TRANSPORTATION SOLUTIONS DEFENSE AND EDUCATION FUND

16 Monte Cimas Avenue   Mill Valley, CA 94941   415-380-8600   383-0776 fax

December 16, 2005
By E-Mail & Fax

Dan Leavitt, Deputy Director
CA High Speed Rail Authority
925 L Street, Suite 1425
Sacramento, CA 95814

Re: Scoping Comments for Bay Area to Central Valley High-Speed Train

Dear Mr. Leavitt:

The Transportation Solutions Defense and Education Fund, TRANSDEF, has been an advocate for the regional planning of transportation, land use and air quality for the past decade. We were active in preserving the Transbay Terminal as the terminus for High-Speed Rail in California. On the basis of our familiarity with Bay Area transportation issues, we offer the following scoping comments on the EIS/R being prepared for the Bay Area to Central Valley High-Speed Train.

Alternative Definition
Define an Altamont alternative as follows:

1. Use the HSR portion (gold colored lines) and lower-speed local portions (red colored lines) of the plan drawn by Architecture 21, available at
http://www.arch21.org/BARegRail.dir/regrailindex.html
and as shown in more detail in maps linked to
http://www.arch21.org/CaHighSpeed.dir/Altamont_Tour.dir/tourindex.html

2. Assume that an all-day expanded ACE service shares the HSR tracks to San Jose, using the same trainsets as HSR so as to be compatible (they might possibly be designed for 125 mph instead of 225 mph to save weight and money). These trains would stop at HSR and local stations as defined above. Service levels would be designed to meet demand at local stops, with many or most trains turning around at Fremont or Livermore to go back to San Jose. This service would be an upgrade of the currently planned BART extension to San Jose, and would replace it. Use the ridership projections developed by the Regional Rail Study. For an example of a schedule that intermingles HSR and local trains, see
http://mtcwatch.com/Transit%20Maps/Rapid%20Exports/HSRinfo.pdf

3. Build the local stations with 3 or 4 tracks through them, as needed, to allow HSR trains to pass through them safely, as well as to pass these ACE local trains. Build passing tracks as needed to allow HSR trains to get around local trains which serve more stops.

4. Count the ship traffic that currently passes through/under the Dumbarton rail bridge. Evaluate trends to determine whether more ship traffic is likely in the future. On the basis of that analysis, determine whether a low bridge would suffice, if the swing only needed to be opened a few times a year. Determine the potential interruption of train schedules for that scenario. On the basis of this analysis, evaluate this alternative with either a low bridge or a replacement high bridge.

Methodology

1. Evaluate each alternative for unused capacity to carry more trains.

2. Evaluate each alternative for total population living within 20 miles of the tracks.

3. Evaluate each alternative for potential additional ridership to be gained by serving local, interregional, commuter and intercity markets, using compatible trainsets.

4. Evaluate how well each alternative serves Silicon Valley north of San Jose.

5. Carefully peer review all downtown San Jose land use projections for feasibility, political reality, airport flight path height limitations and impacts on adjacent neighborhoods. Evaluate the feasibility of these projections in the context of other San Jose planning initiatives which encourage more parking lots downtown, along with growth in the North First Street area and in Coyote Valley. We are concerned that current projections used for the BART extension project appear to have been manipulated to affect the cost-effectiveness analysis.

Thank you for considering these comments.

Sincerely,

/s/ David Schonbrunn

David Schonbrunn,
President

FAX

Date: December 15, 2005

To: Dan Leavitt, Deputy Director, California High Speed Rail Authority
Phone: (916) 324-1541
Fax: (916) 322-0827

From: Lindy Lowe, Coastal Planner, Bay Conservation and Development Commission
Phone: (415) 352-3642

Re: Comments on the Notice of Preparation for the Program EIR/EIS for a Bay Area to Central Valley High-Speed Train

Please find attached the Bay Conservation and Development Commission's comments on the NOP for the Program EIR/EIS. A hard copy of this letter will follow. If you have any questions or comments, please feel free to contact me at (415) 352-3642 or lindyl@bcdc.ca.gov.

Making San Francisco Bay Better

December 15, 2005

Dan Leavitt, Deputy Director
California High-Speed Rail Authority
925 L Street, Suite 1425
Sacramento, CA 95814

SUBJECT: Notice of Preparation of a Program Environmental Impact Report/Environmental Impact Statement (Program EIR/EIS) for a Bay Area to Central Valley High-Speed Train

Dear Mr. Leavitt,

The San Francisco Bay Conservation and Development Commission (BCDC) appreciates the opportunity to review and comment on the Notice of Preparation (NOP) of a Program Environmental Impact Report/Environmental Impact Statement (Program EIR/EIS). Although our Commission has not had the opportunity to review the NOP, these staff comments are based on BCDC's law, the McAteer-Petris Act and the provisions of its *San Francisco Bay Plan* (Bay Plan).

As a permitting authority along the San Francisco Bay shoreline, BCDC is responsible for granting or denying permits for all Bay filling or dredging within the Bay and for shoreline development that occurs within BCDC's jurisdiction, which is defined in the McAteer-Petris Act as 100 feet landward of and parallel to the shoreline of the Bay. BCDC's regulations also require that proposed projects provide the maximum feasible public access consistent with the project to the Bay and its shoreline.

For BCDC's Bay jurisdiction, an essential part of BCDC's regulatory framework is the Commission's Bay Plan. The Bay Plan includes priority land use designations for certain areas around the Bay to ensure that sufficient areas around the Bay are reserved for important water-oriented uses such as ports, water-related industry, parks, wildlife areas, tidal marshes and salt ponds and managed wetlands. With respect to transportation, the Bay Plan includes findings and policies pertaining to transportation projects that identify the issues that BCDC considers when reviewing such projects. Transportation projects are also reviewed to determine consistency with the other relevant findings and policies within the Bay Plan (e.g., public access, tidal marshes and tidal flats, recreation).

Given the potential adverse impacts that transportation projects can have on Bay resources when located along the Bay shoreline, or in the Bay, it is important that the planning and design of these facilities is done in a way that both protects and enhances the Bay as a regional resource, while ensuring the viability of a safe and efficient transportation system for the Bay Area. The NOP for the High-Speed Rail project contains a number of different alignments, some that may have impacts on Bay resources and some that would largely avoid the Bay. If portions of the preferred alignment are located within BCDC's jurisdiction, it is important for project proponents and sponsors to contact BCDC early in the project planning phase in order to identify impacts to Bay resources early enough in the planning process to avoid and mitigate impacts to these resources. Staff has the following comments on the NOP.

The proposed alignments for the High-Speed Rail system in the urban areas near the Bay appear to be designed to use existing rail infrastructure. In locations within BCDC's jurisdiction where new infrastructure must be developed or existing infrastructure must be expanded, the alignments chosen should be sited and designed to avoid adverse affects on Bay resources (e.g., tidal marshes, tidal flats, restored areas, habitats that support endangered species) and BCDC priority use areas (e.g., waterfront park, beach, wildlife refuge). Infrastructure placement and improvement within BCDC's jurisdiction should also be designed to minimize the amount of fill in the Bay (fill means earth or any other substance or material including pilings or structures placed on pilings) that is necessary and to provide the maximum feasible public access that would be consistent with the project. The design and siting of new infrastructure should incorporate non-motorized public access and preserve and enhance visual access. Historically, rail lines and roadway infrastructure along the Bay shoreline resulted in adverse impacts on non-motorized public access, recreation and visual access in many communities near the Bay shoreline. The provision of non-motorized pathways, such as the Bay Trail, grade separated crossings and the support of non-motorized access to any proposed rail stations will help to ensure that the High-Speed Rail project is integrated fully into the existing communities and transportation systems.

If a bridge is proposed as part of the project, the McAteer-Petris Act identifies bridges as water-oriented uses that can be approved by the Commission if there is not an alternative upland location for the route and if the fill is the minimum necessary to achieve the purposes of the project. The Bay Plan transportation policies include two policies that pertain to bridges. Policy 3 requires that adequate analysis be done to determine that there is no upland alternative for the route and Policy 4 provides guidelines for constructing and designing a bridge over the Bay.

BCDC's staff look forward to working with the High-Speed Rail Authority on any portions of the Bay Area alignment that cross the Bay or traverse its shoreline. Thank you again for the opportunity to review and comment on the NOP for the Program EIR/EIS. If you have any questions please contact me directly at (415) 352-3642.

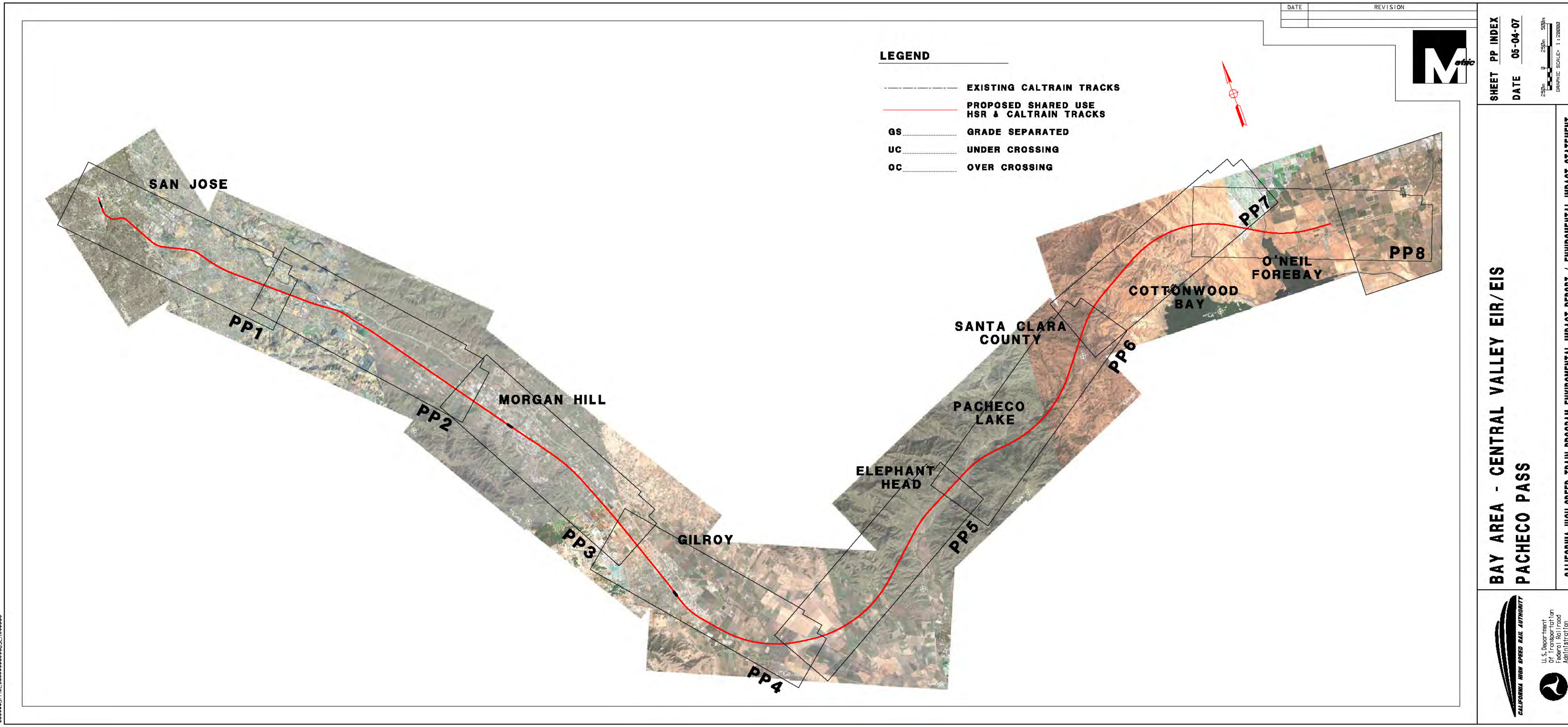
Sincerely,

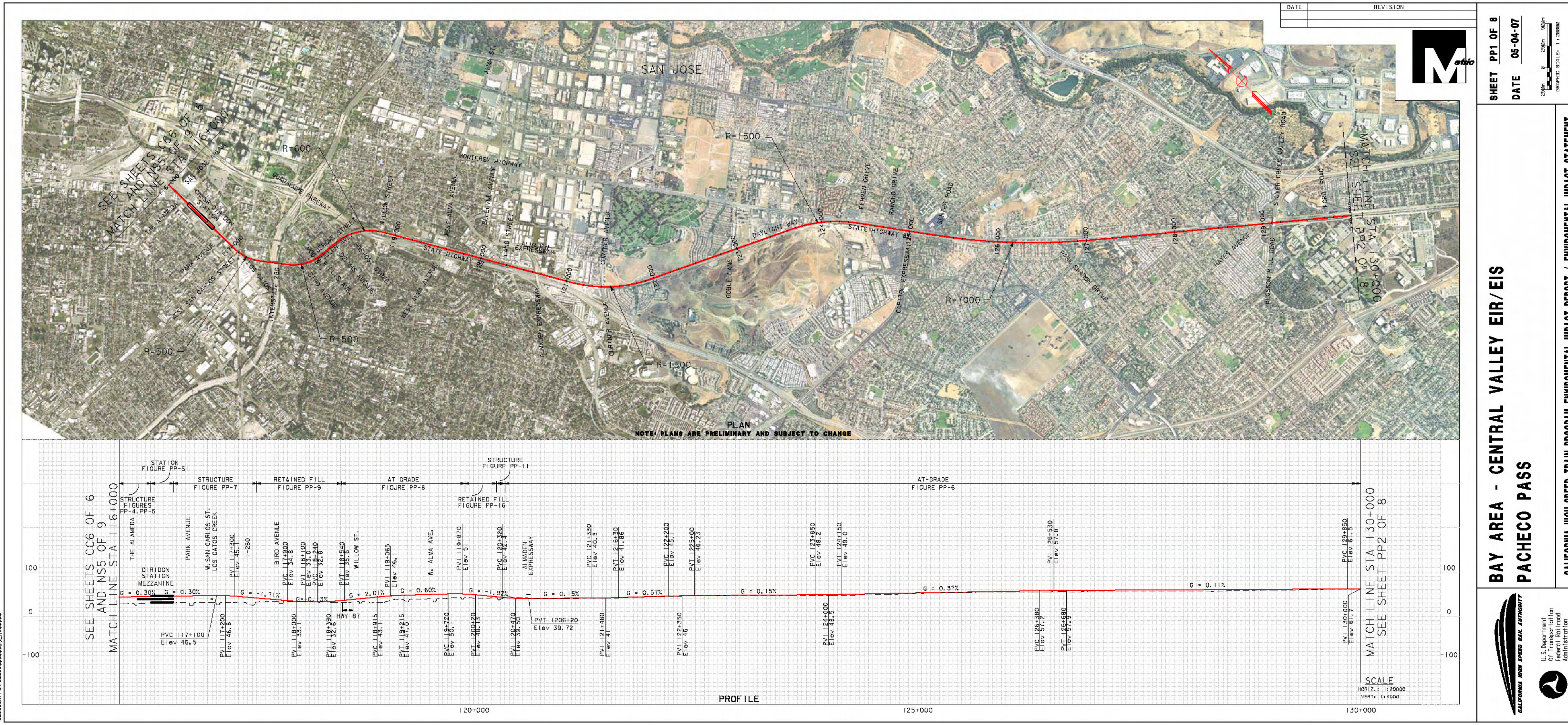
LINDY L. LOWE
Coastal Planner

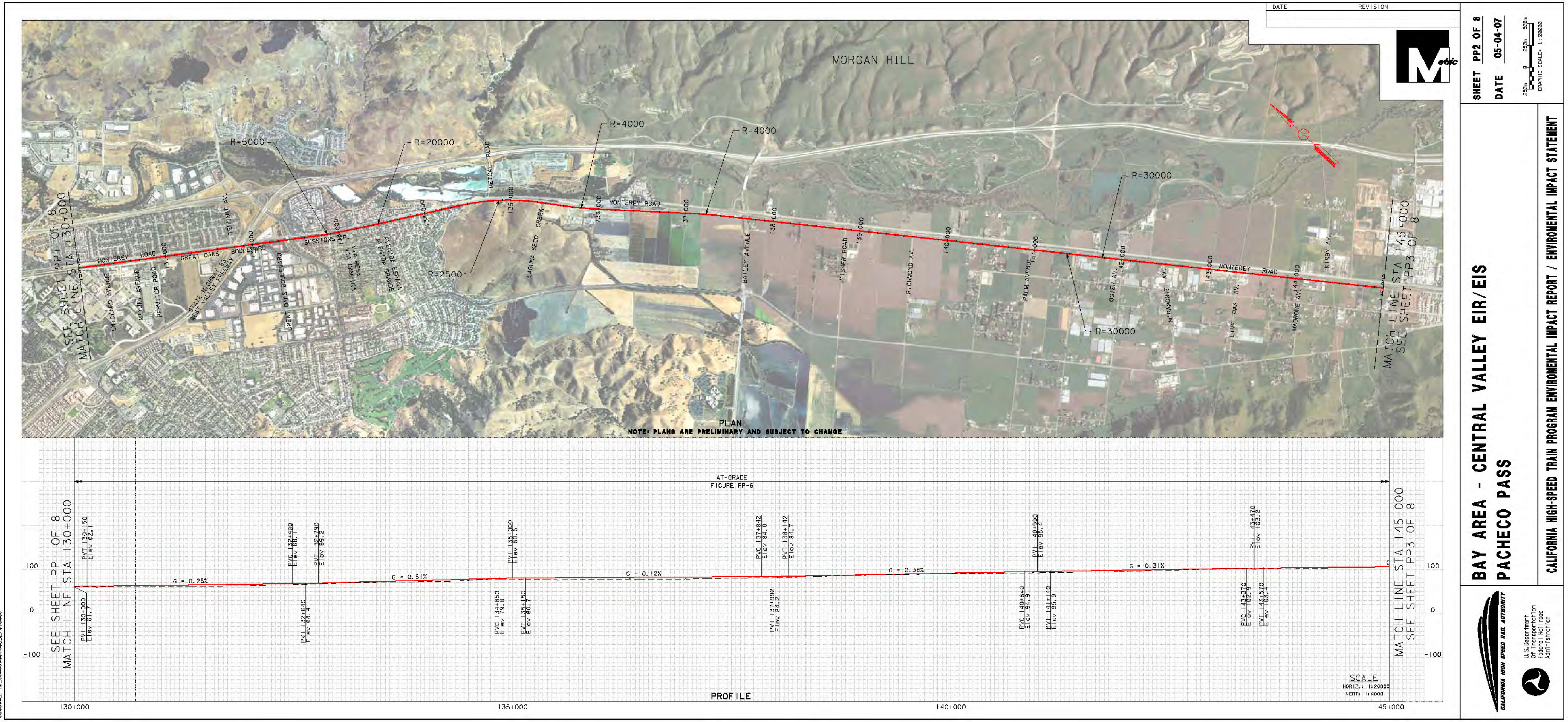
CC. Andrea Gaut, Permit Analyst

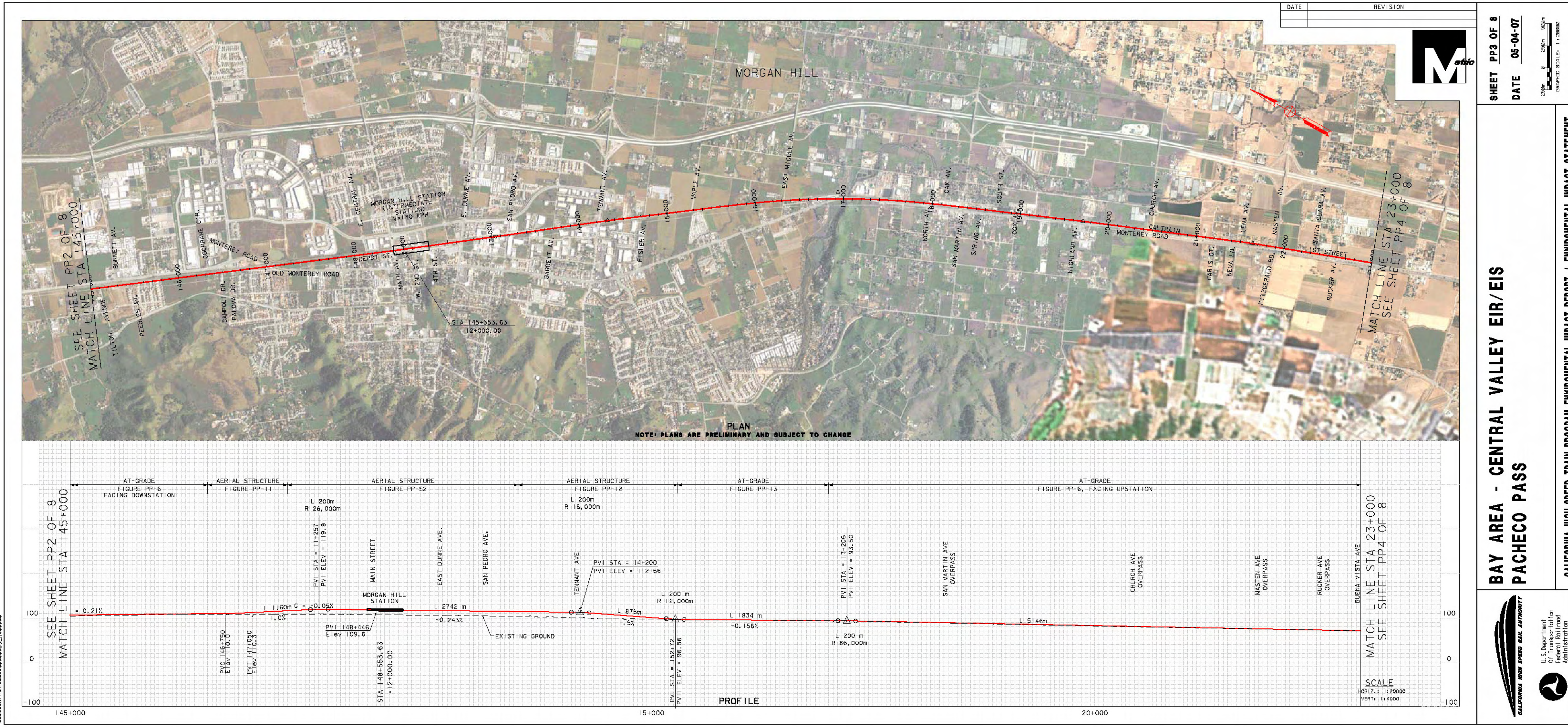
APPENDIX 2-D

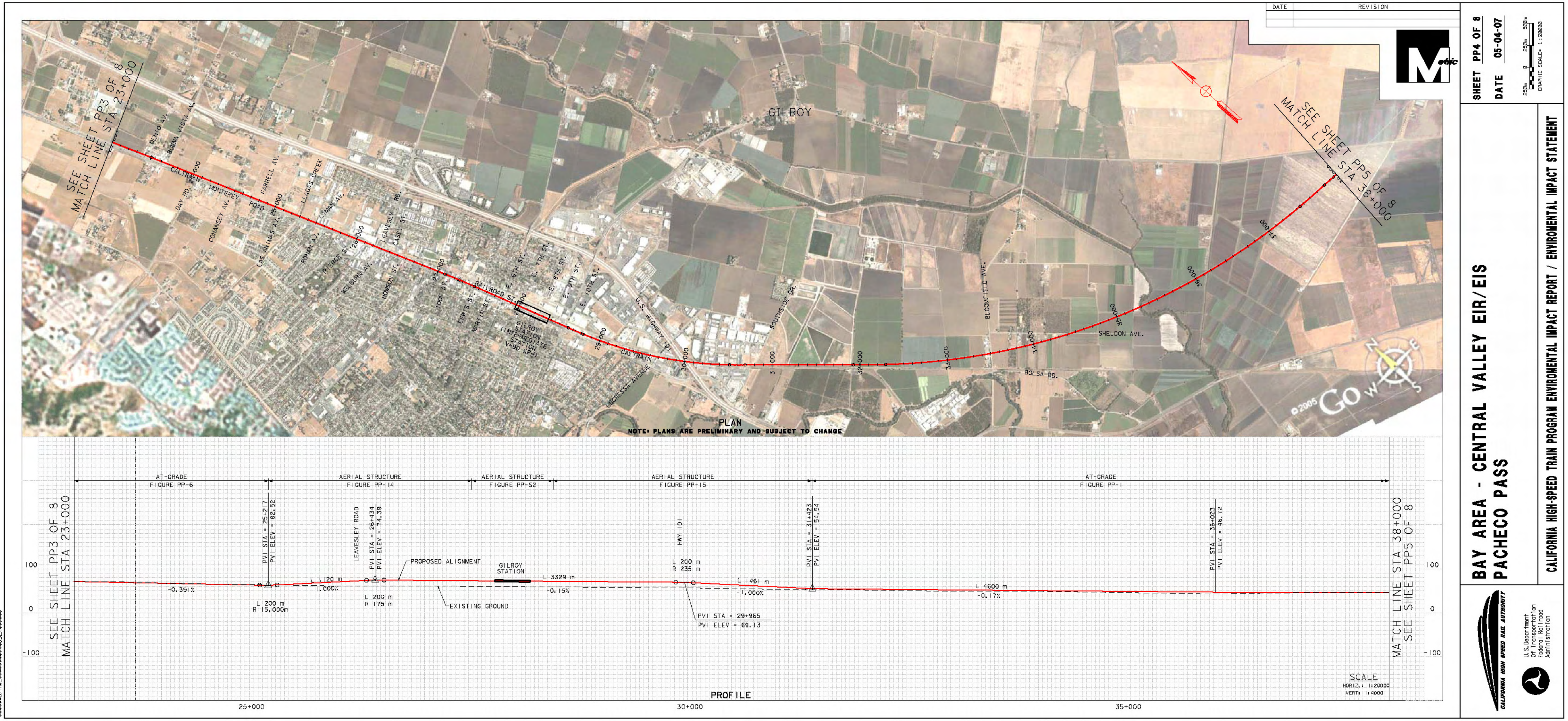
PACHECO PASS

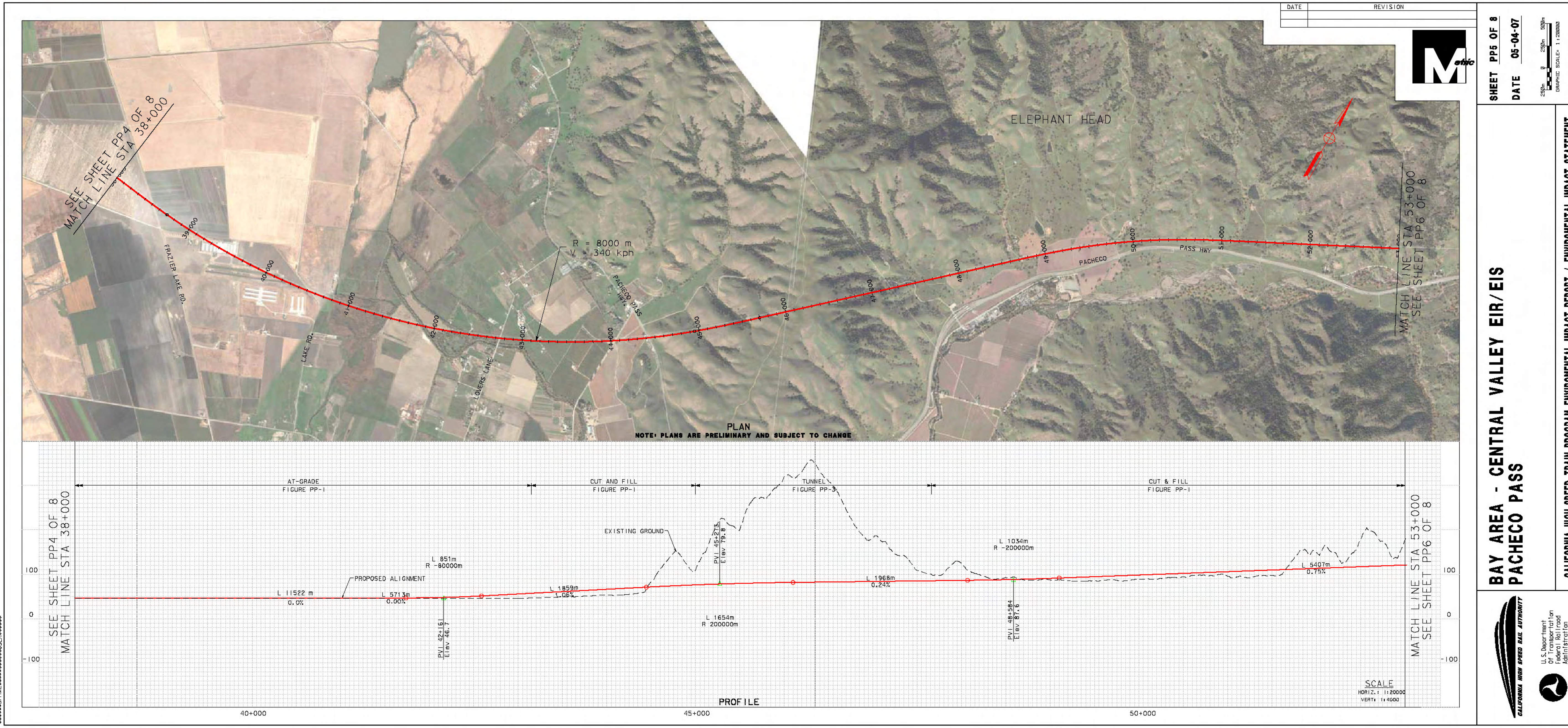

LEGEND
EXISTING CALTRAIN TRACKS
PROPOSED SHARED USE HSR & CALTRAIN TRACKS
GS GRADE SEPARATED
UC UNDER CROSSING
OC OVER CROSSING
SAN JOSE
MORGAN HILL
GILROY
ELEPHANT HEAD
PACHECO LAKE
SANTA CLARA COUNTY
COTTONWOOD BAY
O'NEIL FOREBAY
PP1
PP2
PP3
PP4
PP5
PP6
PP7
PP8
DATE
REVISION
SHEET PP INDEX
DATE 05-04-07
BAY AREA - CENTRAL VALLEY EIR/EIS
PACHECO PASS
CALIFORNIA HIGH-SPEED TRAIN PROGRAM ENVIRONMENTAL IMPACT REPORT / ENVIRONMENTAL IMPACT STATEMENT
CALIFORNIA HIGH SPEED RAIL AUTHORITY
U.S. Department of Transportation Federal Railroad Administration

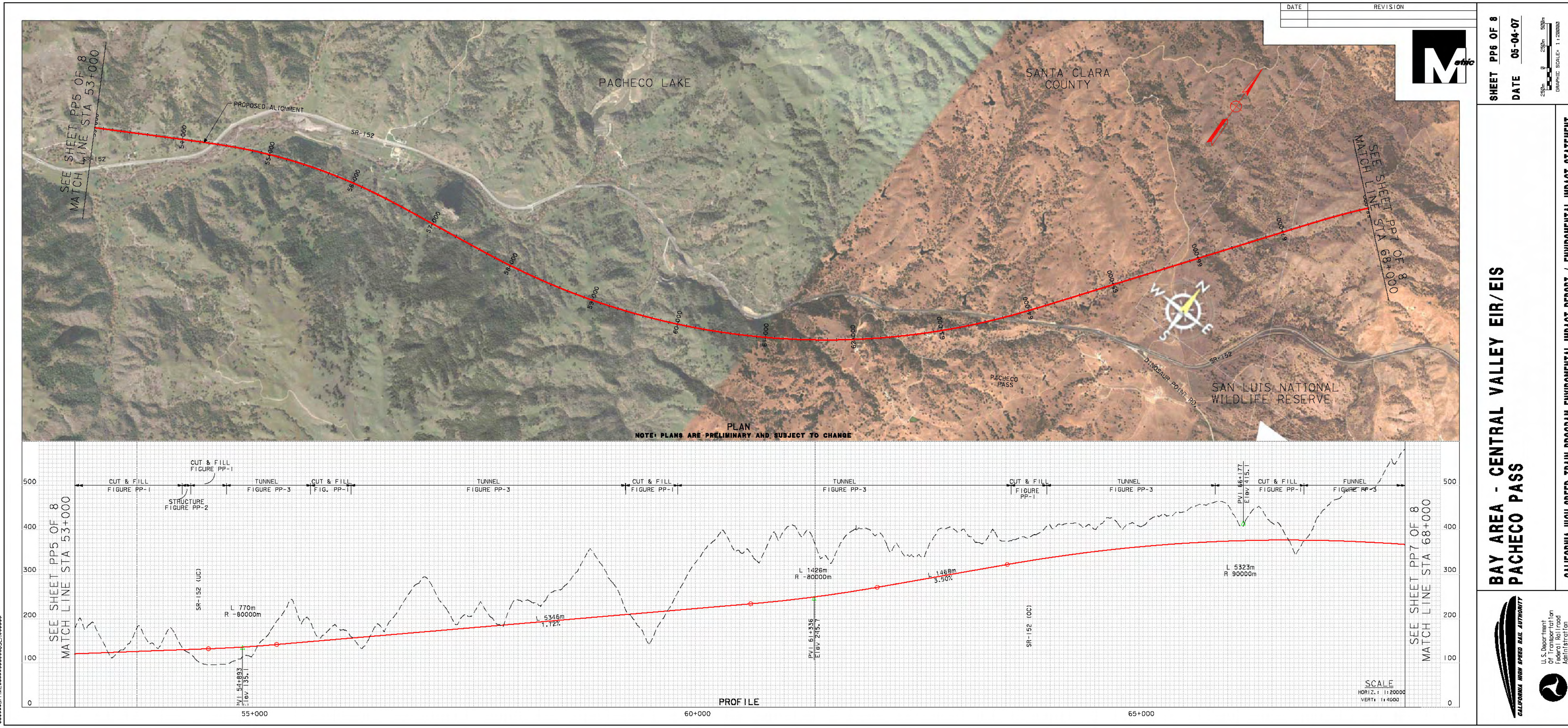

SAN JOSE
PLAN
NOTE: PLANS ARE PRELIMINARY AND SUBJECT TO CHANGE
PROFILE
STATE HIGHWAY
DAYLIGHT WAY
R=600
R=500
R=1500
R=7000
SEE SHEETS CC6 OF 6 AND NS5 OF 9
MATCH LINE STA 116+000
MATCH LINE STA 130+000
SEE SHEET PP2 OF 8
STATION FIGURE PP-S1
STRUCTURE FIGURE PP-7
RETAINED FILL FIGURE PP-9
AT GRADE FIGURE PP-8
STRUCTURE FIGURE PP-11
RETAINED FILL FIGURE PP-16
AT-GRADE FIGURE PP-6
STRUCTURE FIGURES PP-4, PP-5
DIRIDON STATION MEZZANINE
THE ALAMEDA
PARK AVENUE
W. SAN CARLOS ST.
LOS GATOS CREEK
BIRD AVENUE
WILLOW ST.
W. ALMA AVE.
ALMADEN EXPRESSWAY
HWY 87
120+000
125+000
130+000
SCALE
HORIZ. 1:20000
VERT. 1:4000
BAY AREA - CENTRAL VALLEY EIR/EIS
PACHECO PASS
CALIFORNIA HIGH-SPEED TRAIN PROGRAM ENVIRONMENTAL IMPACT REPORT / ENVIRONMENTAL IMPACT STATEMENT
SHEET PP1 OF 8
DATE 05-04-07
DATE
REVISION
U.S. Department of Transportation Federal Railroad Administration

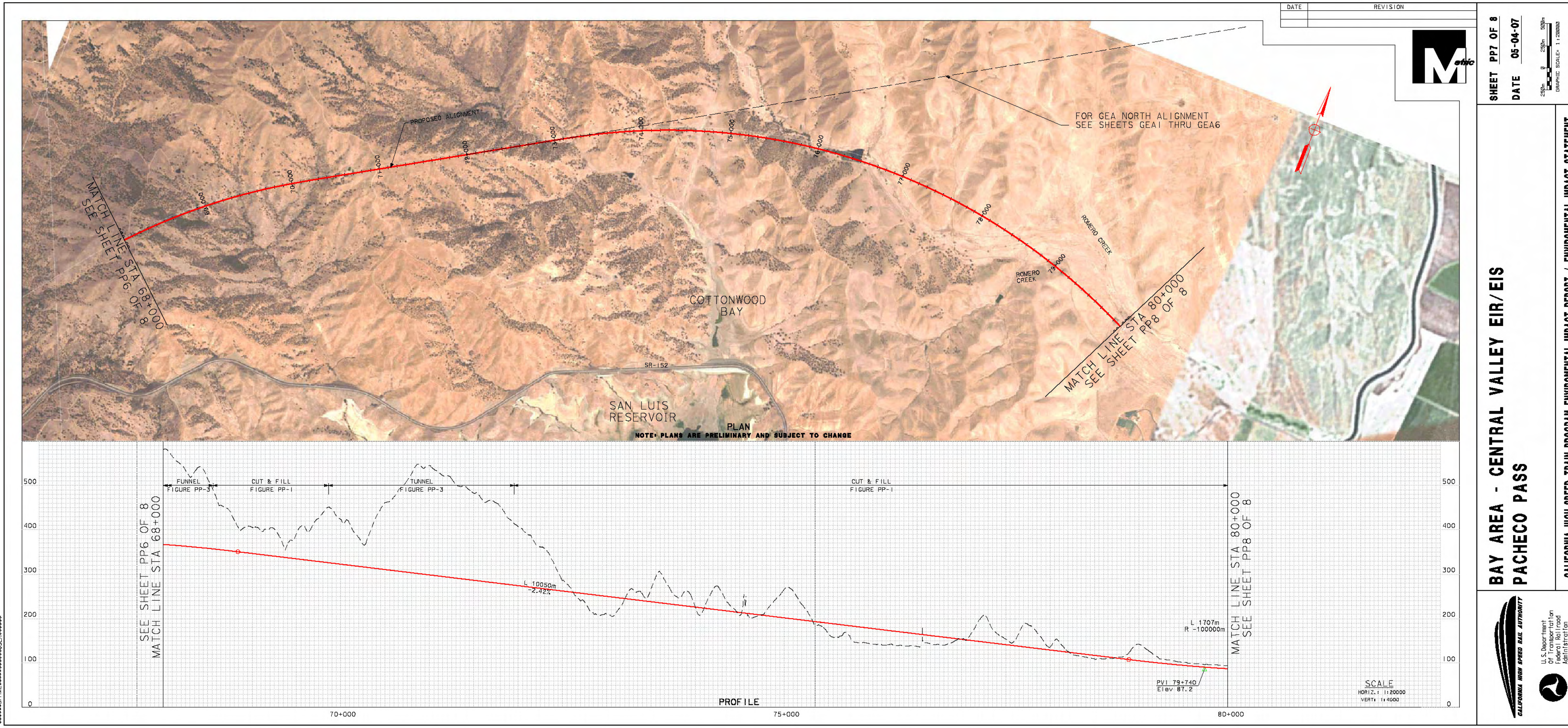

MORGAN HILL
R=5000
R=20000
R=4000
R=4000
R=30000
R=2500
R=30000
MONTEREY ROAD
PLAN
NOTE: PLANS ARE PRELIMINARY AND SUBJECT TO CHANGE
AT-GRADE
FIGURE PP-6
PROFILE
SEE SHEET PP1 OF 8
MATCH LINE STA 130+000
MATCH LINE STA 145+000
SEE SHEET PP3 OF 8
G = 0.26%
G = 0.51%
G = 0.12%
G = 0.38%
G = 0.31%
130+000
135+000
140+000
145+000
SHEET PP2 OF 8
DATE 05-04-07
BAY AREA - CENTRAL VALLEY EIR/EIS
PACHECO PASS
CALIFORNIA HIGH-SPEED TRAIN PROGRAM ENVIRONMENTAL IMPACT REPORT / ENVIRONMENTAL IMPACT STATEMENT
SCALE

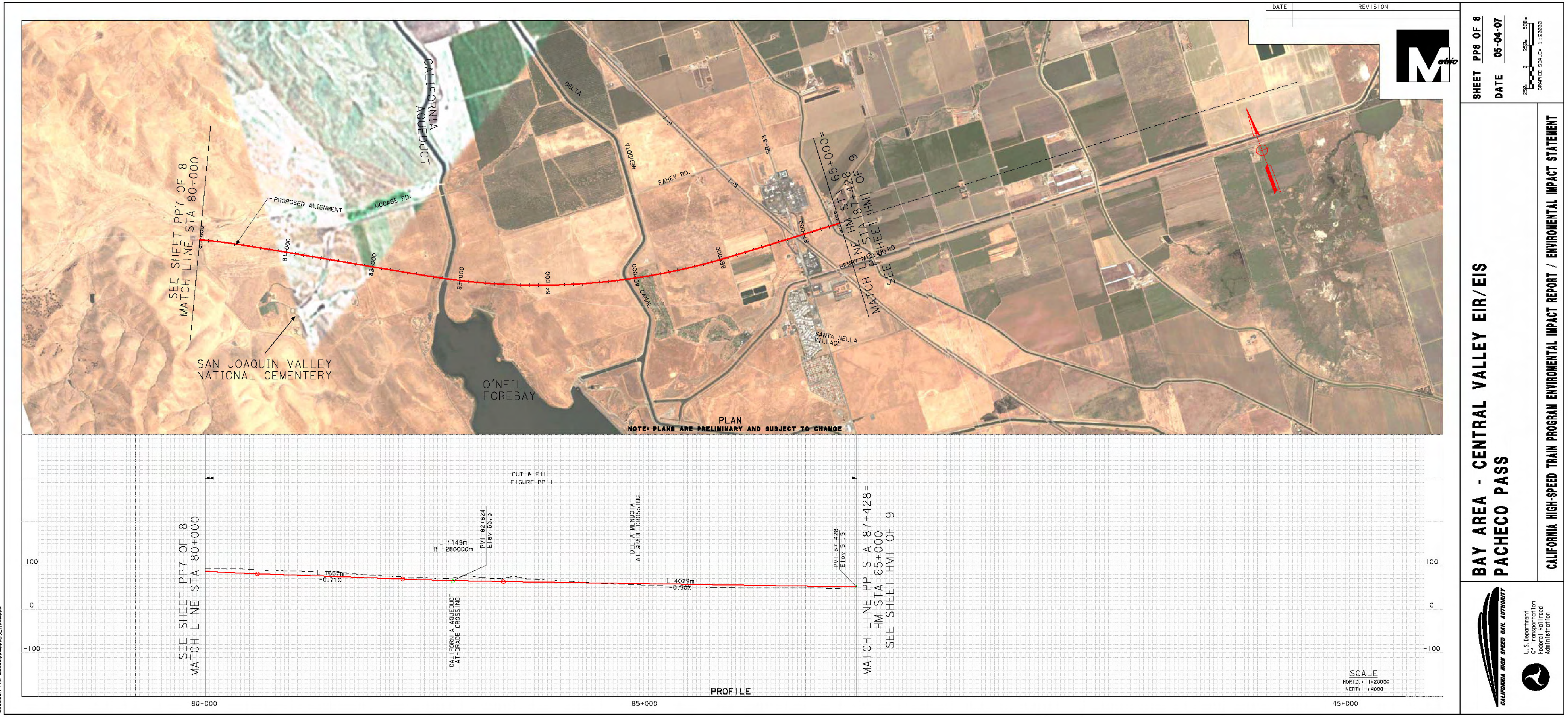

MORGAN HILL
PLAN
NOTE: PLANS ARE PRELIMINARY AND SUBJECT TO CHANGE
PROFILE
SEE SHEET PP2 OF 8
MATCH LINE STA 145+000
MATCH LINE STA 23+000
SEE SHEET PP4 OF 8
MORGAN HILL STATION (INTERMEDIATE STATION) V=130 KPH
STA 145+553.63 =12+000.00
AT-GRADE FIGURE PP-6 FACING DOWNSTATION
AERIAL STRUCTURE FIGURE PP-11
AERIAL STRUCTURE FIGURE PP-S2
AERIAL STRUCTURE FIGURE PP-12
AT-GRADE FIGURE PP-13
AT-GRADE FIGURE PP-6, FACING UPSTATION
EXISTING GROUND
SCALE
HORIZ.: 1:20000
VERT: 1:4000
SHEET PP3 OF 8
DATE 05-04-07
BAY AREA - CENTRAL VALLEY EIR/EIS
PACHECO PASS
CALIFORNIA HIGH-SPEED TRAIN PROGRAM ENVIRONMENTAL IMPACT REPORT / ENVIRONMENTAL IMPACT STATEMENT
U.S. Department of Transportation Federal Railroad Administration

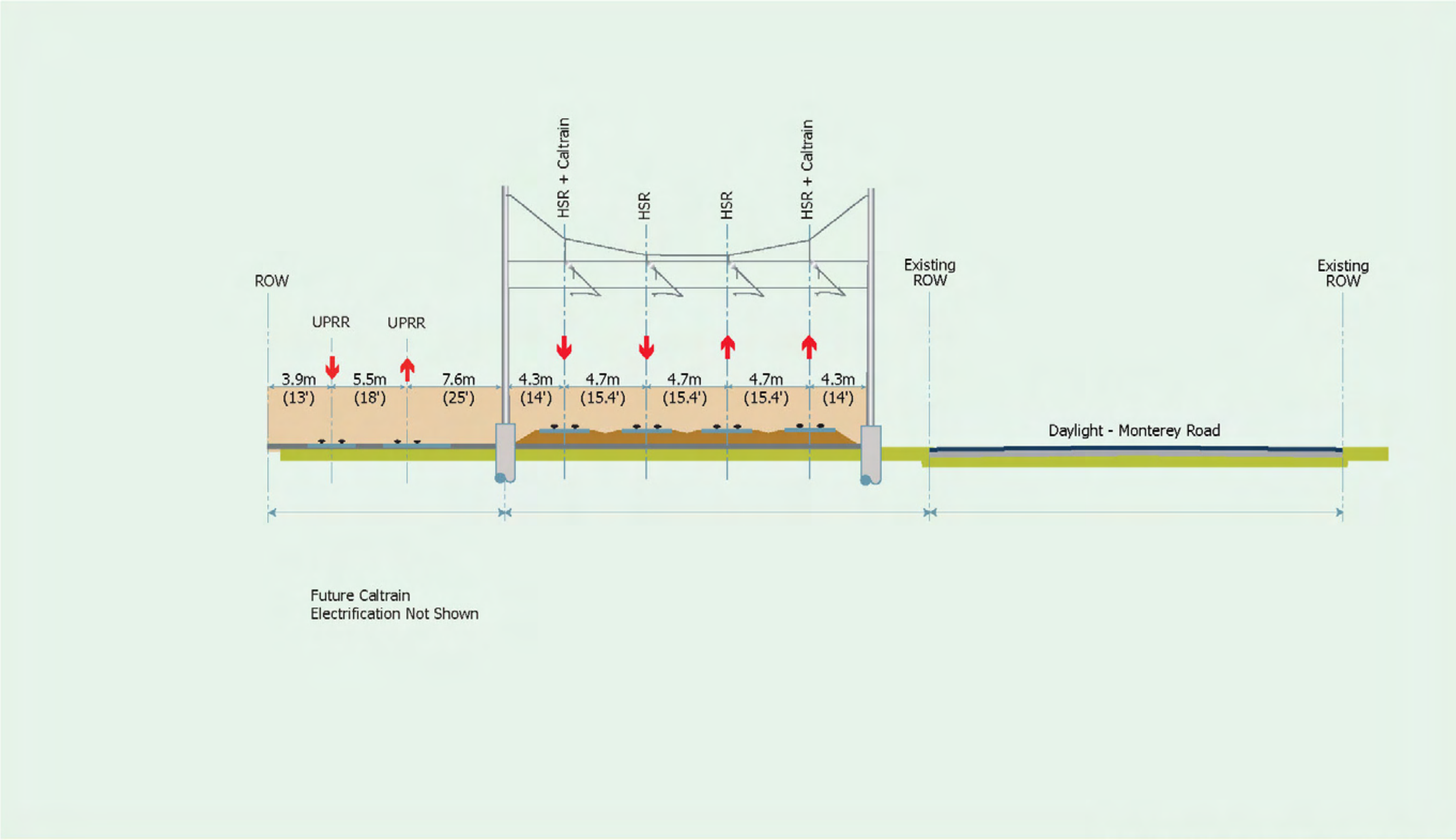

SEE SHEET PP3 OF 8
MATCH LINE STA 23+000
SEE SHEET PP5 OF 8
MATCH LINE STA 38+000
GILROY
PLAN
NOTE: PLANS ARE PRELIMINARY AND SUBJECT TO CHANGE
AT-GRADE FIGURE PP-6
AERIAL STRUCTURE FIGURE PP-14
AERIAL STRUCTURE FIGURE PP-S2
AERIAL STRUCTURE FIGURE PP-15
AT-GRADE FIGURE PP-1
PROPOSED ALIGNMENT
GILROY STATION
EXISTING GROUND
PVI STA = 29+965
PVI ELEV = 69.13
PROFILE
SCALE
25+000
30+000
35+000
SHEET PP4 OF 8
DATE 05-04-07
BAY AREA - CENTRAL VALLEY EIR/EIS
PACHECO PASS
CALIFORNIA HIGH-SPEED TRAIN PROGRAM ENVIRONMENTAL IMPACT REPORT / ENVIRONMENTAL IMPACT STATEMENT


SEE SHEET PP4 OF 8
MATCH LINE STA 38+000
ELEPHANT HEAD
R = 8000 m
V = 340 kph
FRAZIER LAKE RD.
LAKE RD.
PACHECO PASS HWY
PACHECO
PASS HWY
MATCH LINE STA 53+000
SEE SHEET PP6 OF 8
PLAN
NOTE: PLANS ARE PRELIMINARY AND SUBJECT TO CHANGE
AT-GRADE
FIGURE PP-1
CUT AND FILL
FIGURE PP-1
TUNNEL
FIGURE PP-3
CUT & FILL
FIGURE PP-1
EXISTING GROUND
PROPOSED ALIGNMENT
L 11522 m
0.0%
L 851m
R -80000m
L 5713m
0.00%
L 1859m
1.06%
L 1654m
R 200000m
L 1968m
0.24%
L 1034m
R -200000m
L 5407m
0.75%
PVI 42+161
Elev 46.7
PVI 45+273
Elev 79.8
PVI 48+584
Elev 87.6
PROFILE
SCALE
HORIZ. 1:20000
VERT. 1:4000
40+000
45+000
50+000
DATE
REVISION
SHEET PP5 OF 8
DATE 05-04-07
BAY AREA - CENTRAL VALLEY EIR/EIS
PACHECO PASS
CALIFORNIA HIGH-SPEED TRAIN PROGRAM ENVIRONMENTAL IMPACT REPORT / ENVIROMENTAL IMPACT STATEMENT
U.S. Department of Transportation Federal Railroad Administration


PACHECO LAKE
SANTA CLARA COUNTY
PROPOSED ALIGNMENT
SR-152
SEE SHEET PP5 OF 8 MATCH LINE STA 53+000
SEE SHEET PP7 OF 8 MATCH LINE STA 68+000
PACHECO PASS
SAN LUIS NATIONAL WILDLIFE RESERVE
PLAN
NOTE: PLANS ARE PRELIMINARY AND SUBJECT TO CHANGE
CUT & FILL FIGURE PP-1
STRUCTURE FIGURE PP-2
TUNNEL FIGURE PP-3
PROFILE
55+000
60+000
65+000
SCALE
SHEET PP6 OF 8
DATE 05-04-07
DATE
REVISION
BAY AREA - CENTRAL VALLEY EIR/EIS
PACHECO PASS
CALIFORNIA HIGH-SPEED TRAIN PROGRAM ENVIRONMENTAL IMPACT REPORT / ENVIRONMENTAL IMPACT STATEMENT
CALIFORNIA HIGH SPEED RAIL AUTHORITY
U.S. Department of Transportation Federal Railroad Administration


PROPOSED ALIGNMENT
FOR GEA NORTH ALIGNMENT
SEE SHEETS GEA1 THRU GEA6
MATCH LINE STA 68+000
SEE SHEET PP6 OF 8
MATCH LINE STA 80+000
SEE SHEET PP8 OF 8
COTTONWOOD BAY
ROMERO CREEK
SR-152
SAN LUIS RESERVOIR
PLAN
NOTE: PLANS ARE PRELIMINARY AND SUBJECT TO CHANGE
TUNNEL
FIGURE PP-3
CUT & FILL
FIGURE PP-1
L 10050m
-2.42%
L 1707m
R -100000m
PVI 79+740
Elev 87.2
PROFILE
SCALE
HORIZ.: 1:20000
VERT: 1:4000
70+000
75+000
80+000
SHEET PP7 OF 8
DATE 05-04-07
DATE
REVISION
BAY AREA - CENTRAL VALLEY EIR/EIS
PACHECO PASS
CALIFORNIA HIGH-SPEED TRAIN PROGRAM ENVIRONMENTAL IMPACT REPORT / ENVIRONMENTAL IMPACT STATEMENT
CALIFORNIA HIGH SPEED RAIL AUTHORITY
U.S. Department of Transportation Federal Railroad Administration


SEE SHEET PP7 OF 8
MATCH LINE STA 80+000
PROPOSED ALIGNMENT
SAN JOAQUIN VALLEY
NATIONAL CEMENTERY
CALIFORNIA AQUEDUCT
O'NEIL FOREBAY
SANTA NELLA VILLAGE
MATCH LINE PP STA 87+428=
HM STA 65+000
SEE SHEET HM1 OF 9
PLAN
NOTE: PLANS ARE PRELIMINARY AND SUBJECT TO CHANGE
CUT & FILL
FIGURE PP-1
CALIFORNIA AQUEDUCT AT-GRADE CROSSING
DELTA MENDOTA AT-GRADE CROSSING
PROFILE
80+000
85+000
45+000
SCALE
BAY AREA - CENTRAL VALLEY EIR/EIS
PACHECO PASS
CALIFORNIA HIGH-SPEED TRAIN PROGRAM ENVIRONMENTAL IMPACT REPORT / ENVIRONMENTAL IMPACT STATEMENT
SHEET PP8 OF 8
DATE 05-04-07
DATE
REVISION



California High-Speed Train Program EIR/EIS

Figure PP-6

U.S. Department of Transportation
Federal Railroad Administration

San Jose to Los Banos
Pacheco Pass
Typical At-Grade Section
Page 2-E-53

B002294

APPENDIX 2-G

ALIGNMENT ALTERNATIVES AND STATION LOCATION OPTIONS ELIMINATED FROM FURTHER CONSIDERATION

ALIGNMENT ALTERNATIVES AND STATION LOCATION OPTIONS ELIMINATED FROM FURTHER CONSIDERATION

2-G.1.1 San Francisco to San Jose

The alignment alternatives and station location options eliminated from further consideration in this corridor are described below (Figure 2.G-1).

2-G.1.1.1 Alignment Alternatives

- **US-101 Alignment Alternative**: From San Francisco (Transbay Terminal or 4th and King Terminal Station), this alignment alternative would follow the US-101 freeway alignment south to San Jose and be on an exclusive guideway in the US-101 corridor.

This exclusive guideway alignment would have major construction issues involving the construction of an aerial guideway adjacent to and above an active existing freeway facility while maintaining freeway traffic. Limited right-of-way in this corridor would require the extensive purchase of additional right-of-way and nearly exclusive use of an aerial structure between San Francisco and San Jose. In San Francisco, major new tunnel construction would be required.

The US-101 alignment alternative would require many sections of high-level structures to pass over existing overpasses and connector ramps, resulting in high construction costs and constructability issues that would make this alignment alternative impracticable. This alignment alternative would also require relocating and maintaining freeway access and capacity during construction. The aerial portions would introduce a major new visual element along the US-101 corridor that would have visual impacts (intrusion/shade/shadow) on the residential portions for this alignment alternative. In addition, the freeway has substandard features (e.g., medians and shoulders) in many places, and it is assumed that any room that might be available for HST facilities likely would be used by Caltrans to upgrade the freeway in these areas. Construction of the tunnel in San Francisco from the Transbay Terminal site to 17th Street would be difficult because most of the tunnel would need to be constructed using compressed air techniques in soft Bay-fill ground.

