, at the depth and distance from the tunnel to the sensitive buildings in Pacheco Pass, ground-borne noise levels would be expected to be below 25 dBA, well below the impact criteria. There is also a planned cut-and-cover tunnel area of the alignment as it passes under US 101 for Alternative 2 in Morgan Hill and Gilroy Subsection. At receptors in this location, the projected ground-borne noise levels would also be expected to be below 25 dBA, well below the criteria.

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[14] The number of dwelling units in each potentially affected multifamily residential building is not specified.

Table 5-28 2029 and 2040 Plus Project Detailed Vibration Impacts—Alternative 1

Location	Distance to Near HSR Track (feet)	Maximum HSR Speed (mph)	Type of Existing Corridor	Overall Vibration Velocity Level (VdB)[1]				Number of Impacts
				Maximum Existing Vibration Level	Maximum Future Caltrain Vibration Level	Maximum HSR Project Vibration Level	Vibration Impact Criteria	
San Jose Diridon Station Approach Subsection								
Scott Boulevard to Asbury Street	53 - 83	110	Heavily Used	79 - 91	79 - 91	73 - 76	72	12 SF; 4 MF [3]
Asbury Street to San Jose Diridon Station	168	82	Heavily Used	65 [4]	74 [4]	55	72	3 SF [5]
San Jose Diridon Station to West Alma Avenue	143	55	Heavily Used / New	70	68	62	72	0
Monterey Corridor Subsection								
West Alma Avenue to Daylight Way	44 - 325	95 - 120	Moderately Used	72 - 87	73 - 89	51 - 77	72	38 SF; 24 MF [6]
Daylight Way to Blossom Hill Road	83	130	Moderately Used	71	72	59	72	0
Blossom Hill Road to Bernal Way	68	130	Moderately Used	72	72	60	72	0
Morgan Hill and Gilroy Subsection								
Bernal Way to Metcalf Road	66	130	Moderately Used	72	72	60	72	0
Metcalf Road to Palm Avenue	60	125	Moderately Used	72	72	61	72	0
Palm Avenue to Burnett Avenue	31	150	Moderately Used	61	61	63	72	0
Burnett Avenue to Tennant Avenue [2]	41	150	New	49	49	57	72	0
Tennant Avenue to California Avenue [2]	83	150	New	52	52	50	72	0
California Avenue to Highland Avenue	148	154	Moderately Used	57	57	45	72	0
Highland Avenue to Buena Vista	109	220	Moderately Used	58	58	51	72	0
Buena Vista Avenue to Leavesley Road	122	190	Moderately Used	62	62	52	72	0
Leavesley Road to 10th Street	209	150	Moderately Used	65	65	47	72	0

Location	Distance to Near HSR Track (feet)	Maximum HSR Speed (mph)	Type of Existing Corridor	Overall Vibration Velocity Level (VdB)[1]				Number of Impacts
				Maximum Existing Vibration Level	Maximum Future Caltrain Vibration Level	Maximum HSR Project Vibration Level	Vibration Impact Criteria	
10th Street to Santa Clara County Line	480	150	Moderately Used	56 [4]	57 [4]	42	72	0
Santa Clara County Line to SR 152[2]	650	200	New	N/A	N/A	53	72	0
Pacheco Pass Subsection								
Tunnel (2255+00 to 2340+00)[2]	2541	200	New	N/A	N/A	43	72	0
Aerial/Embankment (2340+00 to 325+00)[2]	3530	200	New	N/A	N/A	43	72	0
Tunnel (3325+00 to 4035+00)[2]	1017	200	New	N/A	N/A	49	72	0
Tunnel Portal to I-5[2]	360	200	New	N/A	N/A	56	72	0
San Joaquin Valley Subsection								
I-5 to San Waste Way[2]	320	202	New	N/A	N/A	57	72	0
San Waste Way to North Mercey Springs Road[2]	114	220	New	N/A	N/A	66	72	0
North Mercey Springs Road to Carlucci Road[2]	156	220	New	N/A	N/A	63	72	0
TOTAL								**53 SF, 28 MF**

HSR = high-speed rail
VdB = vibration decibels
SF = single family residential
MF = multifamily residential
[1] Maximum overall vibration velocity levels (VdB re: 1 μin/sec). The ranges shown for the vibration levels in this table are a composite of many receptors and are meant to provide the limits of these values for each geographic location. The data represent the range for vibration-sensitive receptors.
[2] Locations listed as new rail corridors are not adjacent to existing tracks, therefore no corresponding existing or future Caltrain vibration levels are listed.
[3] The vibration impacts between Scott Boulevard to Asbury Street with Alternative 1 are caused by HSR trains.
[4] Maximum existing vibration levels and future non-HSR train vibration levels are from freight trains.
[5] The vibration impacts between Asbury Street to San Jose Diridon Station with Alternative 1 are caused by freight trains due to track shifting closer to the buildings.
[6] The vibration impacts between West Alma Avenue to Daylight Way with Alternative 1 are caused by Caltrain trains and HSR trains.

Table 5-29 2029 and 2040 Plus Project Detailed Vibration Impacts—Alternative 2

Location	Distance to Near HSR Track (feet)	Maximum HSR Speed (mph)	Type of Existing Corridor	Overall Vibration Velocity Level (VdB)[1]				Number of Impacts
				Maximum Existing Vibration Level	Maximum Future Caltrain Vibration Level	Maximum HSR Project Vibration Level	Vibration Impact Criteria	
San Jose Diridon Station Approach Subsection								
Scott Boulevard to Asbury Street	80 - 245	50 - 110	Heavily Used	71 - 81	73 - 83	49 - 73	72	73 SF; 5 MF [3]
Asbury Street to San Jose Diridon Station	168	70	Heavily Used	64	64	54	72	0
San Jose Diridon Station to West Alma Avenue	143	55	Heavily Used / New	70	68	62	72	0
Monterey Corridor Subsection								
West Alma Avenue to Daylight Way	44 - 325	95 - 120	Moderately Used	72 - 87	73 - 89	51 - 77	72	39 SF; 24 MF [4]
Daylight Way to Blossom Hill Road	132	130	Moderately Used	71	72	67	72	0
Blossom Hill Road to Bernal Way	112	130	Moderately Used	72	72	68	72	0
Morgan Hill and Gilroy Subsection								
Bernal Way to Metcalf Road	127	100	Moderately Used	76	77	65	72	1 SF [5]
Metcalf Road to Palm Avenue	346	148	Moderately Used	70	70	63	72	0
Palm Avenue to Tilton Avenue	106	190	Moderately Used	61	61	62	72	0
Tilton Avenue to Tennant Avenue	101	185	Moderately Used	76	76	62	72	0
Tilton Avenue to Tennant Avenue[6]	75[6]	195[6]	Moderately Used	63[6]	63[6]	65[6]	65[6]	1 Vibration Sensitive Facility [6]
Tennant Avenue to California Avenue	202	185	Moderately Used	60	63	57	72	0
California Avenue to Highland Avenue	148	185	Moderately Used	57	57	57	72	0
Highland Avenue to Buena Vista	109	220	Moderately Used	58	58	61	72	0
Buena Vista Avenue to Leavesley Road	122	190	Moderately Used	62	62	62	72	0
Leavesley Road to 10th Street	65	150	Moderately Used	65	65	65	72	0

Location	Distance to Near HSR Track (feet)	Maximum HSR Speed (mph)	Type of Existing Corridor	Overall Vibration Velocity Level (VdB)[1]				Number of Impacts
				Maximum Existing Vibration Level	Maximum Future Caltrain Vibration Level	Maximum HSR Project Vibration Level	Vibration Impact Criteria	
10th Street to Santa Clara County Line	480	150	Moderately Used	56 [7]	57 [7]	52	72	0
Santa Clara County Line to SR 152[2]	650	200	New	N/A	N/A	53	72	0
Pacheco Pass Subsection								
Tunnel (2255+00 to 2340+00)[2]	2541	200	New	N/A	N/A	43	72	0
Aerial/Embankment (2340+00 to 3325+00)[2]	3530	200	New	N/A	N/A	43	72	0
Tunnel (3325+00 to 4035+00)[2]	1017	200	New	N/A	N/A	49	72	0
Tunnel Portal to I-5[2]	360	200	New	N/A	N/A	56	72	0
San Joaquin Valley Subsection								
I-5 to San Waste Way[2]	320	202	New	N/A	N/A	57	72	0
San Waste Way to North Mercey Springs Road[2]	114	220	New	N/A	N/A	66	72	0
North Mercey Springs Road to Carlucci Road[2]	156	220	New	N/A	N/A	63	72	0
TOTAL								**113 SF, 29 MF, 1 Vibration Sensitive Facility**

HSR = high-speed rail
VdB = vibration decibels
SF = single family residential
MF = multifamily residential
[1] Maximum overall vibration velocity levels (VdB re: 1 µin/sec). The ranges shown for the vibration levels in this table are a composite of many receptors and are meant to provide the limits of these values for each geographic location. The data represent the range for vibration-sensitive receptors.
[2] Locations listed as new rail corridors are not adjacent to existing tracks, therefore no corresponding existing or future Caltrain vibration levels are listed.
[3] The vibration impacts between Scott Boulevard to Asbury Street with Alternative 2 are caused by Caltrain trains and HSR trains.
[4] The vibration impacts between West Alma Avenue to Daylight Way with Alternative 2 are caused by Caltrain trains and HSR trains.
[5] The vibration impacts between Bernal Way and Metcalf Road with Alternative 2 are caused by Caltrain trains.
[6] Vibration impact is projected at one non-residential vibration sensitive facility in the Morgan Hill and Gilroy Subsection between Tilton Avenue and Tennant Avenue with Alternative 2 at the Butterfield Professional Center caused by HSR trains.
[7] Maximum existing vibration levels and future non-HSR train vibration levels are from freight trains.