- **Caltrain Corridor Alignment Alternative (Exclusive Guideway):** From San Francisco (Transbay Terminal or 4th and King Terminal Station), this alignment alternative would follow south along the Caltrain rail alignment to San Jose. This alignment alternative would be on an exclusive guideway within the Caltrain corridor.

An exclusive guideway alignment would be impracticable in this area because it would have major construction issues and high capital costs involving the construction of an aerial guideway adjacent to and above an active existing transportation facility, while maintaining rail traffic. It would require the extensive purchase of additional right-of-way and nearly exclusive use of an aerial structure between San Francisco and San Jose.

The aerial portions of this alignment alternative would introduce a new visual element along the Caltrain corridor that would have visual impacts (intrusion/shade/shadow) on the residential portions of this alignment alternative. For the Caltrain exclusive guideway alignment, introduction of the elevated structure for the high-speed tracks and stations would also have adverse impacts on the suburban town centers along the Caltrain corridor (San Mateo, San Carlos, Redwood City, Menlo Park, Palo Alto, and Mountain View). Although the structure would generally be in a commercial area in these centers, it would represent a physical barrier for land use and urban design. Construction of the tunnel in San Francisco from the Transbay Terminal site to 17th Street would be particularly difficult because most of the tunnel would need to be constructed using compressed air techniques in very soft Bay-fill ground. Although the Caltrain exclusive guideway alignment would provide faster potential travel times than any of the other alignment alternatives in this section, this alternative would have the most impacts on cultural resources and would be the least compatible with the existing and planned development on the Peninsula. Samtrans has formally commented that this alternative would not be compatible with its existing and planned Caltrain services and would not be feasible in its existing right-of-way.

- **I-280 Alignment Alternative (Exclusive Guideway)**: From San Francisco (Transbay Terminal or 4th and King Terminal Station), this alignment alternative would follow south along the I-280 freeway alignment to San Jose and be on an exclusive guideway in the I-280 corridor.

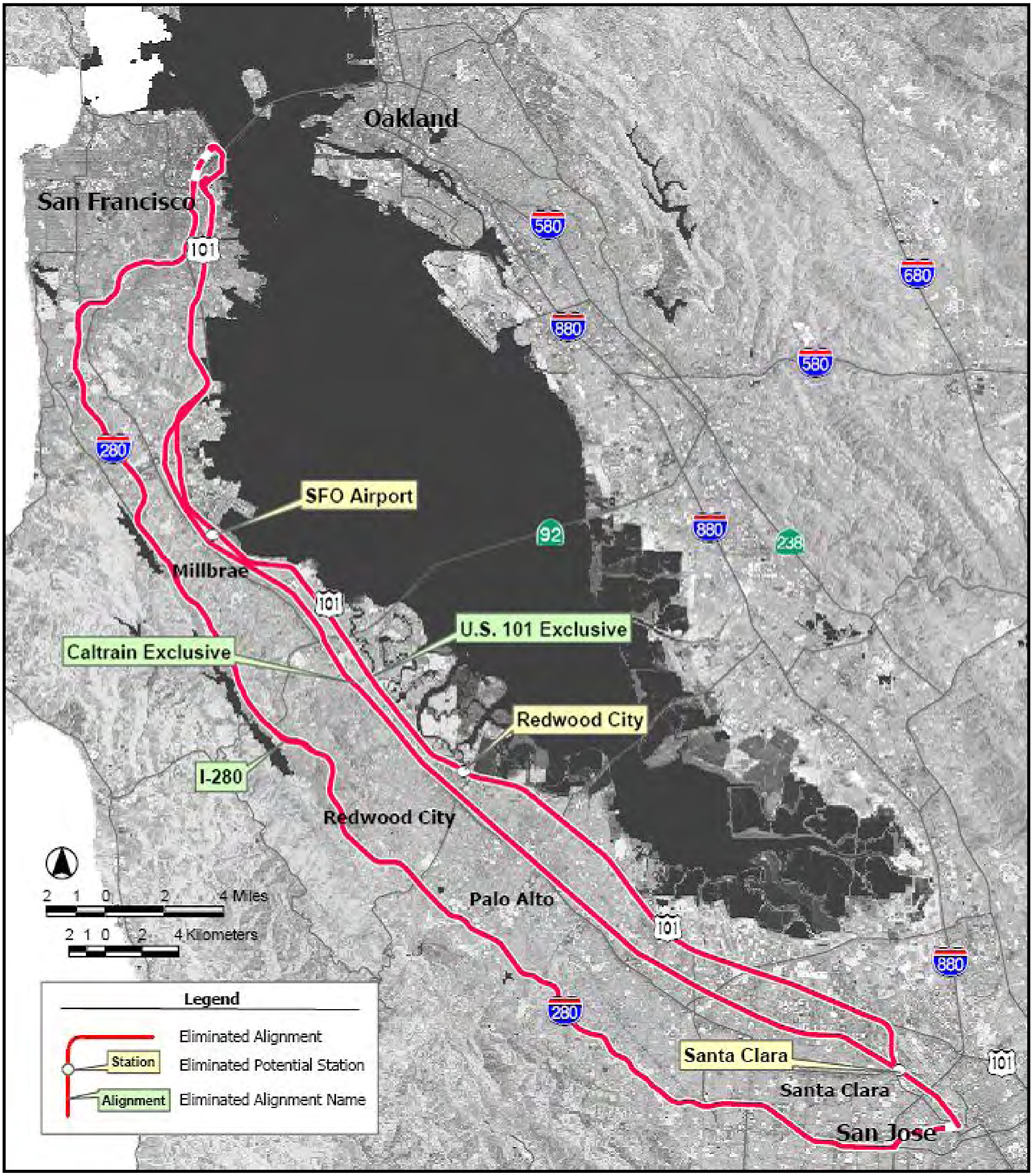
This exclusive guideway alignment would have major construction issues involving the construction of an aerial guideway adjacent to and above an active existing freeway facility while maintaining freeway traffic. Limited right-of-way in this corridor would require the extensive purchase of additional right-of-way and nearly exclusive use of an aerial structure between San Francisco and San Jose. The portion within the City and County of San Francisco is fully developed, and connecting the alignment alternative to Diridon Station in San Jose would require a guideway passing through developed portions of downtown San Jose. These areas would require considerable property acquisition.

The I-280 alignment alternative would require many sections of high-level structures to pass over existing overpasses and connector ramps (in particular at interchanges with Routes 17 (580), 85, and 92), resulting in high construction costs and constructability issues that would make this alignment alternative impracticable. This alignment alternative would also require relocating and maintaining freeway access and capacity during construction. The aerial portions would introduce a major new visual element along the I-280 corridor that would have visual impacts (intrusion/shade/shadow) on the residential portions, nature preserves, and scenic areas for this alignment alternative. In addition, the freeway has substandard features (e.g., medians and shoulders) in many places, and it is assumed that any room that might be available for HST facilities likely would be used by Caltrans to upgrade the freeway in these areas. The considerable earthwork and retaining walls needed through Palo Alto and Woodside would have potentially significant impacts to nature preserves. The I-280 corridor would not allow a convenient connection to San Francisco International Airport from the south—the alignment alternative would have to leave the freeway corridor and pass through Hillsborough and Burlingame to provide access to the airport. For these reasons, the I-280 corridor is not considered to be a practicable alternative for HST service between San Jose and San Francisco.

2-G.1.1.1 Station Locations

The following station location options were considered and eliminated because they were located on alignment alternatives that were eliminated.

- **Millbrae–San Francisco International Airport (US-101).**
- **Redwood City (US-101).**
- **Santa Clara:** A potential link to San Jose International Airport would be at Santa Clara less than 3 miles north of the proposed downtown San Jose station location option. Because the downtown San Jose (Diridon) station site would provide sufficient connectivity to San Jose airport for the foreseeable future, the Authority has determined that the HST system would have no HST station at Santa Clara.



00358.07

U.S. Department of Transportation
Federal Railroad Administration

Figure 2.G-1
San Francisco to San Jose—Alignment Alternatives and Station Location Options Considered but Eliminated from Further Consideration

CALIFORNIA HIGH-SPEED RAIL AUTHORITY

EIR/EIS PUBLIC COMMENTS HEARING

OAKLAND CITY HALL

1 FRANK OGAWA PLAZA, ROTUNDA

AUGUST 28, 2007 - 4:00 O'CLOCK P.M.

---o0o---

REPORTED BY: DEBORAH FUQUA, CSR#12948

cross between Redwood City and Fremont, but that the sky will fall and bay with empty and the fish will die and every bird will fall out of the sky if the High-Speed Rail train runs on the same exact corridor is novel. PH-O12-1

Thank you.

HONORABLE QUENTIN KOPP: Thank you, Mr. Mlynarik.

Mr. Bigelow.

JIM BIGELOW: Jim Bigelow. And today I'm here with the Menlo Park Chamber of Commerce. And I've been affiliated with the Dumbarton Rail project for 20 years. Before I talk about that and some of the interface with the High-Speed Rail, I want to make it clear that our chamber of commerce strongly supports the statewide need for High-Speed Rail. PH-O13-1

Going and cutting to the chafe on the Dumbarton Rail corridor, currently there is a project to reactivate a freight line into a commuter rail system. San Mateo County purchased 11 miles, from the Redwood junction to the Newark junction on the east side of the bay. And across the bay, it's a single track in the middle. PH-O13-2

When it is refurbished and put back into service, estimated to be 2012, it would be with diesel locomotives and heavy rail because there is not funds in the near term to electrify that portion of the line from Union City over to the CalTrain main line.

CalTrain has made a commitment that it will operate equipment from the main line area over to Union City, which is the terminus of that line. There are some key facts that should be thought of in the environmental aspects. The project right now is going through environmental clearance. And there are a variety of issues.

One is the construction times are going to be constrained on the refurbishment because of the mating season, which is several months every year of the species to which the east side of the Dumbarton Rail goes through on the Don Edward's Wildlife Area. PH-O13-2 Cont.

Another issue that's come up, the Dumbarton Rail features a swing bridge, an old swing bridge that would be refurbished that's 18 feet above the water. The maintenance of the South Bay levees -- and Alviso for example, is below sea level. In order to maintain the levee system, both south of the Dumbarton Rail corridor and north, a 37-foot-high dredge has to work back and forth through that area. So you have to be able to get through the rail line.

So for the Dumbarton Rail project, the U.S. Coast Guard has jurisdiction on the navigable waterway that passes through the line. All we have to do is provide opportunities with the two-week notice to make arrangements to allow the dredge to move back and forth.

So the low-level plan that's for High-Speed Rail, as an example, that's an issue that you need to consider in one of your three options for crossing the Dumbarton corridor.

Last but not least, the only reason the Dumbarton Rail project is going through refurbishment is the $1.00 toll bridge increase on the bay bridges, Regional Measure 2. The three counties put up seed money, and we currently have about 300 million on what now is anticipated to be at least a $500 million-plus refurbishment project. So it may need to be phased. PH-O13-2 Cont.

And so there's nothing in the plan that would really accommodate High-Speed Rail on that right of way that is owned by SamTrans. So I would suggest you would need to look to an adjacent crossing and not look at the Dumbarton. And it falls under a different set of categories because it's a refurbishment not a new crossing.

Thank you.

HONORABLE QUENTIN KOPP: You started by saying that San Mateo County bought that facility.

JIM BIGELOW: 50 percent, from the State.

HONORABLE QUENTIN KOPP: You meant the Joint Powers Authority, didn't you?

JIM BIGELOW: The way it ended up, the San Mateo County Transportation Authority put up the money --

HONORABLE QUENTIN KOPP: I know that.

JIM BIGELOW: -- for half. And the State has a loan for half. And that State loan will be paid off in, I believe, 2008.

The reason it's owned by SamTrans is because the Transportation Authority that's been putting up the money is a sunset agency. So the title for the 11-mile right of way on the record is owned by SamTrans.

HONORABLE QUENTIN KOPP: And not by the JPA?

JIM BIGELOW: No.

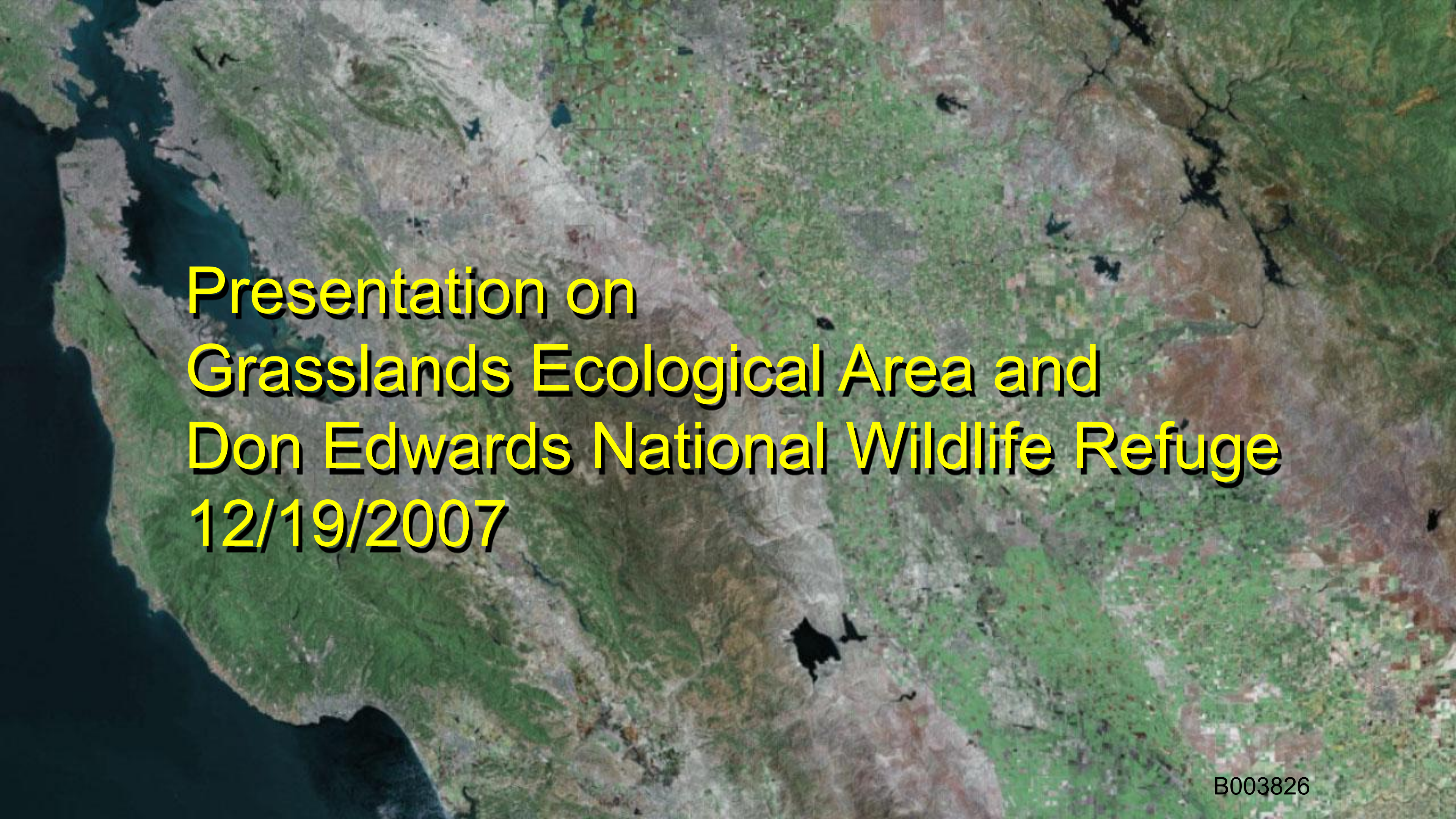
HONORABLE QUENTIN KOPP: Thank you.

JIM BIGELOW: You're welcome.

HONORABLE QUENTIN KOPP: Yes, current information.

All right. Stuart Cohen, Transportation and Land Use Coalition.

STUART COHEN: Good afternoon, and thank you for holding this large number of hearings. The Transportation and Land Use Coalition is a coalition Bay Area-wide of just over 100 environmental, civic, social justice, and housing organizations. PH-O14-1



Presentation on
Grasslands Ecological Area and
Don Edwards National Wildlife Refuge
12/19/2007


Oakland
San Francisco
Altamont Pass
Modesto
Merced
San Jose
Don Edwards NWR
Pacheco Pass
Grasslands
Ecological Area
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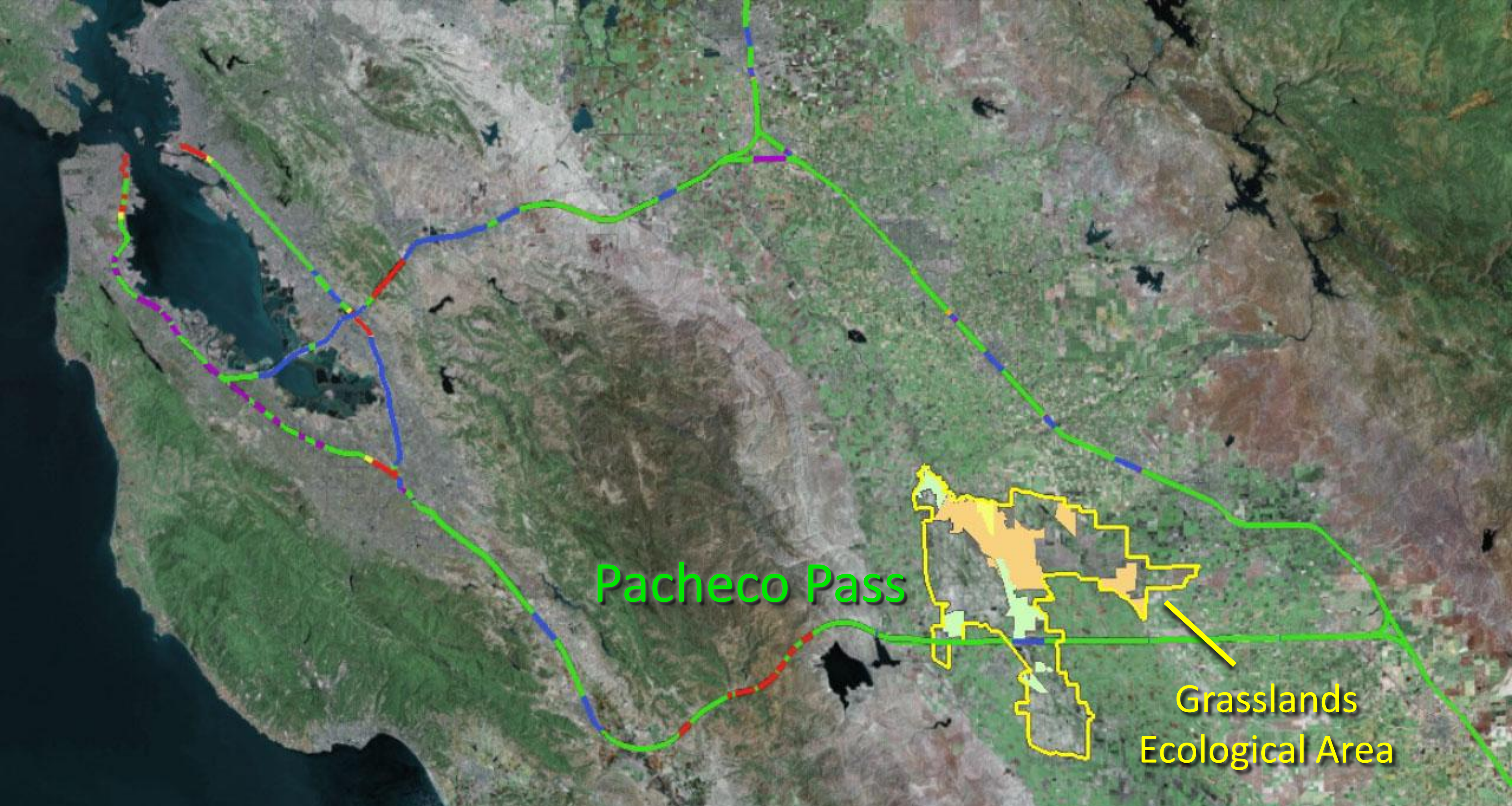

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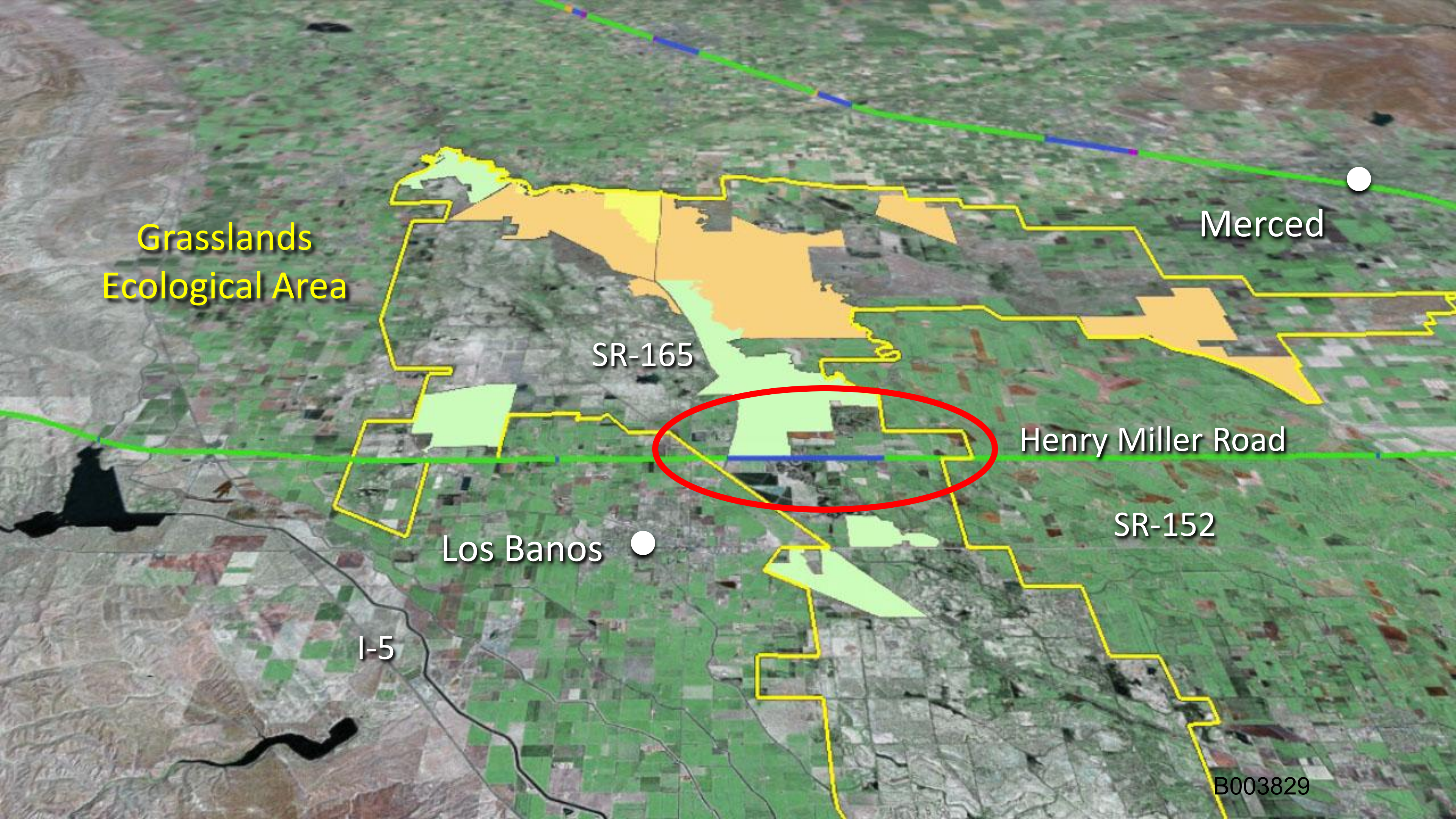
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SR-152
Los Banos
I-5
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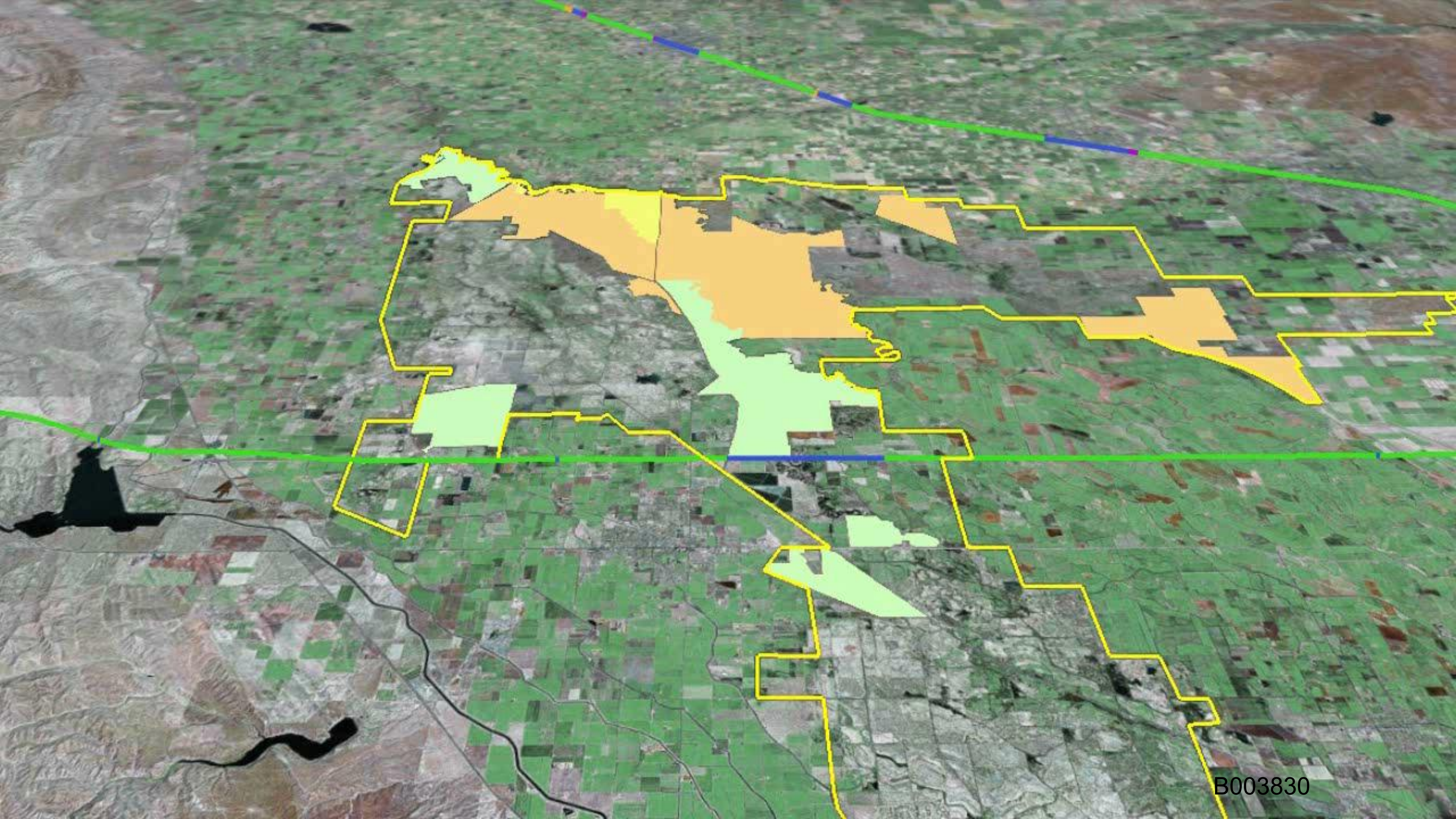

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San Pedro Canal
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B003842


Los Banos
Santa Fe Grade
Duck Ponds
Mud Slough
Los Banos
Wildlife Area
B003843

B003844

Los Banos
Santa Fe Grade
Duck Ponds
Mud Slough
Los Banos
Wildlife Area
B003845

B003846


SR-165
Santa Fe Grade
San Luis Canal
Los Banos
Wildlife Area
B003847

B003848


SR-165
Santa Fe Grade
San Luis Canal
Los Banos
Wildlife Area
B003849

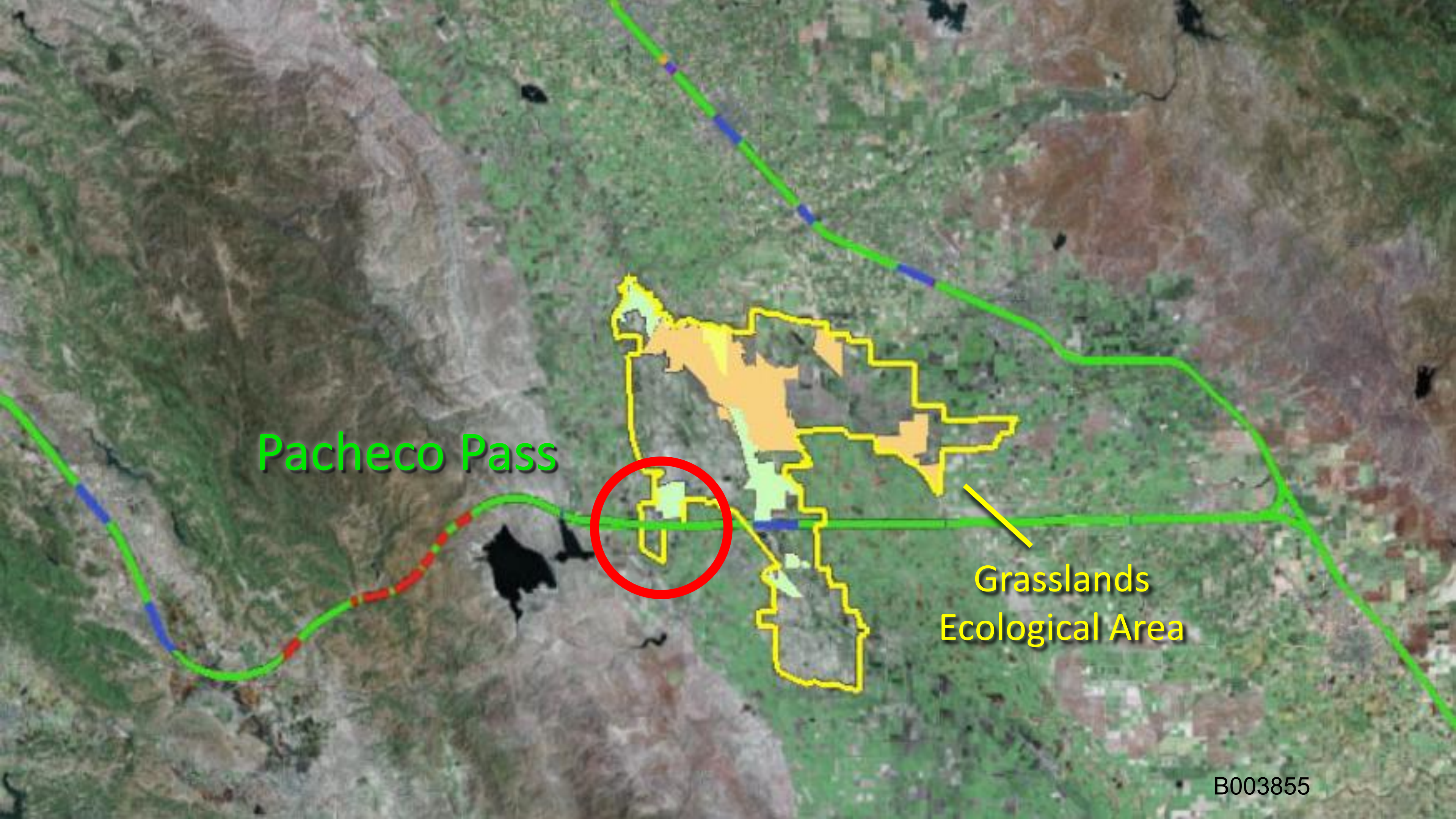
B003850


Nantes Avenue
SR-165
B003851

B003852

B003853


Ingomar Road
Los Banos Creek
B003854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Grasslands
Ecological Area
B003855


Ingomar Road
Volta Road
Volta Wildlife Area
B003856

B003857

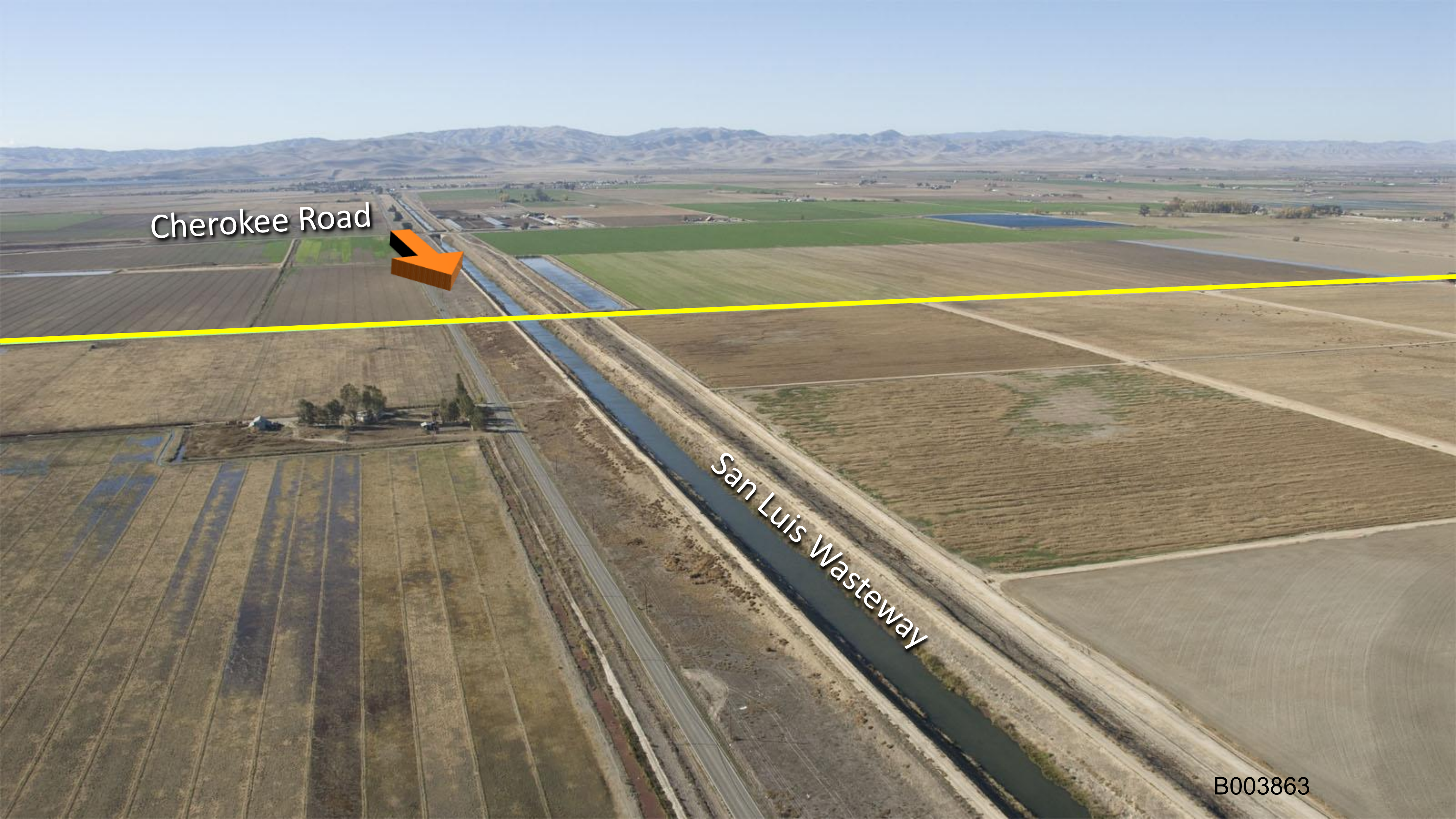

San Luis Wasteway
UPRR
Ingomar Road
B003858

B003859


San Luis Wasteway
UPRR
Ingomar Road
B003860

B003861

B003862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San Luis Wasteway
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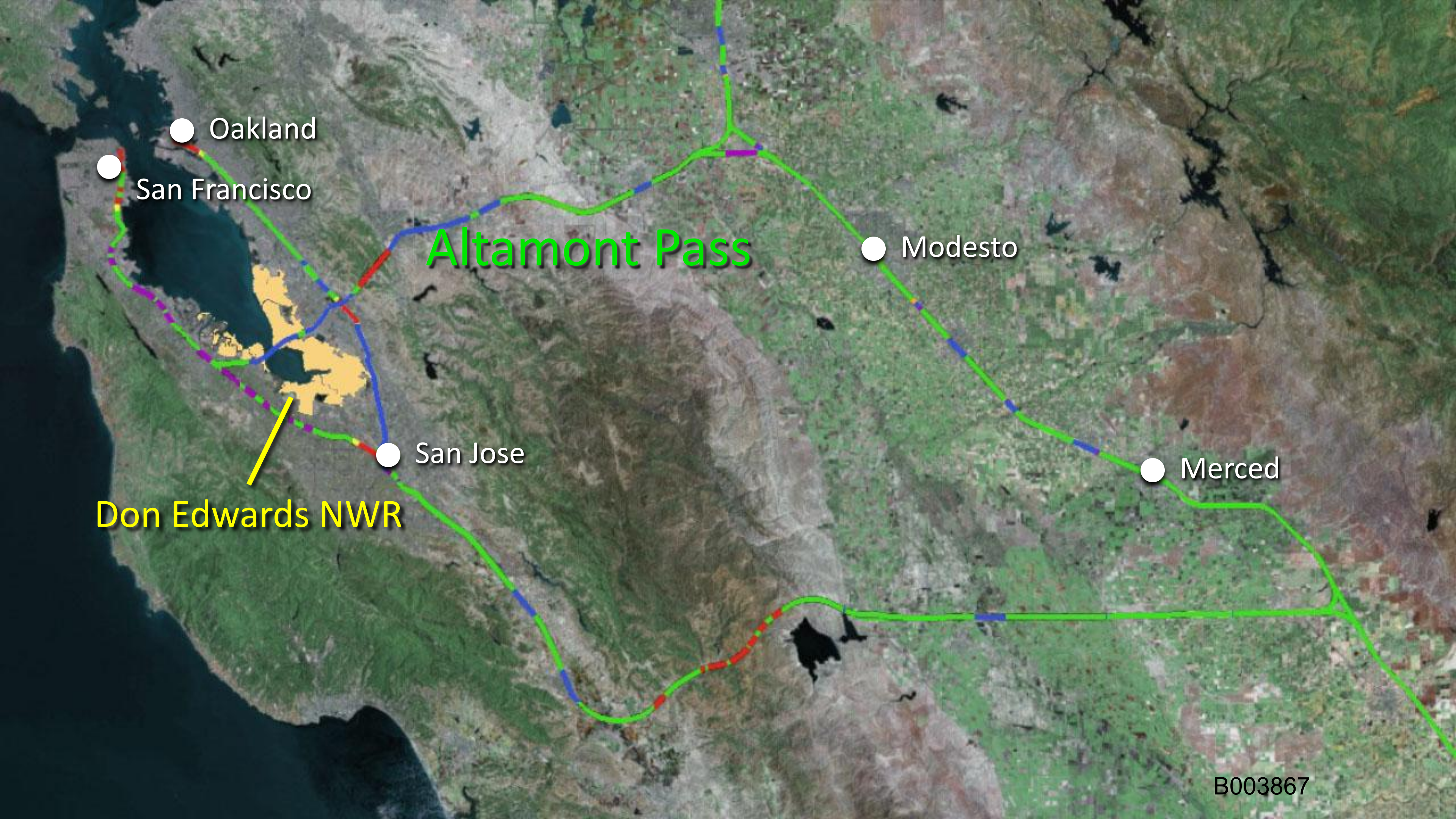
B003864

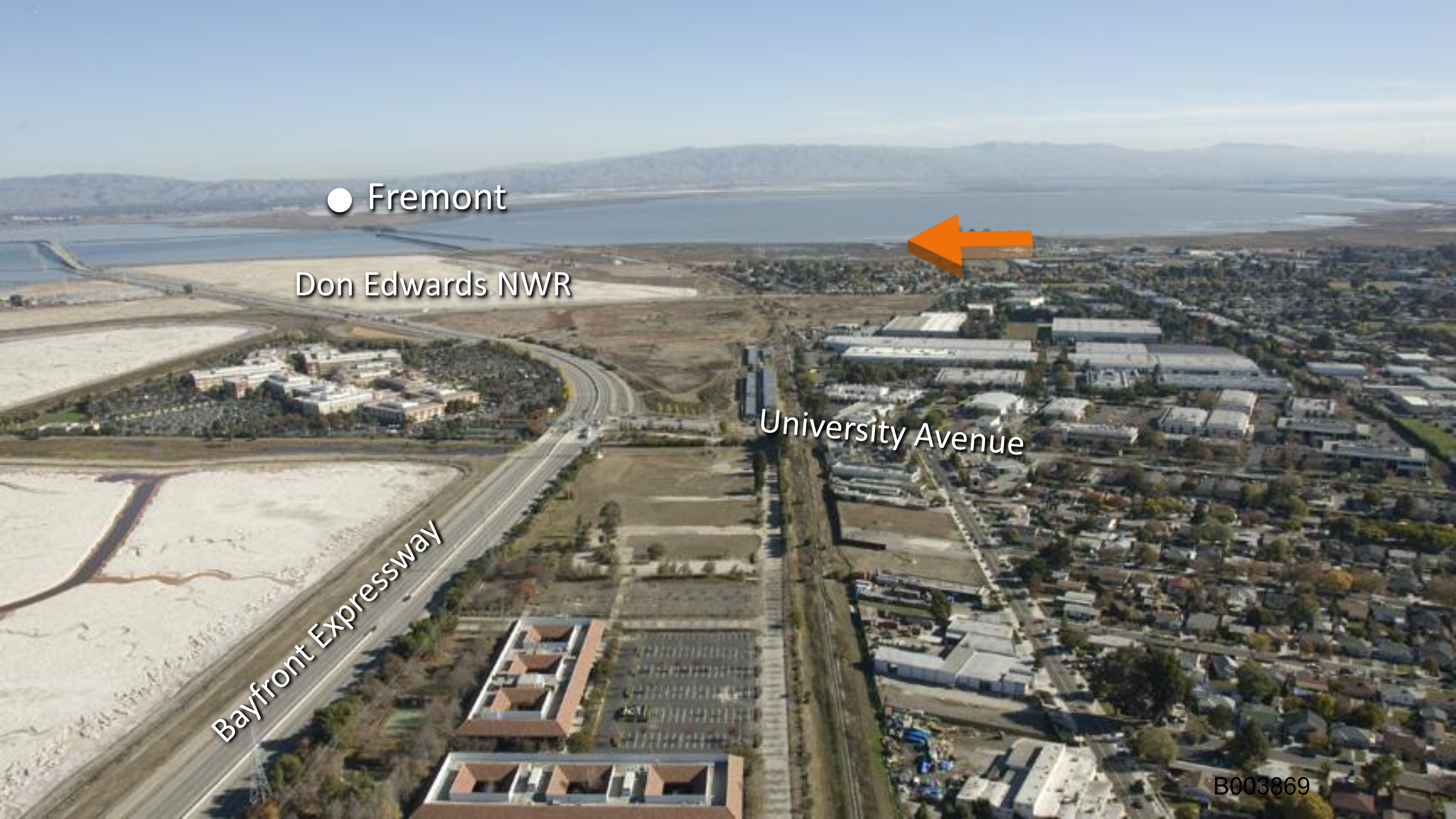

I-5
Leota Road
San Luis Wasteway
Cherokee Road
B003865

B003866


Oakland
San Francisco
Altamont Pass
Modesto
San Jose
Merced
Don Edwards NWR
B003867


San Francisco
Oakland
SF International Airport
Hayward Bridge
Union City
Dumbarton Bridge
Newark
East Palo Alto

B003868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Don Edwards NWR
University Avenue
Bayfront Expressway
B003869


B003870


Fremont
Dumbarton Bridge
Don Edwards NWR
Don Edwards NWR
B003871

B003872


Union City
Fremont
Dumbarton Bridge
Don Edwards NWR
B003873


Union City
Dumbarton Bridge
Don Edwards NWR
B003874


Union City
Fremont
Don Edwards NWR
B003875

B003877

B003878

B003879

B003880


Fremont
Willow Street
Thornton Avenue
B003881


Oakland
San Francisco
Altamont Pass
Modesto
San Jose
Merced
Pacheco Pass
B003882

2 ALTERNATIVES

This chapter describes the network and alignment alternatives and station location options considered for the proposed California HST system in the Bay Area to Central Valley study region. This Program EIR/EIS is a program-level environmental document, and the analyses herein are intended to define broad differences between alternatives. The level of detail for alternatives is conceptual or general rather than site-specific (40 CFR § 1508.28; 14 CCR § 15385). Subsequent project-level environmental documents and analyses would assess site-specific engineering and environmental impacts for alternatives selected in this Program EIR/EIS.

The alternatives discussed in this chapter were developed considering previous studies defining the project and information gathered in the scoping process. All alternatives that have been considered in this Program EIR/EIS process are described in this chapter, including those rejected from further consideration and the basis for their rejection. The No Project/No Action (No Project), HST Network, and HST Alignment Alternatives are described in detail in this chapter, and their development is summarized.

Several terms specific to the project are defined below. See Chapter 15, "Glossary," for definitions of technical and other terms.

- **Study Region:** Bay Area to Central Valley region encompassing all six study corridors.
- **No Project Alternative:** Represents the region's (and state's) transportation system (highway, air, and conventional rail) as it is today and with implementation of programs or projects that are in regional transportation plans and have identified funds for implementation by 2030.
- **Study Corridors:** Six linear geographic belts or bands being considered for the HST system that connect different parts of the study region. They are distinct in terms of land use, terrain, and construction configuration (mix of at-grade, aerial structure, and tunnel sections) and generally follow the route of a transportation facility.
- **HST Network Alternatives:** Represent different ways to implement the HST system in the study region with combinations of HST Alignment Alternatives and station location options. These HST Network Alternatives are identified in Chapter 2 and compared in Chapter 7.
- **HST Alignment Alternatives:** General location for HST tracks, structures, and systems for the HST system between logical points within study corridors; they are generally configured along or adjacent to existing rail transportation facilities. These HST Alignment Alternatives are described in Chapter 2, analyzed in Chapter 3, and compared and used to create HST Networks in Chapter 7.
- **HST Alignment Segment:** A portion of an alignment (often defined to distinguish subalternatives) that can be combined with other segments to form an alignment.
- **Station Location Options:** General locations that represent the most likely HST stations based on current knowledge, consistent with the objective to serve the state's major population centers.

2.1 Summary of Alternatives

This section provides a brief synopsis of the alternatives analyzed by the Authority and the FRA in this Program EIR/EIS.

2.1.1 No Project Alternative

The No Project Alternative represents the state's transportation system (highway, air, and conventional rail) as it is today and would be after implementation of programs or projects that are currently in regional transportation plans and have identified funds for implementation by 2030.

2.1.2 High-Speed Train Network and Alignment Alternatives

HST Network Alternatives represent different ways to implement the HST system in the study region to better understand the implications of selecting certain HST Alignment Alternatives and station location options. The HST system would continue outside the study region to the major metropolitan areas in the state, as described in the statewide program EIR/EIS (California High-Speed Rail Authority and Federal Railroad Administration 2005). The Authority and the FRA developed a range of potential alignment alternatives and station location options in the study region (Figure 1.1-1). Informed by previous studies and the scoping process, the Authority and the FRA evaluated the potential HST Alignment Alternatives and identified those that best meet the project purpose and need, are reasonable, and are feasible.

The proposed HST system selected in the statewide program EIR/EIS (California High-Speed Rail Authority and Federal Railroad Administration 2005) and further analyzed in this Program EIR/EIS is electrified steel-wheel-on-steel-rail dedicated service, with a maximum speed of 220 mph (350 kph). A fully grade-separated, access-controlled right-of-way would be constructed, except where the system would be able to share tracks at lower speeds with other compatible passenger rail services. Shared-track operations would use existing rail infrastructure in areas where construction of new separate HST facilities would not be feasible. Although shared service would reduce the flexibility and capacity of HST service because of the need to coordinate schedules, it would also result in fewer environmental impacts and a lower construction cost.

2.2 Chapter Organization

The remainder of this chapter is organized into the following three sections:

- Section 2.3 describes the development of the proposed HST system.
- Section 2.4 describes the No Project Alternative.
- Section 2.5 describes the HST Alternatives considered in this Program EIR/EIS, including the HST Network Alternatives, the HST Alignment Alternatives, station location options, and maintenance facility location options. Alignment alternatives and station location options considered and rejected are also described.

2.3 Development of Alternatives

This section describes the process used to evaluate conceptual alternatives presented in previous feasibility studies and identified through the scoping process for the HST system, leading to the set of HST Network Alternatives and HST Alignment Alternatives that are analyzed in this Program EIR/EIS. Key criteria used to distinguish among alternatives are described in Chapter 1, "Purpose and Need and Objectives," and include connectivity, right-of-way constraints and compatibility, ridership potential, constructability, and environmental impacts.

2.3.1 Background

Since 1994, three planning and feasibility studies and a statewide program EIR/EIS have been completed under the direction of the California Department of Transportation (Caltrans), the former California Intercity High Speed Rail Commission (Commission), and the Authority. The specific scopes of work of the feasibility studies differed, but they all focused on identifying potential HST technologies and corridors and broadly evaluated their feasibility. The three feasibility studies culminated in the Authority's final business plan (Business Plan) for an economically viable HST system that would serve major metropolitan areas of California (California High-Speed Rail Authority 2000). Also, in 1997, the FRA published *High-Speed Ground Transportation for America,* a national study examining the commercial feasibility of new high-speed ground transportation systems (Federal Railroad Administration 1997). This commercial feasibility study uniformly applied economic principles to weigh likely investment needs, operating performance, and social benefits of different types of train services in regional travel markets. The Authority followed these principles and in the Business Plan defined a practical approach to construct, operate, and finance an HST system that would yield solid financial returns to the state and provide potentially dramatic transportation benefits to all Californians. A preferred alignment and potential station locations were selected for most of the proposed statewide HST system as part of the final statewide program EIR/EIS (California High-Speed Rail Authority and Federal Railroad Administration 2005). However, between the San Francisco Bay Area and Central Valley, a broad corridor was identified for further evaluation.

These environmental, planning, and feasibility studies considered environmental constraints and potential impacts, with the objective of avoiding or minimizing impacts on sensitive resources where possible. Most of the study corridors considered follow existing highways or railroad lines, particularly in urban areas, to avoid or minimize environmental impacts. Many of the alignments for corridor and station locations emerged from regional and local agency input. Potential station locations were identified for operational and ridership forecasting purposes, and alternative sites were considered as part of the corridor evaluation. However, specific station sites were not selected. The studies were done consecutively, such that each subsequent study benefited from and built on previous work to further refine and develop potential station location options. The scope, timing, and products of each of the three studies, the Business Plan, and the statewide program EIR/EIS are described below. The relationship between the feasibility studies is illustrated in Figure 2.3-1.

A. LOS ANGELES TO BAKERSFIELD PRELIMINARY ENGINEERING FEASIBILITY STUDY (1994)

In 1994, Caltrans completed a study that analyzed the feasibility of constructing an HST system across the Tehachapi Mountains in southern California. The Tehachapi Mountains is one of the largest physical constraints (if not the largest physical constraint) to the development of a statewide HST network. The study produced an evaluation of the various HST technologies, as well as engineering drawings, cost estimates, and preliminary environmental analysis for potential alignments traversing the Tehachapi Mountains. The study also produced drawings and cost estimates for potential stations, developed operating plans, and estimated travel times for this segment of a statewide system. The study is documented in the *Los Angeles–Bakersfield Preliminary Engineering Feasibility Study Final Report* (California Department of Transportation 1994).

Alignments were studied using then-current aerial photographs and maps at a scale of 1 inch (in) equals 200 feet (ft). The feasibility study included preliminary engineering analysis of several key technical issues (e.g., structures, tunneling, and unit capital costs). The corridors studied traversed a variety of terrain (e.g., urban development, mountains, and valley floor). The study provided an important foundation for the subsequent statewide corridor evaluation studies.

The feasibility study considered a broad range of alternative alignments and then focused on the most viable routes. Two main corridors between Los Angeles and Bakersfield were considered feasible in terms of cost, travel time, potential ridership, and environmental constraints: Interstate 5 (I-5)/Grapevine and Palmdale–Mojave (Antelope Valley).

B. CORRIDOR EVALUATION AND ENVIRONMENTAL CONSTRAINTS ANALYSIS (1996)

The Commission conducted a three-phase study, which was completed in 1996. The first phase defined the most promising corridor alignments for linking the San Francisco Bay Area and Los Angeles (Figure 2.3-2). The second phase examined these alternative corridors between Los Angeles and the Bay Area in more detail. The third phase examined potential HST system extensions to Sacramento, San Bernardino/Riverside, Orange County, and San Diego.

The study identified potential station locations; estimated travel times; developed construction, operation, and maintenance cost estimates; analyzed environmental constraints and possible mitigation measures; and, in an iterative process with a ridership study prepared for the Commission, developed a conceptual operating plan. The corridors considered in all phases of this study are described in the *High-Speed Rail Corridor Evaluation and Environmental Constraints Analysis Final Report* (California Intercity High Speed Rail Commission 1996).

This analysis was completed concurrently with studies addressing four other aspects of a proposed high-speed rail system: ridership and revenue projections, institutional and financial options, economic impacts and benefit/cost analysis, and public participation. The corridors recommended for study by the 1996 analysis are shown in Figure 2.3-3.

C. HIGH-SPEED RAIL CORRIDOR EVALUATION (1999)

In September 1998, the Authority initiated a study to evaluate the viability of various corridors throughout the state for a statewide HST system. The Authority was legislatively mandated to move forward in a manner that was consistent with and continued the work of the Commission. Potential corridors were evaluated for capital, operating, and maintenance costs; travel times; and engineering, operational, and environmental constraints. This study is documented in the *California High-Speed Rail Corridor Evaluation Final Report* (California High-Speed Rail Authority 1999).

This study provided the Authority with a basis for recommending a potentially feasible network of HST corridors for further study. Although previous studies had been limited in the number of alternatives that could be analyzed in certain areas of the state, other potential corridors and new issues were identified in the 1999 study as regional and local agencies provided their input on the recommendations of the previous studies.

D. BUSINESS PLAN

The Business Plan presents a reasoned approach for constructing, operating, and financing an efficient and economically viable statewide HST system capable of speeds up to 220 mph (350 kph) that would be electrically powered and fully grade-separated and link California's major metropolitan areas. The Business Plan was based on the analysis from the *High-Speed Rail Corridor Evaluation* (1999), as well as ridership and revenue, cost-benefit, financial planning, and system integration studies.

The Business Plan concluded that "a high-speed train system is a smart investment in the state's future mobility. It will yield solid financial returns to the state and provide potentially dramatic transportation benefits to all Californians. It is a system that can be operated without public subsidy. The public's investment should be limited to that which is necessary to ensure the construction of the basic system."

The analysis and objectives summarized in the Business Plan found that an HST system would be able to:

- Return twice as much financial benefit to the state's citizens as it costs.