Table 5-30 2029 and 2040 Plus Project Detailed Vibration Impacts—Alternative 3

Location	Distance to Near HSR Track (feet)	Maximum HSR Speed (mph)	Type of Existing Corridor	Overall Vibration Velocity Level (VdB)[1]				Number of Impacts
				Maximum Existing Vibration Level	Maximum Future Caltrain Vibration Level	Maximum HSR Project Vibration Level	Vibration Impact Criteria	
San Jose Diridon Station Approach Subsection								
Scott Boulevard to Asbury Street	80 - 245	50 - 110	Heavily Used	71 - 81	73 - 83	49 - 73	72	73 SF; 5 MF [3]
Asbury Street to San Jose Diridon Station	204	65	Heavily Used	52	52	51	72	0
San Jose Diridon Station to West Alma Avenue	143	55	Heavily Used / New	70	68	62	72	0
Monterey Corridor Subsection								
West Alma Avenue to Daylight Way	44 - 325	95 - 120	Moderately Used	72 - 87	73 - 89	51 - 77	72	38 SF; 24 MF [4]
Daylight Way to Blossom Hill Road	83	130	Moderately Used	71	72	59	72	0
Blossom Hill Road to Bernal Way	68	130	Moderately Used	72	72	60	72	0
Morgan Hill and Gilroy Subsection								
Bernal Way to Metcalf Road	66	130	Moderately Used	72	72	60	72	0
Metcalf Road to Palm Avenue	60	125	Moderately Used	72	72	61	72	0
Palm Avenue to Burnett Avenue	31	150	Moderately Used	61	61	63	72	0
Burnett Avenue to Tennant Avenue [2]	41	150	New	49	49	57	72	0
Tennant Avenue to California Avenue [2]	83	150	New	52	52	50	72	0
California Avenue to Highland Avenue	148	153	Moderately Used	57	57	45	72	0
Highland Avenue to Buena Vista Avenue [2]	119	185	Moderately Used / New	40	40	49	72	0
Buena Vista Avenue to Leavesley Road[2]	311	196	New	46	46	57	72	0
Leavesley Road to Bloomfield Avenue[2]	158	216	New	22	22	62	72	0
Bloomfield Avenue to SR 152[2]	487	200	New	N/A	N/A	54	72	0

Location	Distance to Near HSR Track (feet)	Maximum HSR Speed (mph)	Type of Existing Corridor	Overall Vibration Velocity Level (VdB)[1]				Number of Impacts
				Maximum Existing Vibration Level	Maximum Future Caltrain Vibration Level	Maximum HSR Project Vibration Level	Vibration Impact Criteria	
Pacheco Pass Subsection								
Tunnel (2255+00 to 2340+00)[2]	2470	200	New	N/A	N/A	43	72	0
Aerial/Embankment (2340+00 to 3325+00)[2]	3530	200	New	N/A	N/A	43	72	0
Tunnel (3325+00 to 4035+00)[2]	1017	200	New	N/A	N/A	49	72	0
Tunnel Portal to I-5[2]	360	200	New	N/A	N/A	56	72	0
San Joaquin Valley Subsection								
I-5 to San Waste Way[2]	320	202	New	N/A	N/A	57	72	0
San Waste Way to North Mercey Springs Road[2]	114	220	New	N/A	N/A	66	72	0
North Mercey Springs Road to Carlucci Road[2]	156	220	New	N/A	N/A	63	72	0
TOTAL								**111 SF, 29 MF**

HSR = high-speed rail
VdB = vibration decibels
SF = single family residential
MF = multifamily residential
[1] Maximum overall vibration velocity levels (VdB re: 1 µin/sec). The ranges shown for the vibration levels in this table are a composite of many receptors and are meant to provide the limits of these values for each geographic location. The data represent the range for vibration-sensitive receptors.
[2] Locations listed as new rail corridors are not adjacent to existing tracks, therefore no corresponding existing or future Caltrain vibration levels are listed.
[3] The vibration impacts between Scott Boulevard to Asbury Street with Alternative 3 are caused by Caltrain trains and HSR trains.
[4] The vibration impacts between West Alma Avenue to Daylight Way with Alternative 3 are caused by Caltrain trains and HSR trains.

Table 5-31 2029 and 2040 Plus Project Detailed Vibration Impacts—Alternative 4

Location	Distance to Near HSR Track (feet)	Maximum HSR Speed (mph)	Type of Existing Corridor	Overall Vibration Velocity Level (VdB)[1]				Number of Impacts
				Maximum Existing Vibration Level	Maximum Future Caltrain Vibration Level	Maximum HSR Project Vibration Level	Vibration Impact Criteria	
San Jose Diridon Station Approach Subsection								
Scott Boulevard to Asbury Street	53 - 194	59 - 79	Heavily Used	66 - 91	73 - 91	68 - 87	72 - 75	62 SF; 43 MF; 1 Hotel; 1 Institutional [3]
Asbury Street to San Jose Diridon Station	302	41	Heavily Used	64	65	59	72	0
San Jose Diridon Station to West Alma Avenue	25 - 217	42 - 90	Heavily Used	61 - 82	73 - 89	67 - 85	72 - 75	82 SF; 13 MF; 1 Place of Worship [3]
Monterey Corridor Subsection								
West Alma Avenue to Daylight Way	60 - 346	110	Moderately Used	70 - 87	73 - 91	66 - 86	72	125 SF; 25 MF [4]
Daylight Way to Blossom Hill Road	28 - 311	110	Moderately Used	70 - 82	73 - 89	66 - 84	72	263 SF; 67 MF; 1 Fire Dept; 4 Hotel [4]
Blossom Hill Road to Bernal Way	177 - 315	110	Moderately Used	70 - 75	73 - 78	66 - 72	72 - 75	91 SF; 5 MF; 1 Place of Worship [4]
Blossom Hill Road to Bernal Way[5]	180[5]	110[5]	Moderately used	72[5]	72[5]	69[5]	65[5]	1 Vibration Sensitive Facility [5]

Location	Distance to Near HSR Track (feet)	Maximum HSR Speed (mph)	Type of Existing Corridor	Overall Vibration Velocity Level (VdB)[1]				Number of Impacts
				Maximum Existing Vibration Level	Maximum Future Caltrain Vibration Level	Maximum HSR Project Vibration Level	Vibration Impact Criteria	
Morgan Hill and Gilroy Subsection								
Bernal Way to Metcalf Road	35 - 984	110	Moderately Used	65 - 80	68 - 83	61 - 78	65 - 72	279 SF; 14 MF; 1 Hospital [6]
Metcalf Road to Palm Avenue	207 - 304	110	Moderately Used	70 - 71	73 - 74	66 - 68	72	6 SF [6]
Palm Avenue to Burnett Avenue	108	110	Moderately Used	64	68	62	72	0
Burnett Avenue to Tennant Avenue	20 - 46	110	Moderately Used	69 - 76	75 - 91	69 - 83	72	1 SF; 3 MF [6]
Tennant Avenue to California Avenue	25 - 35	110	Moderately Used	69 - 82	77 - 83	72 - 77	72	11 SF; 100 MF [6]
California Avenue to Highland Avenue	152	110	Moderately Used	56	61	55	72	0
Highland Avenue to Buena Vista	80	110	Moderately Used	65	68	63	72	0
Buena Vista Avenue to Leavesley Road	134	110	Moderately Used	64	67	62	72	0
Leavesley Road to 10th Street	71 - 103	110	Moderately Used	67 - 76	75 - 79	70 - 74	72	2 MF [6]
10th Street to Santa Clara County Line	283	120	Moderately Used	56 [7]	57 [7]	53	72	0
Santa Clara County Line to SR 152[2]	650	200	New	N/A	N/A	53	72	0
Pacheco Pass Subsection								
Tunnel (2255+00 to 2340+00)[2]	2541	200	New	N/A	N/A	43	72	0
Aerial/Embankment (2340+00 to 3325+00)[2]	3530	200	New	N/A	N/A	43	72	0
Tunnel (3325+00 to 4035+00)[2]	1017	200	New	N/A	N/A	49	72	0
Tunnel Portal to I-5[2]	360	200	New	N/A	N/A	56	72	0

Location	Distance to Near HSR Track (feet)	Maximum HSR Speed (mph)	Type of Existing Corridor	Overall Vibration Velocity Level (VdB)[1]				Number of Impacts
				Maximum Existing Vibration Level	Maximum Future Caltrain Vibration Level	Maximum HSR Project Vibration Level	Vibration Impact Criteria	
San Joaquin Valley Subsection								
I-5 to San Waste Way[2]	320	202	New	N/A	N/A	57	72	0
San Waste Way to North Mercey Springs Road[2]	114	220	New	N/A	N/A	66	72	0
North Mercey Springs Road to Carlucci Road[2]	156	220	New	N/A	N/A	63	72	0
TOTAL								**920 SF, 272 MF, 1 Institutional, 2 Places of Worship, 5 Hotels, 1 Fire Dept, 1 Hospital, 1 Vibration Sensitive Facility**

HSR = high-speed rail
VdB = vibration decibels
SR = State Route
SF = single family residential
MF = multifamily residential
[1] Maximum overall vibration velocity levels (VdB re: 1 µin/sec). The ranges shown for the vibration levels in this table are a composite of many receptors and are meant to provide the limits of these values for each geographic location. The data represent the range for vibration-sensitive receptors.
[2] Locations listed as new rail corridors are not adjacent to existing tracks, therefore no corresponding existing or future Caltrain vibration levels are listed.
[3] The vibration impacts in the San Jose Diridon Station Approach Subsection with Alternative 4 are caused by Caltrain trains with increased maximum speed up to 110 mph and by HSR trains.
[4] The vibration impacts in the Monterey Corridor Subsection with Alternative 4 are caused by Caltrain trains with increased maximum speed up to 110 mph and by HSR trains.
[5] Vibration impact is projected at one non-residential vibration sensitive facility in the Monterey Corridor Subsection between Blossom Hill Road to Bernal Way with Alternative 4 at the Great Oaks Research Park caused by HSR trains.
[6] The vibration impacts in the Morgan Hill and Gilroy Subsection with Alternative 4 are caused by Caltrain trains with increased maximum speed up to 110 mph and by HSR trains.
[7] Maximum existing vibration levels and future non-HSR train vibration levels are from freight trains.

5.3 Summary of Impacts

The noise and vibration impacts for the four project alternatives are shown in Table 5-32 for both the construction phase and operations phase.

5.3.1 Noise

5.3.1.1 Construction Noise

Construction of the project would require the use of mechanical equipment that would generate temporary increases in noise and result in temporary construction impacts at noise-sensitive locations. For typical track construction scenarios, the residential nighttime 8-hour L_{eq} criterion of 70 dBA would potentially be exceeded up to 374 feet from the clear-and-grub construction activity and as far away as 774 feet from the concrete pour aerial structure activity; for the PG&E upgrades, these criteria would be exceeded as far away as 522 feet from the conductor installation construction activity. These distances would be applicable to all four project alternatives. The Authority and its contractors would comply with FTA and FRA guidelines for minimizing noise impacts at sensitive receptors during project construction (NV-IAMF#1), but construction noise impacts would remain. Distances to potential construction noise impacts for various types of activity would be the same for all alternatives.