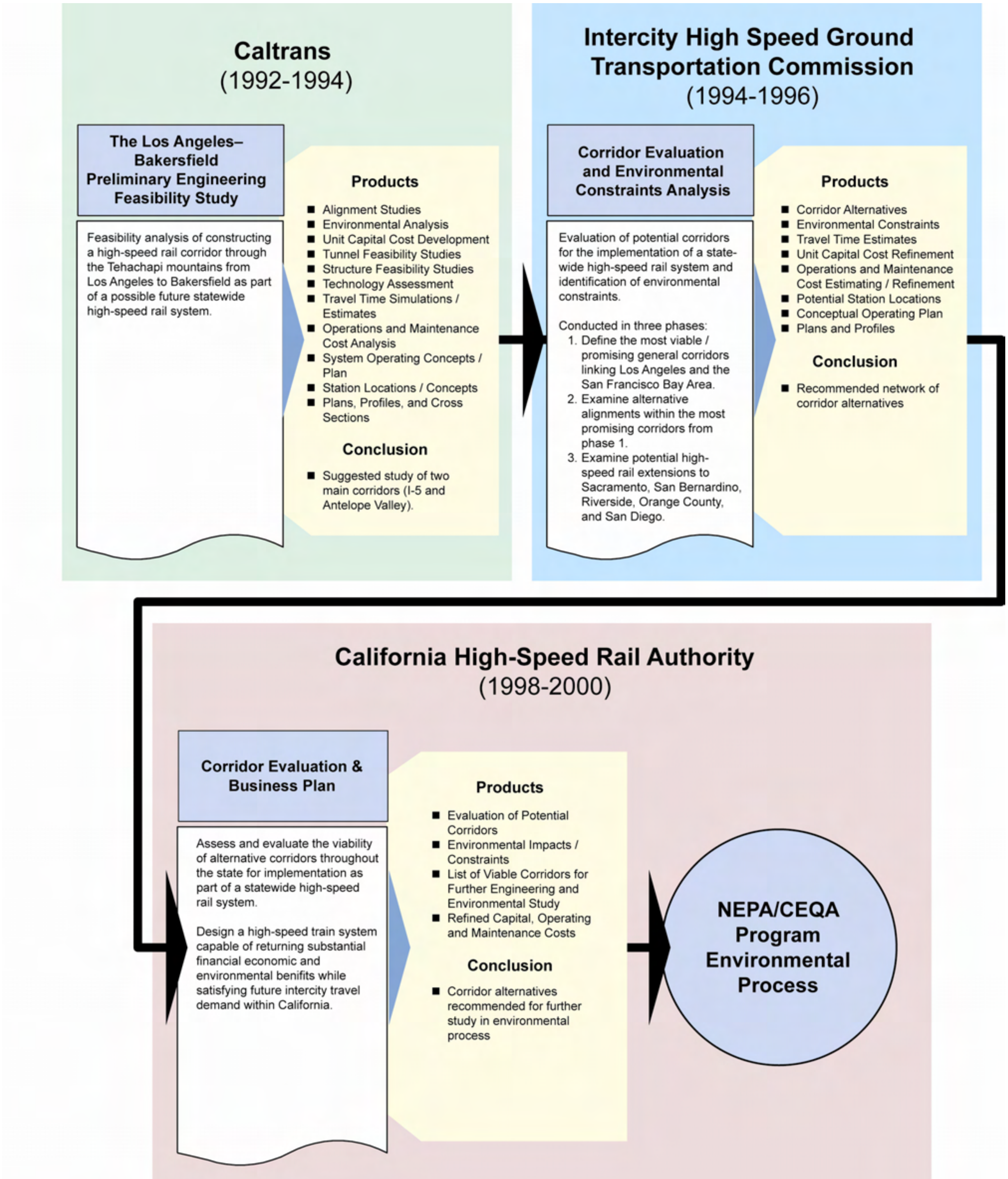

Figure 2.3-1
Relationship between Previous California High-Speed Train Studies

U.S. Department of Transportation
Federal Railroad Administration

Figure 2.3-2
Initial Phase Corridors
(Commission Studies, 1996)

B003903

Figure 2.3-3
Corridors for Continued Consideration
(Commission Studies, 1996)

U.S. Department
of Transportation
Federal Railroad
Administration

B003905

- Carry at least 32 million intercity passengers and another 10 million commuters annually.
- Generate about $900 million in revenues and return an operational surplus of more than $300 million per year.

The Authority recommended initiating a formal environmental review process with a systemwide program-level EIR/EIS on the HST network described in the Business Plan.

2.3.2 Statewide Program EIR/EIS

The Authority certified the final statewide program EIR/EIS, and the FRA issued a Record of Decision for the more than 700-mile-long HST system in November 2005. This statewide process took 4 years to complete at a cost of about $20 million. The HST Alternative was the selected system alternative and was identified as the environmentally preferred alternative under NEPA, as well as the environmentally superior alternative under CEQA. To serve the same number of travelers as the HST system was projected to carry by 2020, California would have to build nearly 3,000 lane-miles of freeway, plus five new airport runways and 90 departure gates at a cost two to three times more than the HST Alternative. The program EIR/EIS concluded that high-speed trains can decrease dependency on foreign oil, preserve energy, decrease air pollutants, and discourage sprawl while having less impact on the natural environment than expanding highways and airports.

Preferred alignments and potential HST station location options were selected for most of the statewide HST system as part of the final program EIR/EIS. Between the San Francisco Bay Area and Central Valley, a broad corridor was identified for further evaluation (Figure 1.1-1). In November 2005, the Authority and FRA initiated the preparation of this separate next-tier Program EIR/EIS to address the choice of a corridor/general alignment and station locations in the San Francisco Bay Area to the Central Valley region of the HST system.

A. SELECTED HIGH-SPEED TRAIN SYSTEM ALTERNATIVE

The HST Alternative for the over 700-mile-long HST system connecting the major metropolitan areas in California was selected by the Authority and FRA with the statewide program EIR/EIS (California High-Speed Rail Authority and Federal Railroad Administration 2005) and this prior decision forms the basis for the proposed action. HST alternatives considered in this Program EIR/EIS (Section 2.5) represent different ways to implement the HST system in the Bay Area to Central Valley study region. This section describes the characteristics of the HST system that were determined in the 2005 Authority and FRA decisions, to provide the framework necessary to evaluate the HST Alignment Alternatives and the HST Network Alternatives for this study region. Since the 2005 decision, a new high-speed rail ridership forecasting model, new travel demand forecasts, and a 2030 HST operating plan have been developed, as described in Section 2.3.3. These current models have updated and refined the selected HST Alignment Alternatives for further consideration of the HST system in this document.

Travel Times and Frequency of Service

Independent ridership and revenue forecasts (Charles River Associates 1996 and 2000) prepared for the Business Plan showed that competitive travel times and frequent service are essential to attract travelers to an HST system. For the HST system to be economically feasible, operating speeds over 200 mph (322 kph), high frequencies of service, and efficient operations are necessary. For this fundamental reason, the Authority and the FRA selected criteria that the proposed HST system would operate at speeds of up to about 220 mph (350 kph) and developed a conceptual service plan that makes the HST system highly competitive with travel by air or auto. It is important to note that maximum speeds cannot be achieved on many portions of the proposed system, particularly the heavily constrained urban areas (Figure 2.3-4). Express travel between downtown San Francisco and downtown Los Angeles could be accomplished in just over 2.5 hrs. The trip between downtown Los Angeles and downtown San Diego would take about 1 hour and 18 minutes. Table 2.3-1 shows current estimates of express travel times between a sample of the cities to be served.

Table 2.3-1
Optimal Express Travel Times (220 mph [350 kph])

Altamont Travel Time (hh:mm) / Pacheco Travel Time (hh:mm)	San Francisco	Oakland	San José	Sacramento	Fresno	Los Angeles	San Diego	
San Francisco	N/A	N/A	N/A	01:06	01:18	02:36	03:54	San Francisco
Oakland	N/A	N/A	N/A	00:53	01:04	02:23	03:40	Oakland
San José	00:30	00:22	N/A	00:49	01:01	02:19	03:37	San José
Sacramento	01:47	01:38	01:18	N/A	00:59	02:17	03:35	Sacramento
Fresno	01:20	01:12	00:51	00:53	N/A	01:24	02:42	Fresno
Los Angeles	02:38	02:30	02:09	02:11	01:24	N/A	01:18	Los Angeles
San Diego	03:56	03:48	03:27	03:29	02:42	01:18	N/A	San Diego
	San Francisco	Oakland	San Jose	Sacramento	Fresno	Los Angeles	San Diego	

N/A Not Applicable | Altamont Pass Test Alignment | Pacheco Pass Test Alignment

Note: Based on Altamont Pass Test Alignment B (I-580/UPRR) and Pacheco Pass Test Alignment B (Caltrain/Gilroy/Henry Miller/UPRR).

Ridership forecasts for the Pacheco Pass (terminating in San Francisco) and the Altamont Pass (terminating in San Francisco and San Jose) have been used as the *representative demand* for defining the intercity travel need for the HST Alignment Alternatives in this Program EIS/EIR.

The projected HST travel times account for alignment, train performance characteristics, acceleration and deceleration capabilities, and passenger comfort criteria. HST system operators and manufacturers of HST equipment were consulted in the development of the travel times and design criteria for the proposed HST system.

Safety and Security

The safe operation of the HST system would be of the utmost importance. To this end, the HST system would be a fully grade-separated and fully access-controlled guideway with intrusion monitoring systems. This means that the HST infrastructure (e.g., mainline tracks and maintenance and storage facilities) would be designed to prevent access by unauthorized vehicles, persons, animals, and objects. The capital cost estimates include allowances for appropriate barriers (fences and walls), state-of-the-art communication, access-control, and monitoring and detection systems. All aspects of the HST system would conform to the latest federal requirements regarding transportation security. The HST trainsets (train cars) would be pressure sealed to maintain passenger comfort regardless of aerodynamic changes along the line.

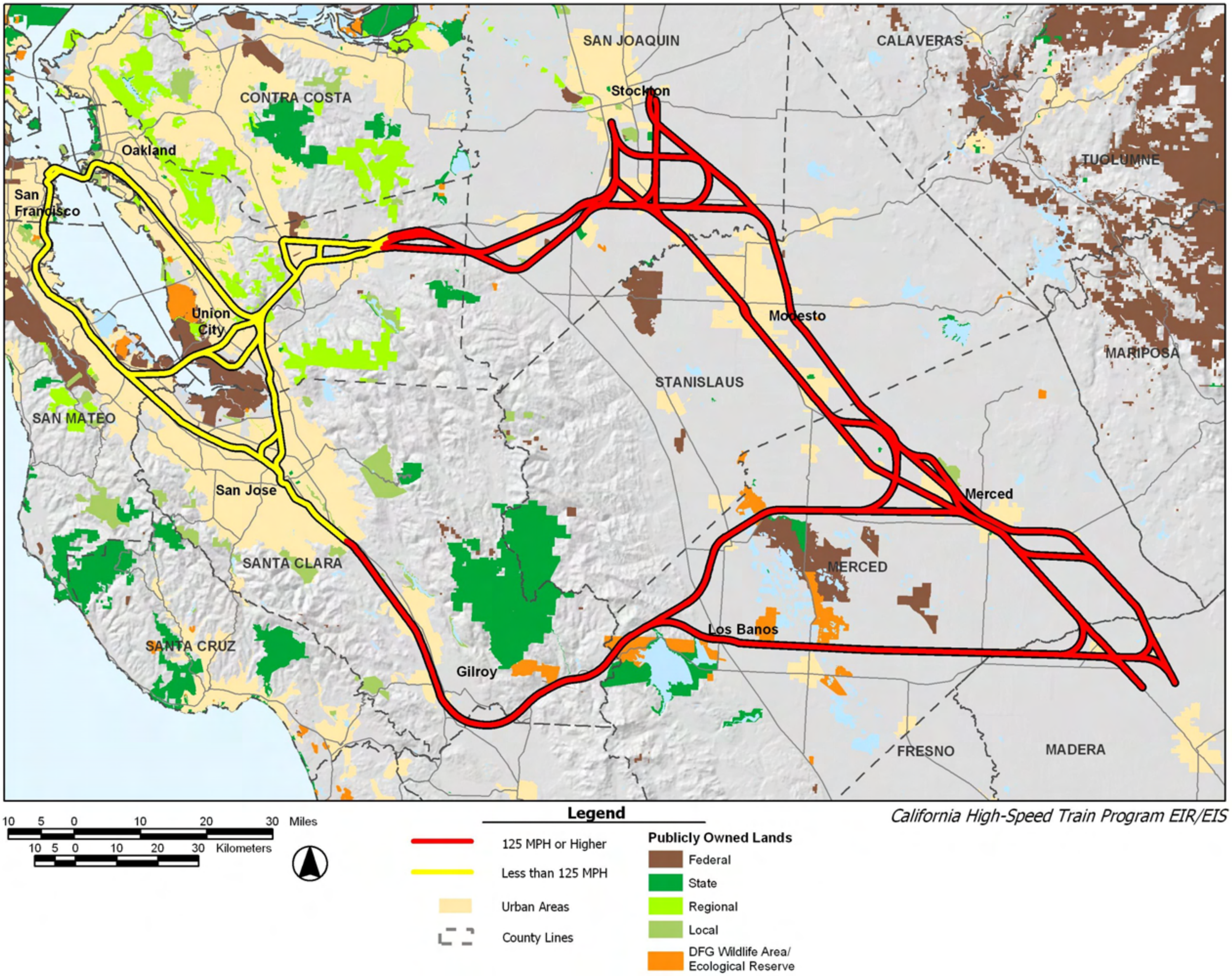

Figure 2.3-4
Potential Average Operating Speeds

Electrification

Trains would draw electric power from overhead wires connected to the commercial power grid and, in braking, would regenerate electricity back to the grid, thereby conserving power and reducing costs. The statewide program EIR/EIS energy analysis concluded that the HST system would have a net energy benefit as compared to the No Project Alternative but would result in an increase in electric power demand. This Program EIR/EIS assessed the total energy that would be needed from California's electricity grid to power and operate the proposed HST system from its commencement (a portion of the system) to full implementation. The HST system does not include the construction of a separate power source. The analysis concluded that sufficient electricity is expected to be available to power the proposed HST system, as segments are constructed and begin operating, because power generation is expected to grow to meet increased demand in the state, and the power needs of the proposed HST system represent a small part of that overall increase in demand.

The power supply would consist of a 2-by-25-kilovolt (kV) overhead catenary system for all electrified portions of the statewide system. Supply stations would be required at approximately 30-mile intervals. Based on the estimated power needs of this system, these stations would need to be approximately 20,000 square ft (200 ft by 100 ft). Switching stations would be required at approximately 15-mile intervals. These stations would need to be approximately 7,500 square ft (150 ft by 50 ft). Paralleling (booster) stations would be required at approximately 7.5-mile intervals. These stations would need to be approximately 5,000 square ft (100 ft by 50 ft). Each station would include a control house that would need to be approximately 800 square ft (40 ft by 20 ft). These facilities are not sited as part of the program-level of environmental review. However, the facilities defined fall well within the potentially affected environment areas considered in program-level studies. Facility placement, sizing, and spacing would be determined during subsequent project-level environmental review.

Potential for Freight Service

The proposed HST system could be used to carry small packages, parcels, letters, or any other freight that would not exceed typical passenger loads. This service could be provided either in specialized freight cars on passenger trains or on dedicated lightweight freight trains. In either case, the lightweight freight vehicles would be required to have the same performance characteristics as the passenger equipment. This type of freight could be accommodated without adjustment to the passenger operational plan or modification to the passenger stations and was therefore included in the funding scenario described in the Business Plan.

A high-speed freight service might also be provided on specialized medium-weight freight trains. This specialized freight equipment would have limited axle loads (19 metric tons compared to the conventional freight standard of 27 metric tons per axle), would operate at speeds of up to 125 mph (200 kph), and would be scheduled at night to avoid conflict with passenger or maintenance operations. A medium-weight freight service could carry high-value or time-sensitive goods such as electronic equipment and perishable items. Although such a service would not interfere with passenger operations, it would require loading and unloading facilities separate from the passenger stations. Additional pick-up and distribution networks for this type of freight might also be required. Although the Authority recognizes the potential for overnight medium-weight freight service on the proposed high-speed tracks, it has not been included in this analysis. Discussions with potential high-speed freight operators could be initiated as part of subsequent project development with appropriate analysis.

Performance Criteria

The Authority and the FRA previously defined performance criteria for the HST in the statewide program EIR/EIS for the HST system (California High-Speed Rail Authority and Federal Railroad

Administration 2005), drawing on many prior feasibility and corridor evaluation studies. To meet the travel time and service quality goals, the statewide HST system will be capable of speeds in excess of 200 mph (320 kph) on fully grade-separated tracks with state-of-the-art safety, signaling, and automated train control systems. These performance criteria are summarized in Table 2.3-2.

Table 2.3-2
HST Performance Criteria

Category	Criteria
System Design Criteria[1]	Electric propulsion system. Fully grade-separated guideway. Fully access-controlled guideway with intrusion monitoring systems. Track geometry must maintain passenger comfort criteria (smoothness of ride, lateral acceleration less than 0.1 g [G forces]).
System Capabilities	All-weather/all-season operation. Capable of sustained vertical gradient of 3.5% without considerable degradation in performance. Capable of operating parcel and special freight service as a secondary use. Capable of safe, comfortable, and efficient operation at speeds over 200 mph. Capable of maintaining operations at 3-minute headways. Capable of traveling from San Francisco to Los Angeles in approximately 2.5 hrs. Equipped with high-capacity and redundant communications systems capable of supporting fully automatic train control.
System Capacity	Fully dual track mainline with off-line station stopping tracks. Capable of accommodating a wide range of passenger demand (up to 26,000 passengers per hour per direction). Capable of accommodating normal maintenance activities without disruption to daily operations.
Level of Service	Capable of accommodating a wide range of service types (express, semi-express/limited stop, and local).

Description of High-Speed Train Technology

The selected HST Alternative (California High-Speed Rail Authority and Federal Railroad Administration 2005) consists of steel-wheel-on-steel-rail trains capable of meeting the Authority's performance criteria (Table 2.3-2) that would be able to share tracks at reduced speeds with other compatible train services. These high-speed trains are capable of maximum operating speeds up to 220 mph (350 kph) (Figure 2.3-5). All HST systems in operation around the world use electric propulsion with overhead catenary. These include the Train à Grande Vitesse (TGV) in France, the Shinkansen in Japan, and the InterCity Express (ICE) in Germany.

To operate at high speeds, a dedicated, fully grade-separated right-of-way is necessary with more stringent alignment requirements than those needed for lower-speed lines. Therefore, this state-of-the-art, high-speed, steel-wheel-on-steel-rail technology would operate in the majority of the statewide system in dedicated (exclusive track) configuration. However, where the construction of new separate HST infrastructure would be infeasible, shared track operations would use improved rail infrastructure and electrical propulsion. It would be possible to integrate HST systems into existing

1 *Engineering Criteria*, January 2004.

Intercity Express (ICE)

Shinkansen

conventional rail lines in the congested urban areas with resolution of potential equipment and operating compatibility issues by the FRA and the California Public Utilities Commission. Potential shared-use corridors would be limited to sections of the statewide system with extensive urban constraints. Shared-use corridors would meet the following general criteria in addition to the performance criteria:

- Uniform control/signal system.
- Four tracks at stations (to allow for through/express services and local stopping patterns).
- Three to four mainline tracks (depending on capacity requirements of HST and other services).
- Physical or temporal separation from conventional freight traffic.

Using this technology, the proposed HST system would be constructed with consistent dual tracking in a variety of construction sections (e.g., at grade, elevated structure, tunnel), as appropriate for the constraints of each specific section. These typical construction sections are illustrated in Figures 2.3-6, 2.3-7, and 2.3-8.

Design Practices

Design practices have also been identified that would be employed as the project is developed further in the project specific environmental review, final design, and construction stages. These practices will be applied to the implementation of the HST system to avoid, minimize, and mitigate potential impacts. Some key design practices are summarized below:

- Use of existing transportation corridors would be maximized. Nearly 70% of the adopted preferred HST alignments are either within or adjacent to a major existing transportation corridor (existing railroad or highway right-of-way).
- Tracks that are fully grade separated from all roadways would be used.
- Multi-modal transportation hubs would be used.
- Electric power, high-quality track interface, and smaller, lighter, and more aerodynamic trainsets would be used, which would result in less noise than existing commuter and freight trains because HST do not have the rumble associated with diesel engines and use a design that greatly minimizes track noise.
- Transit-oriented design (TOD) and smart growth land use policies would be used. Station area development principles that would be applied at the project-level for each HST station and the areas around the stations would include:
  - Higher density development.
  - A mix of land uses (retail, office, hotels, entertainment, residential, etc.) and housing types to meet the needs of the local community.
  - A grid street pattern and compact pedestrian-oriented design that promotes walking, bicycle, and transit access.
  - Context-sensitive building design that considers the continuity of the building sizes and coordinates the street-level and upper-level architectural detailing, roof forms, and rhythm of windows and doors.
  - Limits on the amount and location of development-related parking, with a preference that parking be placed in structures.
- Portions of the system would be in tunnel or on aerial structure, which would avoid and/or minimize impacts to surface water resources.

- Measures to avoid water infiltration would be taken.
- Underpasses or overpasses or other appropriate passageways would be designed to avoid, minimize, and/or mitigate any potential impacts to wildlife movement.
- In-line construction would be used for sensitive areas, as defined at the project level.

2.3.3 Formulation of Alternatives for the Bay Area to Central Valley Region

With the initiation of this Program EIR/EIS, the Authority and the FRA began the process of defining reasonable and feasible HST Alignment Alternatives and station location options in the study region. The process involved consideration of the purpose and need for the proposed action and consultation with public agencies and the public, as described below.

A. AGENCY AND PUBLIC INVOLVEMENT AND SCOPING

Agency and public input was obtained during the scoping process pursuant to CEQA and NEPA. The notice of preparation (NOP) was released November 14, 2005, and the notice of intent (NOI) was published in the Federal Register on November 28, 2005. Written comments were received in response to these notifications.

Scoping activities for this Program EIR/EIS were conducted between November 15 and December 16, 2005. Because of the geographic extent and complexity of the proposed project, a series of six scoping meetings were held throughout the region, along with other meetings, briefings, and involvement activities. Each scoping meeting had an afternoon session (from 3:00 to 5:00 p.m.) and an evening session (from 6:00 to 8:00 p.m.) to accommodate agencies, interested parties, and the general public.

The Program EIR/EIS scoping process identified areas of potential concern related to the proposed HST system in the study region. Many comments related to a preference for either Altamont Pass or Pacheco Pass alignment alternatives. Many comments indicated the need for an improved statewide transportation system that is reliable, cost effective, and easy to use. Many comments emphasized the need for an HST system to connect to existing transportation systems, including airports. Providing for potential freight service was also a frequent theme, as was the need to separate HST and heavy freight operations. Issues of concern about the environment typically focused on potential noise and visual impacts, safety, and impacts on air quality and sensitive habitats. The potential for growth inducement was also raised. The scoping process and outcomes, including comments and concerns, are documented in the *Bay Area to Central Valley Scoping Report* (California High-Speed Rail Authority and Federal Railroad Administration 2006).

B. AGENCY INVOLVEMENT

Following the issuance of the NOI and NOP and the scoping meetings, the Authority and the FRA formed a working group of representatives from 27 federal and state agencies to assist in the environmental review process. The interagency group met during the Program EIS/EIR development to discuss major issues from the perspective of these agencies and to provide input to the lead agencies to help focus the analysis and streamline the review process.

The federal and state agency representatives included in this process were asked to provide input for the following specific areas:

- Scope of the Program EIR/EIS.
- Purpose and need statement.
- Technical methods of analysis and study area definition.

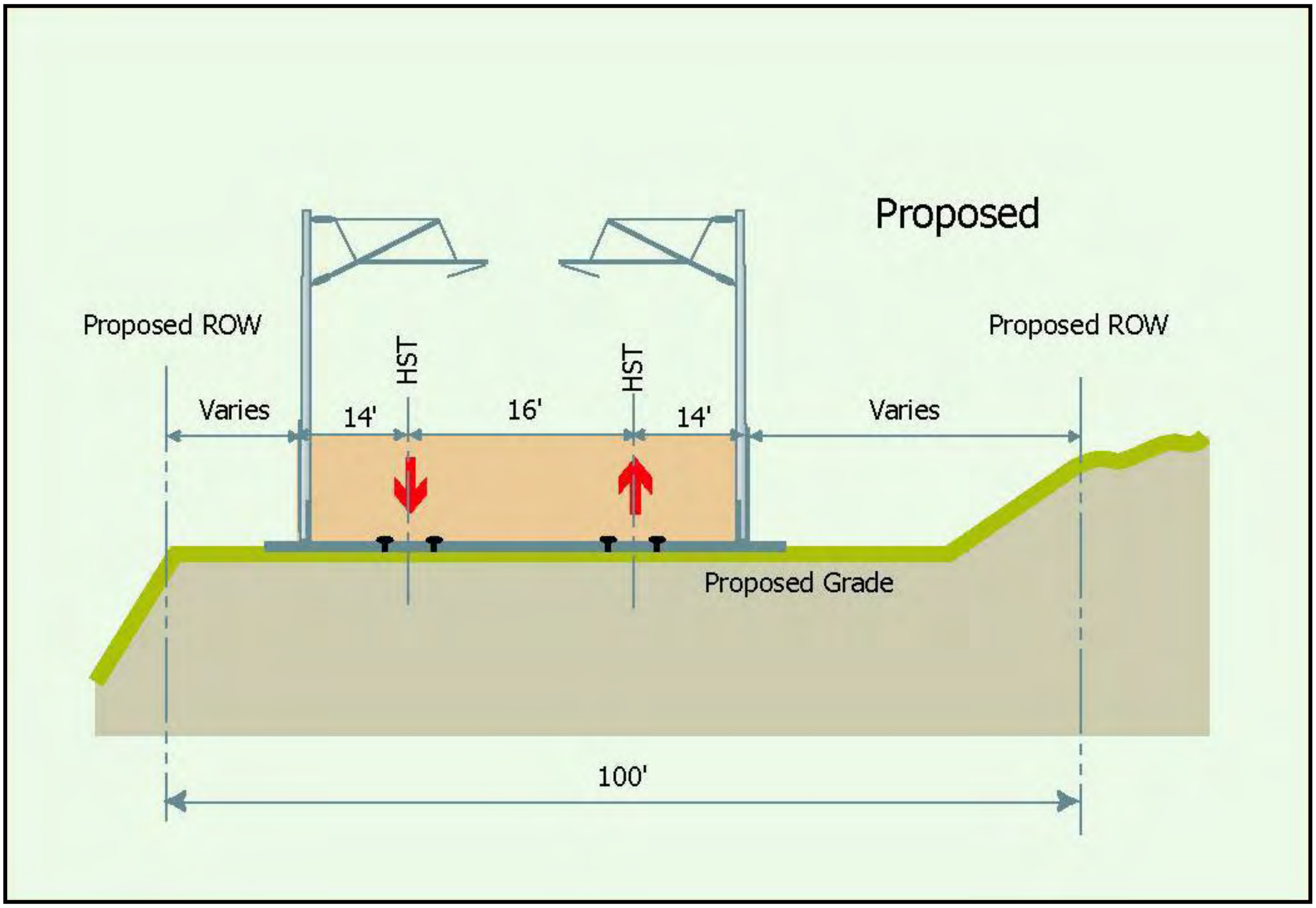

Figure 2.3-6
At-Grade Section

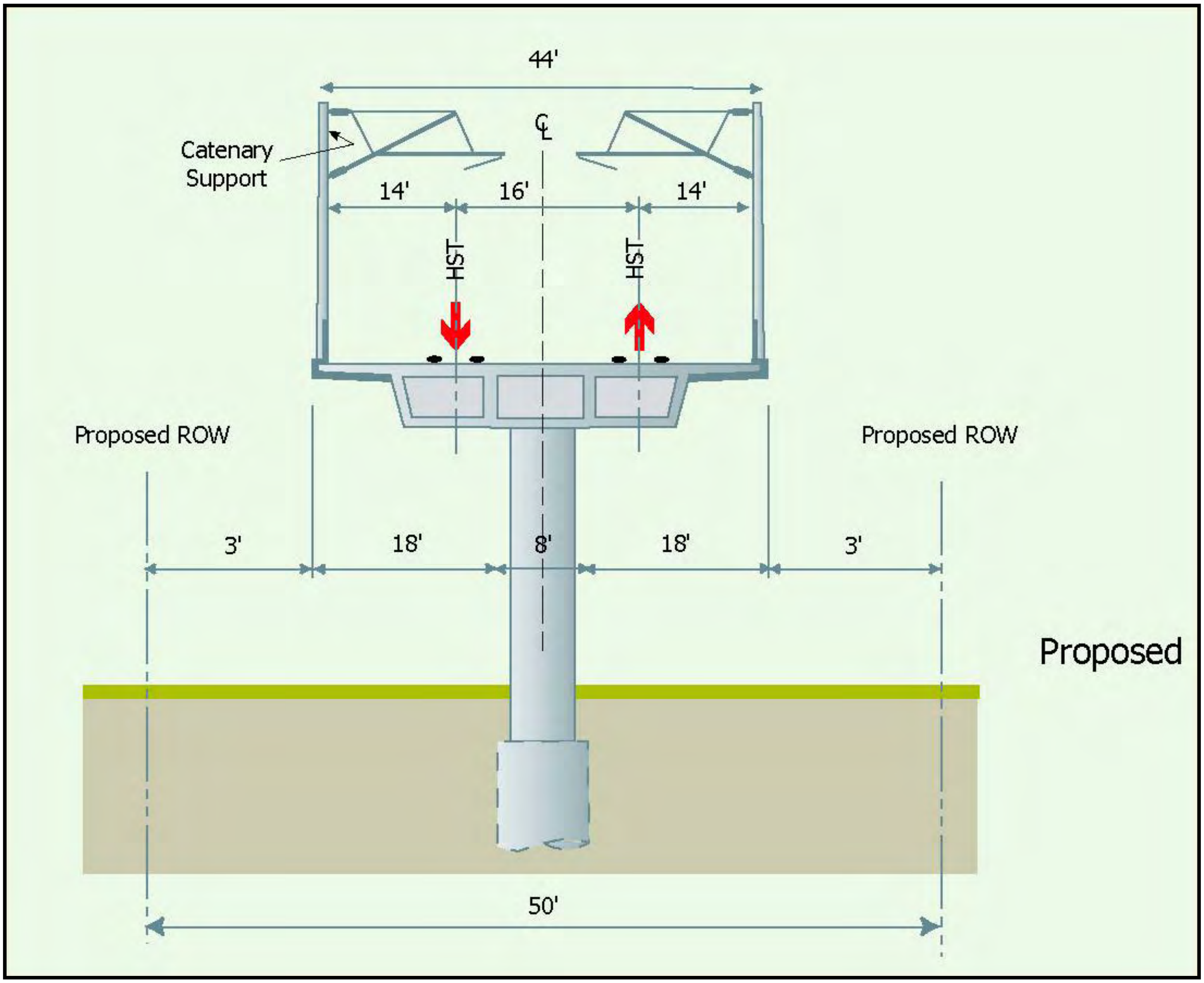

Figure 2.3-7
Elevated Structure

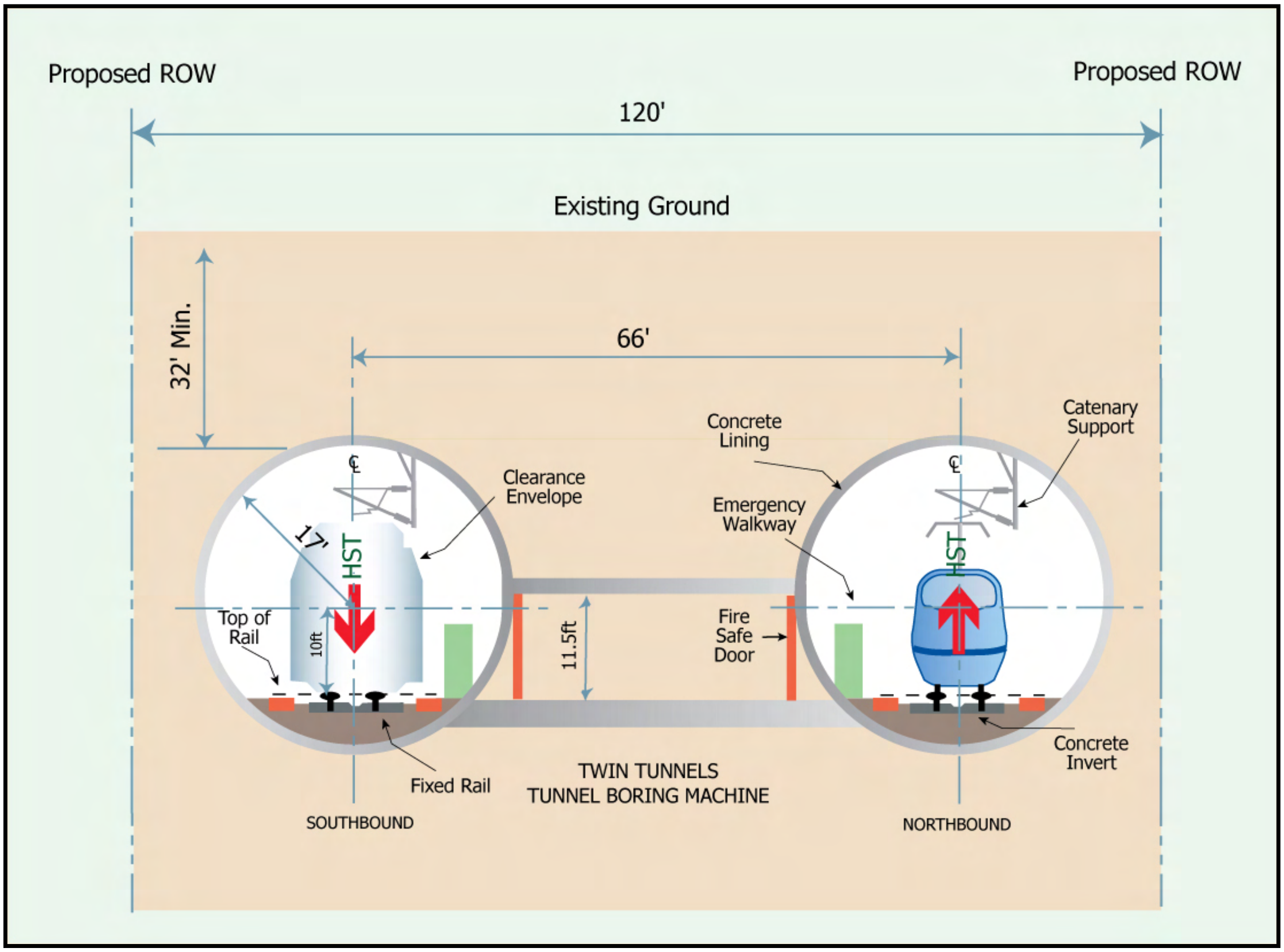

Figure 2.3-8
Twin Tunnels

- Substantive issues of particular concern.
- Sources of information and data relevant to their agencies.
- Avoidance, minimization, and mitigation strategies.
- Definition of alternatives to be analyzed in the Program EIR/EIS.
- Procedural requirements and permits or approvals necessary for subsequent phases of environmental review.

The Authority also invited input from regional and local agencies in areas potentially affected by the proposed HST system. Meetings of the Authority's governing board were also a forum for providing information about the environmental process. These meetings were held in major cities in the study region to provide a convenient opportunity for regional and local public participation and input.

As discussed in Section 1.1, the FRA is the lead federal agency for NEPA compliance, and federal cooperating agencies are the USACE and EPA. The FRA developed a memorandum of understanding (MOU) with the federal cooperating agencies to clarify expectations for the preparation and review of the Program EIR/EIS and for CWA Section 404 review. The federal cooperating agencies have met during the environmental review process to provide input to the Program EIR/EIS, and their involvement is expected to continue throughout the program environmental process.

C. TRAVEL DEMAND AND RIDERSHIP FORECASTS

Since previous ridership and revenue forecasts were prepared about 10 years ago for the Business Plan, a new intercity travel demand model was created by Cambridge Systematics for the MTC in partnership with the Authority to provide current and more refined ridership forecasts. New ridership forecasts were prepared using the new model in 2006 and 2007 to support continued development and environmental review of the proposed HST system. The model takes into account trends in travel demand, congestion, and other adverse travel conditions, which imply the market for intercity travel in California that the proposed HST system could serve will grow faster than the population by up to 46% over the next 30 years.

According to the base, or low, travel demand forecast prepared using the new model, the HST system would carry at least 88 million passengers per year by 2030 (Table 2.3-3). This estimate conservatively assumes current costs for air and automobile transportation would remain constant in real value. HST service plans were also adjusted to satisfy the new forecast for high-speed train travel demand. The proposed HST base ridership estimate also includes nearly 69,000 commuters riding every weekday by 2030, or about 25 million commuter passengers annually (out of the total 88 million annual riders). Analyses were also performed as part of the independent ridership and revenue forecasts (Cambridge Systematics 2007), using different assumptions for a 50% real increase in the costs for air and automobile travel, which resulted in a high forecast of potential ridership for the HST system of 117 million annual passengers for 2030 (36 million riders would be commuters) (Table 2.3-3).

Ridership for the HST system is now estimated to be between 88 million and 117 million passengers for 2030, with a potential for further ridership growth beyond 2030. These new ridership forecasts are higher than those analyzed in the previous program EIR/EIS for the HST system; however, this analysis is consistent with that provided in the previous document because the infrastructure and facilities footprints analyzed in that document would accommodate the new ridership forecasts. The purpose of and need for this project is to meet a part of California's future intercity travel demand in 2030 and beyond. Although the HST system would have the capacity to carry many more passengers than indicated in the high ridership forecast, by using longer trains, double-decker cars, or more frequent service (e.g., the Shinkansen system in Japan carries more than 300 million passengers annually), it is reasonable to assess the HST alternatives using forecast ridership rather than theoretical capacity.

For analysis of the proposed HST system in this Program EIR/EIS, both low and high forecasts were prepared for the No Project Alternative and two of the representative HST networks serving both San Francisco and San Jose (i.e., one for the Altamont corridor and one for the Pacheco corridor). The two representative HST networks defined the upper and lower bounds for the ridership forecasts. To assess relative changes between No Project and the HST alternatives where ridership is a governing factor, the appropriate forecasts were compared (i.e., high No Project to high HST or low No Project to low HST). The high ridership forecast of 117 million intercity trips, which includes the 36 million commuter trips figure, serves as the representative worst-case scenario for analyzing the potential environmental impacts from construction and operation of the HST system through 2030. This high forecast was generally used to define and develop the HST alternatives and is also referred to hereafter as the *representative demand*. In some specific analyses (e.g., energy, air quality, and transportation), the HST system would result in potential benefits. In those cases, analysis using the low ridership forecasts is used in this Program EIS/EIR.

Table 2.3-3
2030 Ridership Forecasts

Ridership Forecast	Year	Intercity Passengers Annually (millions)	Purpose
High [a]	2030	117 (includes 36 commuter trips)	Serves as a representative worst-case scenario for analyzing the potential for adverse environmental impacts from construction and operation of the HST system.
Low [b] (also called base)	2030	88 (includes 25 commuter trips) [c]	Used in analyses of beneficial effects from the HST system.

[a] Assumes a 50% real increase in costs for air and automobile transportation.
[b] Conservatively assumes current costs for air and automobile transportation.
[c] Included for analysis in 3.1, Traffic; 3.2, Travel Conditions; 3.3, Air Quality; and 3.5, Energy.

D. CONCEPTUAL SERVICE PLAN

To satisfy the travel time, service quality, and expected ridership (representative demand) criteria developed for the Business Plan, and accounting for the general characteristics of the corridors considered, the conceptual service plan must provide a wide variety of service options. A mix of express, semi-express, local, and regional trains would serve both intercity passengers and long-distance commuters. For HST service to be economically viable, train operations must be frequent and efficient.

According to the 2030 operating plan, a total of 124–139 weekday trains in each direction would be provided to serve the statewide HST travel market as forecast for the low- and high-end scenarios. Ninety-one to ninety-six of the trains would run between northern and southern California, and the remaining 33–43 trains would serve shorter distance markets. The basic service pattern would provide most passenger service between 6 a.m. and 8 p.m., with a few trains starting or finishing trips beyond these hours. One hundred and twenty-four to one hundred and thirty-nine trains per day could be a highly frequent operation; however, as shown below, when divided into five types of service, the frequency is greatly reduced. Frequencies would be further reduced to serve multiple end points. For example, for HST service between northern and southern California through the Central Valley, some trains would go to the Bay Area and others to Sacramento. Therefore, although there could be 19–25 local trains, only a portion of these would serve each endpoint. The following five types of intercity trains are planned:

- Express (16 trains per day): Trains running between Sacramento, San Jose, or San Francisco and Los Angeles or San Diego without intermediate stops.
- Semi-Express (17–26 trains per day): Trains running between Sacramento, San Jose, or San Francisco and Los Angeles and San Diego with intermediate stops at major Central Valley cities such as Modesto, Fresno, and Bakersfield.
- Suburban-Express (30–35 trains per day): Trains running between northern and southern California and locally within the major metropolitan areas (i.e., the San Francisco Bay Area and the Los Angeles area) at the beginning and end of the trip without intermediate stops in the Central Valley.
- Local (19–25 trains per day): Trains stopping at all stations. Some of these local trains might ultimately be operated as a "skip stop" or semi-express service, where trains would stop at only a portion of the possible stations on a specific line, to improve the service and better match patterns of demand.
- Regional (33–43 trains per day): Sacramento to San Francisco service and early morning service from the Central Valley to San Francisco or Los Angeles/San Diego.

E. HST ALIGNMENT ALTERNATIVES DEVELOPMENT

The development of the alternatives considered in this Program EIR/EIS incorporated the principles established for the HST Alternative selected in the statewide program EIR/EIS and set forth in the Business Plan to minimize capital and operating costs while maximizing total benefits. The FRA and the Authority recognized that the HST system would require a commitment of substantial resources and addressed the broad issues related to the development of a proposed HST system in the statewide program EIR/EIS (California High-Speed Rail Authority and Federal Railroad Administration 2005). Based on the information developed in the earlier studies discussed above and the selected HST Alternative, as well as through public and agency coordination and scoping, the Authority and the FRA were able to identify potential alternatives for implementation of the proposed HST system in the study region.

The Authority and the FRA began developing the alternatives by seeking to identify the most reasonable, practicable, and environmentally sensitive HST Alignment Alternatives and station locations for analysis in this Program EIR/EIS. As part of this process, alternatives previously considered were reevaluated, and a screening of potential alignment alternatives and station location options was conducted. This screening analyzed all reasonable and practical alignment alternatives and station location options within viable HST corridors.

The evaluation of potential HST Alignment Alternatives and station location options used the following standardized criteria: construction, environment, land use compatibility, right-of-way, connectivity/accessibility, and ridership/revenue.

The screening of alignment alternatives and stations comprised the following key activities:

- Review of past alignment and station location options identified within viable corridors from previous studies.
- Identification through the environmental scoping process of alignment alternatives and station location options not previously evaluated.

- Evaluation of alignment alternatives and station location options using standardized engineering, environmental, and financial criteria (described above) and evaluation methodologies at a consistent level of analysis.
- Identification of the ability of alignment alternatives and station location options to meet defined objectives.

The results of this analysis were documented in the *Draft Alignment Alternatives and Potential Station Locations Options Report* (California High-Speed Rail Authority and Federal Railroad Administration 2006), presented at the Authority's March 22, 2006, Board Meeting, and in the *Additional Potential HST Alignment and Stations Considered but Rejected Report* (California High-Speed Rail Authority and Federal Railroad Administration 2006) presented at the Authority's August 9, 2006, Board Meeting. Technical data, combined with public and agency input, provided the Authority and the FRA with the necessary information to focus further studies for the Program EIR/EIS on those alignment alternatives, station location options, and HST systems that represent a reasonable range of practicable alternatives to meet the project purpose and attain several objectives established by the Authority. Those objectives include:

- Maximize ridership and revenue potential.
- Maximize connectivity and accessibility.
- Maximize compatibility with existing and planned development.
- Maximize avoidance of areas with geologic and soils constraints.
- Maximize avoidance of areas with potential hazardous materials.
- Minimize operating and capital costs.
- Minimize impacts on natural resources.
- Minimize impacts on social and economic resources.
- Minimize impacts on cultural resources.

Complex issues associated with the tunneling were addressed as part of the statewide program EIR/EIS process. This work focused on the feasibility, construction methods, and cost assumptions associated with proposed tunneling for the HST system and resulted in the Authority's objective of minimizing the amount of tunneling required, particularly the use of long tunnels (more than 6 mi [10 km] long), due to cost, time of construction, and potential for delay. Tunnels more than 12 mi (19 km) long are considered infeasible for this project, and it is the Authority's objective to cross major fault zones at grade. The technical information produced as part of the statewide program EIR/EIS is documented in the *Tunneling Issues Report* (California High-Speed Rail Authority January 2004).

F. RELATED PROGRAMS AND STUDIES

The purpose of the proposed HST system includes "interfaces between the HST system and major commercial airports, mass transit and the highway network" (Section 1.2.1). Planned commuter rail improvements in the study region described below are related and would connect to the proposed HST system. These plans and projects have been considered in the development of the HST Alignment Alternatives and station location options.

San Francisco Bay Area Regional Rail Plan

Approved by Bay Area voters in March 2004, the Regional Measure 2 (RM2) Traffic Relief Plan provides funding to various transit operating assistance and capital projects and programs that have been determined to facilitate travel in the toll bridge corridors. One provision of RM2 provides for the preparation of a Regional Rail Plan to guide near- and long-term planning for an integrated and expanded passenger rail system that would also accommodate freight needs (Streets and Highways Code Section 30914 [c] [33]). Additionally, RM2 calls for the analysis of alternative California HST alignments between the Central Valley and the Bay Area, which have been used to inform this Program EIR/EIS. These two RM2 study elements have been integrated to provide a fully comprehensive San Francisco Bay Area Regional Rail Plan. RM2 provides a $4.5 million budget for the study.

The MTC, BART, Caltrain, and the Authority, along with a coalition of rail passenger and freight operators, have prepared this comprehensive Regional Rail Plan. As required by RM2, MTC adopted the Regional Rail Plan in September 2007 (available at http://www.mtc.ca.gov/planning/rail/).

The Regional Rail Plan examines ways to incorporate passenger trains into existing rail systems, improve connections to other trains and transit, expand the regional rapid transit network, increase rail capacity, coordinate rail investment around transit-friendly communities and businesses, and identify functional and institutional consolidation opportunities. The plan also includes a detailed analysis of potential high-speed rail routes between the Bay Area and the Central Valley consistent with the Authority's environmental review of the proposed rail lines. Overall, the plan looks at improvements and extensions of railroad, rapid transit, and high-speed rail services for the near term (5–10 years), intermediate term (10–25 years), and long term (beyond 25 years).

The Regional Rail Plan is intended to create a rail network that addresses the anticipated growth in transportation demand and help deliver the long-range vision of rail for the Bay Area. The Regional Rail Plan's network and services are intended to:

- Address the combined challenges of moving people and goods.
- Link people with commercial, employment, and residential centers.
- Expand capacity for goods movements to support the regional economy.
- Identify the most cost-effective investments.
- Serve as the backbone of an integrated regional transit network with seamless connections at key transit hubs to local transit services.
- Accommodate development of statewide high-speed rail, and enable operation of regional services along high-speed lines, and vice-versa.
- Include policies and incentives to encourage local governments to create well-designed, walkable communities with a mix of services near transit.
- Promote a governance structure that can develop regional system improvements and deliver coordinated, customer-oriented services.

MTC, BART, Caltrain, and the Authority staffs are managing the Regional Rail Plan. As required in RM2, a steering committee consisting of regional rail passenger operators, freight railroad operators, and county congestion management agencies provided direction during the plan development. The steering committee was the forum for coordinated review and comment on the plan prior to its submission to MTC for approval. An advisory group of regional specialists in the fields of academia, business, land use, and the environment also helped to refine the study's technical analysis. Outreach to freight and rail operators, public agencies, and community stakeholders was ongoing throughout the study process.

Capitol Corridor Rail Service

The Capitol Corridor, having recently completed track improvements between Oakland and San Jose that allowed an increase in service frequency, is planning to implement a next phase of capacity increasing projects in the Oakland to San Jose corridor and a series of track improvements aimed at reliability in the Oakland to Sacramento corridor. A track capacity enhancement project is also planned for the Auburn to Sacramento corridor which will allow, in a phased project implementation approach, service frequency increases in this portion of the corridor. Projects previously programmed by the State include the Capitol Corridor Joint Powers Authority's (CCJPA's) contribution to the San Jose 4th Main Track project and the Bahia Track Improvement project.

With the recent passage of Proposition 1B, a series of projects that jointly benefit both freight and passenger rail are identified. The projects may include a revised Alameda Creek crossing in the Niles Junction area which will allow transfer of freight rail traffic to and from the Altamont Pass from the Oakland Port in a more expeditious route than is done currently running freight through Fremont. This improvement coupled with improvements at a junction point in South Hayward will allow passenger trains (Capitol Corridor and the planned Dumbarton Rail service) to avoid freight conflicts for a portion of the route between Oakland and San Jose. Double tracking is also planned north of the South Hayward point which will provide for additional track capacity for freight and passenger trains. A costly project planned for the route at some point will be to upgrade or replace the bridge crossing between Martinez and Benicia to avoid the conflicts created when waterborne vessels require the current bridge to be lifted. The anticipated increases in freight traffic coupled with passenger rail service are expected to become so frequent that the delays caused by bridge liftings could create catastrophic delays for all forms of rail service.

Caltrain Corridor Commuter Rail Service

The Caltrain Joint Powers Board (JPB) forecasts a robust increase in Caltrain ridership driven by population increase, work force increase, and convenience and economic influences. Reports generated by the Caltrain discuss the "pull" demand composed of elective riders who could chose the automobile but elect to ride the commuter rail system as a preferred provider. According to the Caltrain JPB, this latent demand has been proven to be real based on the extraordinary growth in ridership realized in 2005 and 2006.

The first 5 years of the Caltrain capital program focuses on a program called the State of Good Repair. This program concentrates on optimizing the current system's performance. The activities in this program range from improvements to the signaling and communications systems to replacing old bridges, from improving the approach speeds and flexibility at the San Francisco terminus to eliminating the last of the hold-out stations. The product of this portion of the program is an optimal condition of the current system which will enable larger programs with minimal impact to performance.

The current method of Caltrain operation will reach its maximum capacity in less than 5 years, even with the system improvements previously mentioned. Electrification, which is required for connection to the Transbay Transit Center and to accommodate the HST on the line, presents the JPB with two implementation options to consider, each with fundamental performance differences. The first option is to purchase electrified locomotives to haul standard passenger coaches that currently run on Caltrain. This solution is relatively low risk for the JPB and supports operations to the Transbay Transit Center. However, this solution is problematic for the Authority because standard North American rail equipment is not compatible with HSTs currently in service around the world, and the HST would require high-level platforms.

The second option for the JPB is to procure electric multiple units (EMUs) that would be compatible with the European or Japanese HSTs that the Authority may select (non-FRA compliant). This option would support operations to the Transbay Transit Center and shared corridor operations with the HST and offer the JPB more flexible trains with better performance characteristics. The JPB has found this solution to be cost effective on a lifecycle basis, but there is greater risk to the JPB in that the Authority, CPUC, FRA, and Union Pacific Railroad (UPRR) must all reach agreement for implementation.

Altamont Commuter Express Service

The San Joaquin Regional Rail Commission, which owns and operates the Altamont Commuter Express (ACE), operates four daily roundtrips, Monday–Friday between Stockton and San Jose through the Altamont Pass. The 86-mile ACE corridor directly serves three counties and eight cities between the Central Valley and the Silicon Valley. The trains stop at three San Joaquin stations (Stockton, Lathrop/Manteca, and Tracy), four Alameda County Stations (Livermore [2], Pleasanton, and Fremont), and in Santa Clara County (Santa Clara [2] and San Jose).

ACE is working with the UPRR to complete a major signal upgrade project between Fremont and Stockton to improve reliability and speed on the route. Over the next 5-year period, ACE will be implementing capital projects that improve reliability and increase speeds in the Stockton to Fremont section of the corridor.

ACE is completing two planning/implementation studies.

- The *ACE Corridor Analysis Study* is focused on identifying improvements to ACE Service, which includes the potential purchase of a separate agency-owned corridor for the ACE service and short haul freight between the Port of Oakland and the Central Valley, and providing a better connection to BART. The draft corridor analysis study was completed in August 2007.
- The *Expansion Opportunities Analysis* is looking at the expansion opportunities for commuter rail service. Corridors that are being reviewed are:
  - Merced to Sacramento.
  - Stockton to Oakland (Delta Route).
  - Los Banos to Tracy.

Dumbarton Rail Project

The March 2004 voter approval of RM2 included funding to reconstruct the out-of-service Dumbarton rail line between Southern Alameda County and the San Francisco Peninsula. The reconstructed rail bridge across the bay would be the key component in the establishment of the commuter rail service between the Union City BART station and the Caltrain line on the peninsula.

New trackway connections would also need to be constructed in the vicinity of the Union City BART station to provide the transfer connection. Service would begin at Union City in the morning and would carry commuters to the west bay via Union Pacific tracks in Fremont and Newark, continuing on the publicly owned and reconstructed Dumbarton segment. Rail equipment comparable to current Caltrain rolling stock is expected to be employed.

The reconstructed Dumbarton segment includes embankment, trestle structure, and two swing bridges; most of the segment is single track with limited passing sidings. New stations would be built in Menlo Park and Newark as well as at the Intermodal Station at Union City. The connections of the Dumbarton Line to Caltrain in Redwood City would also be improved as part of the project. The project is currently being considered for phased implementation due to funding constraints and the inability to reach a track sharing agreement with the Union Pacific Railroad. The initial phase would include the reconstruction of the publicly owned right of way between Newark and Redwood City.

Rail service would operate from a Newark station across the reconstructed bridge to Redwood City and Caltrain. A second component of the project, the Union City Intermodal Station, would also be constructed and utilized by the Capital Corridor service.

Environmental studies are now under preparation; preliminary engineering is also underway to refine the estimated cost for rehabilitating the bay-crossing structures. Local land use plans, both adopted or under preparation, support TOD at the project station locations.

While the Dumbarton Rail project might be able to be completed prior to implementation of the HST system, it conflicts with the proposed HST system and the JPB's Caltrain Corridor EMU option. Conventional trains to be used for the Dumbarton rail service would not be compatible with HSTs currently in service around the world, nor with the similar EMUs proposed for use by the JPB. The rehabilitated Dumbarton Bridge would still be a single track bridge that could not accommodate HST service should the Altamont Corridor with a bay crossing be selected. Alternatively, if high density regional rail service is developed in the future along this route, a double track bridge across the bay would likewise be necessary.

G. PROJECT PHASING

Building an HST system of over 700 miles would tax the state's resources, such as its financial, human, and material needs, and the Authority must deal with both environmental and engineering challenges. Like all the other HST networks implemented throughout the world, the Authority has determined that California HST system must be built in phases that are carefully planned; each phase in turn must be built in stages.

In order to better utilize limited resources, the Authority selected the first phase (Phase 1) and will concentrate most of its resources to the construction of that phase[2]. While placing emphasis on Phase 1, the Authority will also continue with necessary planning, environmental studies, and other activities to advance and preserve those routes and stations that are not included in Phase 1.

The major factors considered in the development of the phasing plan include the following:

- Availability of funds.
- The utility of each phase.
- Time needed for construction.
- Availability of public and private partners.
- Need for right-of-way acquisition.

The phasing decision took into consideration the cost, ridership, and revenue data presented to the Board on April 18, 2007. The phasing decision is also based on the following needs and goals:

- Early utilization of some segments.
- Some degree of local and regional participation in the early construction and funding.
- Serving many regions.
- Significant operating surplus to include a private partner in the construction and operation.
- Development of a high-speed segment of around 100 miles for building, testing, and commissioning the high-speed trainsets, equipment, and systems.

[2] At the May 23, 2007, Authority meeting in Sacramento.

- Completion in less than 10 years from today.

Phase 1: Anaheim to Los Angeles to Merced and the San Francisco Bay Area

Phase 1 connects the major metropolitan areas of the state while serving the fastest growing region, the Central Valley. Phase 1 is the backbone of the proposed HST system, producing the highest potential ridership and revenue, which in all likelihood will attract substantial private sector financing. Within Phase 1, the Authority will capitalize on early improvements already planned and underway for certain corridors as well as developing a high-speed train segment in the Central Valley that will provide for the commissioning and testing of the equipment.

The San Diego to Los Angeles section of the HST system is a later phase because the SCAG is continuing its studies aimed at magnetic levitation (Maglev) HST service between Los Angeles, Ontario, and Riverside. Similarly, in the San Diego region, the San Diego Association of Governments (SANDAG) will be studying the potential use of Maglev technology between San Diego and Riverside. The section from Merced to Sacramento is a later phase due to the lower ridership potential than the connection to the Bay Area.

2.4 No Project Alternative

The No Project Alternative describes the study region without implementation of the HST system and is the basis for comparison of the HST Alignment Alternatives. The No Project Alternative represents the state's transportation system (highway, air, and conventional rail) as it is currently and as it would be after implementation of programs or projects that are currently projected in RTPs, have identified funds for implementation, and are expected to be in place by 2030. This financially constrained level of infrastructure improvement (based on the expected federal, state, regional, and local funding) was analyzed in consideration of the considerable growth in population and transportation demand that is projected to occur by 2030. The No Project Alternative addresses the geographic area that serves the major destination markets for intercity travel and that would be served by the proposed HST system in the study region. This area extends generally from the San Francisco Bay Area and Sacramento through the Central Valley. Figure 2.4-1 illustrates the existing intercity transportation infrastructure that serves these major travel markets.

The No Project Alternative satisfies the statutory requirements under CEQA and NEPA for an alternative that does not include any new action or project beyond what is already committed. The No Project Alternative includes the existing and future statewide intercity transportation system based on programmed and funded improvements through 2030, according to the following sources of information.

- State Transportation Improvement Project (STIP).
- Regional Transportation Plans (RTPs), financially constrained projects for all modes of travel.
  - Transportation 2030 Plan for the San Francisco Bay Area, MTC, February 2005.
  - *2006 Metropolitan Transportation Plan,* Sacramento Area Council of Governments (SACOG), Adopted March 16, 2006.
  - *2004 Regional Transportation Plan*, Council of Fresno County Governments, Adopted July 22, 2004.
  - *2004 Regional Transportation Plan for Merced County*, Merced County Association of Governments (MCAG), Adopted August 19, 2004.
  - *2004 Regional Transportation Plan: Vision 2030*, San Joaquin Council of Governments.
  - *2004 Regional Transportation Plan*, Stanislaus Council of Governments, 2004.

- Airport plans
- Intercity passenger rail plans

The future improvements that would be part of the No Project Alternative are also included in the assumed future 2030 baseline conditions for the Study Region under the HST Network and Alignment Alternatives. The No Project Alternative includes highway, aviation, and conventional rail elements, as discussed below.

2.4.1 Highway Element

The No Project highway system that currently serves the intercity travel market in the study region proposed to be served by the HST Alternative includes the highways identified in Table 2.4-1 and illustrated in Figure 2.4-1. The No Project Alternative includes this existing highway system, as well as funded and programmed improvements on the intercity highway network based on financially constrained RTPs developed by regional transportation planning agencies. Intercity highway improvements included as part of the No Project Alternative include infrastructure projects, as well as intelligent transportation system (ITS) and other potential system improvements programmed to be in operation by 2030. The improvements consist primarily of individual interchange improvements and roadway widening projects on limited segments of the highway network. As such, the improvements do not cumulatively add considerable line capacity to the highway system. The intercity highway improvements included as part of the No Project Alternative are identified by county in Appendix 2-A. This list of projects is consistent with "the Bay Area/California High-Speed Rail Ridership and Revenue Forecasting Study" which supplied the ridership numbers for this EIR/EIS.

Table 2.4-1
Existing California Intercity Highway System

Interstate Highway	U.S. Highway	State Route
I-5	US-101	SR-14
I-80		SR-17
I-205		SR-24
I-280		SR-92
I-580		SR-99
I-680		SR-237
I-880		SR-237

2.4.2 Aviation Element

The air transportation system evaluated under the No Project Alternative consists of 5 airports that currently provide commercial service in the study region proposed to be served by the HST Alignment Alternatives (study area). The airports do not necessarily provide commercial service between the same intercity markets as the proposed HST system. These airports are illustrated in Figure 2.4-1 and listed below.

- San Francisco International Airport (SFO).
- Oakland International Airport (OAK).
- Norman Y. Mineta San Jose International Airport (SJC).
- Modesto City-County-Harry Sham Field (MOD).
- Merced Municipal/Macready Field (MCE).

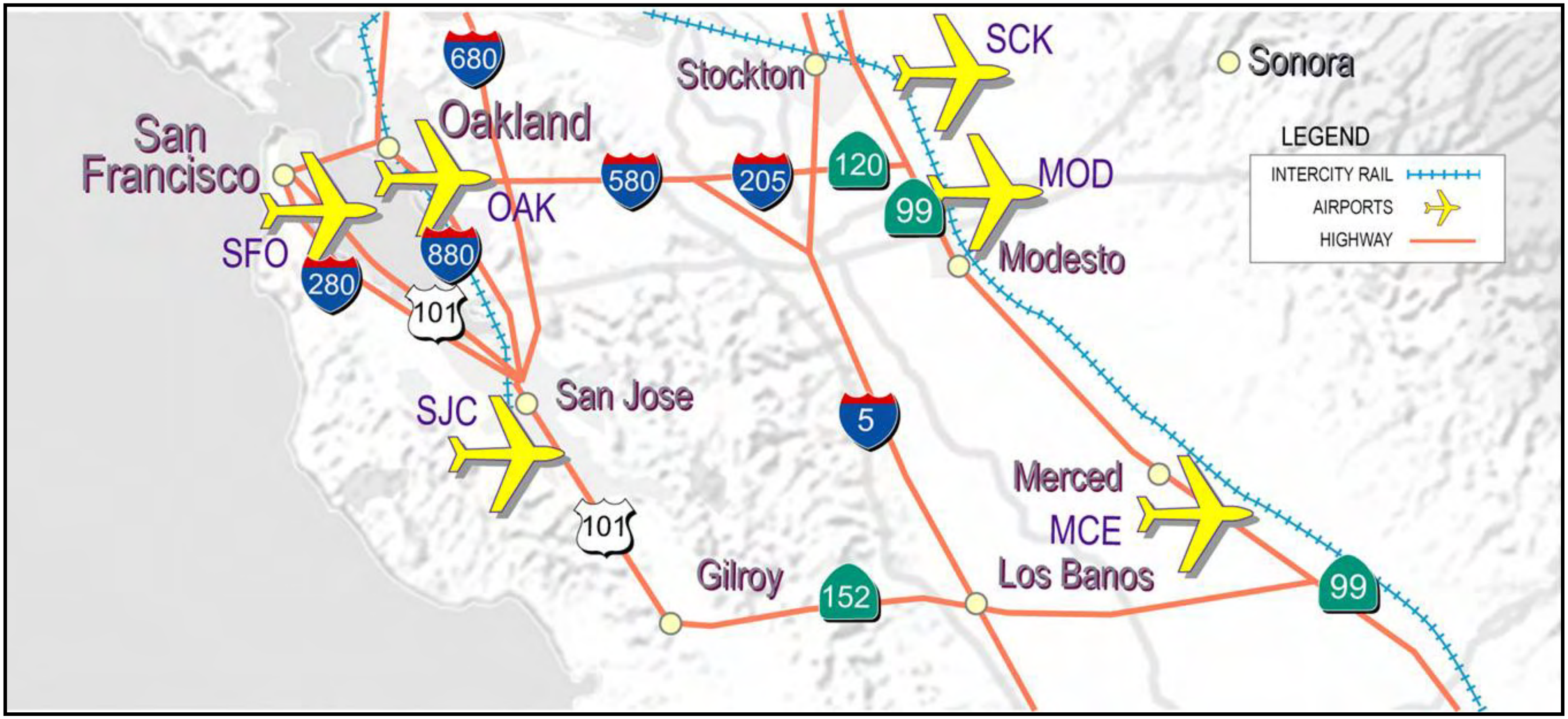

Figure 2.4-1
Study Area Transportation System

The airport development process is distinct from the highway and rail development processes and is not documented in local/regional transportation plans or in the STIP. In addition, because many airport improvements are funded with a combination of public and private funds, there is limited formal public documentation identifying committed projects that are likely to be operational by 2030.

For this analysis and to conceptualize a 2030 No Project airport system, criteria for airport development were developed to review proposed projects and determine their likelihood for implementation and operation by the year 2030. Proposed airport improvements were evaluated based on a review of available documentation, interviews with airport planning and development professionals, local area knowledge, and public agency input. An airport improvement is deemed likely to be implemented and operational by 2030 if the improvement meets the following criteria:

- Has been identified in an approved or under-development airport master planning program, environmental document, regional aviation system planning document, or capital improvement program, and
- Is reasonably practical to place into operation by 2030.

By applying this approach, the airport improvements likely to be funded, programmed, and operational by 2030 are summarized in Table 2.4-2.

Only a portion of the programmed, funded, and potentially operational improvements for 2030 are related to California intercity trips entirely made within the state. The projected aviation improvements were adjusted to represent only the intra-California proportional share, based on the Passenger Survey for California Market Demand in the *Official Airline Guide [OAG]* (Parsons Brinckerhoff 2002) as summarized in Table 2.4-3. The addition of this proportion of improvements to the existing 2001 airport facilities and aviation system is represented in the No Project Alternative. Appendix 2-B provides a detailed description of the aviation element of the No Project Alternative.

Table 2.4-2
Assumed Total Programmed, Funded, and Operational Airport Improvements[a]

Airport	Passenger Terminal Size (square feet)	Runways	Gates	Primary Access Lanes	Parking Spaces (On-/Off-Site)
Bay Area					
Oakland (OAK)	320,000	0	12	2[c]	10,000
San Jose (SJC)	500,000	0	17	2	6,400

[a] Total improvements assumed to be programmed, funded, and operational by 2030.

[b] The City and County of San Francisco and the FAA have commenced preparation of an EIR/EIS for a runway expansion/reconfiguration at SFO that may occur before 2030. It is not assumed as part of the No Project improvements because it does not meet the criteria as established.

[c] Includes the Oakland Airport Connector project, which is under construction. The connector is a 3 (approx.)-mile people mover, operating on exclusive guideway connecting the Oakland International Airport to the BART Coliseum Station.

Sources: Master planning and environmental documents, regional aviation system planning documents, and interviews with local area airport staff and airport planners (Chapter 12).

Table 2.4-3
Assumed Programmed, Funded, and Operational Improvements
Adjusted for Trips inside California*

Airport	Passenger Terminal Size (square feet)	Runways	Gates	Highway Lanes	Parking Spaces (On-/Off-Site)
Bay Area					
Oakland (OAK)	192,000	0	7	1	6,010
San Jose (SJC)	245,000	0	8	1	3,140

* Adjusted to represent the proportional share of improvements by 2030 for intercity California trips only. Assumed intercity California trips are Oakland 60% and San Jose 49%

Sources: *Official Airline Guide Passenger Survey for California Market Demand*, August 2002 and Parsons Brinckerhoff 2002.

2.4.3 Conventional Passenger Rail and Bay Area Transit Elements

Existing intercity passenger rail service is provided on four principal corridors covering more than 1,300 route mi (2,092 route km) and spanning almost the entire state. The No Project passenger rail network is composed of two of these corridors (Capitol corridor and San Joaquin corridor) as illustrated in Figure 2.4-1 and described below. Within these corridors, the intercity passenger service shares track with freight and/or commuter services. The primary portions of these corridors serve the same intercity markets as the proposed HST Alignment Alternatives. All the intercity passenger rail system improvements identified in the STIP and the Caltrans California Intercity Rail Capital Program for implementation prior to 2030 are included in the No Project Alternative and are identified in Appendix 2-C-2. To increase levels of passenger service, the improvements consist of additional track capacity, maintenance and storage facilities, grade-crossing improvements, track and signal improvements, and expanded or upgraded passenger stations.

The transit projects assumed as part of the No-Build project are listed in Appendix 2-C-1. This project list is consistent with the "Future Baseline" list assumed for the "Bay Area/California High-Speed Rail Ridership and Revenue Forecasting Study," which provided the ridership numbers for this EIR/EIS.

2.5 High-Speed Train Alternatives

HST Network Alternatives represent different ways to combine HST Alignment Alternatives and station location options to implement the HST system in the study region. This Program EIR/EIS focuses on analysis and describes overall effects related to HST Alignment Alternatives. Because there are many possible combinations of alignments and stations, representative HST Network Alternatives are considered and described to better understand the implications of selection of certain alignment alternatives and station location options. Representative network alternatives are shown in Table 2.5-1.

The network alternatives vary in their ability to meet the purpose and need and objectives of the HST system and provide additional data to inform the future identification of preferred alignment alternatives and station location options. Although HST Alignment Alternatives and station location options were screened and evaluated to identify those that are likely to be reasonable and practicable and to meet the project's purpose and need, the representative network alternatives have not yet been so evaluated. The network alternatives were developed to enable an evaluation and comparison of how various combinations of alignment alternatives would meet the project's purpose and need and how each would perform as a HST network (e.g., travel times between various station locations, anticipated ridership, operating and maintenance costs, energy consumption, and auto trip diversions). Extensive summary data about the network alternatives are presented in Chapter 7, and important differences are identified to inform decision makers and the public in the Summary.

The different system characteristics, as well as environmental factors of the network alternatives, present complex choices. Informed by public review and comment on the draft Program EIR/EIS, the Authority prepared the evaluation for consideration by the Authority board after the public comment period. Chapter 8 of this final Program EIR/EIS presents this evaluation and identifies the preferred HST Alignment Alternatives and station location options, as well as the Preferred HST Network Alternative.

Table 2.5-1
Summary Table of Representative High-Speed Train Network Alternatives

Network Alternatives	Alignments for Representative Alternative
Altamont Pass	
San Francisco and San Jose Termini	Caltrain Corridor (San Francisco to Dumbarton) Dumbarton (High Bridge)[1] Niles/I-880 (Niles Junction to San Jose via I-880)[2] East Bay Connection (Dumbarton/Niles XS) UPRR (Niles to Altamont) Tracy Downtown (UPRR Connection) UPRR (Central Valley)
Oakland and San Jose Termini	Niles /I-880(West Oakland to Niles Junction) Niles /I-880 (Niles Junction to San Jose via I-880)[2] East Bay Connections (Dumbarton/Niles XN and Dumbarton/Niles XS) UPRR (Niles to Altamont) Tracy Downtown (UPRR Connection) UPRR (Central Valley)
San Francisco, Oakland, and San Jose Termini	Caltrain Corridor (San Francisco to Dumbarton) Dumbarton (High Bridge)[1] Niles /I-880(West Oakland to Niles Junction) Niles /I-880 (Niles Junction to San Jose via I-880)[2] East Bay Connections (Dumbarton/Niles XN and Dumbarton/Niles XS) UPRR (Niles to Altamont) Tracy Downtown (UPRR Connection) UPRR (Central Valley)
San Jose Terminus	Niles /I-880 (Niles Junction to San Jose via I-880) [2] East Bay Connection (Dumbarton/Niles XS) UPRR (Niles to Altamont) Tracy Downtown (UPRR Connection) UPRR (Central Valley)
San Francisco Terminus	Caltrain Corridor (San Francisco to Dumbarton) Dumbarton (High Bridge)[1] UPRR (Niles to Altamont) Tracy Downtown (UPRR Connection) UPRR (Central Valley)

Network Alternatives	Alignments for Representative Alternative
Altamont Pass (continued)	
Oakland Terminus	Niles /I-880(West Oakland to Niles Junction) East Bay Connection (Dumbarton/Niles XN) UPRR (Niles to Altamont) Tracy Downtown (UPRR Connection) UPRR (Central Valley)
Union City Terminus	Niles /I-880(Union City BART to Niles Junction) East Bay Connection (Dumbarton/Niles XN) UPRR (Niles to Altamont) Tracy Downtown (UPRR Connection) UPRR (Central Valley)
San Francisco and San Jose – via SF Peninsula	Caltrain Corridor (San Francisco to Dumbarton) Caltrain (Dumbarton to San Jose) Dumbarton (High Bridge) UPRR (Niles to Altamont) Tracy Downtown (UPRR Connection) UPRR (Central Valley)
San Francisco, San Jose, and Oakland – with no San Francisco Bay Crossing	Caltrain Corridor (San Francisco to Dumbarton) Caltrain (Dumbarton to San Jose) Niles /I-880(West Oakland to Niles Junction) Niles /I-880 (Niles Junction to San Jose via I-880)[2] East Bay Connections (Dumbarton/Niles XN and Dumbarton/Niles XS) UPRR (Niles to Altamont) Tracy Downtown (UPRR Connection) UPRR (Central Valley)
Oakland and San Francisco – via Transbay Tube	Transbay Crossing – Transbay Transit Center Niles /I-880(West Oakland to Niles Junction) East Bay Connection (Dumbarton/Niles XN) UPRR (Niles to Altamont) Tracy Downtown (UPRR Connection) UPRR (Central Valley)
San Jose, Oakland, and San Francisco – via Transbay Tube	Transbay Crossing – Transbay Transit Center Niles /I-880(West Oakland to Niles Junction) Niles /I-880 (Niles Junction to San Jose via I-880)[2] East Bay Connections (Dumbarton/Niles XN and Dumbarton/Niles XS) UPRR (Niles to Altamont) Tracy Downtown (UPRR Connection) UPRR (Central Valley)

Pacheco Pass	
San Francisco and San Jose Termini	Caltrain Corridor (San Francisco to Dumbarton) Caltrain (Dumbarton to San Jose) Pacheco (San Jose to Western Valley) Henry Miller (Western Valley to BNSF/UPRR) Henry Miller UPRR Connection BNSF - UPRR
Oakland and San Jose Termini	Niles /I-880(West Oakland to Niles Junction) Niles /I-880 (Niles Junction to San Jose via I-880) Pacheco (San Jose to Western Valley) Henry Miller (Western Valley to BNSF/UPRR) Henry Miller UPRR Connection BNSF - UPRR
San Francisco, Oakland, and San Jose Termini	Caltrain Corridor (San Francisco to Dumbarton) Caltrain (Dumbarton to San Jose) Niles /I-880(West Oakland to Niles Junction) Niles /I-880 (Niles Junction to San Jose via I-880) Pacheco (San Jose to Western Valley) Henry Miller (Western Valley to BNSF/UPRR) Henry Miller UPRR Connection BNSF - UPRR
San Jose Terminus	Pacheco (San Jose to Western Valley) Henry Miller (Western Valley to BNSF/UPRR) Henry Miller UPRR Connection BNSF - UPRR
San Jose, San Francisco, and Oakland – via Transbay Tube	Transbay Crossing – Transbay Transit Center Caltrain Corridor (San Francisco to Dumbarton) Caltrain (Dumbarton to San Jose) Pacheco (San Jose to Western Valley) Henry Miller (Western Valley to BNSF/UPRR) Henry Miller UPRR Connection BNSF - UPRR
San Jose, Oakland, and San Francisco – via Transbay Tube	Transbay Crossing – Transbay Transit Center Niles /I-880(West Oakland to Niles Junction) Niles /I-880 (Niles Junction to San Jose via I-880) Pacheco (San Jose to Western Valley) Henry Miller (Western Valley to BNSF/UPRR) Henry Miller UPRR Connection BNSF - UPRR

Pacheco Pass with Altamont Pass (Local Service)	
San Francisco and San Jose Termini	Caltrain Corridor (San Francisco to Dumbarton) Caltrain (Dumbarton to San Jose) Dumbarton (High Bridge) UPRR (Niles to Altamont)[3] Tracy Downtown (UPRR Connection)[4] UPRR (Central Valley) Pacheco (San Jose to Western Valley) Henry Miller (Western Valley to BNSF/UPRR) Henry Miller UPRR Connection
Oakland and San Jose Termini	Niles /I-880(West Oakland to Niles Junction) Niles /I-880 (Niles Junction to San Jose via I-880) East Bay Connections (Dumbarton/Niles XN & Dumbarton/Niles XS) UPRR (Niles to Altamont)[3] Tracy Downtown (UPRR Connection)[4] UPRR (Central Valley) Pacheco (San Jose to Western Valley) Henry Miller (Western Valley to BNSF/UPRR) Henry Miller UPRR Connection
San Francisco, Oakland, and San Jose Termini (without Dumbarton Bridge)	Caltrain Corridor (San Francisco to Dumbarton) Caltrain (Dumbarton to San Jose) Niles /I-880(West Oakland to Niles Junction) Niles /I-880 (Niles Junction to San Jose via I-880) East Bay Connections (Dumbarton/Niles XN and Dumbarton/Niles XS) UPRR (Niles to Altamont)[3] Tracy Downtown (UPRR Connection)[4] UPRR (Central Valley) Pacheco (San Jose to Western Valley) Henry Miller (Western Valley to BNSF/UPRR) Henry Miller UPRR Connection
San Jose Terminus	Niles /I-880 (Niles Junction to San Jose via I-880) [2] East Bay Connection (Dumbarton/Niles XS) UPRR (Niles to Altamont)[3] Tracy Downtown (UPRR Connection)[4] UPRR (Central Valley) Pacheco (San Jose to Western Valley) Henry Miller (Western Valley to BNSF/UPRR) Henry Miller UPRR Connection

1 Does not include Dumbarton Wye South to Caltrain segment.
2 Does not include Niles Junction to Niles Wye South (Niles/I-880 5A) segment.
3 Does not include “express tracks” through Pleasanton station.
4 Does not include “express tracks” through Tracy station.

2.5.1 HST Alignment Alternatives and Station Location Options

Informed by previous studies and the scoping process, the Authority and the FRA evaluated potential HST Alignment Alternatives in the study region and defined those that best meet the project purpose, which is *to provide a reliable high-speed electrified train system that links the major Bay Area cities to the Central Valley, Sacramento, and Southern California, and that delivers predictable and consistent travel times. Further objectives are to provide interfaces between the HST system and major commercial airports, mass transit and the highway network and to relieve capacity constraints of the existing transportation system in a manner sensitive to and protective of the Bay Area's and California's unique natural resources.* The study region is shown in Figure 1.1-1. The Authority and FRA conducted a screening evaluation to identify potential alignment alternatives and station location options that are anticipated to be practicable, reasonable, and feasible for further consideration in this Program EIR/EIS. These alignment alternatives and station location options are shown in Figure 2.5-1 and described as part of this section.

The screening evaluation included the following activities:

- Review of alignment alternatives and station location options identified in previous studies in the study region.
- Identification of alignment alternatives and station location options not previously evaluated.
- Evaluation of alignment alternatives and station location options using standardized engineering, environmental, and financial criteria and evaluation methodologies.
- Evaluation of alignment alternatives and station location options against defined objectives.

The alignment and station-screening evaluation was combined with public and agency input that together provided the Authority and the FRA with the necessary information to identify a reasonable range of alignment, station location, and HST corridor options. The evaluation of potential HST Alignment Alternatives and station location options within viable corridors used the following standardized criteria:

- Construction: Substantial engineering and construction complexity as well as excessive initial and/or recurring costs were considered criteria for project impracticability because they present logistical constraints.
- Environment: A high potential for considerable impacts to natural resources including water resources, streams, floodplains, wetlands, and habitat of threatened or endangered species was considered a criterion for failing to meet project objectives.
- Land Use Compatibility: Substantial incompatibility with current or planned local land use as defined in local plans was considered a criterion for failing to meet project objectives.
- Right-of-Way: A lack of available right-of-way or extensive right-of-way needs that would result in excessively high acquisition costs for a corridor, technology, alignment, or station were considered criteria for project impracticability.
- Connectivity/Accessibility: Limited connectivity with other transportation modes (aviation, highway, or transit systems) that would impair the service quality and could reduce ridership of the HST system was considered a criterion for failing to satisfy the project purpose.
- Ridership/Revenue: Longer trip times or suboptimal operating characteristics that would result in low ridership and revenue were considered criteria for failing to satisfy the project purpose.

Table 2.5-2 presents the relationship of objectives and criteria applied in the screening evaluation. The objectives and criteria used in this evaluation represent further refinement of those used in previous studies and incorporated the HST system performance goals and criteria. Alignment alternatives and station location options were considered and compared based on these established objectives and criteria.

Table 2.5-2
High-Speed Rail Alignment and Station Evaluation Objectives and Criteria

Objective	Criteria
Maximize ridership/revenue potential	Travel time Length Population/employment catchment area
Maximize connectivity and accessibility	Intermodal connections
Minimize operating and capital costs	Length Operational issues Construction issues Capital cost Right-of-way issues/cost
Maximize compatibility with existing and planned development	Land use compatibility and conflicts Visual quality impacts
Minimize impacts on natural resources	Water resources impacts Floodplain impacts Wetland impacts Threatened and endangered species impacts
Minimize impacts on social and economic resources	Environmental justice impacts (demographics) Farmland impacts
Minimize impacts on cultural and parks/wildlife refuge resources	Cultural resources impacts Parks and recreation impacts Wildlife refuge impacts
Maximize avoidance of areas with geologic and soils constraints	Soils/slope constraints Seismic constraints
Maximize avoidance of areas with potential hazardous materials	Hazardous materials/waste constraints

Engineering criteria, such as operational, construction, and right-of-way issues, were evaluated qualitatively. The screening evaluation criteria are consistent with the criteria applied in the previous studies. The criteria related to HST operations are based on accepted engineering practices, the criteria and experiences of other railway and HST systems, and the comments of HST manufacturers.

The broad objectives and criteria related to the environment used for evaluation reflect the objectives of NEPA and CEQA and are consistent with the objective of the CWA Section 404(b)(1) to provide consideration of alternatives to minimize impacts on waters of the United States. The environmental constraints and impacts criteria focus on environmental issues that can affect the location or selection of alignments and stations.

The results of the alignment and station evaluation are described in the *Draft Alignment Alternatives and Potential Station Location Options Report* (California High-Speed Rail Authority and Federal Railroad Administration 2006), which was presented at the March 22, 2006, Authority Board meeting, and the *Additional Potential HST Alignments and Stations Considered but Rejected Report,* which was presented

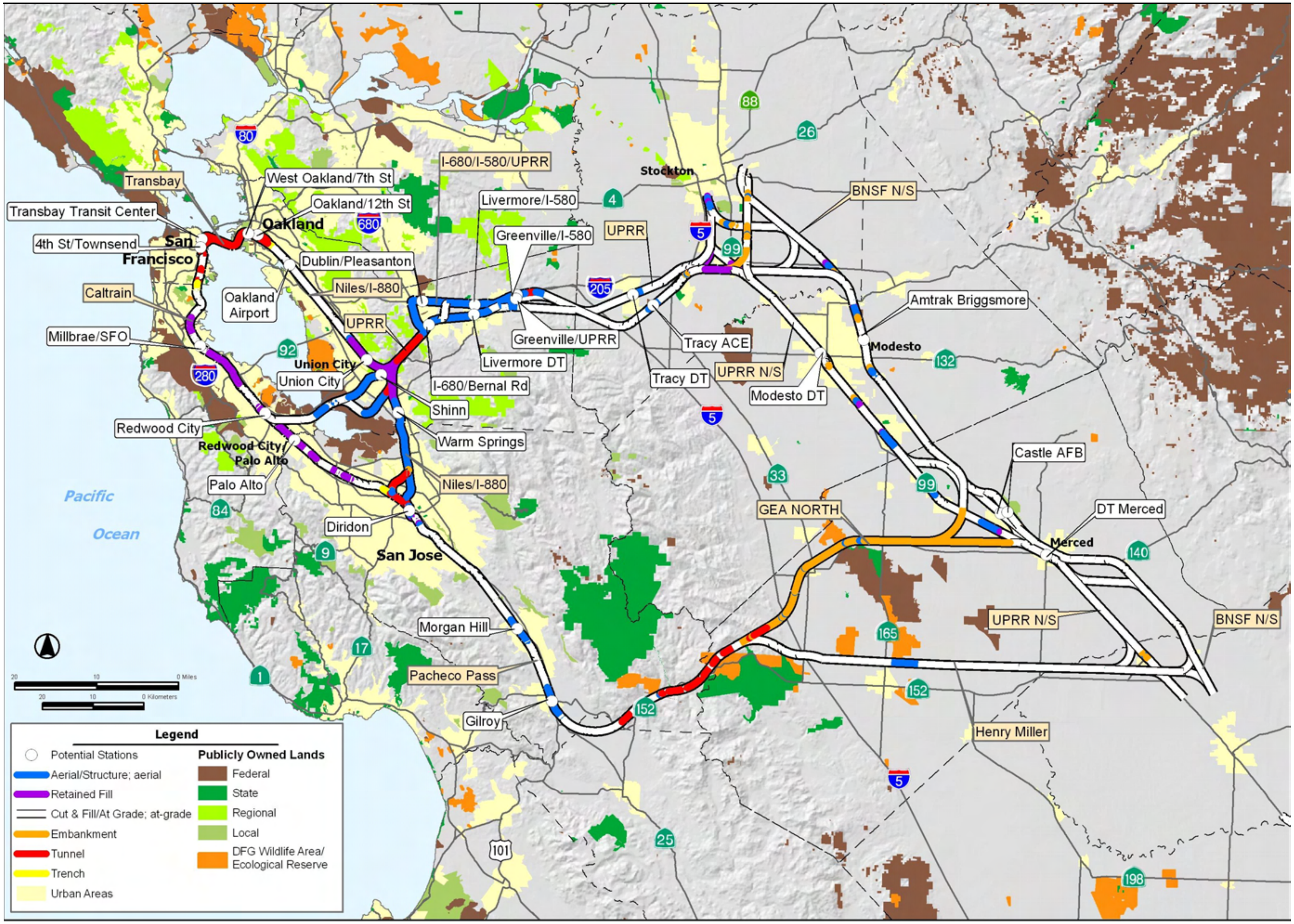

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Figure 2.5-1
Bay Area to Central Valley—High-Speed Train Alignment Alternatives and Station Location Options Carried Forward for Further Consideration

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at the August 9, 2006, Authority Board meeting. Some alignment alternatives and station location options were considered and removed from further study.

- For most of the alignment alternatives and station location options not carried forward, failure to meet the general project purpose and objectives and practicability constraints were the primary reasons for elimination.
- Environmental criteria were considered a reason for elimination when an alignment alternative or station location option had considerably more probable environmental impacts than other practicable alignment alternatives or station location options for the same corridor.
- General project purpose and objectives were considered in terms of ridership potential, connectivity and accessibility, incompatibility with existing or planned development, and severe operational constraints.
- Practicability constraints were considered in terms of cost, constructability, right-of-way constraints, and other technical issues. To assess the constructability of tunnels, some specific thresholds were established to help guide the evaluation. Continuous tunnel lengths of more than 12 mi (19 km) were considered impracticable, and the crossing of major fault zones at grade was also identified as a necessary criterion. For other practicability considerations (e.g., right-of-way constraints, construction issues, costs) thresholds could not be established for this program-level evaluation and impracticability was determined based on professional judgment.

Environmental constraints are identified for alignment alternatives only if they constituted primary reasons for elimination. The remaining alignment alternatives and station location options were determined to generally meet the objectives described in the purpose and need and are analyzed in detail in this Program EIR/EIS.

Proposed HST Alignment Alternatives are generally configured along or adjacent to existing rail transportation facilities, instead of creating new transportation corridors. Although a wide range of options have been considered, the Authority's initial conceptual approach, previous corridor evaluations, and the evaluation conducted as part of this Program EIR/EIS have consistently shown a potential for fewer substantial environmental impacts along existing highway and rail facilities than on new alignments through both developed and undeveloped areas. Although increasing the overall width of existing facilities could have potential impacts on the amount of land disturbed similar to those of creating new facilities, creating new facilities would also introduce potential incompatibility and severance issues in both urban communities and rural settings (farmlands, open spaces).

The station location options described in this section were identified generally and represent the most likely sites based on current knowledge, consistent with the objective to serve the state's major population centers. There is a critical tradeoff between accessibility of the system to potential passengers and the resulting HST travel times (i.e., more closely spaced stations will lengthen the travel times for local service as well as express services). The station locations shown here are spaced approximately 50 mi (80 km) apart in rural areas and 15 mi (24 km) apart in the metropolitan areas. Additional or more closely spaced stations would negatively affect travel times and the ability to operate both express and local services.

Several key factors were considered in identifying potential station stops, including speed, cost, local access times, potential connections with other modes of transportation, ridership potential, and distribution of population and major destinations along the route. Again, the ultimate locations and configurations of stations cannot be determined until the project-level environmental process has been completed.

As part of the development of the *Bay Area Regional Rail Plan* (Section 2.3.3), some HST Alignment Alternatives are being were considered for regional rail "overlay" services that would be implemented by other transportation agencies in cooperation with the Authority. Overlay services would involve operating regional commuter trains on the HST infrastructure and serving additional non-HST regional rail stations. These regional rail stations and services are not integral to the HST system and are not alternatives in this Program EIR/EIS; however, they are considered in the cumulative analysis of HST Alignment Alternatives as related but separate potential projects.

To facilitate this analysis, the study area was divided into six corridors within the study region:

- San Francisco to San Jose.
- Oakland to San Jose.
- San Jose to Central Valley.
- East Bay to Central Valley.
- San Francisco Bay Crossings.
- Central Valley Alignment.

These corridors connect different parts of the study region and are fundamentally different and distinct in terms of land use, terrain, and construction configuration (mix of at-grade, aerial structure, and tunnel sections). The HST Alignment Alternatives and station location options considered in each corridor of the study region are discussed below. Table 2.5-3 shows the HST Alignment Alternatives, which are made up of alignment segments. Table 2.5-3 also lists the segments by map name and location description. Figure 2.5-2 illustrates the segment breakdown of each of the alignment alternatives. The analyses in Chapter 3, "Affected Environment, Environmental Consequences, and Mitigation Strategies," compile and report information about the affected environment and environmental consequences for each alignment alternative and segment as outlined in the tables. The purpose of Chapter 7, "High-Speed Train Network and Alignment Alternatives Comparisons," is to summarize and compare the physical and operational characteristics and potential environmental consequences associated with the HST Network Alternatives and for the various HST Alignment Alternatives within the six corridors. The HST Alignment Alternatives and station location options are described below.

Table 2.5-3
Summary Table of Alignment Alternatives and Station Location Options

Corridor	**Possible Alignments[a]**	**Alignment Alternative[b]**	**Segment[c]**	
			Map Name (Figure 2.5-2)	**Location Description**
San Francisco to San Jose: Caltrain	1 of 1	San Francisco to Dumbarton	Caltrain 1	Transbay Transit Center to 4th/Townsend
			Caltrain 2	4th/Townsend to Millbrae/SFO
			Caltrain 3	Millbrae/SFO to Redwood City
			Caltrain 4	Redwood City to Caltrain
	1 of 1	Dumbarton to San Jose	Caltrain 5	Caltrain to Dumbarton Wye
			Caltrain 6	Dumbarton Wye to Palo Alto
			Caltrain 7	Palo Alto to Santa Clara
			Caltrain 8	Santa Clara to Diridon Station
Station Location Options				
Transbay Transit Center				

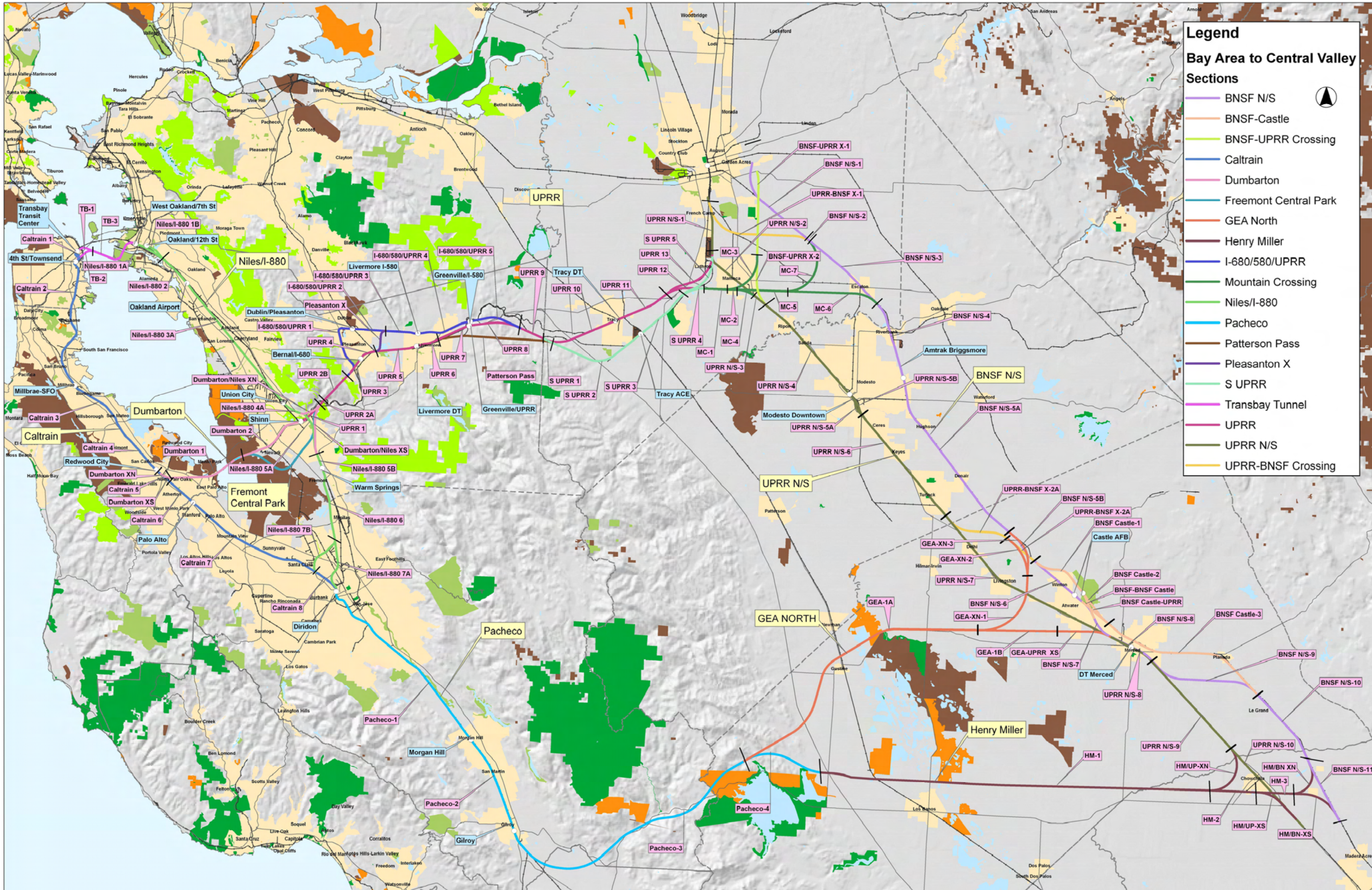

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Figure 2.5-2
Alignment Segments and Station Location Options That Compose the High-Speed Train Alignment Alternatives

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Corridor	Possible Alignments[a]	Alignment Alternative[b]	Segment[c]	
			Map Name (Figure 2.5-2)	Location Description
4th and King (Caltrain)				
Millbrae/SFO				
Redwood City (Caltrain)				
Palo Alto (Caltrain)				
Oakland to San Jose: Niles/I-880	1 of 2	West Oakland to Niles Junction	Niles/I-880 1A	West Oakland to Jack London Square
			Niles/I-880 2 (A &B)	Jack London Square to Oakland Coliseum
			Niles/I-880 3A	Oakland Coliseum to Union City (BART)
			Niles/I-880 4A	Union City (BART) to Niles Junction
		12th Street/City Center to Niles Junction	Niles/I-880 1B	12th Street/City Center to Jack London Square Niles
			Niles/I-880 2 (A & B)	Jack London Square to Oakland Coliseum
			Niles/I-880 3A	Oakland Coliseum to Union City (BART)
			Niles/I-880 4A	Union City (BART) to Niles Junction
	1 of 2	Niles Junction to San Jose via Trimble	Niles/I-880 5A	Niles Junction to Niles Wye (S)
			Niles/I-880 5B	Niles Wye (S) to Warm Springs
			Niles/I-880 6	Warm Springs to Trimble Rd.
			Niles/I-880 7B	Trimble Rd. Option
			Caltrain 8	Santa Clara to Diridon Station
		Niles Junction to San Jose via I-880	Niles/I-880 5A	Niles Junction to Niles Wye (S)
			Niles/I-880 5B	Niles Wye (S) to Warm Springs
			Niles/I-880 6	Warm Springs to Trimble Rd.
			Niles/I-880 7A	I-880 – Trimble Rd. to Diridon
Station Location Options				
West Oakland/7th Street				
12th Street/City Center				
Coliseum/Airport				
Union City (BART)				
Fremont (Warm Springs)				
San Jose to Central Valley: Pacheco Pass	1 of 1	Pacheco	Pacheco 1	Diridon to Morgan Hill
			Pacheco 2	Morgan Hill to Gilroy
			Pacheco 3	Gilroy to San Luis Reservoir
	1 of 3	Henry Miller	Pacheco 4	San Luis Reservoir to Valley Floor

Corridor	Possible Alignments[a]	Alignment Alternative[b]	Segment[c]	
			Map Name (Figure 2.5-2)	Location Description
		(UPRR Connection)	HM-1	Western Valley to Henry Miller UP Wye
			HM-2	Henry Miller UP North Wye to UP South Wye
			HM/UP-XN	Henry Miller Wye North to UPRR
			HM/UP-XS	Henry Miller Wye South to UPRR
		Henry Miller (BNSF Connection)	Pacheco 4	San Luis Reservoir to Valley Floor
			HM-1	Western Valley to Henry Miller UP Wye
			HM-2	Henry Miller UP North Wye to UP South Wye
			HM-3	Henry Miller UP South Wye to BNSF Wyes
			HM/BN-XN	Henry Miller Wye North to BNSF
			HM/BN-XS	Henry Miller Wye South to BNSF
		GEA North	GEA-1	San Luis Reservoir to Atwater Wye
			GEA-BNSF XN	GEA Atwater Wye North to BNSF
			GEA-UPRR XS	GEA Atwater Wye South to Merced UP
Station Location Options				
San Jose (Diridon)				
Morgan Hill (Caltrain)				
Gilroy (Caltrain)				
East Bay to Central Valley: Altamont Pass	1 of 4	I-680/ 580/UPRR	UPRR 2 (A & B)	Niles Canyon to Sunol
			I-680/580/UPRR 1	Sunol to Dublin/Pleasanton BART
			I-680/580/UPRR 2	Dublin/Pleasanton BART to El Charo Road
			I-680/580/UPRR 3	El Charo Road to Livermore (I-580)
			I-680/580/UPRR 4	Livermore (I-580) to Greenville
			I-680/580/UPRR 5	Greenville to Altamont Pass
			UPRR 9	Altamont Pass to County Line
		I-580/UPRR	UPRR 2 (A & B)	Niles Canyon to Sunol
			UPRR 3	Sunol to Pleasanton
			UPRR 4	Pleasanton to El Charo
			Pleasanton X	UPRR to I-580 connector
			I-680/580/UPRR 3	El Charo Road to Livermore (I-580)
			I-680/580/UPRR 4	Livermore (I-580) to Greenville
			I-680/580/UPRR 5	Greenville to Altamont Pass
			UPRR 9	Altamont Pass to County Line
		Patterson Pass/UPRR	UPRR 2 (A & B)	Niles Canyon to Sunol
			UPRR 3	Sunol to Pleasanton

Corridor	Possible Alignments[a]	Alignment Alternative[b]	Segment[c]	
			Map Name (Figure 2.5-2)	Location Description
			UPRR 4	Pleasanton to El Charo
			UPRR 5	El Charo to Livermore
			UPRR 6	Livermore to Patterson Pass cut off
			Patterson Pass	Patterson Pass
		UPRR	UPRR 2 (A & B)	Niles Canyon to Sunol
			UPRR 3	Sunol to Pleasanton
			UPRR 4	Pleasanton to El Charo
			UPRR 5	El Charo to Livermore
			UPRR 6	Livermore to Patterson Pass cut off
			UPRR 7	Patterson Pass cut off to Greenville
			UPRR 8	Greenville to Altamont Pass
			UPRR 9	Altamont Pass to County Line
	1 of 4	Tracy Downtown (BNSF Connection)	UPRR 10	County Line to Tracy Downtown
			UPRR 11	Tracy Downtown to I-205
			UPRR 12	I-205 to S. UPRR
			UPRR 13	I-205 to Lathrop – northern
			MC-1	Southwestern Manteca
			MC-2	Southeastern Manteca
			MC-5	Northern Escaton Wye to BNSF
			MC-6	Southern Escaton Wye to BNSF (part 1)
			MC-7	Southern Escaton Wye to BNSF (part 2)
		Tracy ACE Station (BNSF Connection)	S UPRR 1	County Line to South of Tracy
			S UPRR 2	South of Tracy to Tracy ACE Station
			S UPRR 3	Tracy ACE Station to I-205
			S UPRR 4	I-205 to Southeast of Manteca
			S UPRR 5	I-205 to Lathrop – Southern
			MC-1	Southwestern Manteca
			MC-2	Southeastern Manteca
			MC-5	Northern Escaton Wye to BNSF
			MC-6	Southern Escaton Wye to BNSF (part 1)
			MC-7	Southern Escaton Wye to BNSF (part 2)
		Tracy ACE Station (UPRR Connection)	S UPRR 1	County Line to South of Tracy
			S UPRR 2	South of Tracy to Tracy ACE Station
			S UPRR 3	Tracy ACE Station to I-205
			S UPRR 4	I-205 to Southeast of Manteca
			MC-1	Southwestern Manteca

Corridor	Possible Alignments[a]	Alignment Alternative[b]	Segment[c] Map Name (Figure 2.5-2)	Segment[c] Location Description
			MC-2	Southeastern Manteca
			MC-3	Eastern Manteca UPRR South to BNSF
			MC-4	Manteca to Escaton Wye
		Tracy Downtown (UPRR Connection)	UPRR 10	County Line to Tracy Downtown
			UPRR 11	Tracy Downtown to I-205
			UPRR 12	I-205 to S. UPRR
			UPRR 13	I-205 to Lathrop – northern
			MC-1	Southwestern Manteca
			MC-2	Southeastern Manteca
			MC-3	Eastern Manteca UPRR South to BNSF
			MC-4	Manteca to Escaton Wye
	2 of 2	East Bay Connections	Dumbarton/Niles XN	Niles to Union City – Niles Wye (E) to Niles Wye (N)
			Dumbarton/Niles XS	Niles to Fremont – Niles Wye (E) to Niles Wye (S)
Station Location Options				
Pleasanton (I-680/Bernal Rd)				
Pleasanton (BART)				
Livermore (Downtown)				
Livermore (I-580)				
Livermore (Greenville Road/UPRR)				
Livermore (Greenville Road/I-580)				
Tracy (Downtown)				
Tracy (ACE)				
San Francisco Bay Crossings	1 of 2	Trans Bay Crossing – Transbay Transit Center	TB-1	Transbay Transit Center tube to SF Bay
			TB-3	SF Bay to West Oakland
		Trans Bay Crossing – 4th & King	TB-2	4th/Townsend tube to SF Bay
			TB-3	SF Bay to West Oakland
	1 of 6	Dumbarton (High Bridge)	Dumbarton XN	Dumbarton Wye North to Caltrain
			Dumbarton XS	Dumbarton Wye South to Caltrain
			Dumbarton 1 (High Bridge)	Dumbarton Bay Crossing to Don Edwards
			Dunbarton-2	Don Edwards to Shinn (Centerville Line)
			UPRR 1	Shinn to Niles Wye (E)
		Dumbarton	Dumbarton XN	Dumbarton Wye North to Caltrain

Corridor	Possible Alignments[a]	Alignment Alternative[b]	Segment[c] Map Name (Figure 2.5-2)	Segment[c] Location Description
		(Low Bridge)	Dumbarton XS	Dumbarton Wye South to Caltrain
			Dumbarton 1 (Low Bridge)	Dumbarton Bay Crossing to Don Edwards
			Dumbarton-2	Don Edwards to Shinn (Centerville Line)
			UPRR 1	Shinn to Niles Wye (E)
		Dumbarton (Tube)	Dumbarton XN	Dumbarton Wye North to Caltrain
			Dumbarton XS	Dumbarton Wye South to Caltrain
			Dumbarton 1 (Tube)	Dumbarton Bay Crossing to Don Edwards
			Dunbarton-2	Don Edwards to Shinn (Centerville Line)
			UPRR 1	Shinn to Niles Wye (E)
		Fremont Central Park (High Bridge)	Dumbarton XN	Dumbarton Wye North to Caltrain
			Dumbarton XS	Dumbarton Wye South to Caltrain
			Dumbarton 1	Dumbarton Bay Crossing to Don Edwards
			Fremont Central Park (High Bridge)	Don Edwards to Niles (E) via Fremont Central Park
		Fremont Central Park (Low Bridge)	Dumbarton XN	Dumbarton Wye North to Caltrain
			Dumbarton XS	Dumbarton Wye South to Caltrain
			Dumbarton 1	Dumbarton Bay Crossing to Don Edwards
			Fremont Central Park (Low Bridge)	Don Edwards to Niles Wye (E) via Fremont Central Park
		Fremont Central Park (Tube)	Dumbarton XN	Dumbarton Wye North to Caltrain
			Dumbarton XS	Dumbarton Wye South to Caltrain
			Dumbarton 1	Dumbarton Bay Crossing to Don Edwards
			Fremont Central Park (Tube)	Don Edwards to Niles Wye (E) via Fremont Central Park
Station Location Options				
Union City (Shinn)				
Central Valley	1 of 6	BNSF – UPRR	BNSF N/S 1	North Stockton South to UPRR Connection
			BNSF N/S 2	BNSF Parallel to UPRR tracks
			BNSF N/S 3	Parallel tracks South through Escaton
			BNSF N/S 4	Escaton South to Amtrak Briggsmore
			BNSF N/S 5	Amtrak Briggsmore to UPRR/BNSF Connection
			BNSF N/S 6	UPRR/BNSF Connection to Atwater

Corridor	Possible Alignments[a]	Alignment Alternative[b]	Segment[c]	
			Map Name (Figure 2.5-2)	Location Description
			BNSF N/S 7	Atwater to Downtown Merced
			UPRR N/S 8	Merced South to BNSF Connection
			UPRR N/S 9	BNSF Connection South to Henry Miller Wye
			UPRR N/S 10	BNSF Henry Miller Wye
		BNSF	BNSF N/S 1	North Stockton South to UPRR Connection
			BNSF N/S 2	BNSF Parallel to UPRR tracks
			BNSF N/S 3	Parallel tracks South through Escaton
			BNSF N/S 4	Escaton South to Amtrak Briggsmore
			BNSF N/S 5	Amtrak Briggsmore to UPRR/BNSF Connection
			BNSF N/S 6	UPRR/BNSF Connection to Atwater
			BNSF N/S 7	Atwater to Downtown Merced
			BNSF N/S 8	Merced South to UPRR Connection
			BNSF N/S 9	UPRR Connection East to Castle Connection
			BNSF N/S 10	Castle Connection to Henry Miller Wye
			BNSF N/S 11	Henry Miller Wye
		UPRR N/S	UPRR N/S 1	French Camp to Lathrop
			UPRR N/S 2	Lathrop through Manteca
			UPRR N/S 3	Manteca South to BNSF/UPRR
			UPRR N/S 4	BNSF/UPRR South to Modesto
			UPRR N/S 5(A or B)	UPRR Modesto South – Western Option
			UPRR N/S 6	South Modesto to BNSF Connection
			UPRR N/S 7	BNSF Connection South to Merced
			UPRR N/S 8	Merced South to BNSF Connection
			UPRR N/S 9	BNSF Connection South to Henry Miller Wye
			UPRR N/S 10	BNSF Henry Miller Wye
		BNSF Castle	BNSF N/S 1	North Stockton South to UPRR Connection
			BNSF N/S 2	BNSF Parallel to UPRR tracks
			BNSF N/S 3	Parallel tracks South through Escaton
			BNSF N/S 4	Escaton South to Amtrak Briggsmore
			BNSF N/S 5	Amtrak Briggsmore to UPRR/BNSF Connection
			BNSF Castle 1	From BNSF southeast to Castle AFB

Corridor	Possible Alignments[a]	Alignment Alternative[b]	Segment[c] Map Name (Figure 2.5-2)	Segment[c] Location Description
			BNSF Castle 2	Castle AFB South to BNSF connect
			BNSF Castle 3	BNSF South of Castle to UPRR Connect
			BNSF N/S 10	Castle Connection to Henry Miller Wye
			BNSF N/S 11	Henry Miller Wye
		UPRR – BNSF Castle	UPRR N/S 1	French Camp to Lathrop
			UPRR N/S 2	Lathrop through Manteca
			UPRR N/S 3	Manteca South to BNSF/UPRR
			UPRR N/S 4	BNSF/UPRR South to Modesto
			UPRR N/S 5(A OR B)	UPRR Modesto South – Western Option
			UPRR N/S 6	South Modesto to BNSF Connection
			UPRR – BNSF X2	North South Connection East of Stockton (South Portion)
			BNSF Castle 1	From BNSF southeast to Castle AFB
			BNSF Castle 2	Castle AFB South to BNSF connect
			BNSF Castle 3	BNSF South of Castle to UPRR Connect
			BNSF N/S 10	Castle Connection to Henry Miller Wye
			BNSF N/S 11	Henry Miller Wye
		UPRR – BNSF	UPRR N/S 1	French Camp to Lathrop
			UPRR N/S 2	Lathrop through Manteca
			UPRR N/S 3	Manteca South to BNSF/UPRR
			UPRR N/S 4	BNSF/UPRR South to Modesto
			UPRR N/S 5(A OR B)	UPRR Modesto South – Western Option
			UPRR N/S 6	South Modesto to BNSF Connection
			UPRR – BNSF X2	BNSF crossing to UPRR – Southeast of Turlock
			BNSF N/S 6	UPRR/BNSF Connection to Atwater
			BNSF N/S 7	Atwater to Downtown Merced
			UPRR N/S 8	Merced South to BNSF Connection
			UPRR N/S 9	BNSF Connection South to Henry Miller Wye
			UPRR N/S 10	BNSF Henry Miller Wye
Station Location Options				
Modesto (Downtown)				
Briggsmore (Amtrak)				
Merced (Downtown)				

Corridor	Possible Alignments[a]	Alignment Alternative[b]	Segment[c]	
			Map Name (Figure 2.5-2)	Location Description
Castle AFB				

[a] Several alignment alternatives will be selected to create representative HST Network Alternatives (Chapter 7).

[b] Not every segment in an alignment would necessarily be selected to be considered as part of a network alternative.

[c] A segment may be part of more than one alignment alternative.

A. BAY AREA TO CENTRAL VALLEY ALIGNMENT ALTERNATIVES AND STATION LOCATION OPTIONS CARRIED FORWARD

The alignment alternatives and station location options analyzed in this Program EIR/EIS are shown in Figure 2.5-1. Several operating scenarios for combinations of terminus stations were investigated, with HST Network Alternatives ranging from one to three termini (San Francisco, Oakland, and San Jose) for direct HST service to the Bay Area. Conceptual designs were developed for all of the alignment alternatives and station location options carried forward. These designs are illustrated in plan and profile sheets (Appendix 2-D), cross sections (Appendix 2-E), and station fact sheets (Appendix 2-F). Conceptual designs are based on *Engineering Criteria* (California High-Speed Rail Authority and Federal Railroad Administration 2004). Maps illustrating the horizontal alignment and profile type (aerial, at grade, or tunnel) are shown in Figure 2.5-3.