5.3.1.2 Operations Noise

Project operations would permanently increase noise levels above the ambient noise environment at sensitive receptors. Alternative 4 would have the most severe and moderate operations noise impacts, followed by Alternative 2, Alternative 1, and Alternative 3, and impacts would be greater under the 2040 Plus Project condition compared to 2029. Under the 2040 Plus Project condition without the DDV and TDV, there would be 337 severe noise impacts and 1,200 moderate impacts under Alternative 1, 755 severe impacts and 1,844 moderate impacts under Alternative 2, 222 severe impacts and 834 moderate impacts under Alternative 3, and 1,212 severe impacts and 1,666 moderate impacts under Alternative 4. Under the 2040 Plus Project cumulative condition without the DDV and TDV, there would be 879 severe noise impacts and 2,556 moderate impacts under Alternative 1, 1,237 severe impacts and 1,932 moderate impacts under Alternative 2, 647 severe impacts and 2,357 moderate impacts under Alternative 3, and 1,589 severe impacts and 1,933 moderate impacts under Alternative 4.

With the DDV and TDV under the 2040 Plus Project condition, there would be 347 severe noise impacts and 1,195 moderate impacts under Alternative 1, 766 severe impacts and 1,838 moderate impacts under Alternative 2, 233 severe impacts and 845 moderate impacts under Alternative 3, and 1,224 severe impacts and 1,658 moderate impacts under Alternative 4. Under the 2040 Plus Project cumulative condition with the DDV and TDV, there would be 890 severe noise impacts and 2,550 moderate impacts under Alternative 1, 1,249 severe impacts and 1,925 moderate impacts under Alternative 2, 658 severe impacts and 2,361 moderate impacts under Alternative 3, and 1,601 severe impacts and 1,928 moderate impacts under Alternative 4.

Project operations would generate traffic and associated noise at HSR stations. Near the San Jose Diridon Station, the largest L_{dn} contribution from the parking facilities at the nearby noise receptors would be 29 dBA. Near the Downtown Gilroy Station, the largest L_{dn} contribution from the parking facilities at the nearby noise receptors would be 40 dBA. Near the East Gilroy Station, the largest L_{dn} contribution from the parking facilities at the nearby noise receptors would be 28 dBA. The additional noise from parking facilities would be substantially lower (at least 18 dB less) than the projected L_{dn} from HSR operations.

Project operations would also generate additional noise associated with train movements in and out of the MOWF near Gilroy. Under Alternatives 1 and 2, the L_{dn} contribution from the South Gilroy MOWF at that nearest receptor would be 40 dBA (more than 20 dBA less than HSR operations). Under Alternative 3, the L_{dn} contribution from the East Gilroy MOWF at that nearest receptor would be 47 dBA, more than 20 dB less than the HSR operations contribution at that receptor. The nearest receptors to the Alternative 4 South Gilroy MOWF would be approximately

900 feet away. In this neighborhood, the highest L_{dn} contribution from the MOWF would be 45 dBA, more than 18 dB less than the HSR operations contribution at that receptor.

Project construction would result in permanent changes in the local roadway network that would require some diversion and rerouting of traffic. The diversion of traffic would not be expected to affect noise levels because traffic on local roadways provides only a minor contribution to overall noise levels.

Project operations would generate additional traffic and traffic-related noise under the 2029 Plus Project and 2040 Plus Project conditions. Permanent increases in traffic-related noise would be similar for all four alternatives and would occur at roadways segments near San Jose Diridon Station, along Monterey Corridor, and near Gilroy. In 2029, seven roadway segments under Alternatives 1 and 2 and six roadway segments under Alternatives 3 and 4 would have the potential for noise level increases greater than or equal to 3 dB, compared to existing noise conditions. In 2040, operations of all project alternatives would result in 12 roadway segments with the potential for noise level increases greater than or equal to 3 dB. The majority of these traffic noise impacts would occur near the San Jose Diridon Station and along Monterey Road.

The potential for passing HSR train noise to startle or surprise humans near the HSR track and to result in human annoyance was determined to be unlikely for dedicated sections of the alignment and at one location for blended service in Morgan Hill under Alternative 4. Analysts also evaluated the potential for livestock to experience stress associated the noise of passing trains in exceedance of the FRA's recommended threshold. Where livestock operations are within approximately 30 feet of the edge of the HSR right-of-way, adverse effects would occur within 30 feet of the HSR right-of-way. In locations where HSR trains are sounding warning horns, livestock within approximately 285 feet of HSR tracks could experience adverse effects.

Substation operations would not generate additional noise impacts when compared to the operations train noise impacts that exceed FRA criteria. Under Alternative 4, the combined train and TPSS operations would generate severe noise impacts at 30 apartment residences; moderate noise impacts would occur for Alternates 2, 3, and 4. The greatest impacts would occur along Alternative 4, followed by Alternative 1 and 3, and with Alternative 2 having the fewest impacts. The difference in substation noise impacts among the project alternatives is predominately the result of site placement of TPSS or paralleling station sites; the Alternative 4 San Jose TPPS site would be directly adjacent to a large multifamily apartment building.

5.3.2 Vibration

5.3.2.1 Construction Vibration

Construction of the project alternatives would result in vibration impacts potentially causing human annoyance and building damage. Most construction activities would only cause annoyance from vibration within 160 feet of the mechanical equipment. Some equipment, such as pile driving or ongoing demolition work would have the potential to cause annoyance from vibration within 300 feet. Buildings close to pile-driving activity (within 50 feet) would have the potential for structural damage. Incorporation of NV-IAMF#1 would minimize construction vibration and the potential for it to cause annoyance or damage to buildings. However, even with NV-IAMF#1, some sensitive receptors would still be exposed to ground-borne vibration that could result in annoyance or building damage.

Construction of tunnels in the Pacheco Pass Subsection would result in human-perceptible vibration in occupied buildings within approximately 100 feet of TBM operations; however, the tunnel depth near the closest occupied building would be more than 200 feet. Near the closest sensitive buildings, the tunnel would be more than 200 feet deep and 1,000 feet away horizontally. At these large distances and depths, ground-borne vibration would be well below the impact criteria. Similarly, at the depth and distance from the tunnel to the sensitive buildings in Pacheco Pass, ground-borne noise levels are expected to be below 25 dBA, thus below the lowest impact criteria. There is also a planned cut-and-cover tunnel area of the alignment as it passes under US 101 for Alternatives 1 and 2 in Morgan Hill and Gilroy Subsection. At receptors in this location, the projected ground-borne noise levels are expected to be below 25 dBA, also below the lowest impact criteria. At these distances, it is not anticipated that vibration from the TBM would be an issue.

5.3.2.2 Operations Vibration

Project operations would cause permanent vibration impacts (annoyance) at sensitive receptors. Alternative 1 would result in 81 vibration impacts, Alternative 2 would result in 143 vibration impacts, Alternative 3 would result in 140 vibration impacts, and Alternative 4 would result in 1,203 vibration impacts. Under Alternatives 1-3, the majority of these vibration impacts would occur in the San Jose Diridon Station Approach and the Monterey Corridor Subsections, with the remaining vibration impacts occurring in the Morgan Hill and Gilroy Subsection. Under Alternative 4, the majority of the vibration impacts would occur in the Monterey Corridor and Morgan Hill and Gilroy Subsections, with the remaining vibration impacts occurring in the San Jose Diridon Station Approach Subsection. Project operations would not have the potential to cause building damage because the vibration levels would not approach damage thresholds. See Section 4.2.1, Descriptors, for additional discussion.

Table 5-32 Summary of Impacts

Effect	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Construction-Related Noise				
Construction noise impacts	Temporary noise impacts at noise sensitive locations would exceed the residential nighttime 8-hour L_{eq} criterion of 70 dBA for typical track construction activities up to 374 feet from the clear-and-grub construction activity and up to 774 feet from the concrete pour aerial structure activity. For the PG&E upgrades, these criteria would be exceeded as far away as 522 feet from reconductoring activity. These distances would be applicable to all four project alternatives.	Similar to Alternative 1, with fewer noise impacts in Morgan Hill and Gilroy and Monterey Corridor Subsections.	Similar to Alternative 1, without noise impacts on downtown Gilroy businesses.	Similar to Alternative 1, but no concrete pour aerial structure activity from San Jose to Gilroy. This would have more impacts in Morgan Hill.
Operations-Related Noise				
2029 Plus Project operations noise impacts	▪ 310 (313) moderate impacts ▪ 47 (51) severe impacts	▪ 599 (601) moderate impacts ▪ 38 (43) severe impacts	▪ 227 (233) moderate impacts ▪ 34 (37) severe impacts	▪ 1,001 (1,004) moderate impacts ▪ 190 (197) severe impacts

Effect	Alternative 1	Alternative 2	Alternative 3	Alternative 4
2040 Plus Project operations noise impacts	▪ 1,200 (1,195) moderate impacts ▪ 337 (347) severe impacts	▪ 1,844 (1,838) moderate impacts ▪ 755 (766) severe impacts	▪ 834 (845) moderate impacts ▪ 222 (233) severe impacts	▪ 1,666 (1,658) moderate impacts ▪ 1,212 (1,224) severe impacts
2029 Plus Project cumulative operations noise impacts	▪ 1,620 (1,623) moderate impacts ▪ 71 (75) severe impacts	▪ 1,426 (1,427) moderate impacts ▪ 200 (205) severe impacts	▪ 1,306 (1,312) moderate impacts ▪ 48 (51) severe impacts	▪ 1,500 (1,496) moderate impacts ▪ 475 (501) severe impacts
2040 Plus Project cumulative operations noise impacts	▪ 2,556 (2,550) moderate impacts ▪ 879 (890) severe impacts	▪ 1,932 (1,925) moderate impacts ▪ 1,237 (1,249) severe impacts	▪ 2,357 (2,361) moderate impacts ▪ 647 (658) severe impacts	▪ 1,933 (1,928) moderate impacts ▪ 1,589 (1,601) severe impacts
Annoyance from onset of HSR passby	Operations would not cause human annoyance from the startle effect of HSR train passbys within dedicated sections of the alignment because the threshold for sudden onset noise would occur within the right-of-way, which would be fenced to prohibit public access			Operations would cause initial human annoyance from the startle effect of HSR train passbys at one location within 23 feet of the tracks in Morgan Hill. Effects south and east of Gilroy would be the same as Alternatives 1, 2 and 3.
HSR station noise	Noise contribution from parking facilities: ▪ 29 dBA L_{dn} at San Jose Diridon Station ▪ 40 dBA L_{dn} at the Downtown Gilroy Station This additional noise would be substantially lower than noise from HSR trains.	Noise contribution from parking facilities: ▪ 29 dBA L_{dn} at San Jose Diridon Station ▪ 40 dBA L_{dn} at the Downtown Gilroy Station This additional noise would be substantially lower than noise from HSR trains.	Noise contribution from parking facilities: ▪ 29 dBA L_{dn} at San Jose Diridon Station ▪ 28 dBA L_{dn} at the East Gilroy Station This additional noise would be substantially lower than noise from HSR trains.	Noise contribution from parking facilities: ▪ 29 dBA L_{dn} at San Jose Diridon Station ▪ 40 dBA L_{dn} at the Downtown Gilroy Station This additional noise would be substantially lower than noise from HSR trains.
Maintenance facility noise	40 dBA L_{dn} contribution from train movements at the South Gilroy MOWF, substantially lower than the noise from operating HSR trains. No additional impact is projected.		47 dBA L_{dn} contribution from train movements at the East Gilroy MOWF, substantially lower than the noise from operating HSR trains. No additional impact is projected.	45 dBA L_{dn} contribution from train movements at the Alternative 4 MOWF, substantially lower than the noise from operating HSR trains. No additional impact is projected.