The relation of each of the alignment alternatives to other existing transportation facilities is also a key aspect of the conceptual designs. This information defines the general physical characteristics of the alternatives for consideration in the environmental technical analyses presented in this Program EIR/EIS. Figure 2.5-4 illustrates the alignment characteristics (relation to existing corridors and proposed configurations) for the alignment alternatives carried forward.

San Francisco to San Jose

The alignment alternatives and station location options in this corridor carried forward for further consideration are illustrated in Figure 2.5-5 and discussed below.

Alignment Alternatives Carried Forward

- Caltrain Alignment (Shared-Use Four-Track): From San Francisco, this alignment alternative would follow south along the Caltrain rail alignment to Dumbarton and from there to San Jose. This alignment alternative assumes that the HST system would share tracks with Caltrain commuter trains. The entire alignment would be grade separated. Station location options would include a station in the lower level of the proposed new Transbay Transit Center in San Francisco or a station at 4th and King Streets, a station in Millbrae to serve SFO, and a station in either Redwood City or Palo Alto. The Caltrain shared-use alignment would take advantage of the existing rail infrastructure and would be mostly at-grade.

Station Location Options Carried Forward

San Francisco

- Transbay Transit Center: This potential station location would serve the Caltrain shared-use alignment as a downtown terminal station.
- 4th and King (Caltrain): This potential station location would serve the Caltrain shared-use four-track alignment as a downtown terminal station.

San Francisco International Airport
- Millbrae: This potential station would serve as a connection with SFO.

Mid-Peninsula
- Redwood City (Caltrain): This potential station location would provide accessibility and serve the population between San Jose and San Francisco.
- Palo Alto (Caltrain): This potential station location would provide accessibility and serve the population between San Jose and San Francisco.

Oakland to San Jose

The alignment alternatives and station location options in this corridor carried forward for further consideration are illustrated in Figure 2.5-6 and discussed below. Figure 2.5-6A shows greater detail around Niles Junction.

Alignment Alternatives Carried Forward
- Niles Subdivision Line to I-880 (Niles/I-880): From Oakland, this alignment alternative would travel south following the UPRR's Niles Subdivision Line (i.e., Hayward Line) transition to the UPRR's Warm Springs Subdivision (Milpitas Line) at Niles Junction and then transition to the I-880. Station location options include Oakland, Oakland Airport and Union City (BART) or Fremont (Warm Springs).

  The alignment would be at-grade along the Niles Subdivision Line and on an aerial structure in the median of I-880. The I-880 HST portion would mostly be on an aerial configuration from Fremont to San Jose. This alignment would require the construction of columns and footings in the wide median of I-880.

- Niles Subdivision Line to I-880 to Trimble Road (Niles/I-880/Trimble Rd.): From Oakland, this alignment alternative would travel south following the UPRR's Niles Subdivision Line (i.e., Hayward Line), transition to the UPRR's Warm Springs Subdivision (Milpitas Line) at Niles Junction and then transition to I-880 and then to Trimble Road. Station location options include Oakland, Oakland Airport, and Union City (BART) or Fremont (Warm Springs).

  The alignment would be at-grade along the Niles Subdivision Line and on an aerial structure in the median of I-880. The I-880 HST portion would mostly be on an aerial configuration from Fremont to San Jose. The Trimble Road segment would be on an aerial structure and in a tunnel (where adjacent to San Jose International Airport). This alignment would require the construction of columns and footings in the wide median of I-880.

Station Location Options Carried Forward
Oakland
- West Oakland: This potential station location would serve Oakland the Niles/I-880 Alignment.
- 12th Street/City Center: This potential station location would serve Oakland from the Niles/I-880 Alignment

Oakland International Airport
- Coliseum/Airport BART Station: This potential station location would serve the Oakland Airport from the Niles/I-880 Line.

Southern Alameda County
- Union City (BART): This potential station location would serve the population centers between Oakland and San Jose from the Niles/ I-880 Line.
- Fremont (Warm Springs): This potential station location would serve the population centers between Oakland and San Jose from the Niles/ I-880 Line.

San Jose to Central Valley

The alignment alternatives and station location options in this corridor carried forward for further consideration are illustrated in Figure 2.5-7 and discussed below.

Alignment Alternatives Carried Forward
Pacheco Pass Alignments

- Caltrain/Pacheco/Henry Miller Avenue: This alignment alternative would extend south along the Caltrain/UPRR rail corridor through the Pacheco Pass and a portion of the Grasslands Ecological Area (GEA) along Henry Miller Road and then across the San Joaquin Valley. Station location options include the existing San Jose (Diridon) Station and Gilroy (near the existing Caltrain Station) or Morgan Hill (near the existing Caltrain Station).
- Caltrain/Pacheco/GEA North/Merced: This alignment alternative would extend south along the Caltrain/UPRR rail corridor through the Pacheco Pass, pass through the northern portion of the GEA and then across the San Joaquin Valley. Station location options include the existing San Jose (Diridon) Station and Morgan Hill (near the existing Caltrain Station) or Gilroy (near the existing Caltrain Station).

Station Location Options Carried Forward
San Jose

- San Jose (Diridon): This potential station location would serve all alignments (Caltrain/Monterey Highway rights-of-way) out of San Jose.

South Santa Clara County

- Morgan Hill (Caltrain): This potential station location would serve all the Pacheco Pass alignment alternatives.
- Gilroy (Caltrain): This potential station location would serve all the Pacheco Pass alignment alternatives.

East Bay to Central Valley

The alignment alternatives and station locations in this corridor carried forward for further consideration are illustrated in Figure 2.5-8 and discussed below.

Alignment Alternatives Carried Forward
Altamont Pass

- UPRR: This alignment alternative would extend east via a relatively direct routing (mostly in tunnel) between Niles Junction and I-680 then use the UPRR alignment through Pleasanton and Livermore before transitioning to the I-580 corridor through the Altamont Pass to Tracy. Station location options include the Pleasanton (Bernal/I-680) Station, Livermore (near downtown), or Livermore (Greenville Rd.) and Tracy (downtown) or Tracy (ACE).
- I-580/UPRR: This alignment alternative would extend east via a relatively direct routing (mostly in tunnel) between Niles Junction and I-680 then use the UPRR alignment through Pleasanton before transitioning to the I-580 corridor through Livermore and the Altamont Pass to Tracy. Station location options include the Pleasanton (Bernal/I-680) Station, Livermore (I-580), or Livermore (Greenville Rd.) and Tracy (downtown) or Tracy (ACE).
- I-580/I-680/UPRR: This alignment alternative would extend east via a relatively direct routing (mostly in tunnel) between Niles Junction and I-680 then use the I-680 alignment before transitioning I-580 corridor (at the I-580/I-680 junction). Station location options include the Pleasanton (BART) Station, Livermore (I-580), or Livermore (Greenville Rd.) and Tracy (downtown) or Tracy (ACE).

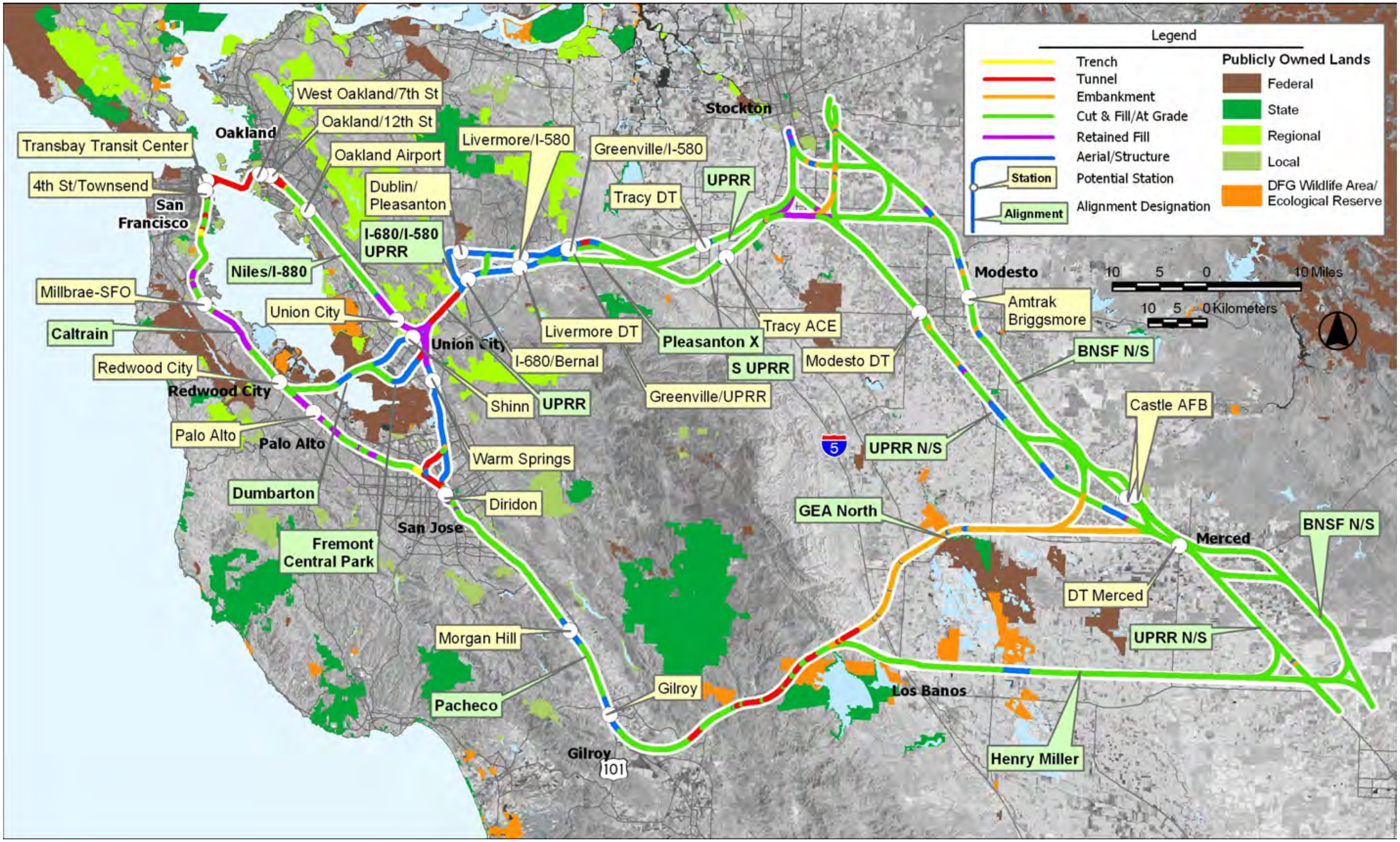

Figure 2.5-3
Profile Characteristics

B003956

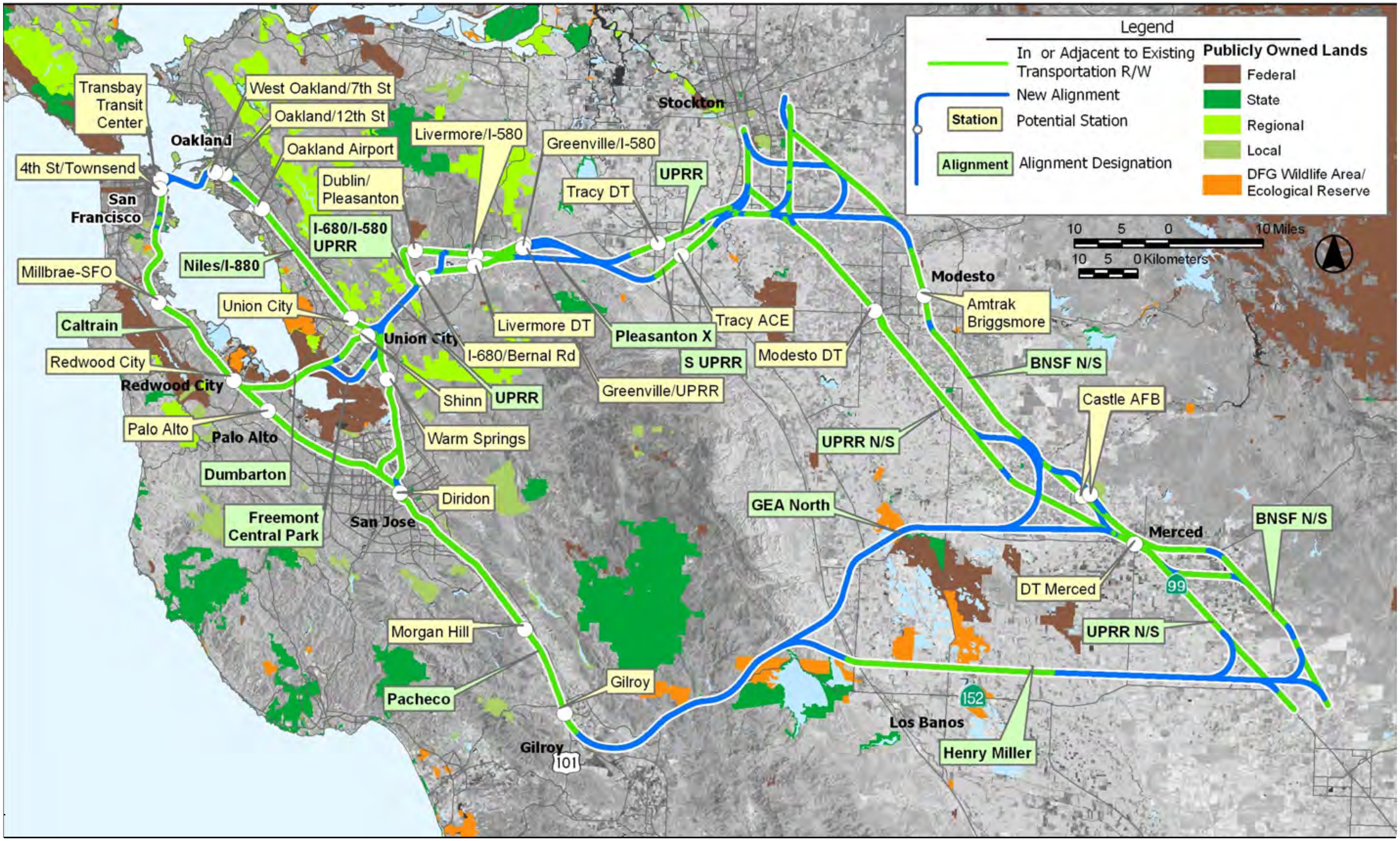

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Figure 2.5-4
Relation to Existing Transportation Corridors

B003957

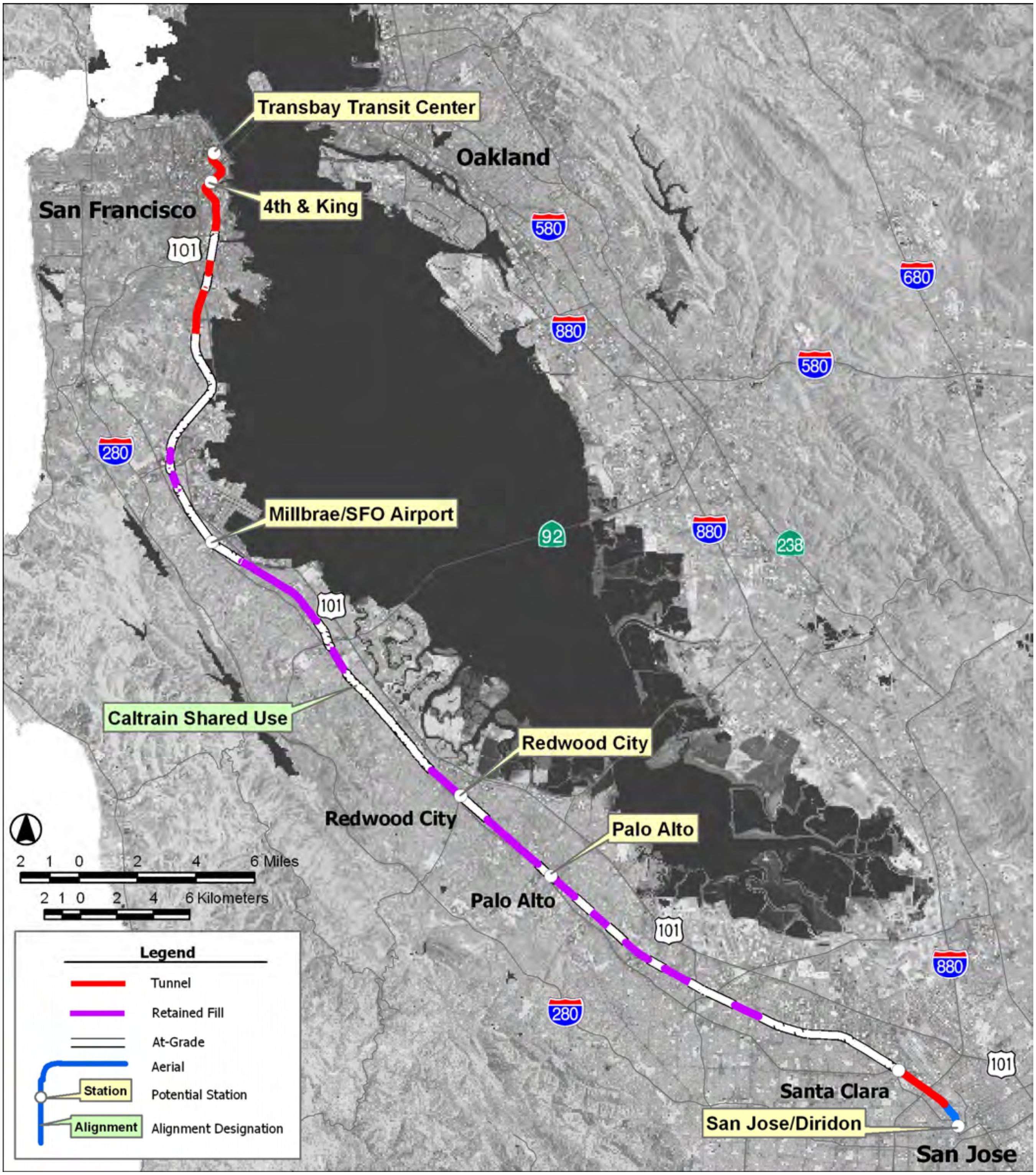

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Figure 2.5-5
San Francisco to San Jose—Alignment Alternatives and Station Location Options Carried Forward for Further Consideration

B003958

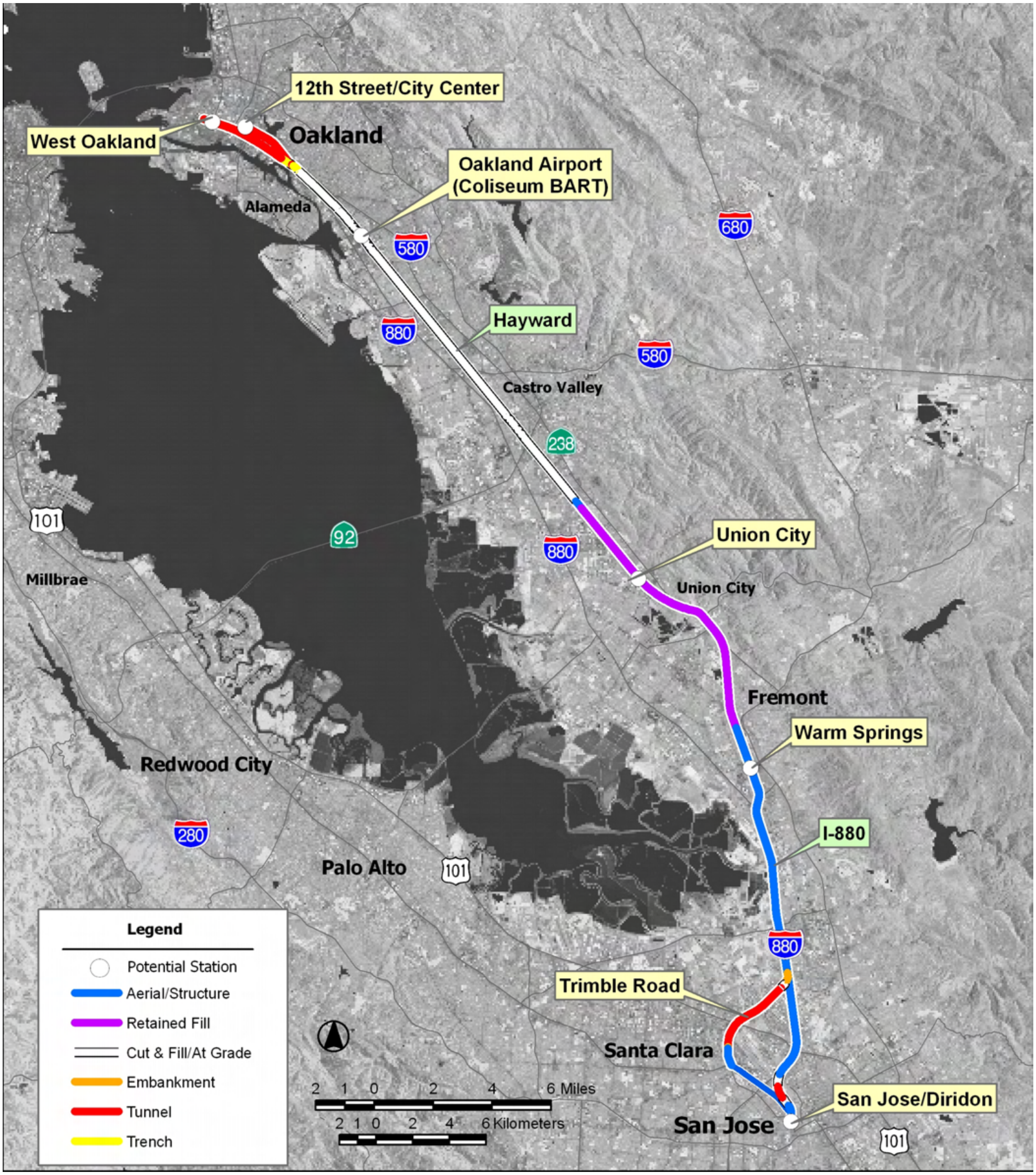

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Figure 2.5-6
Oakland to San Jose—Alignment Alternatives and Station Location Options Carried Forward for Further Consideration

B003959

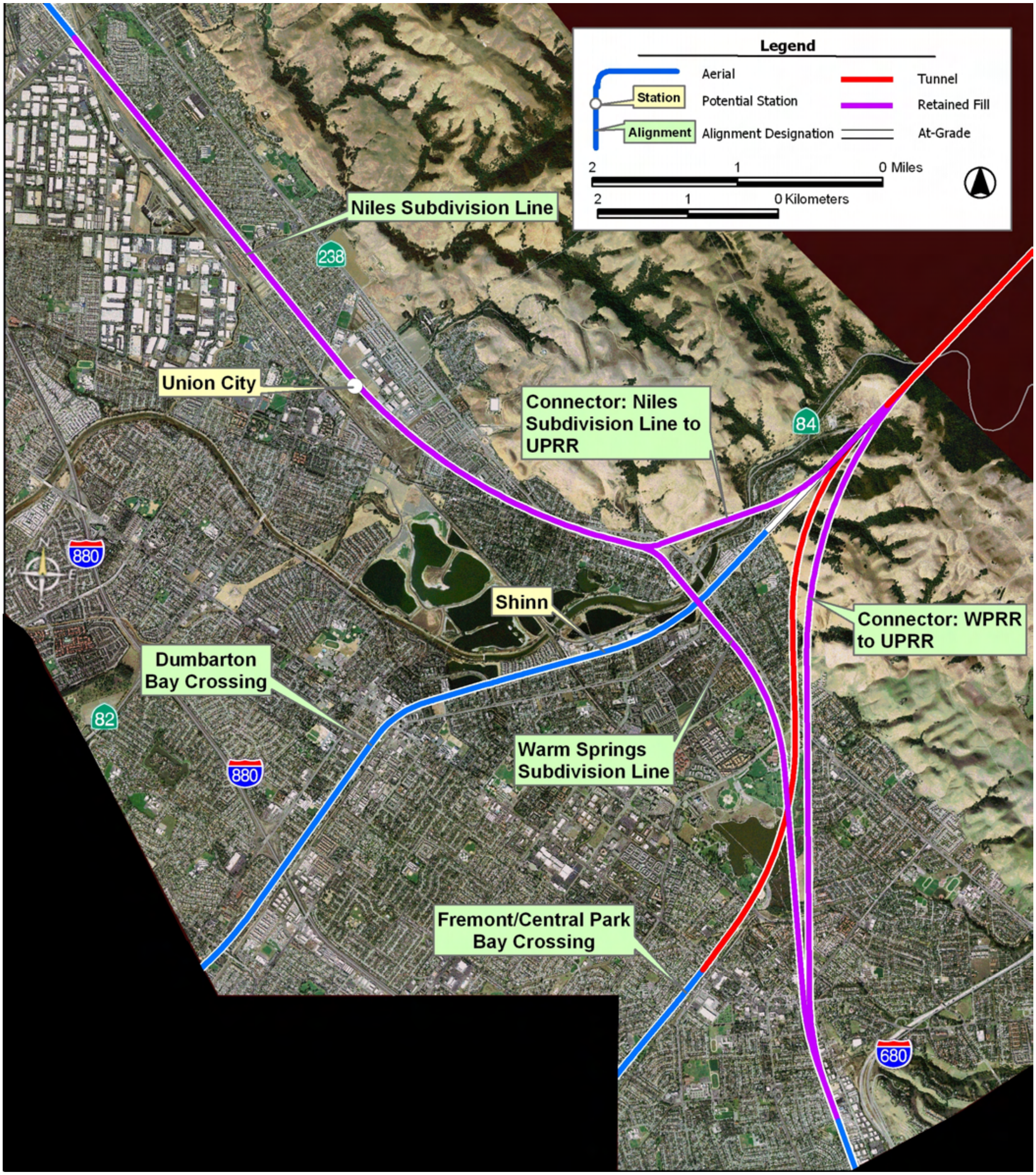

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Figure 2.5-6A
Niles Junction—Alignment Alternatives and Station Location Options Carried Forward for Further Consideration

B003960

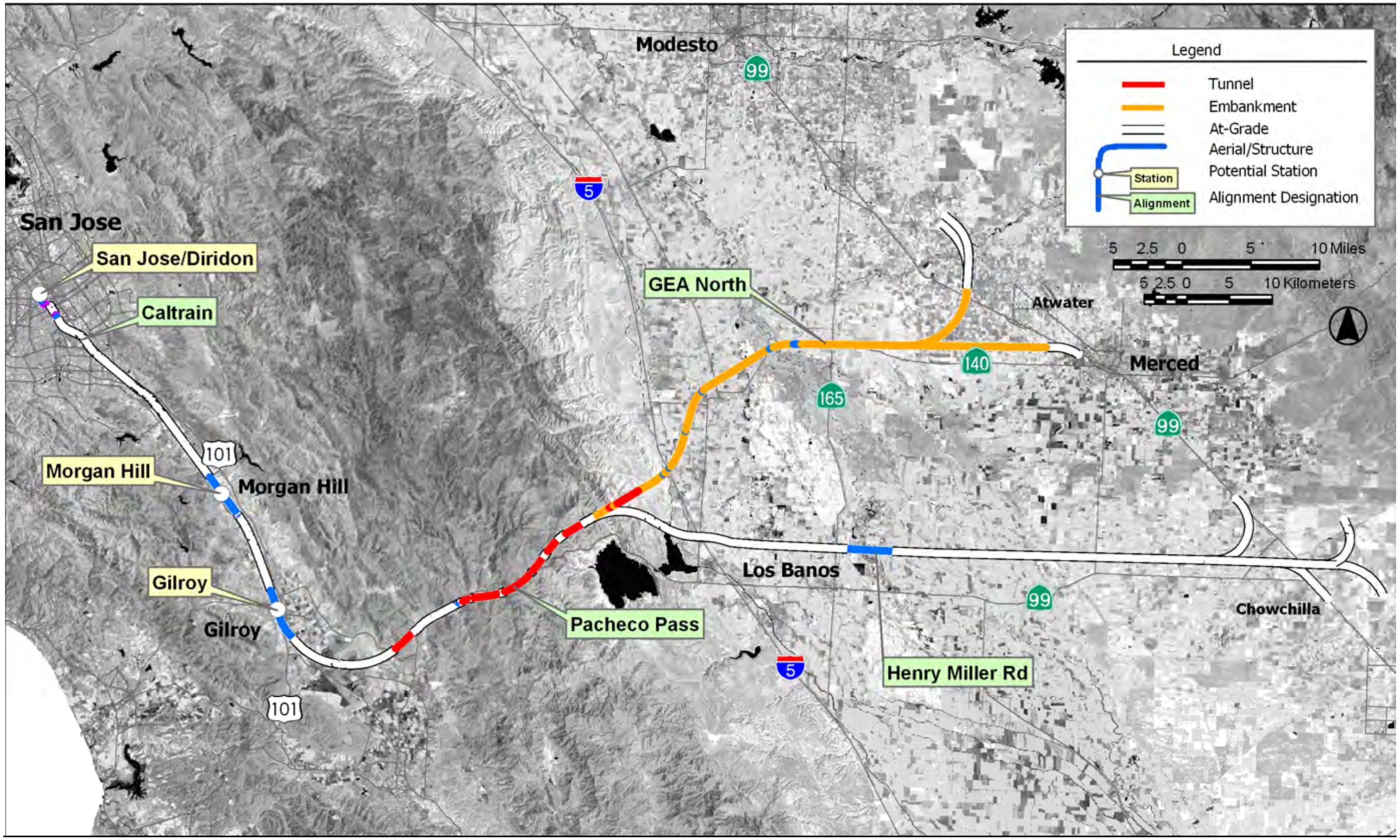

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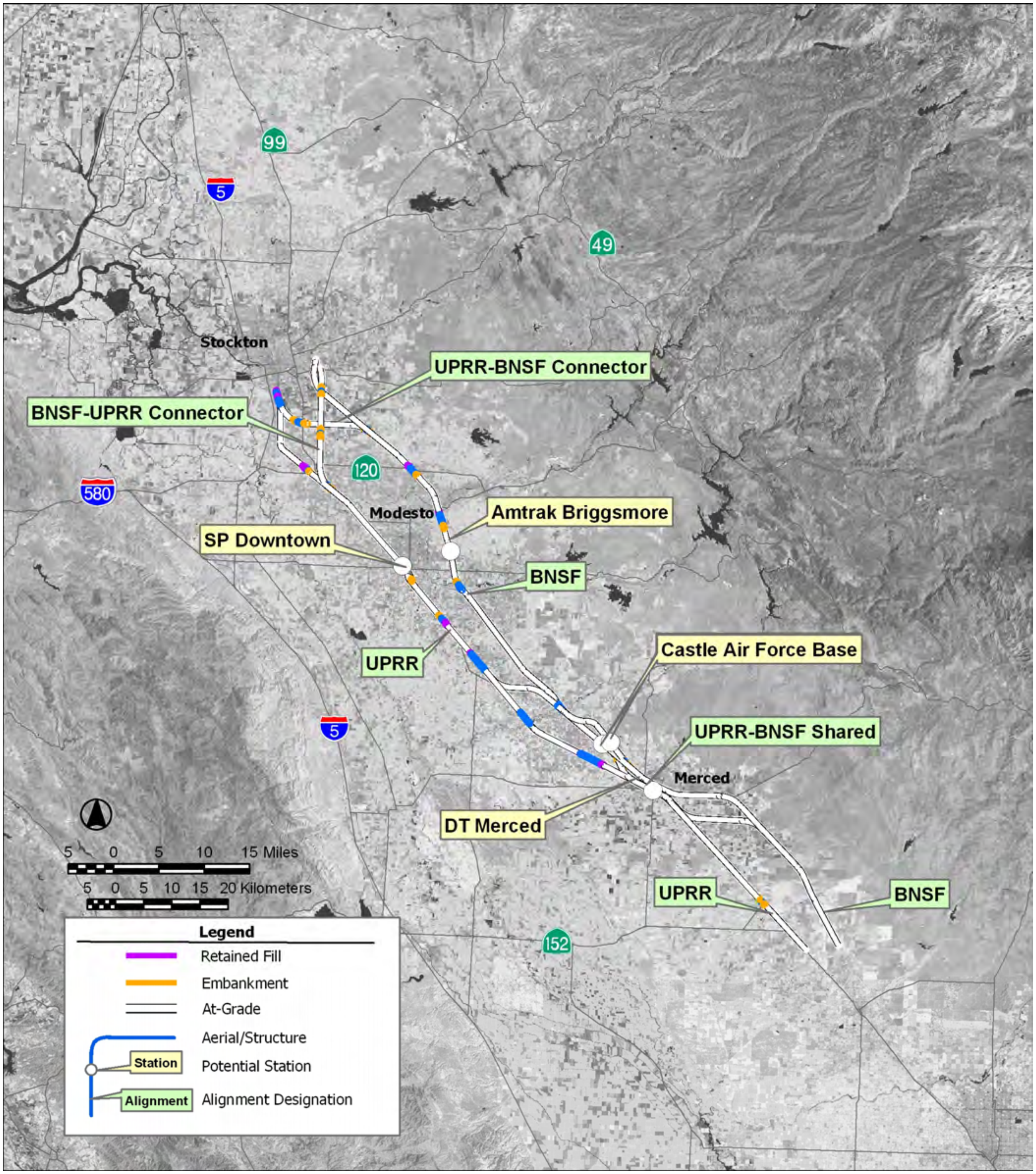
Figure 2.5-7
San Jose to Central Valley—Alignment Alternatives and Station Location Options Carried Forward for Further Consideration

Table 2.5-4
Bay Area to Merced: High-Speed Train Alignment Alternatives and Station Location Options Considered and Eliminated

Alignment or Station	Reason for Elimination							
	Construction	Incompatibility	Right-of-Way	Connectivity / Accessibility	Revenue / Ridership	Alignment Eliminated*	Environment	Environmental Concerns
San Francisco to San Jose								
US-101 Alignment (exclusive guideway)	P	S	P				P	Visual, land use (right-of-way acquisition) impacts
Caltrain Corridor (exclusive guideway)	P	P	P				P	Visual, land use (right-of-way acquisition), cultural resources impacts
I-280 Alignment	P		P				P	Visual, land use (right-of-way acquisition) impacts
Station Locations								
Millbrae–SFO (US-101)						P		
Redwood City (US-101)						P		
Santa Clara (Caltrain)					P			Station area would be served by Diridon Station only 3 miles away
Oakland to San Jose								
Mulford Line	P	P	P				P	Visual, land use, wetlands, parklands impacts
I-880 (Note: Only Oakland to Fremont portion to be eliminated)	P		P					
Former WPRR Rail Line to Mulford Line (WPRR/Niles/Mulford alignment)	P						P	Wetlands, parklands impacts
Hayward Line via tunnel to Mulford Line (Hayward/Tunnel/Mulford alignment)	P	S	P				P	Wetlands, parklands, land use impacts; seismic constraints
Former WPRR Rail Line via tunnel to Mulford Line (WPRR/Tunnel/Mulford)	P	S	P				P	Wetlands, parklands, land use impacts; seismic constraints
Former WPRR Rail Line to Hayward Line to I-880 (WPRR/Hayward/I-880)	P							
Former WPRR (Warm Springs to San Jose)	P		P					
Tunnel under Fremont Central Park	P						S	Seismic constraints, parklands
Station Locations								
Lake Merritt		P		P				
Jack London Square	P			P				
I-880 Hegenberger						P		
Coliseum BART (WPRR)						P		
Mowry Avenue	P					P		
San Jose to Central Valley								

Alignment or Station	Reason for Elimination							
	Construction	**Incompatibility**	**Right-of-Way**	**Connectivity / Accessibility**	**Revenue / Ridership**	**Alignment Eliminated***	**Environment**	**Environmental Concerns**
Merced Southern alignment (Central Valley Portion of San Jose-Merced section for Diablo Range Direct alignments)							P	San Luis National Wildlife Refuge impacts
Direct Tunnel Alignment (Northern or Southern Connection to Merced	P						S	Seismic constraints
Diablo Range Direct Alignments (Northern Alignment and alignments through Henry Coe State Park)	P						P	Parklands, habitat fragmentation, high value aquatic resources, visual, noise impacts
Caltrain/Morgan Hill/Foothill/Pacheco Pass Alignment	P	P		P			P	Visual, land use impacts
Caltrain/Morgan Hill/East US-101/Pacheco Pass Alignment		P		P				
Caltrain/Morgan Hill/Pacheco Pass Alignment	P		P					
Station Locations								
Morgan Hill (Foothills)				P		P		
Morgan Hill (east of US-101)				P		P		
Los Banos					P		P	Water resources, threatened and endangered species, growth related impacts
East Bay to Central Valley								
SR-84/South of Livermore		S		S			P	Natural resources, habitat and endangered species, agricultural lands, water resources impacts
SR-84/I-580/UPRR		S		S			P	Natural resources, habitat and endangered species, agricultural lands, water resources impacts
I-580: Bay Fair to Pleasanton	P		S					Construction, logistical constraints, right-of-way
Station Locations								
Pleasanton (I-680/SR-84)				S		P		
Livermore (Greenville Rd/SR-84/UPRR)				S		P		
Livermore (Isabel/SR-84)				S		P		
Central Valley Alignments								
West of SR-99				P			P	Farmlands, water resources, floodplains, severance impacts
East of SR-99				P			P	Farmlands, water resources, floodplains, severance impacts



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Federal Railroad Administration

Figure 2.5-11
Central Valley Alignment—Alignment Alternatives and Station Location Options Carried Forward for Further Consideration

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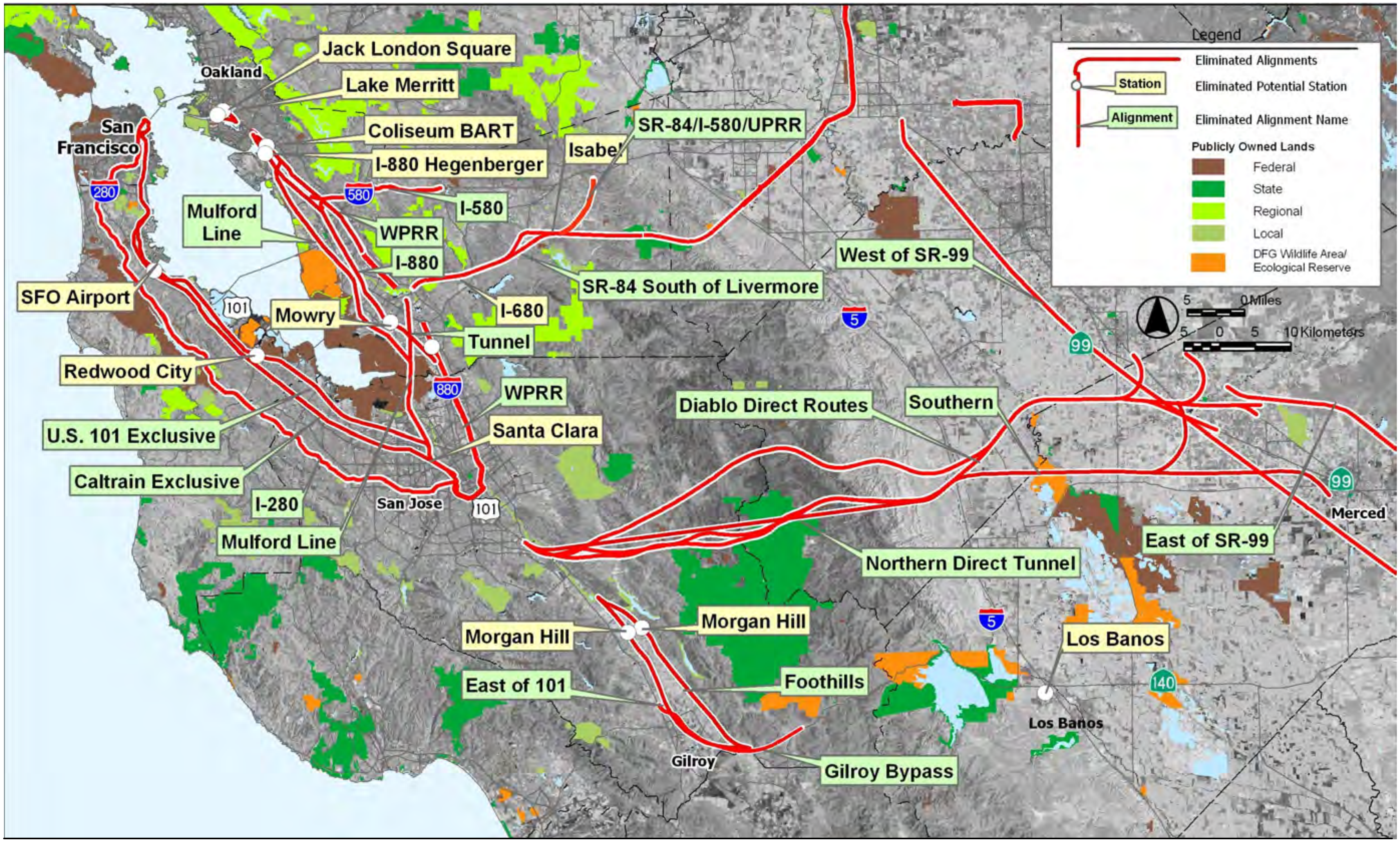

Figure 2.5-12
Alignment Alternatives and Station Location Options Considered but Eliminated from Further Consideration

Alignment or Station	Reason for Elimination: Construction	Incompatibility	Right-of-Way	Connectivity/ Accessibility	Revenue/ Ridership	Alignment Eliminated*	Environment	Environmental Concerns
Definitions:								

Reason: Primary (P) and secondary (S) reasons for elimination.

Construction: Engineering and construction complexity and initial and/or recurring costs would render the project impracticable and logistical constraints.

Environment: High potential for considerable impacts to natural resources, including water resources, streams, floodplains, wetlands, and habitat of threatened or endangered species, would fail to meet project objectives.

Incompatibility: Incompatibility with current or planned local land use as defined in local plans would fail to meet project objectives.

Right-of-Way: Lack of available rights-of-way or extensive right-of-way needs would result in high acquisition costs and/or delays that would render the project impracticable.

Connectivity/Accessibility: Limited connectivity with other transportation modes (aviation, highway, and/or transit systems) would impair the service quality, could reduce ridership of the HST system, and would fail to meet the project purpose.

Ridership/Revenue: The alignment/station would result in longer trip times and/or have suboptimal operating characteristics and would have low ridership and revenue and would fail to meet the project purpose.

Alignment Eliminated: Station or connection eliminated because the connecting alignment was eliminated.

* Alignment Eliminated column applies only to station locations. If an alignment is eliminated, a specific station location may no longer be necessary.

2.5.3 Maintenance and Storage Facilities

Representative maintenance and storage facilities that would be necessary to support the HST fleet have been considered in this Program EIR/EIS. A rail system simulation model was used to develop an overall operating and maintenance concept, based on an HST system with termini in both San Francisco and Oakland, that would be responsive to the forecast representative demand and that could deliver the levels of HST service desired. Only general track locations and infrastructure configurations were developed for these facilities for this Program EIR/EIS. Other possible sites would be considered when detailed system requirements, land use, and site information are available at the project level. The specific facilities considered in this Program EIR/EIS are listed below and illustrated in Figure 2.5-13.

- West Oakland: One site for a fleet storage/service and inspection/light maintenance facility could be located two blocks northwest of where Peralta Street intersects Mandela Parkway and southeast of where the alignment is parallel to I-880.
- Merced: One site for a fleet storage/service and inspection/light maintenance facility could be located near Castle AFB.

Because of the constraints of existing urban development around some of the terminus station locations, it is assumed that only minimal storage and very basic service, inspection, and light maintenance functions would be integrated into the station infrastructure. The majority of the fleet storage and service, inspection, maintenance, and repair requirements are assumed to be supported at two types of independent facilities that were defined and generally sited.

3 AFFECTED ENVIRONMENT, ENVIRONMENTAL CONSEQUENCES, AND MITIGATION STRATEGIES

3.0 Introduction

This chapter addresses potential impacts on environmental resources, treating each resource in a separate subsection. CEQA encourages state agencies to prepare joint CEQA-NEPA documents and also to rely on EISs prepared for compliance with NEPA to satisfy CEQA requirements where possible and appropriate. The Authority and the FRA have used their best judgment in preparing this combined Program EIR/EIS to satisfy both CEQA and NEPA requirements, and, as a result, it contains more information than is mandated by either the federal or state statutory and regulatory requirements. Including this information is appropriate because of the complex and unusual nature of, and the technical issues involved in, the project, the proposed HST system. In addition, Chapter 9, "Unavoidable Adverse Environmental Impacts," includes summary information on certain CEQA requirements discussed in this chapter.

Each environmental resource section of this chapter includes potential mitigation strategies that would be further refined during project-level design and analysis for sections of the HST system. Specific design features are outlined that will be applied during the implementation of the HST system to avoid, minimize, or mitigate potential impacts.

The Authority has focused on avoiding and minimizing potential impacts through rigorous planning and thoughtful design. The Authority has minimized overall impact potential by defining alignments to stay within existing public and railroad rights-of-way to the extent feasible, while still accommodating the appropriate features and design standards for the alternatives. The program level of environmental analysis provides a means to avoid and minimize adverse environmental impacts in the review and refinement of HST Alignment Alternatives and station location options, and identifies mitigation strategies for further consideration in project-level documents. The potential impacts associated with the implementation of the proposed HST system, many of which will be highly site specific, would be further addressed during subsequent project-level environmental review. During project-level review more precise information will be available regarding the location and design of proposed facilities. Using the level of design and engineering detail to be provided during project-level analyses, the Authority will implement approved mitigation strategies; further investigate ways to avoid, minimize, and mitigate potential impacts; and identify site-specific mitigation for sections of the HST system.

3.0.1 Purpose and Content of This Chapter

The purpose of this chapter is to describe existing environmental conditions in the areas that would be affected by the proposed HST Alignment Alternatives and the No Project Alternative, evaluate potential environmental impacts associated with constructing and operating the HST Alignment Alternatives, and present potential program-level mitigation strategies to avoid or reduce those impacts. The analysis presented in this chapter addresses the general effects of a program of actions that would make up the proposed HST system in the Bay Area to Central Valley study region. This chapter describes the general differences in potential environmental consequences between the No Project Alternative and the HST Alignment Alternatives identified in Chapter 2. The analysis also identifies key differences among the potential impacts associated with the various HST Alignment Alternatives and station location options, to support the selection of preferred alignments and station location options in the Bay Area to Central Valley study region.

Chapter 7, "High-Speed Train Network and Alignment Alternatives Comparisons," summarizes and compares the physical and operational characteristics and potential environmental consequences associated with the various HST Alignment Alternatives and describes the differences among the HST

Network Alternatives. A preferred HST Network Alternative and preferred alignment was identified following public and agency comment on the draft Program EIR/EIS and is defined in Chapter 8.

Many sources were used in the preparation of this document. References to these sources are cited in text and in Chapter 14.

3.0.2 Organization of This Chapter

This chapter is organized into sections by resource topic. The resource topics are grouped as follows.

- Transportation and related topics-air quality, noise and vibration, energy, and electromagnetic interference.
- Human environment-land use and community impacts, parklands, farmlands and agriculture, aesthetics and visual resources, socioeconomics, utilities and public services, and hazardous materials/wastes.
- Cultural resources (archaeological resources, historic properties) and paleontological resources.
- Natural environment-geology and seismic hazards, hydrology and water resources, and biological resources, including wetlands.
- Section 4(f) and 6(f) resources (certain types of publicly owned parklands, recreation areas, wildlife/waterfowl refuges, and historic sites).

Each resource topic section contains the following information.

- Regulatory requirements and methods of evaluation.
- Affected environment.
- Environmental consequences.
- Role of design practices in avoiding and minimizing effects. Mitigation strategies and CEQA significance conclusions.
- Subsequent analysis.

The methods of evaluation and regulatory requirements discussions for each resource topic describe the assumptions, approach for evaluation, and criteria used to identify potential impacts as significant (potentially requiring mitigation) and identify the relevant statutes and CEQA, NEPA, or regulatory agency guidelines relevant to future project approvals or decisions for that resource topic. The methods of impact evaluation were developed with input from state and federal resource agencies. The agencies acknowledge that this is a planning-level EIR/EIS aimed at making broad decisions to help determine the corridors and alignments to carry forward for project-level environmental evaluation. Key differences in potential impacts of each of the alignment alternatives are described.

As described in Chapter 2, "Alternatives," ridership for this system was estimated to vary between 90 million and 117 million passengers (32 million riders would be long-distance commuters) for 2030. For this Program EIR/EIS, the higher ridership forecast of 117 million intercity trips, including 32 million long-distance commute trips, provides a reasonable representation of total capacity and serves as a representative worst-case scenario for analyzing the potential environmental impacts from the physical and operational aspects of the alternatives in 2030. This higher forecast is generally used as a basis for defining the alternatives and is referred to hereafter as the representative demand. In some specific analyses (e.g., energy, air quality, transportation), high-end forecasts would result in potential benefits.

In those cases, additional analysis is included to address the impacts associated with lower ridership forecasts.

The affected environment discussions summarize the information that provides the basis for analysis of potential environmental impacts on each environmental resource. Information in the affected environment discussions is presented for each of the six identified corridors in the study region. The six corridors are San Francisco to San J:Jse, Oakland to San J:Jse, San Jose to Central Valley, East Bay to Central Valley, San Francisco Bay Crossings, and Central Valley. Because the proposed HST system would not be operational until the year 2020, the affected environment discussions describe both the existing conditions as of 2006 and, where appropriate and not overly speculative, the anticipated 2030 conditions that would pertain when the project becomes operational. For disciplines where projections of future changes in existing conditions would be overly speculative, the existing 2006 conditions were used as a proxy for the 2030 conditions. For some disciplines-such as transportation, energy, air quality, and land use-future conditions are routinely projected in adopted regional or local planning documents or are forecast by public agencies. In these cases, the existing conditions and the projected 2030 conditions were used as the basis for impact analysis. The technical studies addressing each resource topic provided key information for the preparation of the affected environment discussions.

The environmental consequences discussions describe the potential environmental impacts (both adverse and beneficial) of the HST Alignment Alternatives in comparison to the No Project Alternative. Each discussion begins by comparing existing conditions with 2030 No Project conditions to describe the consequences of the No Project Alternative and how environmental conditions are expected to change during the timeframe required to bring the proposed HST system online. Po described above, existing (2006) conditions were used as a proxy for 2030 No Project conditions where 2030 baseline information was unavailable, could not be projected, or would be overly speculative. Using 2030 No Project conditions as a basis for comparison, the analysis of impacts then addresses direct and indirect impacts for the proposed HST Alignment Alternatives, as well as potential cumulative impacts. Measures that already have been included as part of the proposed HST Alignment Alternatives to reduce or avoid potential environmental impacts were incorporated into this analysis; examples include locating the alignment within an existing transportation corridor and tunneling to avoid surface disruption in sensitive areas, such as parklands and wildlife habitat areas. The impact analyses compare logical segments of the alignment alternatives and station location options with one another.

For many of the environmental resources, broad study areas were defined to describe a wide context of the existing resources in proximity to proposed improvements. For example, the study area for floodplains extends 100 ft (30.5 meters [m]) on either side of the centerline of the alignment considered. However, the right-of-way necessary for the improvements considered is much smaller (e.g., only 25 ft [7.6 m] on either side of centerline for HST). Potential HST alignment floodplain impacts are described for the 50 ft (25 m) in total width typically needed for the track structures.

Potential impacts on public services, such as traffic and circulation and utilities, are also addressed in Chapter 3. However, specific issues will be addressed only during subsequent project-level environmental review, when more precise information will be available regarding location and design of the facilities proposed (e.g., elevated, at-grade, access locations, station design features, and fencing type and location). The detail of engineering associated with the project-level environmental analysis will allow the Authority to identify system requirements and further investigate ways to avoid, minimize, and mitigate potential effects on the provision of such services.

A. RELATIONSHIP OF THIS CHAPTER TO OTHER CHAPTERS

- The impacts of the HST system were analyzed using a multistep process and are presented accordingly in several chapters.
- This chapter presents the potential impacts of HST Alignment Alternatives, which are the building blocks for creating representative network alternatives.
- Chapter 7, "High-Speed Train Network and Alignment Alternatives Comparisons," compares the total estimated impacts for the 21 HST Network Alternatives, which represent different ways to

implement the HST system in the study region using combinations of HST Alignment Alternatives and station location options.

- Chapter 5 presents the potential growth effects of the HST system, and Chapter 9 presents the potential unavoidable adverse impacts.

For more information on the relationship between HST Alignment Alternatives and Network Alternatives and for definitions of specific terms, such as study region and station location option, see Chapter 2, "Alternatives."

B. DESIGN FEATURES/PRACTICES AND MITIGATION STRATEGIES

As currently planned, the proposed HST system would avoid and minimize potential negative environmental consequences. Conceptual designs of the HST system meet the project objectives (Chapter 1, "Purpose and Need and Objectives") and design criteria (California High Speed Rail Authority 2004), which set specific goals to avoid and minimize negative environmental consequences. In addition, design and construction practices have been identified that would be employed as the project is developed further in project-level environmental review, final design, and construction stages. Although many of these practices are explicitly included in the project description and included in the capital cost estimates for the project, their application to avoidance and minimization of p:ltential impacts may not be readily apparent. Thus, for each environmental resource topic (section of Chapter 3), applicable design and construction practices and resulting features related to the potential impacts identified in that section are discussed.

The mitigation strategy discussions describe potential approaches that can be identified at a program level for use to avoid, minimize, or reduce potentially significant environmental impacts.

Finally, each resource topic section includes a subsequent analysis discussion summarizing directions for more detailed study during project-level environmental review and documentation.

HST station. Because the HST stations are generally located in the city centers, they are assumed to be located closer to larger population and work centers than airports. The HST line-haul travel fare was estimated using the fare schedule presented in the *Bay Area/California High-Speed Rail Ridership and Revenue Forecasting Study Levels-of-Service Assumptions and Forecast Alternatives Report* (Cambridge Systematics 2007). Interregional and intraregional fares were set using a different set of assumptions to compete more directly with air and commuter rail, respectively.

Table 3.2-19
High-Speed Train One-Way Door-to-Door Trip Passenger Costs (in 2005 Dollars)[a]

City Pairs	Average Total Cost (dollars)
Los Angeles downtown to San Francisco downtown	82
Fresno downtown to Los Angeles downtown	63
Los Angeles downtown to San Diego downtown	43
Burbank (airport) to San Jose downtown	67
Sacramento downtown to San Jose downtown	55

[a] Based on fares plus parking costs, auto operating costs, and tolls paid to access or egress from a train station.
Source: Cambridge Systematics 2007.

Depending on city pair, level of state support for fare subsidies, and competition, intercity passenger rail would be cost-competitive with the HST. On average, given current fares for Amtrak service and the proposed fares for HST, conventional intercity service would cost 4 to 17% less than the HST for the Los Angeles to San Diego and Sacramento to San Jose city pairs listed above, respectively (assuming the same access and egress fees as the HST). These are the only two city pairs with current conventional rail service. Conventional rail would also be considerably less expensive than air, based on the representative city pairs.

Cost Effects of the High-Speed Train Alternatives

The HST alternatives could provide an overall passenger cost savings for all city pairs analyzed. On average, passengers could save from 22% to 87% on the HST, depending on city pair compared with the No Project Alternative. The HST mode is significantly less expensive than the highway mode for long distance travel, is cost-competitive with the highway mode for shorter distance trips between regions, and is always less expensive than the air mode. For all city pairs, the HST provides a price-competitive alternative to existing airline service and the automobile. The passenger costs would not vary noticeably between the HST Alignment Alternatives.