<table>
<tr><th>Effect</th><th>Alternative 1</th><th>Alternative 2</th><th>Alternative 3</th><th>Alternative 4</th></tr>
<tr><td>2029 Plus Project traffic-related noise increases</td><td colspan="2">Roadway segments with an anticipated increase in traffic noise of 3 dB or greater:
▪ 4 roadway segments near the San Jose Diridon Station
▪ 2 roadway segments along Monterey Road
▪ 1 roadway segment near the South Gilroy MOWF</td><td>Roadway segments with an anticipated increase in traffic noise of 3 dB or greater:
▪ 4 roadway segments near the San Jose Diridon Station
▪ 2 roadway segments along Monterey Road</td><td>Roadway segments with an anticipated increase in traffic noise of 3 dB or greater:
▪ 3 roadway segments near the San Jose Diridon Station
▪ 3 roadway segments along Monterey Road</td></tr>
<tr><td>2040 Plus Project traffic-related noise increases</td><td colspan="2">Roadway segments with an anticipated increase in traffic noise of 3 dB or greater:
▪ 5 roadway segments near the San Jose Diridon Station
▪ 6 roadway segments along Monterey Road
▪ 1 roadway segment near the South Gilroy MOWF</td><td>Roadway segments with an anticipated increase in traffic noise of 3 dB or greater:
▪ 5 roadway segments near the San Jose Diridon Station
▪ 6 roadway segments along Monterey Road
▪ 1 roadway segment near the East Gilroy MOWF</td><td>Roadway segments with an anticipated increase in traffic noise of 3 dB or greater:
▪ 4 roadway segments near the San Jose Diridon Station
▪ 6 roadway segments along Monterey Road
▪ 1 roadway segment near the Downtown Gilroy Station
▪ 1 roadway segment near the South Gilroy MOWF</td></tr>
<tr><td>Noise effects on livestock</td><td colspan="4">Livestock within approximately 30 feet of the edge of the HSR right-of-way would experience stress associated with exposure to noise levels above the recommended thresholds for passbys (all alternatives). Livestock within approximately 285 feet of the edge of the HSR right-of-way would experience stress associated with exposure to noise levels from sounding of HSR horns (Alternative 4 only).</td></tr>
<tr><td>Traction power facility noise</td><td>The substation facilities would generate noise but would not incur additional noise impact beyond those from trains and horns.</td><td>Same as Alternative 1</td><td>Same as Alternative 1</td><td>Same as Alternative 1</td></tr>
</table>

Effect	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Construction-Related Vibration				
Construction vibration impacts	Potential annoyance from nighttime vibratory methods within 300 feet of residential structures. Potential building damage from impact pile driving within 50 feet of structures.	Similar to Alternative 1, but potentially with more vibratory compaction at embankments and at grade in Morgan Hill and Gilroy and Monterey Corridor Subsections; less vibratory compaction in San Jose to Scott Boulevard touchdown.	Similar to Alternative 1 to Gilroy and in Monterey Corridor Subsection, but eastern alignment in Gilroy and Morgan Hill Subsection would affect fewer structures; similar to Alternative 2 from Monterey through San Jose.	Similar Alternative 1 east of Gilroy; most vibratory compaction at embankments and at grade of all alternatives; construction within existing right-of-way could require more nighttime work to minimize service disruptions.
Construction TBM vibration impacts	Potential perceptible vibration in occupied buildings within 100 feet of TBM operations for tunnel construction. Tunnel depth at closest occupied building is greater than 200 feet, so vibration from TBM not anticipated to be an issue.			
Operations-Related Vibration				
Operations vibration impacts	81 permanent vibration impacts	143 permanent vibration impacts	140 permanent vibration impacts	1,203 permanent vibration impacts

L_{eq} = sound level equivalent
dBA = A-weighted decibel
PG&E = Pacific Gas and Electric
HSR = high-speed rail
mph = miles per hour
UPRR = Union Pacific Railroad
L_{dn} = day-night sound level
MOWF = maintenance of way facility
dB = decibel
TBM = tunnel boring machine
Impacts associated with the design variants are shown in parentheses. The DDV affects Alternative 4 within the San Jose Diridon Station Approach Subsection; the TDV affects all alternatives within the Morgan Hill and Gilroy, Pacheco Pass, and San Joaquin Valley Subsections.

6 REFERENCES

California High-Speed Rail Authority (Authority). 2008. *California High-Seed Train Project Technical Memorandum Phase 1 Service Plan TM 4.2*, November 22, 2008.

———. 2011. *San Jose to Merced Section Noise and Vibration Technical Report*. Prepared by Parsons Transportation Group. August 2011.

———. 2016. *Connecting and Transforming California: 2016 Business Plan.* May 1, 2016. http://hsr.ca.gov/docs/about/business_plans/2016_BusinessPlan.pdf (accessed October 2019).