3.2.4 High-Speed Train Network Alternatives and Station Location Options Comparison

Travel conditions do not vary considerably between the different HST Alignment Alternatives. Within each corridor, the HST Alignment Alternatives serve similar potential markets and would have the same infrastructure requirements. HST travel time, connectivity, and passenger costs would vary with the HST Network Alternatives. This section discusses the relative travel condition differences between the HST Network Alternatives and station location options.

The Altamont Pass network alternatives include a potential station at Tracy and the Tri-Valley (at Livermore or Pleasanton) and place Merced on the San Francisco to Los Angeles segment of the HST system, which would result in a higher frequency of service to/from Merced. The Tracy station would serve other nearby Central Valley communities (such as Manteca), and the Tri-Valley station would serve not only the Livermore, Pleasanton, and Dublin area but would also be the nearest station for many cities in Contra Costa County. The Altamont Pass network alternatives would therefore improve travel conditions to these markets.

The Pacheco Pass alignment includes a potential station at Gilroy (or Morgan Hill), and Pacheco Pass network alternatives would have more frequent service to San Jose. The populations that would be served by the Gilroy station would have improved travel conditions (including shorter access times and access costs) with the Pacheco Pass network alternatives. The potential Gilroy/Morgan Hill station would have impact on travel conditions for a large area because, in addition to serving Southern Santa Clara County, it would also be the most accessible station location for serving the Santa Cruz, Monterey/Carmel, and Salinas populations.

The selection of an HST network alternative to serve the Bay Area cities will consider many factors, including the ability to meet the purpose and need of the HST system in the Bay area. This Program EIR/EIS evaluates potential service to the Bay Area along the San Francisco Peninsula and/or potential service along the East Bay. If service to San Francisco, Oakland, and San Jose were pursued, the number of intermodal connections would be greatly increased. However, if only one or two of these cities were directly served by the proposed HST system, service to each of the remaining termini stations would be greatly increased. However, the access times and access costs would increase significantly, and the competitiveness of the new mode on the part or parts of the Bay not served would also be reduced. For example, if the East Bay is not directly served, all trains bound for the Bay Area would terminate in downtown San Francisco and/or San Jose. However, there would be no HST link to directly serve Oakland or the Oakland Airport. Potential HST passengers from much of the East Bay would have to either use the Capitol Corridor, mass transit, or drive to San Francisco, San Jose, or the peninsula to use the HST service.

Potential Station Locations

- For service to downtown San Francisco, the Transbay Transit Center and the 4th and King Station were selected for further evaluation. The 4th and King Station is the existing terminus for the Caltrain commuter rail service. This station site (adjacent to AT&T Park) is well connected to the San Francisco Muni system but stops more than 1 mi short of the financial district of downtown San Francisco and does not connect to BART. The Transbay Transit Center would offer significantly greater connectivity to San Francisco and the greater Bay Area than the existing 4th and King site because of its location in the heart of the downtown San Francisco financial district, where many potential HST passengers could walk to the station. In addition, the Transbay Transit Center would serve as the transit hub for all of the major services to downtown San Francisco, with the advantage of direct connections to BART and San Francisco Muni. The 4th and King Station would have about a 2.5-minute shorter line-haul travel time to San Francisco than the Transbay Transit Center because the trains would travel at relatively slow speeds between 4th and King and the Transbay Transit Center, a distance of 1.2 mi (1.9 km). However, because the Transbay Transit Center would offer greater connectivity to San Francisco and the greater Bay Area than the existing 4th and King site, total travel times to downtown destinations via the Transbay Transit Center are expected to be superior.
- The West Oakland station and the 12th Street/City Center station were selected for further consideration for the Oakland terminus station. Both of these potential stations would directly connect with BART, and both would have good freeway access. The 12th Street/City Center station would have superior connectivity because it is located in the heart of downtown Oakland, where many potential HST passengers could walk to the station. The 12th Street/City Center BART station is also a transfer station, providing greater connectivity to the regional rail transit system.
- A potential station to serve San Mateo County would be located either at Redwood City or Palo Alto. Both would be multimodal stations at existing Caltrain station locations. The Palo Alto

CAMBRIDGE SYSTEMATICS

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1.0 Executive Summary

1.0 Executive Summary

This report presents an analysis of the potential economic development and growth effects for the alternatives considered in the Bay Area to Central Valley Program-Level Environmental Impact Report (EIR) and Tier 1 Environmental Impact Statement (EIS). The intent of the analysis is to understand the extent of statewide, regional, and local growth effects in terms of population and employment change, and land consumption associated with these changes. This report:

- Identifies the potential statewide-, regional-, and county-level employment and population changes associated with each alternative;
- Identifies the urban area size needed to accommodate population and employment growth; and
- Identifies the potential for employment and population concentration in the vicinity of high-speed train (HST) stations.

The report presents results for existing conditions (years 2002 and 2005) and a forecast year of 2030.

1.1 Economic Growth and Development Analysis

The potential economic growth stimulus of a transportation investment may be measured not only in terms of its *overall magnitude*, but also in terms of its *relative distribution* among different geographic areas. In economic terms, this distinction is the "generative" versus "distributive" dimensions of growth. Transportation investments, such as airports, highways, transit, and high-speed train, comprise just one of many factors that determine how much growth will occur, and whether it will be generative versus distributive in nature. Other major growth factors, such as education level, housing affordability, land availability, and others, interact in complex and sometimes unpredictable ways for communities, regions, and entire states. Public and private policy tools, such as land use planning and zoning, enterprise development zones, and infrastructure funding, can also influence both the magnitude and the distribution of economic growth.

The results presented in this report were developed in the Transportation Economic Development Impact System (TREDIS), which combines business attraction and macroeconomic simulation model, together with an employment allocation routine and a residential spatial allocation model. The process considered the effects that changes in travel options transportation congestion and delay between existing conditions and future years would have on the State's economic growth. The process also modeled several dimensions of growth and spatial reallocation that could occur with any of the system alternatives, and considered many possible impacts of high-speed train on jobs, population, and land development, including the following:

- Increased employment because of attraction of new businesses to California, or expansion by businesses already located in the State;
- Reallocation of employment because of changes in business location by firms already located in California;
- Population growth associated with business attraction, expansion, and spatial shift;
- Shift in residential population between counties (with fixed employment location) due to changed accessibility for the HST Alternatives (i.e., long-distance commutes);
- Shift in employment for retail and personal service establishments that follow shifts in residential location;
- Changes in densification and development patterns over time, both with and without the presence of an HST station;
- Allocation of population and employment between currently developed and undeveloped areas within each county; and
- Consumption of undeveloped or "raw" land to house projected population and employment growth.

1.2 Statewide and Regional Growth Effects

Statewide population is expected to grow by about 33 percent between 2005 and 2030 (Table 1.1). Compared to the No-Project Alternative, the population growth is roughly 1.3 to 1.4 percent higher for the HST Alternatives. These population differences between alternatives represent the increased accessibility provided by the transportation investments; hence, an HST investment would lead to greater economic growth within the State than the No-Project Alternative. These statewide figures follow the same general pattern at the regional level, with the exception of the North Central Valley, where population growth is about 2 to 3 percent higher for the HST Alternative than the No-Project Alternative. San Diego County is also project to experience 4 to 5 percent higher population growth with the HST alternatives.

The HST population growth rate represents a statewide increase of 500,000 people over the No-Project Alternative. However, the greatest population increase is between 2005 existing conditions and the 2030 No-Project Alternative, with relatively small increases in population growth occurring between alternatives in the year 2030. Specifically, California is projected to add about 12 million people between 2005 and the 2030 No-Project Alternative. Compared to the No-Project Alternative, the Altamont HST Alternative is projected to add about 495,000 people, while the Pacheco HST Alternative is projected to add about 501,000 people.

Table 1.1 Projected Population Growth Rate by Region

Region	Year 2005 Population	Growth Rate (2005 to 2030)		
		No-Project Alternative	Pacheco HST Alternative	Altamont HST Alternative
Alameda County	1,451,065	40.5%	41.4%	41.6%
Contra Costa County	1,017,644	51.6%	52.3%	51.9%
San Francisco County	741,025	7.4%	9.3%	8.1%
San Mateo County	701,175	16.1%	17.1%	17.9%
Santa Clara County	1,705,158	26.3%	28.1%	28.8%
Study Area – Bay Area	5,616,067	30.8%	32.0%	32.2%
Fresno County	878,089	47.8%	49.7%	49.5%
Madera County	142,530	54.2%	61.1%	61.0%
Merced County	242,249	80.8%	86.7%	84.7%
Sacramento County	1,363,423	68.2%	69.1%	69.8%
San Joaquin County	664,796	85.0%	86.7%	88.7%
Stanislaus County	505,492	47.3%	50.0%	55.1%
Study Area – Central Valley	3,796,579	63.9%	66.0%	67.1%
Core Study Area	9,412,646	44.1%	45.7%	46.3%
South Sacramento Valley	658,108	65.7%	66.0%	66.2%
South San Joaquin Valley	1,311,579	51.7%	56.2%	56.1%
Southern California	16,843,742	23.8%	24.6%	24.4%
San Diego County	2,936,609	36.4%	41.2%	40.7%
Rest of California	4,991,463	32.5%	32.6%	32.5%
Statewide Total	**36,154,147**	**33.1%**	**34.5%**	**34.4%**

Source: Cambridge Systematics, Inc., 2007.

Statewide and regional employment growth rates are generally similar to the population growth rates, as shown in Table 1.2. Statewide employment is projected to increase by 37 percent under the No-Project Alternative, with an additional increase of 1.5 percent for the HST Alternative. The HST employment growth rate represents a statewide increase of about 320,000 jobs over the No-Project Alternative, with the Pacheco and Altamont HST Alternatives having nearly identical levels of statewide employment growth. As with population growth, however, this level of difference between the alternatives is very small compared to the overall level of growth represented by the No-Project Alternative relative to the 2005 existing conditions.

Table 1.2 Projected Employment Growth Rate by Region

Region	Year 2005 Employment	Growth Rate (2005 to 2030)		
		No-Project Alternative	Pacheco HST Alternative	Altamont HST Alternative
Alameda County	953,937	30.8%	32.0%	31.9%
Contra Costa County	508,854	50.0%	51.2%	50.8%
San Francisco County	779,357	25.2%	26.2%	25.9%
San Mateo County	522,830	37.2%	38.4%	38.5%
Santa Clara County	1,323,920	33.7%	34.8%	34.8%
Study Area – Bay Area	4,088,898	33.9%	35.0%	34.9%
Fresno County	435,769	35.2%	38.2%	38.0%
Madera County	56,892	60.6%	69.0%	69.3%
Merced County	87,365	31.7%	40.1%	38.5%
Sacramento County	805,978	56.3%	57.4%	57.7%
San Joaquin County	274,155	34.5%	37.0%	38.4%
Stanislaus County	224,491	41.1%	44.2%	48.2%
Study Area – Central Valley	1,884,650	45.4%	48.0%	48.7%
Core Study Area	5,973,548	37.5%	39.1%	39.2%
South Sacramento Valley	456,834	59.6%	60.4%	60.7%
South San Joaquin Valley	576,935	40.1%	44.8%	44.6%
Southern California	9,290,841	32.5%	33.8%	33.7%
San Diego County	1,895,002	46.9%	49.3%	49.7%
Rest of California	2,709,974	39.3%	40.1%	39.9%
Statewide Total	**20,903,134**	**36.9%**	**38.4%**	**38.4%**

Source: Cambridge Systematics, Inc., 2007.

These modest statewide differences, however, conceal more substantial differences that are revealed by comparing some key differences at the regional and county levels:[1]

- Compared to the No-Project Alternative, the HST Alternatives exhibit higher employment and population growth rates in all regions and all counties.

- For the Pacheco HST Alternative, Madera and Merced Counties exhibit the largest relative increase in both population and employment, adding about 12,000 jobs and 24,000 people compared to the No-Project Alternative. Population and employment growth are also relatively strong in the other Central Valley locations, with relative employment growth larger than relative population growth.

[1] Regional results for the HST Alternatives are expressed relative to the No-Project Alternative, unless noted otherwise.

- For the Altamont HST Alternative, Madera, Merced, and Stanislaus Counties exhibit the largest relative increase in both population and employment. As with the Pacheco HST Alternative, population and employment growth also are relatively strong in the other Central Valley locations, with relative employment growth larger than relative population growth.

- Model results suggest that the additional population growth in the HST Alternative is driven by internal job growth related to initiation of HST service, rather than population shifts from the Bay Area and Southern California with commensurate long-distance commuting. Model results suggest a stronger propensity for redistribution of population *within* the Central Valley, with long-distance commuters relocating to lower cost and better positioned (for HST service) housing in areas such as Merced and Stanislaus Counties.

- For the rest of California, the HST Alternative exhibits a small, yet positive growth rate for both population and employment.

The HST Alternatives exhibit noticeable differences in the types of jobs that are attracted to different regions. Table 1.3 depicts the percent of growth by major industry group for the increment of jobs that are induced by the two HST alternatives (i.e., job growth above and beyond the No-Project Alternative). The HST Alternative exhibits a tendency to attract a higher proportion of jobs in the services; government; and finance, insurance, and real estate (FIRE) sectors. The strongest employment sectors for the HST Alternatives tend to be the most compatible for location in higher-density settings, such as near potential HST sites.

A variety of HST network, alignment, and station options were also evaluated in the Bay Area to Central Valley study area. Population and employment growth levels across the study area are projected to be similar among all the options. In general, systemwide growth inducement can be expected to change at similar rates to changes in ridership between HST Network Alternatives due to the close correspondence between HST ridership, highway and air congestion reduction, and traveler benefits. At a county and local level, growth inducement effects will be higher if a county has an HST station for a particular network alternative, and will decrease if no HST station is present. Differences are most likely in cases where HST service is split among multiple Bay Area termini or terminate in San Jose (for the Pacheco HST Alternative) or Union City (for the Altamont HST Alternative).

Table 1.3 Percent of Incremental Growth by Industry
Years 2005 to 2030

	Farming and Mining		Construction and Manufacturing		TCU and Trade		FIRE and Services		Government	
Incremental Growth Rate for Induced Employment	**Pacheco HST**	**Altamont HST**	**Pacheco HST**	**Altamont HST**	**Pacheco HST**	**Altamont HST**	**Pacheco HST**	**Altamont HST**	**Pacheco HST**	**Altamont HST**
Study Area – Bay Area	0%	0%	6%	5%	28%	29%	62%	63%	3%	3%
Study Area – Central Valley	2%	2%	6%	4%	25%	21%	63%	68%	5%	4%
Subtotal – Core Study Area	*1%*	*1%*	*6%*	*5%*	*27%*	*25%*	*62%*	*66%*	*4%*	*4%*
Southern Sacramento Valley	1%	2%	10%	9%	34%	33%	50%	52%	6%	5%
Southern San Joaquin Valley	5%	5%	4%	4%	20%	19%	66%	67%	4%	4%
Southern California	0%	1%	6%	7%	27%	29%	62%	60%	4%	4%
San Diego	0%	0%	4%	3%	32%	26%	59%	66%	4%	4%
Rest of California	4%	4%	9%	10%	38%	45%	44%	36%	5%	6%
Statewide Total	**1%**	**1%**	**6%**	**5%**	**28%**	**27%**	**61%**	**62%**	**4%**	**4%**

Source: Cambridge Systematics, Inc., 2007.

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■ 1.3 Local Growth and Land Consumption

Urbanized areas in the Bay Area and northern Central Valley are expected to grow by 39 percent between 2002 and 2030 under the No-Project Alternative, as shown in Table 1.4. This rate represents an increase of about 392,000 acres from today's 1,001,000 acres within the core study area. Urbanized area growth is expected to be an additional 2 percent (14,500 acres) higher for the Altamont HST Alternative and 1 percent (9,600 acres) higher for the Pacheco HST Alternative. As with the population and employment growth, the level of difference between alternatives for urbanized area size is very small when compared to the overall level of growth represented by the No-Project Alternative relative to the 2000 existing conditions.

Table 1.4 Increase in Urbanized Area Size by Region

Area	Year 2002 Urbanized Area Acreage	Percent Increase (Year 2002 to 2030)		
		No-Project Alternative	Altamont Pass Alternative	Pacheco Pass Alternative
Alameda County	141,654	32%	33%	32%
Contra Costa County	142,467	29%	30%	29%
San Francisco County*	23,277	29%	30%	30%
San Mateo County	70,869	13%	13%	14%
Santa Clara County	184,481	13%	13%	15%
Study Area – Bay Area	562,748	22%	23%	23%
Fresno County	96,977	55%	58%	58%
Madera County	23,255	56%	63%	62%
Merced County	31,712	91%	96%	94%
Sacramento County	157,101	51%	52%	52%
San Joaquin County	74,250	96%	95%	97%
Stanislaus County	55,426	34%	34%	39%
Study Area – Central Valley	438,721	61%	62%	63%
Core Study Area	1,001,469	39%	40%	41%

Source: Cambridge Systematics, Inc., 2007.

* Projected increases in urbanized area for San Francisco County are a function of the average densities used to calculate employment acreage. Because "greenfield" land is not available in San Francisco County, employment growth will need to be accommodated through densification and infill rather than through increases in urbanized area size implied in this table.

In general, HST station areas will establish a relatively stronger market for commercial and office development than the No-Project and Modal Alternatives. Research conducted for the Statewide Program EIR/EIS of urban rail systems in North America and the high-speed rail systems in Europe and Asia supports this conclusion. This research found that

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industries needing large numbers of highly skilled and specialized employees are most attracted to rail station area development, and that a noticeable densification pattern is likely to emerge in the vicinity of many HST stations under regular real estate market forces.

In fact, the research and analysis indicate that the considerably stronger draw of an HST station, when compared to a conventional intercity rail station or freeway interchanges, provides a potent tool for encouraging more compact development patterns. These development patterns would likely offer many businesses a competitive advantage within their industry, because of close proximity to ancillary industries (i.e., industry clustering) and a well-educated labor force. These advantages, known as *economies of agglomeration*, have emerged around the French and Japanese HST stations, and are accepted norms for land use planning for many urban transit station areas in Europe and North America.

The research also found that regulatory-style efforts by cities to encourage increased density and a mix of land uses near rail stations have been effective in creating even denser developments. A Central Valley city, for example, would have an easier time directing new development to downtown sites adjacent to their HST station than the outlying real estate markets created by freeway interchanges under the No-Project Alternative. Furthermore, the strong markets around HST stations are likely to attract development that would otherwise locate throughout a dispersed suburban region. Thus, development around HST stations will consist of both consolidation of currently projected growth (under the No-Project Alternative) and new regional employment and population associated with the HST Alternative.

■ 1.4 Significance of Findings

Overall, the No-Project and HST Network Alternatives represent very similar levels of growth effects in terms of urbanized area size and land consumption needs. The incremental effect of the HST Alternatives relative to the No-Project Alternative is very small when compared to the incremental effect of the No-Project Alternative relative to existing conditions.

Analysis of results for individual counties largely follows these general statewide results. Nonetheless, the HST Alternatives do create some larger incremental growth in some Central Valley locations. However, the incremental employment effect is much larger than the incremental population effect, suggesting that the HST Alternative does a better job at distributing employment throughout the State. Also, this result suggests that HST will not lead to wholesale shifts in residential location from the Bay Area and Los Angeles into the Central Valley.

Experiences in other countries have shown that an HST system can provide a location advantage to those areas that are in proximity to an HST station, while at the same time facilitating broader economic expansion for a much wider geographic region. HST's potential economic boost arises in two ways:

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1. An HST system would provide user benefits (travel time savings, cost reductions, accident reductions) and accessibility improvements for California's citizens; these user benefits can accrue not only to HST travelers, but also to travelers on other modes as trips are diverted from highways and airports resulting in reduced congestion.

2. HST would improve accessibility to labor and customer markets, thereby, improving the competitiveness of the State's industries and the overall economy. With this second effect, businesses that locate in close proximity to an HST station can operate more efficiently than businesses that locate elsewhere. Experience from overseas suggests that this competitive advantage is quite pronounced in high-wage employment sectors that are frequently in high demand in many communities. This second effect is much stronger for the HST Alternatives than the No-Project Alternative.

One of the most telling summary statistics is to combine population and employment growth projections with land consumption forecasts, providing a measure of "land consumed per new job and resident." Essentially, this metric tells us how efficient each alternative is at accommodating the projected growth; since the alternatives have very similar levels of overall growth, the efficiency by which that growth is accommodated becomes very important. Table 1.5 provides the relevant data and resulting metric for each of the alternatives; lower values of the metric suggest greater efficiency. The results indicate that the Pacheco HST Alternative is the most efficient of the alternatives, providing an incremental development density that is 1.3 percent more efficient (i.e., less land per new job and resident) than the No-Project Alternative, while the Altamont Alternative is 0.8 percent more efficient than the No-Project Alternative. The efficiency gains for both HST alternatives are achieved in conjunction with the higher population and employment growth projections compared to the No-Project Alternative.

Table 1.5 Marginal Land Consumption

	No-Project Alternative	**Pacheco HST Alternative**	**Altamont HST Alternative**
Land Consumption (thousands of ac)	392	402	407
Job Growth (thousands of jobs)	2,241	2,337	2,343
Population Growth (thousands of people)	4,155	4,304	4,354
Acres Consumed Per New Job and Resident*	***0.0613***	***0.0605***	***0.0608***
Efficiency Gain/Loss Relative to No-Project Alternative	–	+1.3%	+0.8%

Source: Cambridge Systematics, Inc., 2007.

*Value found by dividing land consumption by the sum of job growth and population growth.

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■ 1.5 Conclusions

All alternatives are associated with robust forecasts of population and employment growth throughout California. The alternatives are similar in terms of potential economic growth effects and land consumption. The major growth effect occurs for the No-Project Alternative in relation to existing conditions, with population and employment growth rates between 30 percent and 90 percent for nearly all counties.

The major difference between the system alternatives relates to the relative level of employment and population growth in different regions of the State. However, these relative differences are small, with a maximum county-level growth rate for the HST Alternatives (relative to the No-Project) of eight percent, and most counties having a differential growth rate of less than three percent.

In spite of these general findings, HST does provide synergistic opportunities to combine with regulatory-based development strategies that could limit land consumption in many counties to roughly the level needed for the other No-Project Alternative. While the HST Alternative leads to modest statewide increases in employment and population, it channels this growth into the areas where it can be managed with regulatory-style land use policies, and spares the vast regions of the State that would otherwise be unlikely to develop the jobs/housing balance and infrastructure to reduce sprawl and long-distance commuting.

2.0 Baseline/Affected Environment

2.0 Baseline/Affected Environment

2.1 Employment and Population Patterns

Over the last 30 years, California's population has grown from 20 million to over 36 million residents, while at the same time adding over 11 million jobs. Starting with the Gold Rush in 1849, California has continuously experienced rapid population and economic growth. Distance from eastern urban areas, an abundance of natural resources, a desirable climate, and numerous other factors have contributed to California's growth into the largest state in the nation.

Though California's economy is one of the most diverse in the world, as shown by the data in Table 2.1, over the last 30 years, its service sector has become the major economic motor increasing its participation over total employment from 21 to 36 percent during that period, while manufacturing and the government sectors decreased their participation from 18 to 9 percent and from 20 to 13 percent, respectively.

Table 2.1 California Employment Growth by Industry

Industry	Employment (1,000s)		Growth	Industry Share	
	1970	2005		1970	2005
Farming	360	628	74%	4%	3%
Mining, Construction	401	1,093	173%	4%	5%
Manufacturing	1,595	1,835	15%	18%	9%
Transportation, Communications and Utilities (TCU)	486	915	88%	5%	4%
Trade	1,801	4,159	131%	20%	20%
Finance, Insurance and Real Estate (FIRE)	724	1,929	166%	8%	9%
Services	1,865	7,568	306%	21%	36%
Government	1,825	2,778	52%	20%	13%
Total	**9,057**	**20,903**	**131%**	**100%**	**100%**

Source: Cambridge Systematics, Inc., 2007.

Year 2005 employment data by industrial sector and region are shown in Table 2.2. These data indicate the diversity in employment mix between different subregions within California. California's Central Valley is one of the most productive agriculture regions, making California the number one agricultural state for the last 50 years. Nearly one-third

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of all employment in the Central Valley is in agricultural-related enterprises, with nearly one-fifth of total employment in the South Central Valley directly in the farming industry. The Central Valley also exceeds the state average in government jobs, while trailing other regions in manufacturing and service-related employment.

The Bay Area has long been a source of finance and high technology. Gold Rush era financiers were headquartered in San Francisco, and much of the wealth generated during that period made its way through San Francisco's financial center. The Bay Area continues to be a financial center and was one of the major locations for the Internet boom of the late 1990s. Silicon Valley has one of the largest concentrations of computer manufacturers and research and development firms in the country. Currently, the Bay Area continues to lead the State in the percent of total jobs in service-related sectors, while trailing other regions in government-related employment.

Los Angeles is the second largest metropolitan area in the U.S., behind New York. Home to over 15 million residents, the Southern California region, which includes Los Angeles, Orange, and San Bernardino Counties, has developed from an agricultural and resort-based economy to a diverse economy, including the major location for the motion picture industry, defense contracting, and services.

Overall, California's economy like the nation's has become less focused on production of goods and more focused on services, entertainment, and trade. These trends hold when one looks beyond employment numbers to the contribution of different industry groups to the overall size of the economy, as shown in Table 2.3. Three service sector industries – business, social, and legal – are among the 10 fastest growing industries in California, with business services' contribution to gross state product (GSP) growing by 1,400 percent since 1977. The overall services sector grew by over 400 percent in real terms. The services and FIRE sectors accounted for nearly one-half of the growth in GSP since 1977, with the combined contribution of these groups growing from 31 to 55 percent of the total economy in California.

As of 2005, California was estimated to have about 36 million residents and nearly 21 million jobs. Table 2.4 displays county-level population and employment totals for the individual counties and county groupings that were included in one of the analysis regions. This table also displays an estimate of current urbanization magnitudes in each county for 2002. As expected, the inner Bay Area Counties, Sacramento County, as well as Southern California have the highest current levels of urbanization, with most other counties in the State having less than 10 percent of land at urbanized densities. All of these values serve as baseline estimates for the analysis of economic growth effects.

Table 2.2 Year 2005 Employment by Industrial Group

	Study Area – Bay Area	% of Regional Total	Study Area – Central Valley	% of Regional Total	Southern Sacramento Valley	% of Regional Total	Southern San Joaquin Valley	% of Regional Total	Southern California	% of Regional Total	San Diego	% of Regional Total	Rest of California	% of Regional Total	Statewide Total	% of Regional Total
Farming	52,986	1%	153,017	8%	23,496	5%	112,116	19%	134,414	1%	41,123	2%	110,438	4%	**627,589**	**3%**
Mining	3,749	0%	1,214	0%	672	0%	10,023	2%	10,066	0%	1,158	0%	4,406	0%	**31,288**	**0%**
Construction	200,188	5%	110,494	6%	35,876	8%	25,670	4%	445,411	5%	101,481	5%	142,577	5%	**1,061,697**	**5%**
Manufacturing	414,079	10%	127,765	7%	25,702	6%	27,893	5%	891,553	10%	122,773	6%	225,106	8%	**1,834,872**	**9%**
TCU	190,166	5%	75,965	4%	18,525	4%	25,136	4%	433,885	5%	60,648	3%	110,200	4%	**914,524**	**4%**
Wholesale	179,813	4%	67,563	4%	16,841	4%	16,446	3%	507,724	5%	66,127	3%	117,540	4%	**972,053**	**5%**
Retail	579,787	14%	297,432	16%	79,839	17%	82,911	14%	1,439,244	15%	285,675	15%	421,947	16%	**3,186,834**	**15%**
FIRE	394,036	10%	149,453	8%	42,296	9%	30,336	5%	893,749	10%	172,543	9%	246,424	9%	**1,928,837**	**9%**
Services	1,630,699	40%	550,584	29%	137,730	30%	135,745	24%	3,467,334	37%	684,891	36%	960,561	35%	**7,567,544**	**36%**
Government	443,395	11%	351,163	19%	75,858	17%	110,659	19%	1,067,460	11%	358,582	19%	370,778	14%	**2,777,895**	**13%**
Total	**4,088,898**	**100%**	**1,884,650**	**100%**	**456,834**	**100%**	**576,935**	**100%**	**9,290,841**	**100%**	**1,895,002**	**100%**	**2,709,974**	**100%**	**20,903,134**	**100%**

Source: Cambridge Systematics, Inc., 2007.

Table 2.3 California Gross State Product by Major Industries

Industry	Gross State Product (2005 Million Dollars)		Growth
	1977	2005	
Farming	14,897	17,773	19%
Mining	6,814	7,441	9%
Construction	25,542	58,768	130%
Manufacturing	93,380	120,744	29%
Transportation & utilities	41,065	48,008	17%
Wholesale trade	37,236	71,109	91%
Retail trade	54,708	87,517	60%
FIRE	89,323	292,279	227%
Services	80,983	405,608	401%
Government	77,216	137,096	78%
Total	**521,163**	**1,246,343**	**139%**

Source: U.S. Bureau of Economic Analysis.

Table 2.4 Year 2005 Population, Employment, and Urbanized Densities

County	Year 2005		Year 2002	
	Population	**Employment**	**Acreage of Land at Urbanized Densities for Employment and/or Population**	**Percent of Land Area at Urbanized Densities**
Alameda County	1,451,065	953,937	141,654	30
Contra Costa County	1,017,644	508,854	142,467	31%
San Francisco County	741,025	779,357	23,277	78%
San Mateo County	701,175	522,830	70,869	25%
Santa Clara County	1,705,158	1,323,920	184,481	22%
Study Area – Bay Area	***5,616,067***	***4,088,898***	***562,748***	***29%***
Fresno County	878,089	435,769	96,977	3%
Madera County	142,530	56,892	23,255	2%
Merced County	242,249	87,365	31,712	3%
Sacramento County	1,363,423	805,978	157,101	25%
San Joaquin County	664,796	274,155	74,250	8%
Stanislaus County	505,492	224,491	55,426	6%
Study Area – Central Valley	***3,796,579***	***1,884,650***	***438,721***	***12%***
Core Study Area Counties	**9,412,646**	**5,973,548**	**1,001,469**	**22%**
Southern Sacramento Valley	658,108	456,834	116,980	4%
Southern San Joaquin Valley	1,311,579	576,935	189,603	2%
Southern California	16,843,742	9,290,841	1,530,221	25%
San Diego County	2,936,609	1,895,002	340,837	13%
Rest of California	4,991,463	2,709,974	3,105,348	6%
Statewide Total	**36,154,147**	**20,903,134**	**6,284,458**	**6%**

■ 2.2 Alternatives Considered

This economic growth analysis considered the three system alternatives developed for the Bay Area to Central Valley Program-Level Environmental Impact Report (EIR) and Tier 1 Environmental Impact Statement (EIS). These system alternatives included No-Project, and two High-Speed Train (HST) Network Alternatives. The physical features of each alternative were followed in preparing the growth analysis. Therefore, the following descriptions of the three alternatives focus on the characteristics that most influence the growth analysis, including key assumptions regarding operational features. Transportation demand results for each system alternative were derived using high end cost assumptions in the MTC Statewide High-Speed Rail Travel Demand Model.

2.2.1 No-Project Alternative

The No-Project Alternative represents the State's transportation system (highway, air, and conventional rail) as it is today and with implementation of programs or projects that are in regional transportation plans and have identified funds for implementation by 2030. This alternative is depicted in Figure 2.1. Chapter 2 of the Program-Level EIR/EIS describes general physical features of the No-Project Alternative in the year 2030.

2.2.2 Altamont and Pacheco HST Alternatives

The Authority has defined a proposed statewide high-speed train system capable of speeds in excess of 200 miles per hour on dedicated, fully grade-separated tracks, with state-of-the-art safety, signaling, and automated train control systems. Steel-wheel on steel rail technology will be considered for the system that would serve the major metropolitan centers of California (extending from Sacramento and the San Francisco Bay Area through the Central Valley, to Los Angeles and San Diego). A specific system of corridors was defined and considered to establish the ridership forecasts. These corridors reflect the Authority's adoption of certain alignment and station preferences following completion of the Statewide Program EIR/EIS. This current analysis is focused on the portion of the statewide system between the Bay Area and Central Valley, with multiple alignment and station options available for Altamont Pass and Pacheco Pass alternatives. These HST alignment and station options are depicted in Figure 2.2.

Quantitative analysis of induced growth and secondary impacts was performed on one HST network alternative each for the Altamont Pass and Pacheco Pass. For both HST alternatives, quantitative modeling was performed using the alignments for the San Francisco and San Jose termini (Network Alternatives A1 and P1[1]) since prior studies conducted by the HSRA suggested that these termini are likely to produce the highest system ridership, and hence the highest potential for induced growth and secondary impacts. Within the core study area, the following HST stations were included in the network alternatives used for quantitative modeling:

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[1] Bay Area to Central Valley Program Level EIR and Tier 1 EIS, Chapter 2, Table 2.5-1.

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Figure 2.1 No-Project Alternative – California Transportation System

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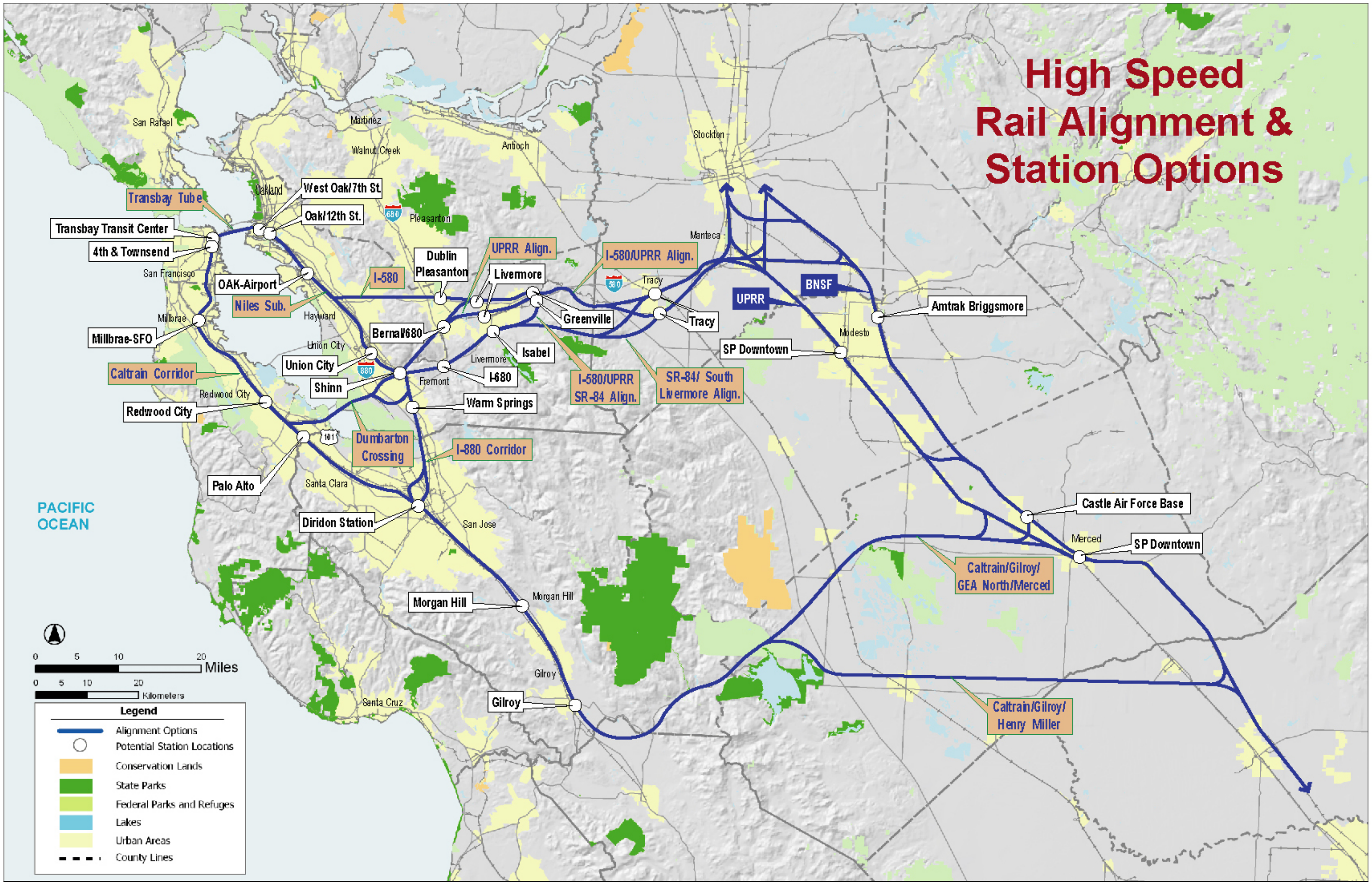
Figure 2.2 Altamont and Pacheco HST Alternatives



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- **Pacheco Pass.** Transbay Transit Center; Millbrae-SFO; Redwood City; San Jose (Diridon Station); Morgan Hill; Gilroy; Merced (SP Downtown); and Modesto (Amtrak Briggsmore).

- **Altamont Pass.** Transbay Transit Center, Millbrae-SFO, Redwood City, Fremont (Warm Springs), San Jose (Diridon Station), Pleasanton (I-680/Bernal Road), Tracy (SP), Modesto (SP Downtown), and Merced (SP Downtown).

2.2.3 Service Phasing

Economic growth effects in any given year are sensitive to the length of time over which changes in economic conditions are assumed to occur. In terms of this analysis, the number of jobs or people that will be generated in an area in 2030 is sensitive to the year in which HST service or some other transportation service is assumed to first be available to that area. For both HST Alternatives, HST service along a trunk line between the Bay Area and LAUS was assumed to begin on January 1, 2016. Service to Irvine, San Diego and Sacramento was assumed to begin on January 1, 2019 for all alignment options.

3.0 Evaluation Methodology

3.0 Evaluation Methodology

■ 3.1 Overview of Methodology

The analytical process to estimate the economic growth effects of the system alternatives requires significant modeling tools and data. Nonetheless, the entire process, which is depicted in Figure 3.1, can be summarized by a few key steps:

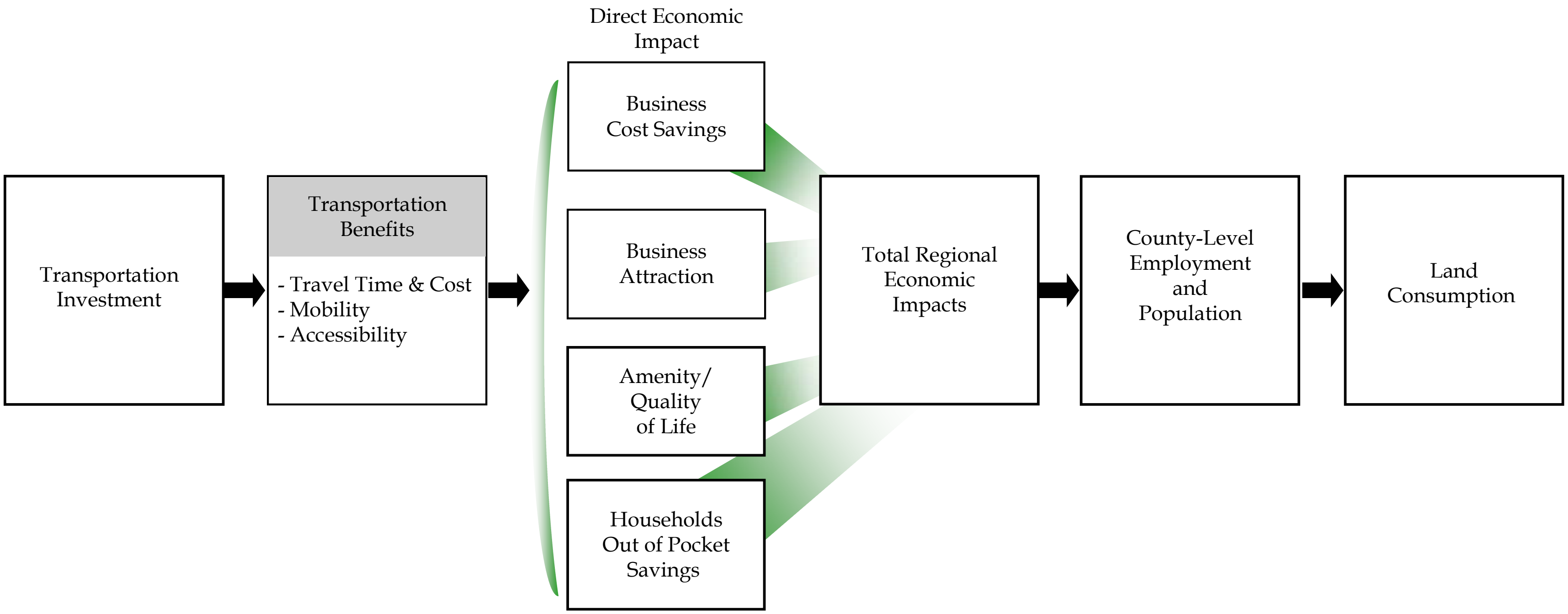
- **Define transportation investments –** This analysis considers the two HST alternatives described in Section 2.0. Within this analysis, the future baseline conditions are assumed to represent the No-Project Alternative, and the economic modeling process is used to forecast the incremental changes of the Altamont and Pacheco HST Network Alternatives.

- **Estimate transportation benefits –** Using results from the HSRA's intercity travel demand model, estimate benefits such as reduced travel times and/or costs of each system alternative for air, highway, or conventional rail trips. The quantification of travel time, cost, accessibility, and societal (pollution or accident reduction) benefits reflects the mobility enhancement provided through improved system performance of non-HST modes, as well as the additional travel option of the HST Alternatives.

- **Estimate direct economic impacts –** Direct economic impacts, which are generated from the transportation benefits of each alternative, generally fall into one of four categories:

  1. Business cost savings – Reductions in travel time and/or cost for long-distance business travelers and commuters benefiting from the transportation improvements;
  2. Business attraction effects – New and relocated firms taking advantage of market accessibility improvements provided through transportation investments;
  3. Amenity (quality of life) changes – Non-business travel time and other societal benefits improve the attractiveness of a region; and
  4. Household out-of-pocket savings – Better modal alternatives and improved levels of service lower household expenditures on fares, vehicles, fuel, and maintenance.

Figure 3.1 Evaluation Methodology



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- **Determine total regional economic impacts –** Many of the direct economic impacts have the potential to create additional multiplier effects on the regional and statewide economies of California. Total regional impacts were estimated using the TREDIS framework, which includes a model of California's economy[1] and a business attraction model (BAM) that adjusts for market access change. For this analysis, total economic impacts include population and industry-specific employment, with impacts forecasted for the 11 counties in the core study area and the remaining five multicounty regions.

- **Estimate land consumption –** County-level population and employment were allocated throughout each county to determine the infill potential and magnitude of currently undeveloped land needed to accommodate growth for each alternative. This analysis was driven by three key pieces of information:

  1. Local land use, zoning, and employment data;
  2. National and international experience with station-area development trends related to HST and fixed guideway transit; and
  3. County-level industry employment and population estimates.

The remainder of Section 3.0 is divided into two parts that focus on statewide and regional growth effects (i.e., population and employment estimates); and local and station area growth effects (i.e., land consumption).

3.2 Statewide and Regional Growth Effects

3.2.1 Evaluation Elements

This section is organized into three parts. The first part describes the development of population and employment forecasts to represent the No-Project Alternative to use as input to the economic modeling process. The second part summarizes the concepts that underlie how transportation improvements lead to economic benefits for the Altamont and Pacheco HST Alternatives. The third part describes how travel time, cost, and accessibility changes lead to the four categories of direct economic benefits and, ultimately, to total economic benefits.

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[1] Transportation and Economic Development Impact System (TREDIS) is an integrated framework that combines a businesses attraction model and an economic model for the California economy and subregions. The economic model combines input-output, cost/response, and trend-forecasting elements.

Base Forecasts for Population and Employment

The growth effects analysis requires forecasts of future population and employment for analysis year 2030. As noted previously, this forecast represents the No-Project Alternative for the analysis year, and is also used as an economic modeling input to estimate incremental population and employment changes of the other system alternatives. Given the products required from this analysis, it was necessary to develop county-level population and employment forecasts for 2030, with employment broken out by one-digit Standard Industrial Classification (SIC) codes. Baseline population forecasts for each county were taken from the California Department of Finance. Baseline employment forecasts were taken from the California Statewide High-Speed Rail Travel Demand Model, and aggregated to the county level. Table 3.1 shows population and employment forecasts.

Table 3.1 Population and Employment Forecasts for the No-Project Alternative

County	2005		2030	
	Population	**Employment**	**Population**	**Employment**
Alameda County	1,451,065	953,937	2,038,482	1,247,413
Contra Costa County	1,017,644	508,854	1,543,053	763,445
San Francisco County	741,025	779,357	796,208	975,823
San Mateo County	701,175	522,830	814,065	717,526
Santa Clara County	1,705,158	1,323,920	2,152,963	1,769,498
Study Area – Bay Area	5,616,067	4,088,898	7,344,771	5,473,705
Fresno County	878,089	435,769	1,297,476	589,226
Madera County	142,530	56,892	219,832	91,364
Merced County	242,249	87,365	437,880	115,054
Sacramento County	1,363,423	805,978	2,293,028	1,259,792
San Joaquin County	664,796	274,155	1,229,757	368,745
Stanislaus County	505,492	224,491	744,599	316,686
Study Area – Central Valley	3,796,579	1,884,650	6,222,572	2,740,867
North Central Valley*	9,412,646	5,973,548	13,567,343	8,214,572
Southern Sacramento Valley	658,108	456,834	1,090,299	729,293
Southern San Joaquin Valley	1,311,579	576,935	1,989,111	808,196
Southern California	16,843,742	9,290,841	20,844,795	12,308,179
San Diego County	2,936,609	1,895,002	4,005,624	2,783,258
Rest of California	4,991,463	2,709,974	6,613,499	3,774,366
Statewide Total	**36,154,147**	**20,903,134**	**48,110,671**	**28,617,864**

Source: Cambridge Systematics, Inc., 2003.

Benefits of Transportation Improvements for the HST Alternatives

Economic analyses of transportation investments necessarily begin with a clear conceptual estimate of changes to transportation demand and service levels (i.e., travel times and costs) over time and between alternatives. These demand and service level changes lead to different types of economic benefits. The primary benefits that were considered in this analysis include the following:

- **Mode shift benefits (travel time and cost savings, induced trips) –** Benefits for users of the HST system were estimated separately by trip purpose for intercity and intraregional trips. The benefits essentially compare the out-of-pocket travel costs, travel times, and special features by mode, as well as travelers' inherent modal preferences to discern the benefits of transportation improvements[2]. These benefits are quantified through a process known as a log sum calculation. This process closely follows procedures employed on earlier HST studies.[3] The computation methodology is described in more detail in Appendix A.

  Travel efficiency benefits are also generated by induced trips.[4] Since these new travelers were previously content not to travel, the average user benefit for induced trips is less than for those who switch mode from air, highway, or conventional rail to HST. Using consumer surplus theory, the average benefit for induced travel is one-half the benefit for a similar county-to-county trip for a mode switcher. Estimation of induced trips uses a weighted average of switchers from automobile and air, based on the proportion of induced trips using each of these modes.

- **Congestion reduction benefits (auto and air delay savings, air operating cost savings) –** To the extent that HST diverts traffic from highways and airports to HST, it frees up highway and airport capacity, and leads to travel efficiency benefits in the form of reduced travel times. The potential for reduced highway delay was forecasted directly in the MTC Statewide High-Speed Rail Travel Demand Model. Diversion of

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[2] As an example, an HST trip between San Francisco and Los Angeles may take slightly more time than traveling by air, but be less expensive enough to make HST an attractive option. Conversely, when compared to an auto trip on the highway, HST is likely more expensive, but typically reduces travel times between cities in California. In addition, some travelers value the productivity (e.g., ability to read, work on a computer, use a cell phone); comfort (e.g., eat, meet people, travel in comfort); and/or safety (e.g., avoid accidents or the fear of accidents) provided by HST on top of pure travel time and cost considerations. Finally, the calculation estimates the benefit that travelers receive by having an additional travel option from which to choose.

[3] *Independent Ridership and Passenger Revenue Projections for High-Speed Rail Alternatives in California*, Appendix C, Charles River Associates, January 2000. *Economic Impact and Benefit/Cost of High-Speed Rail for California*, Final Report, Economics Research Associates, September 1996. *Economic Growth Effects of the System Alternatives for the Program Environmental Impact Report/Environmental Impact Statement*, California High-Speed Rail Authority, July 2003.

[4] Induced trips are generated by the enhanced mobility option provided by HST, whereby, travel that normally would not occur will now be made due to the presence of HST.

trips from air to HST was assumed to lead to a reduction in in-state flights, thereby, decreasing delay at California airports for remaining flight operations. These air delay reductions would provide benefits to travelers and the airline industry due to reduced aircraft operating delays.

Further details on these procedures are provided in Appendix B.

- **Market accessibility benefits (labor, customer, buyer, and supplier) –** Beyond pure travel efficiency benefits, HST may also generate additional economic activity due to better access to labor, supplier, and consumer markets. Simply, if a region gains new or better access to these factors of production (and consumption), then the increased productivity may induce existing firms to expand, or outside firms may be attracted to the area. As such, improvements in accessibility interact with *local economic characteristics*, including land and labor costs and workforce characteristics, to determine the overall level of economic benefit associated with improved transportation networks. The business attraction analysis uses specific measures of accessibility to estimate the magnitude of these impacts. Accessibility is measured not based on the number of trips, but rather by the increased reach to population, employment centers, and other attractions (e.g., airports) afforded through improved travel times and lower costs. Access to consumer markets, for example, is defined as the number of people that can be reached within 60 minutes, while the threshold for producer markets is 90 minutes. The entire market accessibility and business attraction process is described in Appendix C.

- **Societal benefits (accidents, air quality) –** Any auto travel reductions for the HST Alternative could lead to secondary societal benefits, including reduced highway air pollution and reduced highway crash costs. These benefits were estimated by multiplying projected reductions in highway vehicle-miles traveled (VMT) by estimates of the marginal societal cost of auto crashes and air pollution. This analysis relied on marginal costs that were assumed in previous HST studies,[5] including $0.07 per VMT (2005 dollars) for auto crashes and $0.009 per VMT (2005 dollars) for pollution.

Transportation benefits were forecasted largely through application of the MTC Statewide High-Speed Rail Travel Demand Model, as indicated in Appendices A through C. Quantitative analysis of induced growth was performed on specific HST Network Alternatives for the Altamont Pass and the Pacheco Pass.

The potential induced growth effects of other alignment and station options were assessed qualitatively by comparing travel demand model results, reviewing comparable results from the Final Statewide Program EIR/EIS[6], and professional experience.

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[5] *Independent Ridership and Passenger Revenue Projections for High-Speed Rail Alternatives in California*, Appendix C, Charles River Associates, January 2000.

[6] *Economic Growth Effects of the System Alternatives for the Program Environmental Impact Report/ Environmental Impact Statement*, California High-Speed Rail Authority, July 2003.

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Direct Economic Effects

Each of the benefits described above enters one of four input variables in the TREDIS framework as described below and depicted in Figure 3.2:

1. **Production cost savings by industry –** Dollar value of cost savings due to improved HST, air, and highway travel;

2. **Business attraction benefits by industry –** Number of new employees by industry, phased in over 10 years;

3. **Household out-of-pocket savings** – Dollar amount saved by households from lower fares, less fuel consumption, and reduced accidents; and

4. **Amenity changes by region –** Dollar value of societal benefits that increase the livability and attractiveness of California regions.

The direct benefits described above were estimated for each HST alignment scenario as compared to the No-Project Alternative. The TREDIS model was then used to estimate total impacts. Results reflect analysis year 2030 and are shown in detail in Appendix D.

Production Cost Savings

The business trip portion of the travel efficiency benefits leads to production cost savings in terms of increased competitiveness, increased profitability, and the expansion of firms already located in California. Production cost savings can be thought of as a *first-order*, or *direct* economic effect, as these benefits accrue directly to California firms simply by using a more efficient means of travel.[7] Note that for businesses, both travel time savings and other cost savings (on such things as fares, fuel, and maintenance) lead to lower production costs.

Production cost savings in this analysis arise from four sources:

1. Mode shift benefits for business travelers and commuters, both intercity and intraregional;

2. Air and highway congestion savings for business travelers;

3. Accident reductions for business travelers; and

4. Aircraft operation cost savings, which accrue only to the air transportation industry.

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[7] It is important to distinguish between the technical definition of productivity in economics and the use of the term in this context. The *mobility option* of working while one travels does not change the underlying mix of labor and capital that businesses use to produce a unit of goods or services. This mix of production factors (which also includes energy) determines a business' productivity.

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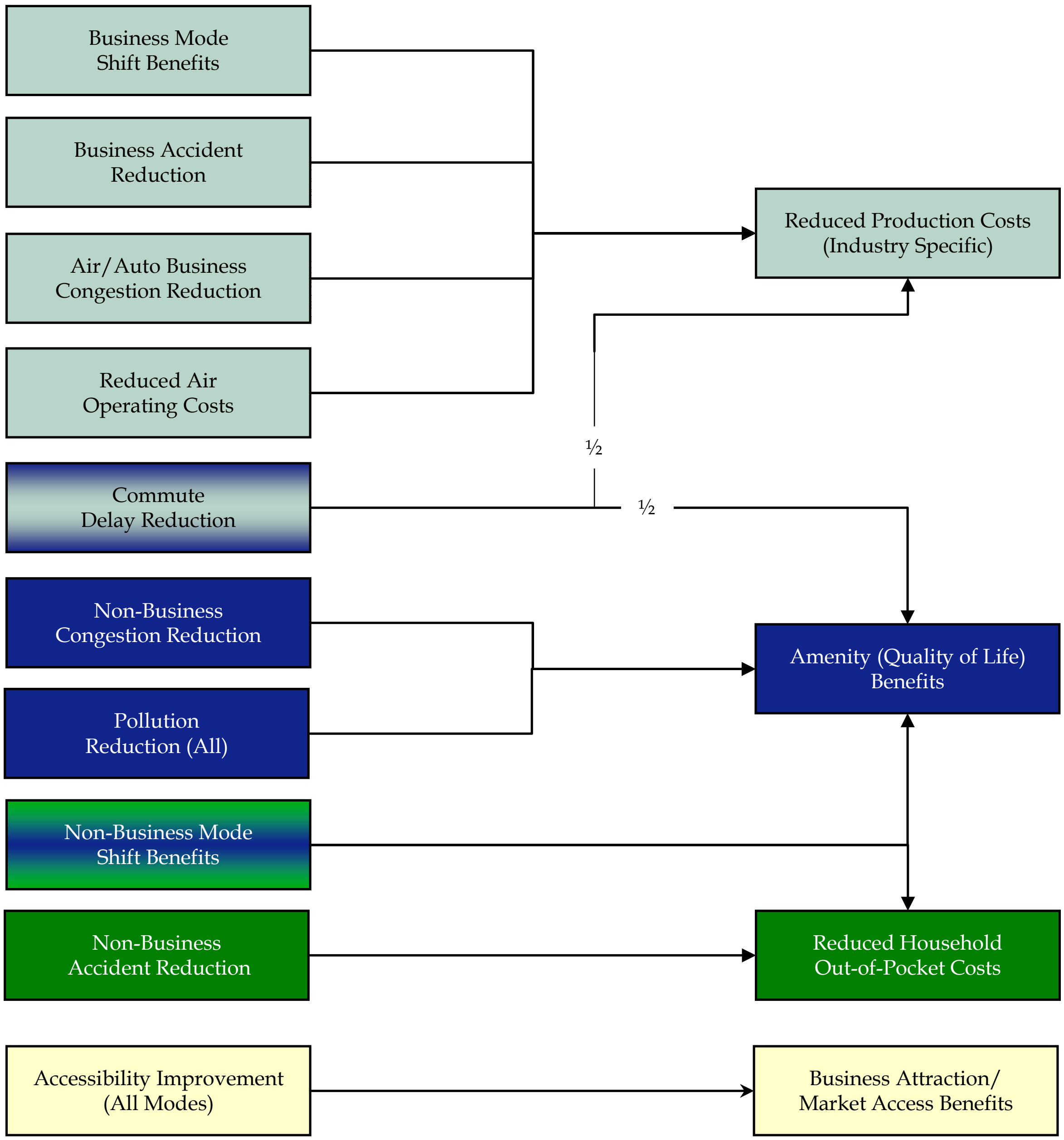
Figure 3.2 How Benefits Accrue to TREDIS Inputs



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Though all of the HST user benefits estimated for business travelers are considered production cost savings in TREDIS, only one-half of the commute benefit is treated as production cost savings. The remainder is treated as a time savings to households, and therefore accrues to the amenity input category. This assumption is consistent with the urban planning literature and economic research.

For intercity travel, the production cost savings were allocated one-half to origin counties and one-half to destination counties. The savings are then allocated to industries within each region to perform the economic impact analysis[8]. The allocation of cost savings to industries is based on the following key factors:

- Industry size – Employment and output by region and industry; and
- Transportation usage by mode by industry from the Transportation Satellite Accounts[9].

Business Attraction

A potential also exists for firms to change their location and expansion decisions based upon improved accessibility afforded by the HST Alternatives. These business attraction effects include the siting of new activities that would otherwise be located outside the HST regions, either elsewhere in California or elsewhere in the U.S. These business attraction effects are driven by improvements in accessibility to customers, workers, and international airports. These improvements have the effect of expanding the effective market areas of HST regions, reducing costs associated with accessing non-local markets, or reducing costs and improving quality of available inputs. These improvements are key factors in shaping business growth in an area. A business attraction model (see Appendix C) was applied to capture how incremental improvements in market access and cost interact with the existing local economic base and characteristics to generate new employment in the HST regions.

Quality of Life/Amenity

Several transportation benefits do not directly affect business competitiveness, but still provide meaningful, quantifiable benefits that affect the quality of life and attractiveness of the State. This analysis incorporated the following four categories of benefits into an "amenity" component for economic modeling purposes:

8 The TREDIS model of California's economy has 55 industrial sectors (most at 3-digit NAICS).

9 The most up-to-date Transportation Satellite Accounts were used in this study. They are jointly produced by the U.S. Bureau of Transportation Statistics and the U.S. Bureau of Economic Analysis.

1. The time component of mode shift benefits for non-business travelers, both intercity and intraregional;

2. Air and highway congestion savings for non-business travelers;

3. Commuter highway congestion reductions (portion not accruing to production cost savings); and

4. Air pollution reductions from changes in highway VMT.

The first category of benefits is a composite of travel time and cost savings. It was separated into value-of-time and out-of-pocket components based on average incomes in each region. Only the value-of-time component was included in the amenity variable.

The amenity variable captures personal time and quality of life benefits that are perceived by local residents to have a value, although they do not directly affect the flow of dollars in the economy. As such, increases in a regional amenity may yield a greater quality of life, thereby, attracting more residents and increasing property values. In this analysis of growth effects for the Bay Area to Central Valley Program EIR/EIS, the amenity variable is included in the analysis of population and employment impacts to provide an upper limit of land use impacts for each HST alternative. As with production cost savings, the amenity benefits are allocated one-half to origin counties and one-half to destination counties.

Household Out-of-Pocket Savings

Finally, transportation improvements affect household spending patterns. In particular, savings in fares, fuel, maintenance, and vehicles frees up more disposable income for households, which may then be spent on other goods and services. This distinction between household out-of-pocket benefits and amenity benefits is important. While both benefits accrue to households, the out-of-pocket savings benefit local businesses through increased consumer spending; whereas, the amenity benefits have no direct economic link to local businesses. This analysis recognizes two sources of household out-of-pocket savings:

1. The cost component of mode shift for non-business travelers, both intercity and intraregional; and

2. Non-business accident reduction.

The first category includes the portion of mode shift benefits not allocated to the amenity input category.

Public Financing Effects of the Modal Alternative

In any analysis of proposed public investments, it is important to consider the potential sources of public financing and how they may affect future public revenue needs (i.e., government expenditures) and consumer spending. The HST Network Alternative is projected to have significant capital costs in excess of the costs needed to fund the No-Project Alternative. For the purposes of this analysis, it was assumed that the total cost of the HST Network Alternative would be funded through revenue sources that would not require direct tax increases or significant diversion of general fund revenues. Examples of these revenue sources include general obligation bonds[10]; Federal grants or loans; private sector participation; local funds (from existing sources); and existing state transportation revenue sources (e.g., gas tax, sales tax on gas). The net effect of this assumption is that the induced growth and secondary impacts presented in this section are in no way influenced by whatever financing plan is eventually established for a potential HST system.

3.2.2 Evaluation Process

Total Regional Economic Impacts

The various direct economic effects are used as inputs to the TREDIS framework. The economic model used in this study is a 16-region model composing the State of California, with 55 industry-sector detail – similar to models used throughout the State and in earlier versions of the HST study. Each regional model contains information about industry production, employment, trade, and household consumption, as well as about how industries respond to changes in transportation costs. Total effects are calculated based on the interconnected response of a region's entire economy to a direct economic "shock." While the TREDIS model provides a number of industry-specific results, the present study focuses on employment by industry as its primary result. Population impacts were then estimated for each region based on the employment results, amenity effects, accessibility impacts, and other region-specific variables.

Economic Analysis Regions

California's 58 counties were grouped into 16 regions for the economic analysis in order to reflect the presence of components of the HST Alternatives in a county, while providing detail within the primary study area for the Bay Area to Central Valley Program-Level EIR/EIS. The regions also reflect the economic interdependence among some counties and relate to widely recognized geographic regions in California. The five counties that comprise the core study area within the Bay Area (Alameda, Contra Costa, San Francisco, San Mateo, and Santa Clara) were kept as separate economic modeling regions in order to better simulate the population and employment growth effects for each system alterna-

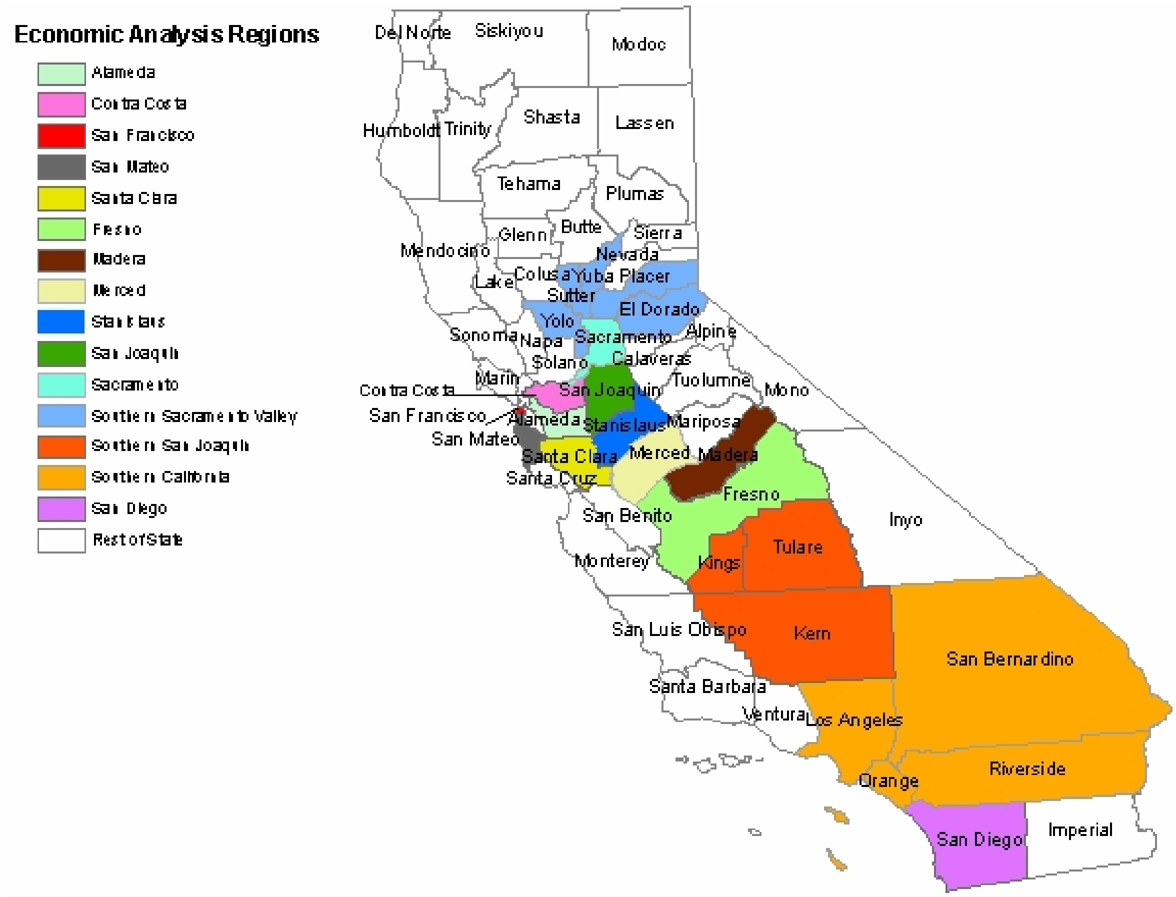
[10]The debt service on General Fund State Revenue bonds often is paid through a commitment of the general fund revenue with no additional tax or other revenue source. A preliminary analysis by the project team suggests that the annual debt service on a $10 billion bond may be within the range of the State's historical and future bonding patterns. While this source of funding does not directly increase taxes, it does divert state expenditures from budget items to debt service. Nevertheless, this diversion is not assumed in this analysis to result in any significant reduction in state expenditures.

tive. A similar process was followed for the six counties that comprise the core study area within the Central Valley. The counties grouped into Southern Sacramento Valley, Southern San Joaquin Valley, Southern California, and San Diego regions were gathered based on economic relationships between the counties. With the exception of the Southern Sacramento Valley, all of these regions were identified for direct HST service in the Final Statewide Program EIR/EIS. The counties gathered as rest of California would not be directly served by any of the HST alternatives. The county groupings that comprise these regions are displayed in Figure 3.3.

The regions and associated counties, which are displayed in Figure 3.3, are the following:

- Core Study Area – Bay Area:
  - Alameda County,
  - Contra Costa County,
  - San Francisco County,
  - San Mateo County, and
  - Santa Clara County;
- Core Study Area – Central Valley:
  - Fresno County,
  - Madera County,
  - Merced County,
  - Stanislaus County,
  - San Joaquin County, and
  - Sacramento County;
- Southern San Joaquin Valley: Kern, Kings, and Tulare Counties;
- Southern California: Los Angeles, Orange, Riverside, and San Bernardino Counties;
- San Diego County;
- Southern Sacramento Valley: El Dorado, Placer, Sutter, Yolo, and Yuba Counties; and
- Rest of California: Remaining 34 counties not included in any of the other 15 regions.

Figure 3.3 Regions Used for Economic Modeling



3.3 Local and Station Area Analysis

The county-level population and employment forecasts served as a key input for conducting a detailed assessment of potential local and station area growth effects. This local area analysis focused on the concept of *land consumption*, or the amount of currently undeveloped land that would be needed to accommodate projected growth in each county. Essentially, the analysis provided an estimate of the population and employment growth that can fit within the currently urbanized areas of each county, and additional acreage of currently undeveloped land that would need to be converted to urbanized densities to accommodate any remaining growth.

The analysis of these localized effects was guided to a large extent by international experience in HST station area development, and a more fine-grained analysis of the effects of population and employment growth and development pattern changes on the land area

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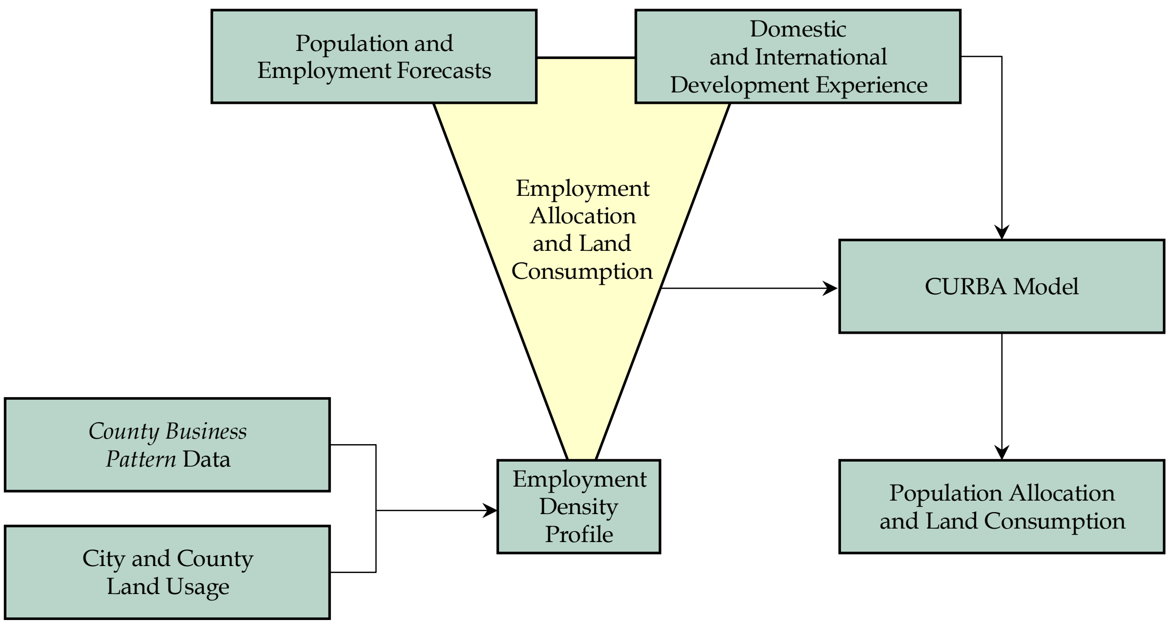
required to accommodate urban functions. This work was organized into the following two basic steps:

1. Estimation of land area required to accommodate forecast employment growth for each alternative; and

2. Estimation of the land area required to accommodate forecast population growth (residential land use) for each alternative.

The general analysis steps, which incorporate work undertaken for the Statewide Program-Level EIR/EIS, are depicted in Figure 3.4 and discussed in the following sections.

Figure 3.4 Land Consumption Analysis Process



Estimation of Employment-Related Land Requirements

Estimates of land required to accommodate employment uses were developed using a statistical analysis based on current development patterns in the State of California, adjusted to reflect expected densification trends over time. The approach provides an estimate of the employment growth that can fit within the currently urbanized areas of each county, and the consumption of currently undeveloped land for any remaining employment growth. The approach is sensitive to differences in development patterns between areas within California, development needs and history by industry, density potential based on location within an urban area, and density patterns related to either market conditions or regulatory strategies.

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The analytical process consisted of the following three main steps:

1. **Development of an employment density profile –** This profile, which was developed using zip code-level employment data, expressed the range of current employment densities by industrial class for different county groupings and specific subregions within the counties. This profile was developed during preparation of the economic growth effects analysis for the Statewide Program-Level EIR/EIS.

2. **Employment allocation –** Forecasted employment was allocated to subregions in each county in a step-wise fashion through the use of the density profiles and the existing employment in each county.

3. **Land consumption tabulation –** Employment acreage requirements were estimated for each county by comparing the urbanized acreage for employment-related land use in each future year with the current urbanized acreage.

This process is described in greater detail in Appendix E.

Estimation of Residential Land Requirements

The California Urbanization and Biodiversity Analysis (CURBA) model was used to allocate population growth to various locations in each county, and to predict raw land consumption resulting from residential construction. CURBA is a spatial decision support system developed within the ESRI ArcGIS software package by the University of California at Berkeley's Institute of Urban and Regional Development.

CURBA uses a number of historically-calibrated spatial statistical models to assign projected population residential growth to various locations in and around the existing urban area. By modifying CURBA's employment distribution, infill allocation, and raw land development densities to reflect information generated as part of the employment analysis, the package was used to estimate the nature and amount of raw land consumption under the various alternatives. The basic steps in the residential analysis included the following:

- **Model calibration –** A spatial-statistical model of historical development patterns was calibrated using detailed land coverage inventories from the California Department of Conservation.

- **Development probabilities –** A binomial logit model was used to estimate development probability for undeveloped sites based on a site's job accessibility, physical and land use constraints, characteristics of adjacent sites, and local land use policies and regulations.

- **Residential infill and redevelopment –** A cross-sectional regression model was used to relate current county infill shares to remaining supplies of undeveloped land, and then project population shares for future analysis years.

- **Growth allocation –** Another cross-sectional regression model was used to project land use densities in each county based on remaining supplies of undeveloped land. Population growth was then allocated to individual sites in order of development probabilities until all population growth is accommodated.

This iterative process is described in greater detail in Appendix F.

4.0 Statewide and Regional Growth Effects

4.0 Statewide and Regional Growth Effects

This chapter describes results of the statewide and regional economic modeling process for the year 2030. The key results presented in this chapter include county- and regional-level population and employment forecasts for each HST Alternative. The first section compares each system alternative in terms of statewide population and employment, while the second section compares the alternatives in terms of regional- and county-level forecasts. The third section compares results for the HST network, alignment, and station options in the Bay Area to Central Valley study area. The fourth section compares these results to ones calculated for the Statewide Program-Level EIR/EIS. Finally, the fifth section provides an overview of the significance of these population and employment forecasts. The discussion in this chapter is supplemented by detailed tables of employment forecasts by industry group in Appendix G.

■ 4.1 Statewide Comparison of System Alternatives

Table 4.1 displays year 2030 population and employment forecasts for the No-Project Alternative and the two HST Network Alternatives. Table 4.2 displays population and employment growth rates for the year 2030; the growth rates in these tables are referenced to 2005 existing conditions. Table 4.3 compares growth rates for HST Alternatives relative to the No-Project Alternative for the year 2030.

4.1.1 No-Project Alternative

On a statewide basis, population is projected to increase by about 12 million, which represents a 33 percent rise between 2005 and 2030. The long-term growth rate averages to about 1.2 percent (0.5 million) annually, which is less than California's 1.8 percent annual population growth rate since 1970, but consistent with long-term population forecasts by the California Department of Finance and the U.S. Census Bureau.

Employment growth rates are somewhat similar, with jobs increasing by about 7.7 million (37 percent) between 2005 and 2030. The long-term growth rate averages about 1.3 percent (0.26 million) per year, which is one-half of the 2.6 percent annual employment growth rate since 1970.

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Table 4.1 Year 2030 Employment and Population

Region	Employment				Population			
		2030				2030		
	2005 Conditions	No-Project Alternative	Pacheco HST Alternative	Altamont HST Alternative	2005 Conditions	No-Project Alternative	Pacheco HST Alternative	Altamont HST Alternative
Alameda County	953,937	1,247,413	1,259,563	1,257,894	1,451,065	2,038,482	2,051,196	2,054,014
Contra Costa County	508,854	763,445	769,521	767,521	1,017,644	1,543,053	1,549,526	1,546,206
San Francisco County	779,357	975,823	983,634	981,068	741,025	796,208	809,680	801,192
San Mateo County	522,830	717,526	723,835	723,899	701,175	814,065	821,063	826,885
Santa Clara County	1,323,920	1,769,498	1,785,181	1,784,281	1,705,158	2,152,963	2,183,649	2,196,405
Study Area – Bay Area	4,088,898	5,473,705	5,521,734	5,514,663	5,616,067	7,344,771	7,415,114	7,424,702
Fresno County	435,769	589,226	602,155	601,294	878,089	1,297,476	1,314,824	1,312,891
Madera County	56,892	91,364	96,173	96,293	142,530	219,832	229,648	229,492
Merced County	87,365	115,054	122,374	121,040	242,249	437,880	452,166	447,409
Sacramento County	805,978	1,259,792	1,268,687	1,271,311	1,363,423	2,293,028	2,305,071	2,314,484
San Joaquin County	274,155	368,745	375,491	379,476	664,796	1,229,757	1,241,285	1,254,281
Stanislaus County	224,491	316,686	323,679	332,624	505,492	744,599	758,256	783,839
Study Area – Central Valley	1,884,650	2,740,867	2,788,559	2,802,038	3,796,579	6,222,572	6,301,250	6,342,396
Core Study Area	5,973,548	8,214,572	8,310,293	8,316,701	9,412,646	13,567,343	13,716,364	13,767,098
South Sacramento Valley	456,834	729,293	732,903	733,942	658,108	1,090,299	1,092,658	1,093,615
South San Joaquin Valley	576,935	808,196	835,245	833,977	1,311,579	1,989,111	2,048,889	2,047,375
Southern California	9,290,841	12,308,179	12,435,533	12,421,683	16,843,742	20,844,795	20,988,962	20,950,544
San Diego County	1,895,002	2,783,258	2,828,805	2,837,183	2,936,609	4,005,624	4,147,239	4,132,577
Rest of California	2,709,974	3,774,366	3,795,828	3,791,032	4,991,463	6,613,499	6,618,328	6,614,836
Statewide Total	**20,903,134**	**28,617,864**	**28,938,605**	**28,934,518**	**36,154,147**	**48,110,671**	**48,612,439**	**48,606,045**

Source: Cambridge Systematics, Inc., 2007.

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Table 4.2 Year 2030 Employment and Population
Percentage Change from Year 2005 Existing Conditions

Region	Employment			Population		
	No-Project Alternative	Pacheco Alternative	Altamont Alternative	No-Project Alternative	Pacheco Alternative	Altamont Alternative
Alameda County	30.8%	32.0%	31.9%	40.5%	41.4%	41.6%
Contra Costa County	50.0%	51.2%	50.8%	51.6%	52.3%	51.9%
San Francisco County	25.2%	26.2%	25.9%	7.4%	9.3%	8.1%
San Mateo County	37.2%	38.4%	38.5%	16.1%	17.1%	17.9%
Santa Clara County	33.7%	34.8%	34.8%	26.3%	28.1%	28.8%
Study Area – Bay Area	33.9%	35.0%	34.9%	30.8%	32.0%	32.2%
Fresno County	35.2%	38.2%	38.0%	47.8%	49.7%	49.5%
Madera County	60.6%	69.0%	69.3%	54.2%	61.1%	61.0%
Merced County	31.7%	40.1%	38.5%	80.8%	86.7%	84.7%
Sacramento County	56.3%	57.4%	57.7%	68.2%	69.1%	69.8%
San Joaquin County	34.5%	37.0%	38.4%	85.0%	86.7%	88.7%
Stanislaus County	41.1%	44.2%	48.2%	47.3%	50.0%	55.1%
Study Area – Central Valley	45.4%	48.0%	48.7%	63.9%	66.0%	67.1%
Core Study Area	37.5%	39.1%	39.2%	44.1%	45.7%	46.3%
Southern Sacramento Valley	59.6%	60.4%	60.7%	65.7%	66.0%	66.2%
Southern San Joaquin Valley	40.1%	44.8%	44.6%	51.7%	56.2%	56.1%
Southern California	32.5%	33.8%	33.7%	23.8%	24.6%	24.4%
San Diego County	46.9%	49.3%	49.7%	36.4%	41.2%	40.7%
Rest of California	39.3%	40.1%	39.9%	32.5%	32.6%	32.5%
Statewide Total	**36.9%**	**38.4%**	**38.4%**	**33.1%**	**34.5%**	**34.4%**

Source: Cambridge Systematics, Inc., 2007.

4.1.2 HST Alternatives

Statewide population and employment forecasts for the HST Alternatives are very similar to the No-Project Alternative. For year 2030, the Pacheco HST Alternative is projected to add about 501,000 (1.04 percent) more people and 320,000 (1.12 percent) more jobs than the No-Project Alternative. The Altamont HST Alternative is projected to add 495,000 (1.03 percent) more people and 316,000 (1.11 percent) more jobs than the No-Project Alternative. This incremental growth for the HST network alternatives represents about an additional year's worth of economic growth above and beyond the No-Project Alternative in year 2030.

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4.2 Regional and County Growth Effects

Each of the system alternatives has varied effects on different parts of the State. Part of this difference is in terms of overall population and growth projections displayed previously in Tables 4.1 and 4.2. Another part of the difference is related to the type of industries that is projected to experience employment growth under each system alternative. Table 4.3 displays industry-specific employment forecasts for 2030 for the three alternatives. Data in Table 4.3 are summarized by the major economic analysis regions, while Appendix G presents county-level detail. Table 4.4 presents the allocation of year 2030 incremental employment growth[1] by industry group for the HST Alternatives. Essentially, Table 4.4 provides a picture of the types of jobs that would be generated by an investment in either the No-Project or HST Alternatives.

4.2.1 San Francisco Bay Area

Under the No-Project Alternative, the Bay Area region is projected to add about 1.4 million jobs and 1.7 million people between 2005 and 2030. These values represent a relative increase of nearly 31 and 34 percent, respectively, over the 2005 conditions. In absolute terms, Alameda County is projected to add the most population (587,000), while Santa Clara is projected to add the most employment (445,000) from current levels. However, growth rates will be higher in Contra Costa County, with increases of over 50 percent between 2005 and 2030 for both population and employment. Among the Bay Area counties, the employment growth rate exceeds the population growth rate for San Francisco and San Mateo.

Under the Pacheco HST Alternative regional population is projected to increase by 70,000 people, while employment is expected to increase by 48,000 jobs over the No-Project Alternative. Under the Altamont HST Alternative, population growth is slightly higher than the Pacheco Alternative, with an increase of near 80,000 people, whereas employment growth is slightly lower than the Pacheco Alternative with an increase of 41,000 jobs over the No-Project Alternative. Santa Clara County is projected to experience the largest absolute increase in population and employment in both HST alternatives. In relative terms for the Pacheco HST Alternative, Alameda County has the highest increase in employment, while San Francisco shows the highest increase in population compared to the No-Project Alternative. For the Altamont HST Alternative, San Mateo County shows the highest relative increase in employment, while Santa Clara shows the highest relative increase in population compared to the No-Project Alternative.

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[1] Incremental employment growth refers to employment that is generated by the HST Alternatives above and beyond the employment projected for the No-Project Alternative.

Table 4.3 Comparison of Employment by Industry Grouping for REMI Regions
Year 2030

	Study Area – Bay Area	% of Total	Study Area – Central Valley	% of Total	Southern Sacramento Valley	% of Total	Southern San Joaquin Valley	% of Total	Southern California	% of Total	San Diego	% of Total	Rest of California	% of Total	Statewide Total	% of Total
Farming	52,986	1%	153,017	8%	23,496	5%	112,116	19%	134,414	1%	41,123	2%	110,438	4%	627,589	3%
Mining	3,749	0%	1,214	0%	672	0%	10,023	2%	10,066	0%	1,158	0%	4,406	0%	31,288	0%
Construction	200,188	5%	110,494	6%	35,876	8%	25,670	4%	445,411	5%	101,481	5%	142,577	5%	1,061,697	5%
Manufacturing	414,079	10%	127,765	7%	25,702	6%	27,893	5%	891,553	10%	122,773	6%	225,106	8%	1,834,872	9%
TCU	190,166	5%	75,965	4%	18,525	4%	25,136	4%	433,885	5%	60,648	3%	110,200	4%	914,524	4%
Wholesale	179,813	4%	67,563	4%	16,841	4%	16,446	3%	507,724	5%	66,127	3%	117,540	4%	972,053	5%
Retail	579,787	14%	297,432	16%	79,839	17%	82,911	14%	1,439,244	15%	285,675	15%	421,947	16%	3,186,834	15%
FIRE	394,036	10%	149,453	8%	42,296	9%	30,336	5%	893,749	10%	172,543	9%	246,424	9%	1,928,837	9%
Services	1,630,699	40%	550,584	29%	137,730	30%	135,745	24%	3,467,334	37%	684,891	36%	960,561	35%	7,567,544	36%
Government	443,395	11%	351,163	19%	75,858	17%	110,659	19%	1,067,460	11%	358,582	19%	370,778	14%	2,777,895	13%
Total	**4,088,898**	**100%**	**1,884,650**	**100%**	**456,834**	**100%**	**576,935**	**100%**	**9,290,841**	**100%**	**1,895,002**	**100%**	**2,709,974**	**100%**	**20,903,134**	**100%**

Source: Cambridge Systematics, Inc., 2007.

Table 4.4 Allocation of Incremental Employment Growth by Industry Groupings

Year 2030

Incremental Growth Rate for Induced Employment (Year 2005 to 2030)	Farming and Mining		Construction and Manufacturing		TCU and Trade		FIRE and Services		Government	
Study Area – Bay Area	0%	0%	6%	5%	28%	29%	62%	63%	3%	3%
Study Area – Central Valley	2%	2%	6%	4%	25%	21%	63%	68%	5%	4%
Subtotal – Core Study Area	1%	1%	6%	5%	27%	25%	62%	66%	4%	4%
Southern Sacramento Valley	1%	2%	10%	9%	34%	33%	50%	52%	6%	5%
Southern San Joaquin Valley	5%	5%	4%	4%	20%	19%	66%	67%	4%	4%
Southern California	0%	1%	6%	7%	27%	29%	62%	60%	4%	4%
San Diego	0%	0%	4%	3%	32%	26%	59%	66%	4%	4%
Rest of California	4%	4%	9%	10%	38%	45%	44%	36%	5%	6%
Statewide Total	1%	1%	6%	5%	28%	27%	61%	62%	4%	4%

Source: Cambridge Systematics, Inc., 2007.

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Historically, this region has had the highest share of FIRE and services industry jobs. This trend is projected to be intensified under the No-Project Alternative. Incremental job growth for the HST Alternatives (i.e., additional jobs created over the No-Project Alternative) are projected to follow historical norms for this region, with 62 percent of the new jobs created in FIRE and services and 34 percent in construction, manufacturing, trade, and TCU.

4.2.2 Northern Central Valley

Under the No-Project Alternative, the northern Central Valley region is projected to add about 855,000 (45 percent) jobs and 2.4 million (64 percent) people between 2005 and 2030. Sacramento County is projected to add the most population (929,000) and employment (453,000) from 2005 levels. In relative terms, population growth will be the highest in San Joaquin County with an 85 percent increase over 2005 conditions, while employment growth will be the highest in Madera County with a 61 percent increase. The key conclusion from these results is that this region will be experiencing tremendous population growth, regardless of the implementation of the HST, and experiences the largest differential between employment and population growth rates.

Under the Pacheco HST Alternative, regional population is projected to increase by a further 79,000 people, while employment is expected to increase by 48,000 jobs over the No-Project Alternative. Under the Altamont HST Alternative, population and employment growth is higher than the Pacheco Alternative, with an increase of nearly 120,000 people and 61,000 jobs over the No-Project Alternative.

The counties in this area all have population growth rates that greatly exceed the statewide average under the No-Project Alternative. All six counties have noticeably higher population growth rates for the HST Network Alternatives, with Merced and Madera Counties showing the largest numeric difference in growth rates between the No-Project and HST Alternatives; this result also holds for Stanislaus County in the Altamont HST Network Alternative. As a group, the population growth rate in these Central Valley counties is highest for the Altamont HST Network Alternative, although Fresno, Madera, and Merced Counties actually have slightly higher growth rates for the Pacheco HST Network Alternative.

These counties also have a wide variation in employment growth rates under the No-Project Alternative with values ranging between 31 percent and 60 percent. All six counties have noticeably higher employment growth rates for the HST Network Alternatives, with Merced and Madera Counties showing the largest numeric difference in growth rates between the No-Project and HST Network Alternatives; this result also holds for Stanislaus County in the Altamont HST Network Alternative. The employment growth rate in these counties as a group is highest for the Altamont HST Network Alternative, with the Altamont HST Network Alternative having the highest growth rate in four of the six counties.

This region has historically exceeded statewide averages for government and farming jobs, while lagging in all other industry groups. This general pattern is projected to change slightly under the No-Project Alternative, with employment shifts from government, farming, manufacturing, trade, and TCU into FIRE and services. The HST Alternatives, on the other hand, are projected to have incremental job growth that is much more heavily oriented towards FIRE and services (66 percent of total), with construction, manufacturing, trade, and TCU accounting for about 28 percent of incremental growth. This region, along with the Southern Central Valley, would experience the largest shift in the nature of employment, and suggests that the HST Alternative will be a strong influence in attracting higher wage jobs to the Central Valley.

4.2.3 Southern Sacramento Valley

Under the No-Project Alternative, the Southern Sacramento Valley region is projected to add about 272,000 jobs and 434,000 people between 2005 and 2030. These values represent an increase of 60 and 66 percent, respectively, over 2005 conditions.

Under the Pacheco HST Alternative, population is projected to increase by about 2,350 people and employment by about 3,600 jobs in 2030 over the No-Project Alternative. Under the Altamont Alternative, both population and employment are expected to be slightly higher than under the Pacheco Alternative, increasing population by 3,300 people and the number of jobs by 4,600 compared to the No-Project Alternative.

As with the northern Central Valley, this region has historically exceeded statewide averages for government and farming jobs, while lagging in all other industry groups to a larger extent than any other region. This general pattern is projected to change under the No-Project Alternative, with employment shifts from farming and government into FIRE and services. However, this region will still lag statewide averages in manufacturing, FIRE, and services, while exceeding statewide averages in government. About one-half on incremental job growth of HST Alternatives is projected to occur in FIRE and services and one-third in trade and TCU.

4.2.4 Southern San Joaquin Valley

Under the No-Project Alternative, the southern Sacramento Valley region is projected to add about 231,000 (40 percent) jobs and 677,000 (52 percent) people between 2005 and 2030. Under the Pacheco HST Alternative, population is projected to increase by about 60,000 people and employment by about 27,000 jobs in 2030 over the No-Project Alternative. Population and employment are expected to be slightly lower for the Altamont HST Alternative than for the Pacheco HST Alternative, increasing population by 58,000 people and 26,000 jobs compared to the No-Project Alternative.

This region currently has the highest share of agricultural employment in the State (one-fifth of the total employment) and the lowest share of FIRE and services jobs (one-third of the total employment), and this general pattern is not projected to change under the No-

Project Alternative. However, incremental job growth under the HST Alternatives is projected to be heavily oriented towards FIRE and services jobs, with about 67 percent of growth occurring in this sector. This region and the northern Central Valley are expected to experience the largest shift in the nature of employment, which suggests that the HST Alternative will be a strong influence in attracting higher wage jobs to these regions.

4.2.5 Southern California

Under the No-Project Alternative, the southern California region is projected to add about 3.0 million (32 percent) jobs and 4.0 million (24 percent) people between 2005 and 2030. Under the Pacheco HST Alternative, population is projected to increase by about 144,000 people and employment by about 130,000 jobs in 2030 over the No-Project Alternative. Under the Altamont HST Alternative, both population and employment are expected to be lower than under the Pacheco HST Alternative, increasing by about 105,000 people and 113,000 jobs compared to the No-Project Alternative.

This region has nearly one-half of total employment in the FIRE and services sectors, and this general pattern is projected be accentuated under the No-Project Alternative. Incremental job growth of HST Alternatives is projected to be more heavily oriented towards FIRE and service sectors, with about 60 percent of growth occurring in this sector.

4.2.6 San Diego County

Under the No-Project Alternative, San Diego County is projected to add about 900,000 (47 percent) jobs and 1.0 million (36 percent) people between 2005 and 2030. Under the Pacheco HST Alternative, population is projected to increase by about 141,000 people and employment by about 45,000 jobs in 2030 over the No-Project Alternative. Under the Altamont Alternative, population is expected to be slightly lower than under the Pacheco Alternative, while employment slightly higher, with population increasing by 126,000 people and the number of jobs by 54,000 compared to the No-Project Alternative.

This region has an average statewide share of FIRE and service jobs (45 percent of the total employment), and this general pattern is projected to be intensified under the No-Project Alternative. Incremental job growth of HST Alternatives is projected to be heavily oriented towards FIRE and services jobs, with about 66 percent of growth occurring in this sector.

■ 4.3 HST Network Alternatives, Alignment Alternatives, and Station Location Options

The discussion of induced growth compares the general nature of impacts associated with the HST Network Alternatives to the No-Project Alternative. Although quantitative employment and population impacts were not generated for every alignment and station location option, qualitative distinctions nevertheless can be made among these options.

For this discussion, the difference in impacts will be most significant between the two general choices of the Altamont and Pacheco Network Alternatives. In the primary study area of this environmental analysis, the Altamont HST Network Alternative would be expected to have a greater influence on growth inducement than the Pacheco HST Network Alternative for two reasons. First, the Altamont HST Network Alternative is projected to induce about 6,000 more jobs and 50,000 more residents than the Pacheco HST Network Alternative in the Bay Area to Central Valley study area. Second, the Altamont HST Network Alternative is likely to have more stations in total than the Pacheco HST Network Alternative, leading to more geographic locations that could experience local and station area growth effects.

Madera and Merced Counties are likely to experience the greatest magnitude of growth effects among all study area counties for both HST Network Alternatives. Stanislaus County is likely to exhibit an equally high magnitude of growth effects with the Altamont HST Network Alternative; under the Pacheco HST Network Alternative, Stanislaus County's growth effects are likely to be much lower.

Many of the HST Network Alternatives have different termini locations in the Bay Area, with some network alternatives having multiple termini locations. Growth inducement is likely to differ for these network alternatives, with differences arising both on a system level and in individual Bay Area counties affected by the HST Network Alternatives. In general, systemwide growth inducement can be expected to change at similar rates to changes in ridership between HST Network Alternatives due to the close correspondence between HST ridership, highway and air congestion reduction, and traveler benefits. At a county and local level, growth inducement will be higher if a county has an HST station for a particular network alternative, and will decrease if no HST station is present.

Among the Pacheco HST Network Alternatives, service to either the Oakland or San Francisco termini is likely to result in similar levels of systemwide growth inducement. Similar levels of growth inducement are likely for service to Oakland <u>and</u> San Francisco via a Transbay Tube. Service to Oakland <u>and</u> San Francisco via Peninsula and East Bay alignments is likely to experience lower growth inducement due to lower HST ridership potential; growth inducement are also likely to be more evenly distributed among the Bay Area counties than for the other HST Network Alternatives. A San Jose-only terminus would likely have the lowest overall growth inducement potential of the Pacheco Network Alternatives due to the much lower HST ridership potential.

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For the Altamont HST Network Alternatives, service to a single Bay Area terminus (San Francisco or Oakland) is likely to result in similar levels of systemwide growth inducement. Similar levels of growth inducement are likely for service to Oakland <u>and</u> San Francisco via a Transbay Tube. HST Network Alternatives with split HST service among any two or three termini are likely to experience lower growth inducement due to lower HST ridership potential; the lowest growth inducement potential is likely for split service to all three Bay Area termini.

All of the Altamont HST alignment alternatives are likely to create equal magnitudes and spatial patterns of induced growth since all alignments offer relatively similar travel time and station location options in the Bay Area.

The two Pacheco HST alignment alternatives, Henry Miller and GEA North, also are likely to produce similar patterns of induced growth for all counties in the core study area. Although these two Pacheco alignment alternatives provide noticeably different HST travel times between the Bay Area and northern Central Valley, there are equally noticeable, yet opposite, travel time differences between the Bay Area and locations south of Merced County. The net effect is that the slight congestion reduction and HST ridership benefits provided by the Henry Miller alignment offset the accessibility benefits (between the Bay Area and northern Central Valley) provided by the GEA North alignment.

For the Pacheco with Altamont HST Network Alternatives, overall growth inducement will be the same or lower than similar termini combinations for either Pacheco or Altamont.

Adding, dropping, or changing station locations will lead to changes in potential growth effects at the station in question, as well as in the HST system as a whole. In individual counties, the most notable situation is in Merced County, where the SP Downtown station could be on either the Sacramento or Southern California HST lines, depending upon the alignment followed west of Merced. The Castle Air Force Base (AFB) station, on the other hand, always would be served by HST service between the Bay Area and Sacramento. In Stanislaus County, the Amtrak Briggsmore station could lead to the urbanization of 1,000 more acres in the County than the SP Downtown station site.[2] This difference between station sites accounts for about 35 percent of the difference in urbanized area size between the Altamont and Pacheco HST Network Alternatives noted for Stanislaus County. In the East Bay, HST stations that interface with the BART system may induce larger overall growth attributable to improved regionwide accessibility. On the San Francisco Peninsula, all proposed HST stations offer the opportunity for intermodal transfers with Caltrain, and all proposed station sites have substantial station-area activity of one form or another. The most likely location for differences in areawide growth inducement is with the San Francisco station location. The Transbay Transit Center offers better access than the 4th/Townsend site to the high density employment and activity center in Downtown San Francisco; this improved accessibility creates higher systemwide HST ridership and is therefore likely to lead to the potential for additional growth inducement.

[2] *Economic Growth Effects of the System Alternatives for the Program Environmental Impact Report/ Environmental Impact Statement*, California High-Speed Rail Authority, Section 5.2, July 2003.

Alternative station locations in the same general vicinity may have different localized growth effects, but overall effects throughout the study area are likely to be similar. Different areawide effects will arise from adding or dropping an HST station for a community or subarea as a whole. For example, not providing an HST station in the Tri-Valley or Tracy areas would likely lower overall growth inducement, because job accessibility and business attraction benefits throughout the study area would be lower. A similar situation would occur for the Pacheco HST Network Alternative if a station were not provided in Gilroy or Morgan Hill; in such a situation, access to the HST system from Monterrey, San Benito, and Santa Cruz Counties would be reduced.

4.4 Comparison of Procedures and Results to the Statewide Program-Level EIR and Tier 1 EIS

The overall economic growth forecasts for this Bay Area to Central Valley Program EIR/EIS are consistent with the results generated in 2003 for the Statewide Program EIR/EIS. The current analysis projects an incremental statewide growth inducement of about 320,000 jobs and 500,000 people by year 2030. The analysis for the 2003 Statewide Program EIR/EIS projected an incremental statewide growth inducement of 240,000 jobs and 170,000 people by year 2020, and 450,000 jobs and 700,000 people by year 2035.

There are several differences in the analysis procedures that help explain these differences between the 2003 and current results. Many of these differences stem from use of the new Metropolitan Transportation Commission (MTC) Statewide High-Speed Rail Travel Demand Model for the current growth inducement analysis.

First, the new travel model used in the current analysis assumes a much higher ridership for high-speed rail than the 2003 analysis. This result essentially follows from a more sophisticated treatment of mode choice variables. In other words, the new model allows for a greater range of mode choices (for example, walking to an HST station instead of driving), and a more complete treatment of travel costs than the previous analysis. The result is that the direct travel time/cost benefits flowing from travelers switching to HST are higher than in the 2003 report.

Second, the present analysis has a more complete treatment of effects on non-HST modes. The most significant difference is that the new travel demand model includes intraregional (local) car and truck trips in addition to intercity trips; whereas, the previous travel model only included the latter. As a result, highway delay reductions are higher in the current analysis, leading to a larger overall impact.

Finally, the TREDIS framework in the current analysis uses the CRIO-IMPLAN model of economic adjustment; whereas, REMI was used for the 2003 analysis. Although both models are well-established for this type of analysis, differences between the model structures affected the treatment of certain variables. For example, the previous analysis treated household value-of-time and out-of-pocket cost savings through a variable that primarily drives demographic migration. In contrast, the current analysis treats household out-of-pocket savings as changing consumer spending patterns, thereby affecting local business output more directly.

■ 4.5 Key Findings

Overall, the No-Project and HST Network Alternatives present very similar levels of growth effects in terms of population and employment growth from year 2005. The incremental effect of the HST Alternatives relative to the No-Project Alternative is very small when compared to the incremental effect of the No-Project Alternative relative to 2005 conditions. California is projected to add about 7.7 million jobs and 12 million people between 2005 and 2030 under the No-Project Alternative, while the HST Alternatives would add around 320,000 (1.11 percent) jobs and 500,000 (1.04 percent) people over the No-Project Alternative.

Analysis of results for individual counties largely follows these general statewide trends among system alternatives. Southern California is projected to add the most jobs and people of all regions for the HST Alternatives in 2030. On a relative basis, southern San Joaquin Valley and the northern Central Valley are expected to show the largest percentage increase in population and jobs under the HST Alternative compared to the No-Project Alternative. Under the HST Alternatives, the statewide incremental employment growth relative to the No-Project Alternative is expected to be higher than the population growth, suggesting that the HST Alternative has a stronger influence in distributing employment throughout the State.

The Altamont HST Alternative is projected to induce the largest incremental population and employment growth rates in Madera, Merced, and Stanislaus Counties. The Pacheco HST Alternative is projected to induce the largest incremental population and employment growth rates in Madera and Merced Counties. The two HST alternatives are projected to have similar growth inducement effects for the Bay Area as a whole, while the Altamont HST Alternative is projected to have a larger growth inducement effect for the Northern Central Valley as a whole.

Regarding the nature of employment generated, the data suggest that under the HST Alternatives, the FIRE and service sectors are the most encouraged with around 61 percent of total incremental employment generated in this sector. The southern San Joaquin Valley and the northern Central Valley are expected to experience the largest shift in the nature of employment, which implies that the HST Alternative will be a strong influence in attracting higher wage jobs to these regions.

5.0 Station Area Growth Effects

5.0 Station Area Growth Effects

This chapter describes how regional population and employment growth could influence the amount of urbanized land required to accommodate the people living and working in each part of the State. The first section compares results for the system alternatives, while the second section compares results by geographic area. The final section provides a summary overview of the significance of these findings. The discussion in this chapter is supplemented by detailed tables of results in Appendices H (Employment Suballocation) and I (Breakout of Employment and Residential Components).

■ 5.1 Comparison of System Alternatives

Table 5.1 summarizes the total acreage of land at urbanized densities needed to accommodate projected employment or population in 2030. Table 5.2 shows the percent change in urbanized land area from the 2002 conditions, as well as the No-Project Alternative.

5.1.1 No-Project Alternative

Population and employment growth under the No-Project Alternative in the core study area is expected to require approximately 392,000 more acres of urbanized land in 2030 than the current estimated urbanized area of approximately 1.0 million acres.[1] This increase is about 40 percent over 2002 conditions. The Northern Central Valley is expected to experience the largest increase in urbanized acreage with a 61 percent increase over 2005 conditions, while the Bay Area is expected to experience an increase of 22 percent.

[1] Estimates of current urbanized area are based on urban land cover data provided by the California Farmland Mapping and Monitoring Program (CFMMP), a division of the California Department of Conservation.

Table 5.1 Year 2030 Size of Urbanized Area by System Alternative
County and Regional Totals

Area	Year 2002 Urbanized Area Acreage	Year 2030 Urbanized Area (In Acres)		
		No-Project Alternative	HST Alternative	
			Pacheco	Altamont
Alameda County	141,654	186,683	187,808	186,942
Contra Costa County	142,467	183,869	184,596	184,288
San Francisco County*	23,277	30,013	30,246	30,172
San Mateo County	70,869	80,304	80,386	80,543
Santa Clara County	184,481	207,833	209,352	211,324
Study Area – Bay Area	562,748	688,702	692,388	693,269
Fresno County	96,977	150,223	153,574	153,243
Madera County	23,255	36,366	37,793	37,778
Merced County	31,712	60,455	62,212	61,611
Sacramento County	157,101	237,818	238,066	239,245
San Joaquin County	74,250	145,776	145,046	146,104
Stanislaus County	55,426	74,267	74,179	76,886
Study Area – Central Valley	438,721	704,905	710,870	714,867
Core Study Area	1,001,469	1,393,607	1,403,258	1,408,136

Source: Cambridge Systematics, Inc., 2007.

* Projected increases in urbanized area for San Francisco County are a function of the average densities used to calculate employment acreage. Since “greenfield” land is not available in San Francisco County, employment growth will need to be accommodated through densification and infill rather than through increases in urbanized area size implied in this table.

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Table 5.2 Year 2030 Size of Urbanized Area by System Alternative

Area	Percent Change from 2002 Existing Conditions			Percent Change from 2030 No-Project Alternative	
	No-Project Alternative	HST Alternative		HST Alternative	
		Pacheco	Altamont	Pacheco	Altamont
Alameda County	32%	33%	32%	0.6%	0.1%
Contra Costa County	29%	30%	29%	0.4%	0.2%
San Francisco County*	29%	30%	30%	0.8%	0.5%
San Mateo County	13%	13%	14%	0.1%	0.3%
Santa Clara County	13%	13%	15%	0.7%	1.7%
Study Area – Bay Area	22%	23%	23%	0.5%	0.7%
Fresno County	55%	58%	58%	2.2%	2.0%
Madera County	56%	63%	62%	3.9%	3.9%
Merced County	91%	96%	94%	2.9%	1.9%
Sacramento County	51%	52%	52%	0.1%	0.6%
San Joaquin County	96%	95%	97%	-0.5%	0.2%
Stanislaus County	34%	34%	39%	-0.1%	3.5%
Study Area – Central Valley	61%	62%	63%	0.8%	1.4%
Core Study Area	**39%**	**40%**	**41%**	**0.7%**	**1.0%**

Source: Cambridge Systematics, Inc., 2007.

* Projected increases in urbanized area for San Francisco County are a function of the average densities used to calculate employment acreage. Since "greenfield" land is not available in San Francisco County, employment growth will need to be accommodated through densification and infill rather than through increases in urbanized area size implied in this table.

As discussed in Section 4.0, population is projected to grow by 44 percent between 2002 and 2030, with employment projected to grow by 37 percent over the same period. Hence, urbanization of undeveloped land is expected to occur at slightly lower rates than overall population and employment growth, reflecting a number of factors:

- A reduction in availability of undeveloped land in some urban counties in the Bay Area, creating higher land costs and market forces for denser development;
- Slight increases in infill and redevelopment, as seen recently in many of the urban counties; and
- An increase in marginal residential densities that has occurred over recent years.[2]

[2] *Raising the Roof: California Housing Development Projections and Constraints, 1997–2020,* California Department of Housing and Community Development; May 2000; Exhibit 17.

5.1.2 HST Alternative

Land consumption for the HST Alternatives is projected to be of the same general magnitude as the No-Project Alternative, when compared to the 2002 conditions. Results show that the Pacheco Alternative is expected to require slightly less urbanized land than the Altamont Alternative, entailing an increase of 40 percent and 41 percent, respectively, over 2005 conditions. Compared to the No-Project Alternative, the Pacheco HST Alternative is projected to urbanize an additional 9,600 acres, while the Altamont HST Alternative is projected to urbanize 14,500 more acres.

5.1.3 Sensitivity Analysis

Unlike the other system alternatives, a high-speed train provides an opportunity for local governments to focus more intensive land uses around rail stations. This opportunity arises from the competitive advantage that some industry groups might draw from proximity to an HST service.[3]

As reported in the technical report for the Statewide Program EIR/EIS[4], higher density, mixed-use development has been observed around rail stations in Europe, Japan, and the United States. While much of this densification is a result of market forces, research suggests that government intervention can accelerate or increase its effect. Strategies for *increasing* station area development include policies such as zoning that encourages mixed use, density bonuses, and maximum parking requirements. Strategies for *accelerating* station area development include joint development under public-private partnerships, tax-increment finance, locating civic institutions near stations, tax abatement programs, and other subsidies.

In addition to the base analysis, a sensitivity analysis was performed as part of the Statewide Program EIR/EIS to test the land consumption effects of land use densification strategies to modestly increase development density in the vicinity of HST stations. The sensitivity analysis included two assumptions:

1. For the residential land area projections, the rate of infill development around HST stations would double; and

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[3] These competitive advantages accrue to some industries due to their need for close proximity to ancillary industries (i.e., industry clustering) and a well-educated labor force. These advantages, known as *economies of agglomeration*, have emerged around the French and Japanese HST stations, and are an accepted norm for land use planning for many urban transit station areas in Europe and North America.

[4] *Economic Growth Effects of the System Alternatives for the Program Environmental Impact Report/ Environmental Impact Statement*, California High-Speed Rail Authority, Section 3.3, July 2003.

2. For the employment land area projections, the development density in the station area was increased from the 55th percentile to the 65th percentile in 2020, and from the 75th percentile to the 90th percentile in 2035. Development densities outside of the station area were not modified.

This scenario could reduce statewide land urbanization by approximately 24,000 acres (0.61 percent) less than the No-Project Alternative in 2020, and approximately 33,000 acres (0.71 percent) in 2035 compared to the No-Project Alternative.

These results represent a low-end estimate of the possible effects of land use densification strategies in combination with the introduction of HST service. This sensitivity test assessed the effects of densification strategies within a nominal one-mile band of a potential HST site. Research suggests that other jurisdictions have had some success in implementing more aggressive and regionwide land use strategies (e.g., urban growth boundaries, maximum parking requirements, jobs housing balance, more diversity of land uses, higher densities, higher service levels of mass transit, etc.) in conjunction with high-capacity intercity and urban transit services. Experience in these areas suggests that more aggressive strategies might be more attractive to policy-makers since HST could offer the economic rationale to developers to cluster their new commercial, industrial, and residential development within easy access to the HST stations. In general, the No-Project Alternative provides no such market incentive.

5.2 Regional and County Growth Effects

Each of the system alternatives has varied effects on different parts of the State. This section describes how population and employment growth is projected to influence the need for urbanized land in various regions and counties.

5.2.1 Bay Area

Under the No-Project Alternative, the Bay Area is projected to experience an increase in urbanized land area of approximately 125,000 acres between 2002 and 2030. This represents a change of 22 percent over 2002 conditions. Alameda County is projected to encounter the largest percent change, adding more than 45,000 acres (32 percent) to 2002 levels of urbanized area of approximately 142,000 acres.

Under the Pacheco HST Alternative, the Bay Area urbanized land is projected to require approximately 3,700 additional acres (0.5 percent) in 2030 compared to the No-Project Alternative. Under the Altamont HST Alternative, the Bay Area urbanized land is projected to require approximately 4,500 additional acres (0.7 percent) in 2030 compared to the No-Project Alternative. The largest absolute and relative increase for both HST alternatives is projected to occur in Santa Clara County requiring nearly 3,500 additional acres or 1.7 percent increase over the No-Project Alternative.

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5.2.2 Northern Central Valley

Under the No-Project Alternative, the northern Central Valley is projected to experience an increase in urbanized land area of approximately 266,000 acres between 2002 and 2030. This represents a change of 61 percent over 2002 conditions. Urbanized acreage in Merced and San Joaquin Counties is projected to almost double in order to accommodate population and employment growth between 2002 and 2030. Sacramento County is projected to experience the largest absolute increase in urbanized acreage – 80,000 acres – between 2002 and 2030.

Under the Pacheco HST Alternative, the northern Central Valley urbanized land is projected to require approximately 6,000 additional acres (0.8 percent) in 2030 compared to the No-Project Alternative, while under the Altamont HST Alternative, an additional 10,000 acres (1.4 percent) is projected to be required. Under both alternatives the largest absolute increase is projected to occur in Fresno County; whereas, the largest percent increase is projected to take place in Madera County. Under the Pacheco HST Alternative, the acreage required to accommodate growth decreases for San Joaquin and Stanislaus Counties by 0.5 and 0.1 percent, respectively, compared to the No-Project Alternative.

5.3 Key Findings

Overall, the No-Project and HST Alternatives present very similar levels of growth effects in terms of urbanized area size and land consumption needs. The incremental effect of HST Alternative relative to the No-Project Alternative is very small when compared to the incremental effect of the No-Project Alternative relative to 2002 conditions.

Analysis of results for individual counties largely follows these general statewide results. Nonetheless, the HST Alternatives do create some larger incremental growth relative to the No-Project Alternative. However, the results suggest that HST will not lead to wholesale shifts in residential location from the Bay Area and Los Angeles into the Central Valley.