———. 2018. *2018 Business Plan: Connecting California, Expanding Economy, Transforming Travel.* June 1, 2018. www.hsr.ca.gov/docs/about/business_plans/2018_BusinessPlan.pdf (accessed February 18, 2020).

———. 2019a. *San Jose to Merced Project Section Biological and Aquatic Resources Technical Report.* November 2019. Sacramento, CA.

———. 2019b. *Merced to Fresno Section: Central Valley Wye Draft Supplemental EIR/EIS*. Sacramento, CA.

———. 2019c. *Merced to Fresno Section: Central Valley Wye Draft Supplemental Environmental Impact Report/Environmental Impact Statement*. Volume 1: Report. May 2019. Sacramento, CA.

California High-Speed Rail Authority (Authority) and Federal Railroad Administration (FRA). 2005. *Final Program Environmental Impact Report (EIR)/Environmental Impact Statement (EIS) for the Proposed California High-Speed Train System*. August 2005.

———. 2008. *San Francisco Bay Area (Bay Area) to Central Valley High-Speed Train (HST) Program Final Environmental Impact Report/Environmental Impact Statement (EIR/EIS).* May 2008.

_____. 2010a. *San Francisco to San Jose Section Noise and Vibration Technical Report*. October 2010.

———. 2010b. *Benchmark Tests for Calibration of CAHST Noise Models*, May 26, 2010.

———. 2012. *Merced to Fresno Section California High-Speed Train Final Project Environmental Impact Report/Environmental Impact Statement and Final Section 4(f) Statement and Draft General Conformity Determination.* Volume I: Report. April 2012. Sacramento, CA, and Washington, DC.

———. 2017. *California High Speed Rail Project EIR/EIS Environmental Methodology Guidelines* Version 5.09. April 2017. Sacramento, CA and Washington, DC.

———. 2019. *Statewide Impact Avoidance and Minimization Features Library*. Revision 16. March 11, 2019. Sacramento, CA and Washington, DC.

California Department of Transportation (Caltrans). 2011. *Traffic Noise Analysis Protocol*. May 2011. www.dot.ca.gov/env/noise/.

California Office of Planning and Research (OPR). 2003. *General Plan Guidelines 2003.* www.opr.ca.gov/planning/general-plan/.

City of Gilroy. 2002. *Gilroy 2002–2020 General Plan*. www.cityofgilroy.org/274/2020-General-Plan (accessed March 23, 2017)

City of Morgan Hill. 2016. *2035 General Plan City of Morgan Hill.* Adopted July 27, 2016. www.ca-morganhill2.civicplus.com/DocumentCenter/View/20686 (accessed December 23, 2016)

City of San Jose. 2011. *Envision: San José 2040 General Plan*. Revised March 23, 2016. www.sanjoseca.gov/DocumentCenter/Home/View/474 (accessed June 3, 2016).

City of Santa Clara. 2010. *2010–2035 General Plan.* Adopted November 16, 2010. http://santaclaraca.gov/government/departments/community-development/planning-division/general-plan (accessed on July 18, 2019)

County of Merced. 2013. *2030 Merced County General Plan*. Adopted December 10, 2013. www.co.merced.ca.us/DocumentCenter/View/6766/2030-General-Plan?bidId= (accessed July 17, 2019)

County of San Benito. 2015. *San Benito County 2035 General Plan.* Adopted July 21, 2015. http://cosb.us/wp-content/uploads/Adopted-2035-GPU.pdf (accessed July 18, 2019).

County of Santa Clara. 1994. *Santa Clara County General Plan: Charting a Course for Santa Clara County's Future 1995–2010.* Adopted December 20, 1994. www.sccgov.org/sites/dpd/PlansOrdinances/GP/Pages/GP.aspx (accessed March 8, 2017).

Federal Highway Administration (FHWA). 2006. *Roadway Construction Noise Model User's Guide*, DOT-VNTSC-FHWA-05-01. U.S. Department of Transportation, Office of Environment and Planning. January 2006. Washington, DC.

Federal Railroad Administration (FRA). 2000. *Horn Noise MS Excel Spreadsheet Model.* July 2012. www.fra.dot.gov/eLib/Details/L04091.

_____. 2012. *High-Speed Ground Transportation Noise and Vibration Impact Assessment*, DOT/FRA/ORD-12/15. U.S. Department of Transportation, Office of Railroad Policy and Development. September 2012. Washington, DC. www.fra.dot.gov/eLib/Details/L04090.

_____. 2018. Horn Noise FAQ. www.fra.dot.gov/Page/P0599.

Federal Transit Administration (FTA). 2018. *Transit Noise and Vibration Impact Assessment Manual.* FTA Report No. 0123. U.S. Department of Transportation, Office of Planning and Environment. September 2018. Washington, DC.

San Benito County Airport Land Use Commission. 2001. *Frazier Lake Airpark Comprehensive Land Use Plan*. www.sanbenitocog.org/clup.php.

San Jose International Airport. 2010. *2027 CNEL Contours for Airport Master Plan (amended 6/8/10)*. www.flysanjose.com/node/2206 (accessed February 8, 2020).

Wilson Ihrig & Associates. 2009. *Crystal Springs Pipeline No. 2 Noise and Vibration Study Impacts and Mitigation Technical Memo*. Orion-ESA Joint Venture. September 2009.

_____. 2014. *Caltrain Peninsula Corridor Electrification Project Noise and Vibration Technical Report*. Prepared for Peninsula Corridor Joint Powers Board. Revised November 2014.

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