One of the most telling summary statistics is to combine population and employment growth projections with land consumption forecasts, providing a measure of "land consumed per new job and resident." Essentially, this metric tells us how efficient each alternative is at accommodating the projected growth; since the alternatives have very similar levels of overall growth, the efficiency by which that growth is accommodated becomes very important. Table 5.3 provides the relevant data and resulting metric for each of the alternatives; lower values of the metric suggest greater efficiency. The results indicate that the Pacheco HST Alternative is the most efficient of the alternatives, providing an incremental development density that is 1.3 percent more efficient (i.e., less land per new job and resident) than the No-Project Alternative, while the Altamont Alternative is 0.8 percent more efficient than the No-Project Alternative. The efficiency gains for both HST alternatives are achieved in conjunction with the higher population and employment growth projections compared to the No-Project Alternative.

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Table 5.3 Marginal Land Consumption

	No-Project Alternative	Pacheco HST Alternative	Altamont HST Alternative
Land Consumption (thousands of ac)	392	402	407
Job Growth (thousands of jobs)	2,241	2,337	2,343
Population Growth (thousands of people)	4,155	4,304	4,354
*Acres Consumed Per New Job and Resident**	*0.0613*	*0.0605*	*0.0608*
Efficiency Gain/Loss Relative to No-Project Alternative	–	+1.3%	+0.8%

Source: Cambridge Systematics, Inc., 2007.

*Value found by dividing land consumption by the sum of job growth and population growth.

6.0 Preparers

6.0 Preparers

The following individuals participated in the analysis of statewide, regional, local, and station area growth effects.

George D. Mazur, P.E., Cambridge Systematics, Inc.

Project Role: Project Manager for consultant team; development of analysis methodologies; lead author of technical reports; processing of travel demand output for use in economic growth models; and estimation of non-user benefits.

Education: B.S. in Civil Engineering from Purdue University; and M.S. in Transportation Engineering from University of California, Berkeley.

Experience: Sixteen years experience in transportation planning and policy, travel demand forecasting, and environmental analysis; registered Professional Engineer in Georgia and California.

Abigail Rolon, Cambridge Systematics, Inc.

Project Role: Lead analyst for estimating traveler benefits and post-processing travel demand and economic model results.

Education: B.A. in Economics from the Center of Economic Research (CIDE), Mexico City, Mexico; and M.A. in Urban Planning from University of California Los Angeles.

Experience: Four years of experience in economic analysis, and two years of experience in transportation planning with emphasis in transportation economics.

Cecily Way, Cambridge Systematics, Inc.

Project Role: Refinement and application of employment land consumption analysis.

Education: B.S. in Civil Engineering from Massachusetts Institute of Technology; M.S. in Transportation Engineering from University of California, Berkeley; and M.C.P. from University of California, Berkeley, in progress.

Experience: Two years in transportation system analysis and planning, with emphasis on land use impacts of transit.

Glen Weisbrod, Economic Development Research Group, Inc.

Project Role: Design and initial construction of the economic growth model to forecast county-level business and population attraction impacts; and technical reviewer for CRIO-IMPLAN model forecasts.

Education: B.A. in Economics from Brandeis University; M.S. in Civil Engineering (Transportation) from Massachusetts Institute of Technology; and M.C.P. in City Planning from Massachusetts Institute of Technology.

Experience: Twenty-six years experience in consulting relating to economic development, economic impact modeling, and transportation; 15 years experience in the application of various economic models to transportation investments; Chair of the Committee on Transportation and Economic Development – Transportation Research Board; current President of Economic Development Research Group.

Lisa Petraglia, Economic Development Research Group, Inc.

Project Role: Design and initial construction of the economic growth model to forecast county-level business and population attraction impacts; and technical reviewer for CRIO-IMPLAN model forecasts.

Education: B.S. from the University of Massachusetts, Amherst; and M.S. in Applied Economics from the University of Massachusetts, Amherst

Experience: Over 15 years experience in economic modeling and policy analysis, focusing on economic impact evaluation; extensive experience with input-output and general equilibrium economic models, including their application to address transportation investments/policies.

Brian Baird, Economic Development Research Group, Inc.

Project Role: Construction and analysis of the TREDIS framework, including the economic growth model and business attraction model.

Education: B.S. in Civil Engineering from the University of Connecticut; and M.S. in Transportation Engineering and M.A. in Economics from the University of Connecticut.

Experience: Seven years experience in consulting and university research related to transportation, economics, and urban systems; five years experience working on interfacing travel demand models and economic impact models.

Rimon Rafia, Consultant

Project Role: Construction and analysis of TREDIS model.

Education: B.A. in Economics from Hebrew University in Jerusalem; and M.A. in Economics from Tel Aviv University

Experience: Mr. Rafiah has over a decade of work experience in transportation economics, including applications of economic analysis for transportation infrastructure investments around the world.

Michael Reilly, Stanford University

Project Role: Technical lead for development of residential land consumption; modified and ran CURBA model; and performed environmental overlay analysis for secondary impacts.

Education: B.A. in Anthropology from University of California; M.C.P. from the University of California; and Ph.D. program in Urban and Regional Planning at University of California.

Experience: Ten years research experience in urban and transportation analysis and modeling, with focus on California land use and development patterns; 10 years research in developing and applying CURBA model.

Appendix A

Estimation of Mode Shift Benefits

Appendix A. Estimation of Mode Shift Benefits

Mode shift benefits for HST system users were estimated through a process known as log-sum calculation. The log-sums results from the 1999 high-speed rail travel demand model were used as a base to forecast mode shift benefits, with a series of adjustments made to reflect differences between the 1999 and current travel demand models, as well as between the Pacheco and Altamont HST network alternatives.

A.1 Log-Sum Values from 1999 Travel Demand Model

Travel efficiency benefits for users of the HST system were estimated separately for intercity business users, intercity non-business users, and long-distance commuters. The benefits were estimated through a process known as a log-sum calculation. Using this process, the total benefit for switching from each mode to HST is calculated as a function of the log sum of utilities for travelers of that mode using the following equation:

$$B_{\text{mode}} = \frac{\mu_{\text{mode}} - \ln(e^{\mu_{\text{mode}}} + e^{\mu_{HSR}})}{\beta_{\text{cost}}}$$

where B_{mode} is the total benefit for that mode, μ_{mode} is the utility of travel on that mode, μ_{HSR} is the utility of travel on high-speed train, and β_{cost} is the coefficient of cost for travel on that mode (to monetize the benefits). The utility of a particular mode is calculated as a function of travel time and out-of-pocket costs, as follows:

$$\mu_{\text{mode}} = \alpha + \beta_{xost} \times Cost + \beta_{IVT} \times IVT + \beta_{Access} \times Access + \beta_{OVT} \times OVT$$

Where β_{cost} is the coefficient of cost for travel on that mode; β_{IVT} is the coefficient of line haul (in vehicle) time on that mode; β_{Access} is the coefficient of access/egress time on that mode; and β_{OVT} is the coefficient of out-of-vehicle (i.e., wait, terminal processing, etc.) on that mode.

These calculations use coefficients from the mode choice model developed for previous work by the HSRA, and travel time and cost information developed for the prior model. The mode choice coefficients for the relevant modes are shown in Table A.1. Monetary values that resulted from these coefficients were adjusted to 2002 dollars for purposes of the REMI analysis in the Statewide Program EIR/EIS.

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Table A.1 Values of Time from Previous HST Mode Choice Models

	Local Air	Conventional Rail	Private Auto	
			Short Distance	Long Distance
Business Trips				
Modal Constant	0.0993	0.7848	-0.6600	-0.7995
Line-haul Time (IVT)	-0.0357	-0.0254	-0.0142	-0.0110
Access/Egress Time	-0.0382	-0.0325	-0.0175*	-0.0184
Wait Time (OVT)	-0.0207	-0.0225		-0.0060
Cost	-0.0505	-0.1046	-0.0450	-0.026
Non-Business Trips				
Modal Constant	0.1174	0.5226	-1.0369	-0.8768
Line-haul Time (IVT)	-0.0373	-0.0197	-0.0057	-0.0066
Access/Egress Time	-0.0141	-0.0212	-0.035**	-0.0093
Wait Time (OVT)	-0.0321	-0.0144		-0.0031
Cost	-0.0744	-0.0860	-0.0553	-0.0293

Source: Charles River Associates, 1996.

* This access/egress coefficient is applied the following ratio of travel times – (*OVT*)*(1.5*access*)/*IVT*.

** This access/egress coefficient is applied the following ratio of travel times – (0.5*OVT*)*(1.5*access*)/*IVT*.

■ A.2 Adjustments to Prior Log-Sum Values

A series of adjustments were undertaken to the prior log-sum values in order to reflect changes between the 1999 and current versions of the high-speed rail travel demand models. The adjustments accounted for differences in the following:

- Structure of analysis regions used for the economic forecasting, necessitating reallocation of log-sum totals;
- Forecasted source of HST ridership (e.g., auto, air, conventional rail, induced travel);
- Values of time;
- Number of trips by mode under high end assumptions;
- Inclusion of non-commute intraregional trips in the new HST travel demand model; and
- Travel model results by region for the Altamont and Pacheco HST network alternatives.

Appendix B

Estimation of Non-User Benefits

Appendix B. Estimation of Non-User Benefits

This appendix describes technical procedures that were followed to estimate non-user benefits for the HST Alternatives. The term "non-user benefits" refers to savings that accrue to individuals who do not use the HST system after service begins. Nonetheless, these individuals might receive residual benefits from travel delay reductions or related areas that arise from diversion of trips to HST from auto, air, and/or conventional rail modes.

B.1 Auto Congestion Reduction Benefits

The HST Alternatives involve diversion of trips from the auto mode to the HST mode. The alternatives also assume that the highway network from the No-Project Alternative remains in place to serve the remaining auto demand of the HST Alternatives. The combination of constant highway capacity and decreased travel demand via auto will lead to reductions in travel delay for individuals who remain in the auto mode.

Auto congestion reduction benefits for each HST alternative were estimated by calculating the absolute difference between the vehicle hours traveled (VHT) under the HST Alternatives and the No-Project Alternative. This calculation relied on results from the MTC Statewide High-Speed Rail Travel Demand Model. For HST, travel demand model results were used for the HST Network Alternatives representing service to San Jose and Oakland termini in the Bay Area. VHT results were tracked separately for trips wholly within a single metropolitan area (intraregional trips), as well as trips between metropolitan areas (intercity trips). Intraregional truck and auto VHT in the Bay Area and Southern California are forecast separately in the travel demand model, and were tracked separately for the congestion reduction calculations. For intraregional trips in other areas and all intercity trips, the travel demand model calculates total VHT. This total was split into auto and truck components using VHT splits of 96.8 percent auto and 3.2 percent truck for intraregional, and 95 percent auto and 5 percent truck for intercity[1].

VHT changes were converted to monetary values by multiplying the absolute change in VHT by values of time (VOTs) corresponding to different trip purposes and regions. For intraregional trips, average hourly wages for the Bay Area, Los Angeles, and the State

[1] *Truck Miles of Travel on the California State Highway System, 1989-2004*, California Department of Transportation Division of Transportation System Information, August 2006.

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were compiled from the Bureau of Labor Statistics and converted into hourly values by trip purposes using shares of wage rates by trip purpose that were determined by MTC. Table B.1 summarizes these intraregional VOTs. For intercity trips, VOTs from the MTC Statewide High-Speed Rail Travel Demand Model were used. These intercity VOTs are shown in Table B.2.

Table B.1 Intraregional Values of Time by Trip Purpose
(2005 Dollars Per Hour)

	Share of Wage Rate	Bay Area	Southern California	California State
Average Hourly Wage		**$24.00**	**$20.40**	**$20.44**
Home-Based Work	46%	$11.20	$9.30	$9.50
Home-Based Shopping	32%	$7.60	$6.30	$6.50
Home-Based Social/Recreational	4%	$0.90	$0.80	$0.80
Home-Based Grade School	2%	$0.40	$0.30	$0.30
Home-Based High School	1%	$0.30	$0.20	$0.20
Home-Based College	3%	$0.80	$0.60	$0.70
Non-Home-Based	5%	$1.30	$1.00	$1.10
Trucks	100%	$24.00	$20.40	$20.44

Source: U.S. Bureau of Labor Statistics and Metropolitan Transportation Commission (http://www.mtc.ca.gov/maps_and_data/datamart/forecast/table4.htm).

Table B.2 Intercity Values of Time by Trip Purpose
(2005 Dollars Per Hour)

	Business Trips	Commute Trips	Other Trips	Truck Trips
Long Trips (>100 miles)	$57.71	$57.71	$18.33	$30.00
Short Trips (<100 miles)	$27.60	$10.12	$7.93	$30.00

Source: *Bay Area/California High-Speed Rail Ridership and Revenue Forecasting Study, Interregional Model System Development*, Cambridge Systematics, Inc., August 2006, Table 3.14.

■ B.2 Pollution and Accident Reduction Benefits

As in the case of congestion reduction benefits, pollution and accident reduction benefits arise from the reduction in vehicle miles traveled (VMT) between the No-Project and the

HST Alternatives, given that the HST Alternatives involve diversion of trips from the auto mode to the HST mode.

Pollution and accident reduction benefits for each HST alternative were estimated by calculating the change in VMT between the No-Project and HST Alternatives. VMT estimates for each economic analysis region were forecast in the MTC Statewide High-Speed Travel Demand Model. VMT changes were then converted to monetary values using conversion rates of $0.07 per VMT to estimate accident reduction benefits, and $0.009 per VMT to estimate pollution reduction benefits. These values were taken from previous HST studies[2] and adjusted for inflation.

B.3 Air Delay Reduction Benefits

The HST Alternatives include transportation system changes that could lead to delay reductions for air travelers when compared to the No-Project Alternative. Specifically, reduction in intrastate air travel with the HST Alternative could reduce the number of intrastate flights needed to accommodate this air demand, thereby, saving time for remaining intrastate, interstate, and international air travelers due to fewer takeoffs and landings at major airports.

This analysis considered the potential for air delay reduction benefits at airports throughout California. As with a previous analysis performed for the HSRA,[3] this analysis focused on airside delay reductions to passengers and aircraft operations at nine major airports in California. Unlike the earlier analysis, however, this current analysis considered the potential for air delay reduction benefits to accrue to other locations throughout the State. Although air carrier airports in these other locations were unlikely to experience meaningful changes in airside travel time, a portion of the air delay reduction benefit from major airports would actually accrue to the regions around these other airports due to changes in overall flight time for intrastate air travel.

Airport Capacity

Airport capacity was determined on a regional basis, which allowed for continuation of assumptions from the earlier HSRA work that flights (particularly intrastate) could shift from airports with high levels of delay to less congested airports in the same region. The following regional groupings were used for major airports:

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[2] *Economic Growth Effects of the System Alternatives for the Program Environmental Impact Report/ Environmental Impact Statement*, Cambridge Systematics, Inc., July 2003.

[3] *Independent Ridership and Passenger Revenue Projections for High-Speed Rail Alternatives in California*, Appendix A, Charles River Associates, January 2000.

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- **Los Angeles –** Los Angeles International, Burbank-Glendale-Pasadena, Ontario International, and Orange County (John Wayne Airport);
- **Bay Area –** San Francisco International, San Jose International, and Oakland International;
- **Sacramento –** Sacramento International; and
- **San Diego –** San Diego International (Lindbergh Field).

Airside operational capacity (annual service volume) was estimated on a regional basis using the existing number of runways and terminal gates, and improvements defined for the No-Project Alternative in the Bay Area to Central Valley Program EIR/EIS. For this analysis, it was assumed that runway and terminal configurations were identical between the No-Project and HST Alternatives. Physical facilities were converted to operational capacity using the following assumptions:

- Gate utilization factor of 525,000 passengers per gate per year[4];
- Gate to runway ratio of 30[5]; and
- Average aircraft load of 74 passengers per operation[6].

The larger of the two values derived from runway and terminal gate improvements was assumed to represent the operational capacity in each region. A summary of the airport physical features and operational capacity used for this analysis is presented in Table B.3.

Table B.3 Airport Characteristics of the System Alternatives

	Airport Physical Features				Annual Service Volumes (Thousands of Operations)	
	Year 2005		Increase from Year 2005 for No-Project and HST Alternatives			
Region	**Runways**	**Gates**	**Runways**	**Gates**	**Year 2002**	**Year 2030**
Los Angeles	10	194	0	24	2,153	2,307
Bay Area	10	172	0	29	1,267	1,455
Sacramento	2	30	0	14	315	405
San Diego	1	41	0	8	270	322

4 *System Alternatives Definition – Deliberative Draft*, California High-Speed Rail Authority, November 18, 2002.

5 ibid

6 This value is a statewide average for major airports, and was derived from data presented in Appendix A of the *Independent Ridership and Passenger Revenue Projections for High-Speed Rail Alternatives in California*.

Air Travel Demand

Results for each system alternative from the MTC Statewide High-Speed Rail Travel Demand Model provided the region-to-region air flows for intrastate air travel. These region-to-region flows were aggregated to flow totals that reflected the regional airport grouping presented earlier. This allocation of analysis regions to the regional groupings was as follows:

- **Los Angeles –** Los Angeles, Orange, Riverside, San Bernardino, and Ventura;
- **Bay Area –** Alameda, Contra Costa, San Francisco, San Mateo, Santa Clara and a portion of the "rest of California";
- **Sacramento –** El Dorado, Placer, Sacramento, Sutter, Yolo and Yuba;
- **San Diego –** San Diego;
- **Northern Central Valley –** Fresno, Madera, Merced, San Joaquin, and Stanislaus;
- **Southern Central Valley –** Kern, Kings, and Tulare; and
- **Rest of State –** The remainder of the "rest of California" not included in the Bay Area.

Estimates were also made of interstate and international enplanements and deplanements in each major region. These estimates were based on results from a previous HSRA analysis that had used travel model results for the Business Plan assumptions.[7] The difference between total airport demand (from the HSRA analysis) and intrastate airport demand (from the MTC Statewide High-Speed Rail Travel Demand Model) provided a year 2030 estimate of interstate and international airport demand (enplanements and deplanements). The total regional airport demand for this current analysis was estimated as the sum of the interstate/international airport demand and the intrastate travel model results for each system alternative.

Commercial aircraft operations within each region were estimated using an assumed average of 74 passengers per operation.

[7] *Independent Ridership and Passenger Revenue Projections for High-Speed Rail Alternatives in California*, Appendix A, Charles River Associates, January 2000.

Airport Delay

Regional airport delay was estimated for each system alternative and HST design option using the equation:[8]

$$Delay\ per\ aircraft\ operation\ (\text{min.}) = 0.19 + 2.33 * \left(\frac{annual\ operations}{annual\ service\ volume} \right)^6$$

Operations and service volume estimates for each system alternative were taken from previous steps. The delay reduction for the Altamont and Pacheco HST Alternatives was derived by subtracting the delay value from these alternatives from the delay value for the No-Project Alternative. Delay reductions, which ranged from 0.1 minute at Sacramento up to 2.7 minutes in the Bay Area, are summarized in Table B.4.

Table B.4 Year 2030 Annual Delay Reduction from No-Project Alternative for Aircraft Operations

	Altamont HST Alternative		Pacheco HST Alternative	
	Time Saved Per Operation (In Minutes)	**Annual Delay Reduction (Thousands of Passenger Hours)**	**Time Saved Per Operation (In Minutes)**	**Annual Delay Reduction (Thousands of Passenger Hours)**
Los Angeles Region	0.98	3,914	1.00	4,004
Bay Area	2.62	7,455	2.67	7,609
Sacramento	0.09	46	0.10	46
San Diego	2.09	2,147	2.14	2,183
Northern Central Valley	–	4	–	4
Southern Central Valley	–	1	–	1
Rest of State	–	29	–	25
Statewide Total	**–**	**13,596**	**–**	**13,872**

Source: Cambridge Systematics, Inc., 2003.

Total delay reduction was calculated for aircraft operators and air travelers in each region by multiplying the delay reduction per operation by the estimated number of aircraft operations and air travel demand, respectively. Separate tabulations were maintained for intrastate and interstate/international travelers.

[8] Levinson, D., and D. Gillen, *The Full Cost of Air Travel in the California Corridor*, presented at the Annual Meeting of the Transportation Research Board, Washington, D.C., January 1999. This equation was used in previous work by the HSRA.

Total regional delay savings for air travelers were split into business and non-business components, assuming that business travel represented about 54.3 percent of total air travel. This percentage represents a statewide average for intrastate air travel using travel demand results from the No-Project Alternative. This percentage was assumed to apply equally to intrastate and interstate/international air travelers.

A portion of the delay reduction within the four major airport regions was assumed to accrue to airports elsewhere in the State. This allocation considered time savings for intra-state air travelers from the northern and southern Central Valley and the rest of the State that travel into or through airports in one of the four major regions. Average delay reductions for flights at each major airport were applied to estimates of air travel between the four major airport regions and elsewhere in the State. The resulting delay reductions were applied to the other airports, and then subtracted from the original delay reduction estimates for the major airports (to avoid double-counting of benefits).

Monetized Benefits

The delay reduction benefits were converted to monetary benefits using the following "values of time" (expressed in 2005 dollars):

- $57.72 per hour for a business or commute traveler;
- $18.33 per hour for a non-business/commute traveler; and
- $2,910 per aircraft operating hour.

The monetary benefits were assumed to accrue one-half at the origin end and one-half at the destination end of each trip. For interstate and international flights, this assumption means that one-half of delay savings is "lost" to some other location, either domestically or internationally.

Appendix C

Analysis of Business Attraction

Appendix C. Analysis of Business Attraction

This analysis considered the potential for increased business activity within the study area as a result of better access to markets. This effect is separate from (and additional to) the economic benefits of improved travel efficiency. Business attraction captures the benefit of new locational advantages resulting from better transportation linkages and expanded market access.

In producing goods, firms rely on access to suppliers and a quality labor force. In addition, many firms also rely on proximity to consumer markets to sell their goods. Transportation projects have the potential to change these economic landscapes by expanding the area within which a business will access suppliers, customers, or workers. This effect may be achieved either by creating new transportation linkages, or by increasing speeds on existing transportation networks. In either case, the new linkages may facilitate scale economies through improved access to producers and skilled labor markets. Over time, this increased productivity may enable existing firms to increase output and employment, and it may draw other firms to the region. The net result is increased output and employment.

These general effects of transportation investments on economic development will depend on changes in accessibility to input (workers and supplies) and output markets, industry sector characteristics, and local economic characteristics. These three factors, which are summarized in Table C.1, comprise the general framework used in the business attraction model (BAM) within TREDIS. Modeling the effects of any particular transportation improvement, however, requires fine-tuning of a generalized BAM to capture the unique characteristics associated with the affected transportation modes and the economic geography of the areas being modeled.

Table C.1 General Business Attraction Modeling Framework

Element	General Indicator
Accessibility Measures	
Product Markets and Suppliers	Level of economic activity within radius
Regional/International Markets	Time to airports, rail centers, ports, etc.
Labor Market Access	Number of workers within fixed radius
Local Area Characteristics	
Labor Cost	Relative manufacturing wage
Office/Warehouse Cost	Relative rents or land/housing costs
Skilled Workers	Percent of population with bachelor's degree
Industry Sector Characteristics	
Space Intensity	Average floor space per worker
Skill Intensity	Percent production workers; average wage
Transportation Intensity	Transportation as % of production costs

C.1 Business Attraction Framework

Accessibility Measures

Accessibility effects capture the absolute influence of transportation improvements on access to labor, supplier, and buyer markets. The relevant radius for labor market access is generally smaller (e.g., 60 to 90 minutes) than for supplier and buyer market access (e.g., 180 to 240 minutes). Accessibility measures capture the effects of transportation improvements on existing firms in an area that will experience lower transportation costs, as well as the overall attractiveness of an area as a site for new firms. Transportation improvements also improve access to regional and international markets by reducing the time and costs to key transportation modes (e.g., airports, rail centers, and sea and river ports). The level of these improvements is measured by the percent reduction in time needed to access these modes and points.

Local Area Characteristics

Improvements in accessibility interact with *local economic characteristics*, including land and labor costs and workforce characteristics, to determine the overall level of economic benefit associated with improved transportation networks. For existing firms, access to new sources of labor is a key factor; with improved access, firms might increase market share or expand the range of activities at existing sites. New firm locations are influenced by similar factors. For example, areas with relatively low-cost land and labor can expect to increase their chances of attracting labor- and land-intensive industrial activities, while those with access to highly skilled labor will be attractive to skilled manufacturing, high-end services, management, and engineering activities.

Industry Sector Characteristics

Industry sector characteristics are important for identifying the types of industries that will be drawn to an area after transportation improvements. The key industry sector characteristics modeled include the following:

- The space intensity of the industry, which measures the average amount of floor space required for each worker;
- Skill intensity, which captures each industry's dependence on skilled labor; and
- Transportation intensity, which reflects the percent of total production costs that go to transportation-related expenses.

Local areas with low costs of industrial space (e.g., land, offices, plants, warehouses) will be attractive to industries that require large amounts of footage per employee. Local areas with a high proportion of skilled workers will be attractive to industries that require highly skilled workers in production and support activities like research and development. In all cases, industries with higher transportation intensities will be more strongly affected by improvements – and associated cost and time savings – associated with infrastructure improvements.

C.2 Modeling Transportation Alternatives for California

Business Attraction Model Modifications

Two primary modifications had to be made to the BAM for this project. First, unlike highway or airport improvements that increase the efficiency with which people *and* freight can be transported, international experience suggests that HST is used almost exclusively for the transport of people. To address this, modifications were made to categorize industries based on the relative weights of personnel versus freight movements in total transportation costs. Second, the economic geography of California is unique: unlike rural areas, where economic activity is more dispersed and networked, or states such as Massachusetts, where a large portion of economic activity is centered around one city (Boston), California is characterized by two primary concentrations of activity – the Bay Area and Los Angeles. To address this, each county affected by HST was categorized according to the likely influence of the Bay Area and Los Angeles on their business attraction potential. Modifications to the BAM used for analysis of California HST are summarized in Table C.2.

Table C.2 Modifications to General Business Attraction Model for HST Analysis

Unique Feature	Modification to BAM
Modal Characteristics	
HST transports primarily people	Industry dependence on business travel
Other modes transport people and freight	Industry dependence on freight movements
Local Area Characteristics	
Concentration of activity in Bay Area	Develop production costs for each county in Bay Area and Northern Central Valley relative to San Francisco
Concentration of activity in Los Angeles	Develop production costs for each county in Southern California and Southern Central Valley relative to Los Angeles
Industry Sector Characteristics	
Cost competitiveness	Off/plant and labor costs
Skill base	Educational attainment levels

Two sets of business attraction effects were modeled for the HST alternatives:

1. The direct accessibility effects of the introduction of HST; and

2. The indirect benefits associated with reductions in highway congestion as highway users switch to HST.

In addition, improvements associated with access to international airports were recognized in the enhanced economic impact model. These are associated with ease of accessing major national and international markets.

For new business attraction, the analysis of HST and highway infrastructure effects proceeded in three steps:

1. Estimation of labor, market, and airport accessibility numbers, with changes used to generate estimates of the overall increases in market size;

2. Characterization of industry sector to estimate the potential of change on activity in each industry, based on the industry's transportation and skill requirements; and

3. Characterization of each county's business environment to translate potential maximum industry sector growth into actual business attraction by county.

In short, the process can be thought of as a matching between industry sector demands and county characteristics that yields estimates of business attraction by industry, county, and mode.

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Labor, Market, and Airport Accessibility

Introduction of HST and improvements in highways and airports will increase access to labor and output markets. For HST modeling, the increase in labor market accessibility was modeled by the increase in the number of workers (as proxied by total employment levels) within a 90-minute radius; for highway improvements, a 60-minute radius was used. Different radii were used to reflect different valuations of time for commuters in each mode: while HST commuters can read, write, and work while commuting, highway users cannot. The proportion of lost time will be higher for highway commuters and, accordingly, acceptable commute lengths lower.

In both alternatives, increased market access is modeled by the change in access to economic activity (as proxied by total employment levels) within a 180-minute radius. With improved market access, existing firms (that can be assumed to have already developed some competitive advantage) expand the potential market areas for their products. These improvements translate into greater sales and employment for existing firms. Thus, firms in counties like Los Angeles, with a broad and deep economic base already in place, are expected to experience growth in the size or range of functions by firms already located there as the effective market area expands. At the same time, greater market access makes peripheral counties with less developed economic bases more attractive locations for the siting of new firms. With improved access, smaller or more remote counties enjoy a greater effective market area and become more attractive than in the past vis-à-vis large economic centers like Los Angeles and San Francisco. In this way, improved market access will be expected to increase the competitiveness of all sites relative to other locations in the U.S., while at the same time improving the attractiveness of California counties that lie on the periphery of the existing industrial centers.

The accessibility estimates were prepared using the MTC Statewide High-Speed Rail Travel Demand Model. For each alternative, the number of people and jobs that were accessible within certain time bands was calculated. The time band was estimated using door-to-door travel times on the fastest available mode between each origin-destination pair. The time band information was then combined with the population and employment forecasts to estimate the total labor and business market access in each county (for each trip purpose, mode, and alternative). In addition, the model was used to estimate the average auto travel time necessary to travel to a major airport from each of the 16 California regions.

Industry Sector Characteristics

The effect of industry sector characteristics was modeled based on the intensity and type (i.e., the relative importance of freight shipments versus personnel movements) of transportation requirements associated with each industry. Intuitively, access to HST would seem to affect most strongly industries, such as legal services, finance, insurance, and management services that utilize transportation services primarily to move persons (an assumption borne out by case studies of business attraction effects of HST in Europe, North America, and Asia). Improvements in highways, on the other hand, will more strongly influence industries that utilize transportation services primarily to move freight, such as manufacturing, warehousing, and distribution firms.

Industry estimates of freight versus personnel movement were developed based on typical business travel expenses calculated from national input/output coefficients from the U.S. Bureau of Economic Analysis. Effects on different industry sectors will also be influenced by the types of workers required by each industry. In general, industries that require higher proportions of skilled and specialized labor benefit from improved labor market access more than those that rely more heavily on low skilled workers. To capture this effect, skill-intensity measures were developed for each industry, based on the proportions of production and non-production workers and average industry sector wages, as reported by the U.S. Department of Labor.

County Characteristics

Two sets of county characteristics were developed:

1. Cost-competitiveness, based on local labor and office/plant/warehouse costs; and
2. Workforce characteristics based on educational attainment levels of the population in each county.[1]

For each county in the Bay Area and northern Central Valley, an overall indicator of cost competitiveness was determined by the costs of land and labor relative to San Francisco County; for counties in the southern Central Valley and Southern California, comparisons were made to Los Angeles County. In conjunction with data on the baseline economic structure (i.e., employment levels by industry in the comparator and other modeled counties), data on county characteristics provide a measure competitiveness of each county relative to the San Francisco and Los Angeles. Combined with county-level accessibility measures, these data are used to estimate the shift in economic activity from the comparator counties to the outlying counties.

Final Adjustments

The business attraction model operates separately and independently for each of the 15 regions directly impacted by the HST alignments. Thus, gross results include some "double-counting" of job creation because jobs drawn to one affected region may have been attracted away from another affected area. For example, some of the BAM-forecasted jobs attracted to Fresno may be drawn away from San Francisco (among other

[1] Data on labor costs were taken from the *County Business Patterns*, U.S. Census Bureau; data on land and office costs were derived from county housing and rental costs from U.S. Census Bureau; and county educational attainment levels were taken from U.S. Census Bureau.

counties). To account for this effect for all of California, a model was developed that determines the likely source of predicted job attraction for each of the 15 BAM regions. The model operates at the county level, and the source county for each attracted job is based on several factors:

- The attracted job's industrial sector;
- The amount of sector-specific employment in any potential source county;
- The sector-specific employment trend in any potential source county relative to the U.S. trend; and
- The effective time and cost involved in travel between the potential source county and county to which jobs are attracted

The model was run for each of the 15 California regions with market access benefits, pooling jobs drawn from any California county. Results were then aggregated back to the 16 regions, and the totals were subtracted from the gross BAM results to determine net business attraction.

Appendix D

Detailed Tabulation of Traveler Benefits

Appendix D. Detailed Tabulation of Traveler Benefits

Table D.1 Year 2030 Traveler Benefit Detail for the Pacheco HST Alternative
(Thousands of 2005 Dollars)

	Core Study Area Bay Area	Core Study Central Valley	Southern Sacramento Valley	Southern San Joaquin	Southern California	San Diego County	Rest of California	Total
Mode Shift Benefits for Intercity Business Travelers	947,872	362,010	71,181	44,578	1,351,478	475,810	261,219	**3,514,149**
Mode Shift Benefits for Intercity Non-Business Travelers	527,229	219,507	45,256	37,669	656,523	217,917	134,539	**1,838,639**
Auto Delay Reduction for Intercity Business Travelers	156,257	408,393	34,499	243,477	711,366	225,321	199,312	**1,978,625**
Auto Delay Reduction for Intercity Non-Business Travelers	235,942	809,914	72,051	379,687	792,745	302,503	343,730	**2,936,572**
Accident Reduction for Business Travelers	163,020	102,355	6,653	61,788	450,053	46,100	78,253	**908,222**
Accident Reduction for Non-Business Travelers	186,809	117,290	7,624	70,805	515,726	52,827	89,672	**1,040,752**
Air Pollution Reduction for Business Travelers	21,525	13,499	877	8,149	60,383	6,080	10,321	**120,834**
Air Pollution Reduction for Non-Business Travelers	24,666	15,469	1,005	9,338	69,194	6,967	11,827	**138,466**
Mode Shift Benefits for Intra-Regional Travelers	40,811	0	0	0	87,862	16,801	0	**145,474**
Auto Delay Reduction for Intra-Regional Travelers	941,251	18,634	3,194	12,036	3,102,342	420,824	341,437	**4,839,716**
Air Delay Reduction for Business Travelers	140,181	957	130	29	73,503	49,351	782	**264,933**
Air Delay Reduction for Non-Business Travelers	37,528	256	35	8	19,678	13,212	209	**70,926**
Air Delay Reduction for Operators	160,076	1,092	80	18	83,935	56,355	484	**302,041**

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Table D.2 Year 2030 Traveler Benefit Details for the Altamont HST Alternative
(Thousands of 2005 Dollars)

	Core Study Area Bay Area	Core Study Central Valley	Southern Sacramento Valley	Southern San Joaquin	Southern California	San Diego County	Rest of California	Total
Mode Shift Benefits for Intercity Business Travelers	928,552	388,268	81,512	45,506	1,355,622	476,292	270,770	**3,546,522**
Mode Shift Benefits for Intercity Non-Business Travelers	491,795	229,688	51,966	36,926	634,307	202,223	132,047	**1,778,952**
Auto Delay Reduction for Intercity Business Travelers	142,673	386,877	35,221	225,115	479,047	187,137	186,994	**1,643,064**
Auto Delay Reduction for Intercity Non-Business Travelers	205,091	766,351	74,044	335,205	685,815	251,690	301,676	**2,619,872**
Accident Reduction for Business Travelers	60,474	99,105	11,371	56,664	433,540	41,757	75,804	**778,715**
Accident Reduction for Non-Business Travelers	69,298	113,566	13,031	64,933	496,803	47,850	86,866	**892,347**
Air Pollution Reduction for Business Travelers	7,976	13,071	1,500	7,473	57,178	5,507	9,998	**102,702**
Air Pollution Reduction for Non-Business Travelers	9,139	14,978	1,719	8,564	65,522	6,311	11,456	**117,689**
Mode Shift Benefits for Intraregional Travelers	40,811	0	0	0	88,036	16,627	0	**145,474**
Auto Delay Reduction for Intraregional Travelers	242,322	25,873	30,511	12,610	3,040,712	517,834	175,307	**4,045,170**
Air Delay Reduction for Business Travelers	137,400	945	125	30	71,891	48,700	888	**259,979**
Air Delay Reduction for Non-Business Travelers	36,784	253	33	8	19,246	13,038	238	**69,600**
Air Delay Reduction for Operators	156,900	1,079	78	19	82,094	55,612	550	**296,330**

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Appendix E

Land Consumption Analysis for Employment

Appendix E. Land Consumption Analysis for Employment

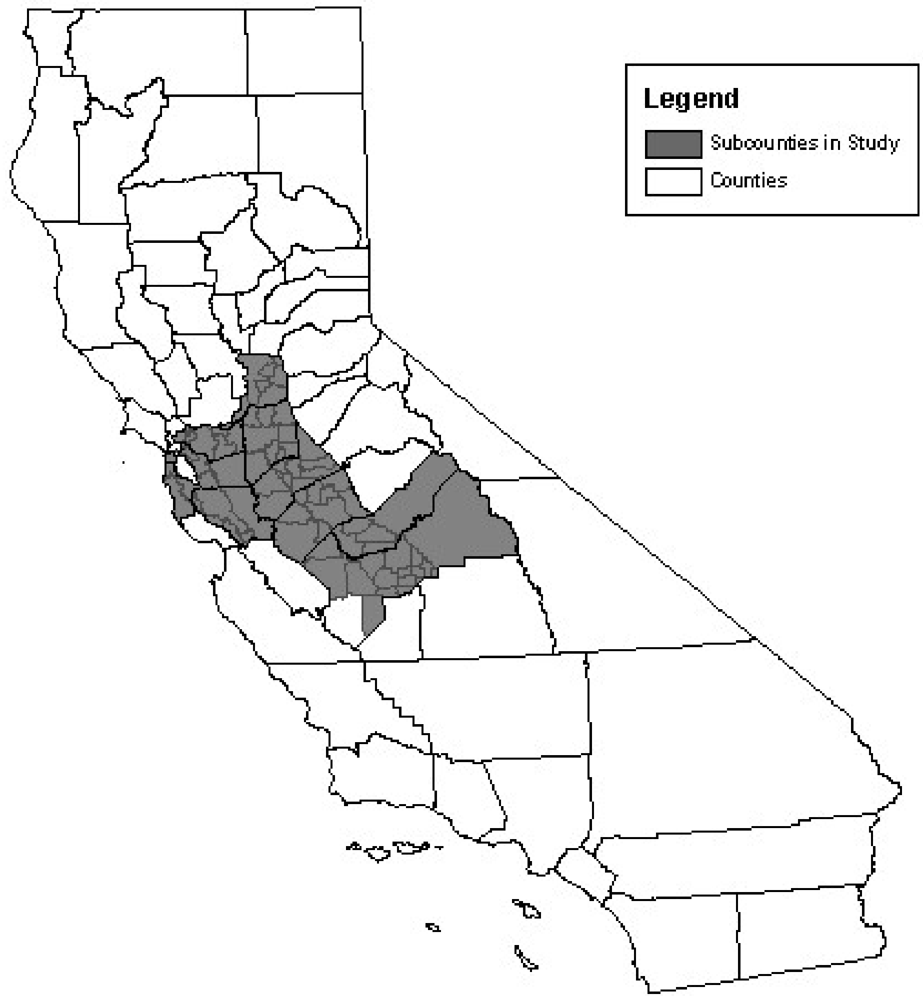
The analytical process for estimating employment-related land consumption was identical to the process followed for the Statewide Program EIR/EIS. This process consisted of three main steps, including development of a database of current employment density for every ZIP code, allocation of forecast employment to segments of the urbanized area around each station, and tabulation of resulting land consumption.

The process began by classifying every ZIP code in the study area into subcounties associated with each station. Subcounties are the basic area of influence assumed for each station. Where no single HST alternative proposes more than one station in a county, the area of influence generally consists of the entire county. Where multiple HST stations exist within a county, the county was divided along ZIP code boundaries into subcounties associated with each station. For large counties with boundaries that extend well beyond 25 miles from the proposed alignment, such as Fresno County that extends far east and west of the corridor, only the portion of the county within the study area was used. By focusing on only those ZIP codes closest to the proposed HST alignment, the influence of development patterns typical of less densely populated portions of the State on the statistical analysis was minimized. Furthermore, the study area boundary concentrates development impacts of HST generally within 25 miles of the corridor, which leads to more reliable results. Figure E.1 shows the subcounties and the study area included in the analysis.

Each subcounty is associated with one "prototype" based on the position of a potential HST station within the system and the nature of existing development patterns in the subcounty. Prototypes included the following:

- Terminal (station at the end of a line in a major city downtown);
- Urban (through station in a small city downtown or other densely urbanized area);
- Suburban (through station in a lower density urbanized area);
- Urban-outlying (through station in a city independent of a major metropolitan area, such as in the Central Valley); and
- Rural (through station in a small rural community).

Figure E.1 Subcounties and Study Area for Employment Land Consumption



Each subcounty is further subdivided into three subregions, which include the following:

1. **Downtown –** Traditional central business district;
2. **Infill –** Rest of currently urbanized area as defined by the U.S. Census; and
3. **Other –** Undeveloped land located outside of the currently urbanized area.

E.1 Disaggregation of Statewide and Regional Employment Forecasts

County-level employment forecasts by industry were allocated to subcounties based on the total current employment in the ZIP codes contained in each subcounty. These disaggregation factors were based on the number of establishments by size class and industry as reported by the U.S. Census in its 1997 ZIP Code Business Patterns (CBP) data; adjusted to 2002 county control totals as reported by Woods and Poole.

E.2 Development of Current Employment Density Profile

Employment density was calculated by industry for each ZIP code in the study area. Employment by ZIP was based on the CBP data. Employment land area was based on land use data provided by each jurisdiction in the study area. Existing land available for employment uses was derived from the calculations of land zoned for employment by one-digit SIC for each ZIP code. In counties for which no zoning data was available, the land available for each industry was calculated using average percentages of total land area available for each use.[1] Different averages were used for each prototype-subregion combination to better reflect local conditions.

Density profiles were developed for each of the 15 prototype-subregion combinations to represent the range of development patterns encountered across the study area. Densities are expressed as employees per acre of land zoned for employment in each industry. The profiles include densities in five percentile increments from the 0th to 100th. Table E.1 shows the median (50th percentile) density value for each industry and prototype-subregion combination.

[1] In Fresno and Madera Counties, the land available was computed based on statewide average shares of total land area by prototype and subregion. In Alameda, Contra Costa, Santa Clara, San Francisco, and San Mateo Counties, land available was computed based on statewide shares of total employment area by prototype and subregion using employment land area data provided by the Association of Bay Area Governments (ABAG). These averages were derived from the calculations by ZIP for the rest of the State.

Table E.1 Median Employment Density by Industry

Subregion	Number of ZIP Codes in Sample	Employment Density (Employees Per Acre)									
		Farming	Mining	Construction	Manufacturing	TCU	Wholesale	Retail	FIRE	Services	Government
Terminal											
Downtown	29	0	0	23	35	36	13	30	72	112	366
Infill	66	0	0	31	3	23	6	19	10	44	324
Other	9	0	0	1	0	0	2	4	2	11	0
Urban											
Downtown	32	0	0	68	35	14	13	20	63	62	405
Infill	430	0	0	42	17	9	9	20	32	36	240
Other	4	0	0	68	17	0	11	644	5	9	3
Suburban											
Downtown	0										
Infill	167	0	0	56	14	4	8	22	49	26	222
Other	16	0	0	15	0	1	0	6	4	16	23
Outlying											
Downtown	11	0	2	49	2	4	4	26	7	50	781
Infill	71	0	0	11	2	2	2	12	4	14	88
Other	12	0	0	10	1	4	1	3	1	1	247
Rural											
Downtown	0										
Infill	69	0	0	23	5	118	5	20	3	24	158
Other	18	0	0	0	2	109	11	4	0	5	194

Note: Development in suburban and rural downtowns is assumed to be the same as in their respective infill areas, because downtowns in these locations are generally not distinguishable from the rest of the urban area at the ZIP code level of geographic detail.

The profile presents the range of densities encountered in all counties potentially served by HST. Assumptions were made based on the review of domestic and international experience about how station area development would intensify over time. Major conclusions from the research translated into the following densification assumptions:

- Expected development intensity of new real estate investment is assumed to be 50th percentile (median) at present in all areas, with normal ongoing infill and refill increasing intensity to 60th percentile by 2030 in downtown and infill areas. *Other* areas continue to develop at median intensity through 2030.

- The No-Project Alternative has no further development intensification effect in downtown, infill, or other areas.

- The HST Alternatives have no further intensification effect outside of the station influence area. While it has been assumed the influence area generally extends in a one-mile radius from a station, this distance can vary due to the ZIP code granularity of the analysis.
- Under regular market forces, the HST Alternatives are assumed to have an intensification effect in station influence area by 2030 (75^{th} percentile).

Table E.2 summarizes the development density gradient of each alternative throughout the station subcounty.

Table E.2 Density Gradient

	Percentile Value of Assumed Density for Subregion and Alternative			
Alternative	**Station Area**	**Downtown Area**	**Infill Area**	**Other Area**
2005 Existing Conditions	n/a	50	50	50
2030 No-Project	n/a	60	60	50
2030 Altamont HST	75	60	60	50
2030 Pacheco HST	75	60	60	50

Note: For Altamont and Pacheco HST Alternatives, subregions are defined as the rest of the No-Project subregion that is not included in the station area.

■ E.3 Allocation of Employment to Subregions and Calculation of Land Requirements

Land consumption was computed for a subcounty by allocating future employment to each subregion in a step-wise fashion. For the No-Project Alternative, a subcounty's forecasted employment was first allocated to the downtown area. The number of additional employees that could be accommodated in the downtown area is computed as the future carrying capacity of the subregion less the current employment in the subregion. The carrying capacity for each industry group is defined as the product of the acres of land available and the assumed employment density per acre based on the density gradient. If the current employment in the downtown area is greater than the assumed future carrying capacity, no additional employment was allocated. Any employment not accommodated in the downtown area was assumed to overflow to the infill area. The above process was then repeated for the infill area, with any remaining employment then assumed to overflow to the other area. The other area employment (by industry) was divided by the appropriate employment density values to arrive at a land consumption estimate for each subcounty, with results then aggregated to the county level.

The step-wise process was modified slightly for the Altamont and Pacheco HST Alternatives, with employment allocation first occurring for the station influence area. If the station is located in the downtown subregion, employment was next allocated to the rest of the downtown area, then to the infill area. If the station is located in the infill or other areas, employment was next allocated to the rest of the infill area, then to the downtown area. In both cases, any remaining employment was allocated to the other area as occurred for the No-Project Alternative.

■ E.4 Tabulation of Results

For this analysis, land consumption was defined as the increase in the acreage of land at urbanized densities in each county. This value is equal to the land acreage in other areas that is needed to accommodate growth in employment and population. The calculation of employment-related land consumption is described in this appendix, while the calculation of population-related values is described in Appendix F. Results for each county are shown in Appendix I.

Appendix F

Land Consumption Analysis for Population

Appendix F. Land Consumption Analysis for Population

The allocation of population growth to various locations along the HST system and the prediction of land consumption resulting from residential construction on raw land were estimated using the California Urbanization and Biodiversity Analysis (CURBA) model. CURBA is a spatial decision support system developed within the ESRI ArcGIS software package by the University of California at Berkeley's Institute of Urban and Regional Development.

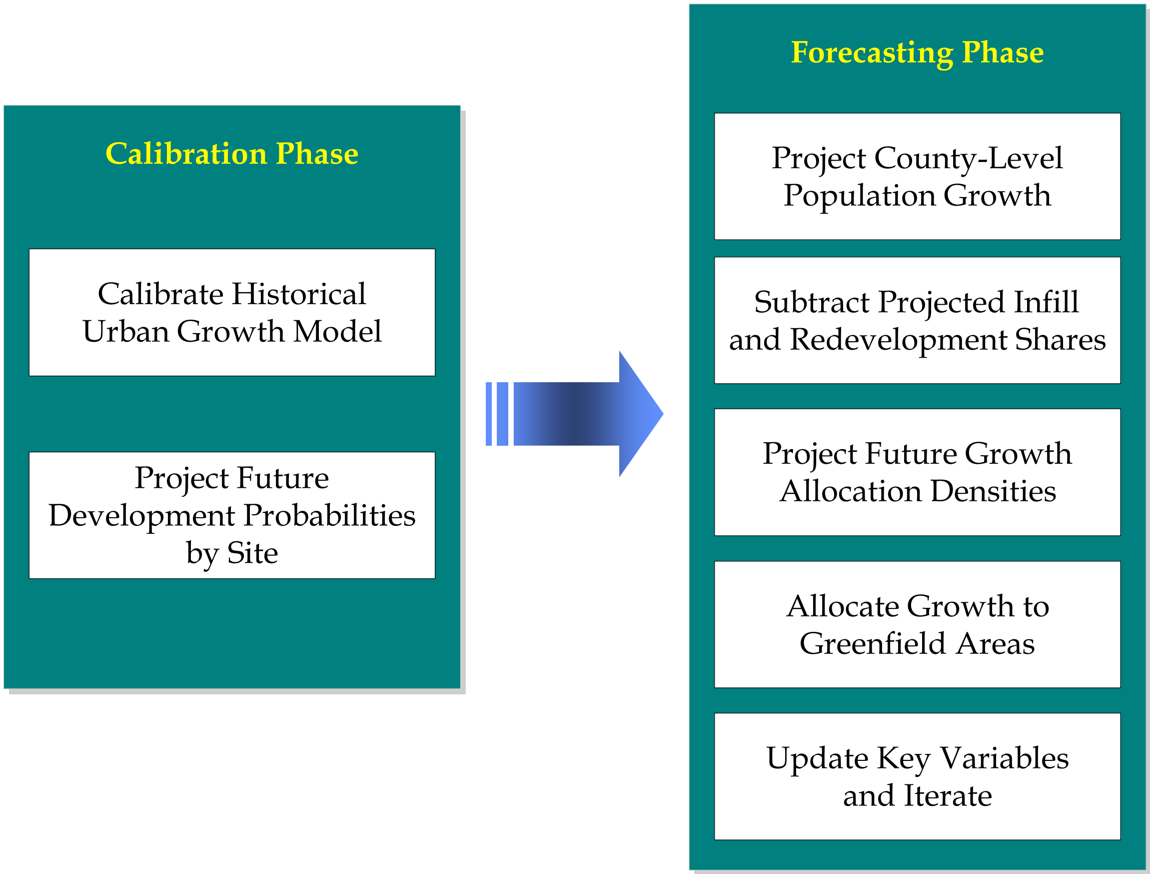
CURBA takes employment and population growth information, and uses a number of historically-calibrated spatial statistical models to assign residential growth to various locations in and around the existing urban area. By modifying CURBA's employment distribution, infill allocation, and raw land development densities, the package was used to estimate the nature and amount of raw land consumption under the various alternatives. An overview of the CURBA forecasting methodology is illustrated in Figure F.1.

F.1 Calibration Phase

The model begins by calibrating a spatial-statistical model of historical development patterns (Step A). Land use change information was obtained from the California Farmland Mapping and Monitoring Program (CFMMP), a division of the California Department of Conservation. Through a combination of remote-sensing and local ground-truthing, the CFFMP conducted detailed bi-annual land cover inventories of urban development in 1988 and 1998. CFMMP data is generally accurate down to the one-hectare level.

The calibrated model parameters are then used with contemporary spatial data to generate a development probability surface describing the likelihood that particular undeveloped sites will subsequently be developed (Step B). Binomial logit models with four categories of independent variables were estimated using a maximum likelihood procedure. To better account for regional variations, three separate models were used, covering all counties in the HST study area. Categories of independent variables include:

Figure F.1 CURBA Forecasting Methodology



- Demand variables, which measure the demand for sites as a function of their accessibility to job opportunities and job growth, as well local income levels, such as the number of jobs within 90-minute travel time of a grid cell and the ratio of community median household income to county median household income;

- Own-site variables, which measure the physical and land use characteristics of each grid-cell as determinants of its development potential, such as the squared distance from each site to the nearest freeway, whether the site is classified as prime farmland by the CFMMP, the average percentage slope of each site, and whether the site falls within the FEMA-designated 100-year flood zone;

- Adjacency and neighborhood variables, which summarize the environmental and land use characteristics of adjacent and neighboring grid-cells, such as the average slope of the cells within near each subject site, and the share of sites near the subject site which are located in the FEMA 100-year flood zone; and

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- Regulatory and administrative variables, which are intended to capture the development-encouraging or constraining effects of different land use policies and regulations, such as whether or not a site is located within an incorporated city.

F.2 Forecasting Phase

As shown in Figure F.1, the forecasting process included five distinct steps. The timing of development is predicted as a function of State and county population growth pressures (Step 1), the share of population accommodated through infill development (Step 2), and the density at which development occurs (Step 3). Projected population growth, net of infill, is then allocated to allowable development sites in order of their projected development probability (from Step B) at designated development densities. The county-level population forecasts were developed as part of an earlier phase of this overall project, and are described in Section 3.0 of the main report. Remaining steps are described in more detail below.

Infill and Redevelopment Shares

Projected infill and redevelopment shares were subtracted to reflect the fact that a significant share of projected population growth will occur within the existing urban footprint in the form of infill or redevelopment. Infill shares tend to rise over time as remaining undeveloped areas are used up and as developers reconsider previously passed-over infill lands. A cross-sectional regression model was developed relating current county infill shares to remaining supplies of undeveloped land. This model was then used to project future population shares in infill and currently undeveloped areas for the year 2030.

Future Growth Allocation Densities

The amount of undeveloped land consumed by future population growth will depend both on the magnitude of growth and on its gross density. Marginal gross densities – that is the gross densities of new development – were estimated for each county by dividing the change in the population between 1988 and 1998 by the change in urbanized land area for the same period. Theory suggests that densities should rise as available supplies of undeveloped land are used up, as developers seek to use remaining lands more intensely. A cross-sectional regression model was developed relating marginal densities to remaining supplies of undeveloped land. This model was then used to project future allocation densities by county for the year 2030. These county-specific estimates are then converted into hectare-specific densities using a rule set reflecting the manner in which General Plans and zoning measures modify allowable densities of development in regards to regional location and natural factors.

Allocate Growth to Currently Undeveloped Areas

Remaining population growth was allocated to undeveloped sites in each county in order of development probability. Starting with the hectare-scale development probability scores derived above, a series of exclusion conditions are developed identifying which sites are to be precluded from development. Projected population growth (from Step 2) for the period 2000-2030 is then allocated to sites at projected densities (from Step 3) in order of development probability (from high to low), subject to any exclusion conditions.

F.3 Key Assumptions

Several assumptions are embedded in the employment and residential land requirements forecasting procedures and their components:

- The same factors that shaped land development patterns in the recent past will continue to do so in the future, and in the same ways. With the exception of the immediate area around HST stations, the employment forecasting procedure allocates future growth to subregions of each metropolitan area based on existing development patterns observed around the State and areas currently designated for employment uses. The residential forecasting procedure allocates future development to individual sites based on their projected development probability, which are estimated using the results of a statistical model calibrated for the period 1988 to 1998. While the exact role of particular factors varies by region, several influences are consistently important, including proximity to freeways, access to jobs, site slope, and site incorporation status. To the extent that these factors are less important in the future, or are important in different ways – or, as is even more likely, that other factors become important – the model results may vary from what is presented here.

- Employment will continue decentralizing within California's four major urban regions – Southern California, the greater San Francisco Bay Area, the Sacramento region, and the southern San Joaquin Valley. Taking advantage of improved freeway access, less expensive land, and lower development costs, job growth during the last 50 years has favored suburban locations over core cities. To the extent that this trend continues – given the increasing importance of telecommunications in shaping economic geography, and in the absence of countervailing policies, there is no reason to believe that it should not – decentralizing job growth will continue to pull population outward, leading to more decentralized growth patterns.

- Average infill rates and population densities will increase with additional development. It is an axiom of economics that scarce resources are used more intensely than plentiful ones. Following this logic, as available supplies of developable land are used up, developers seek ways to use remaining land more intensely, either by increasing densities or through redevelopment. Thus, both development densities and infill activity should increase with population growth. Counteracting this tendency is the desire of many residents to preserve a rural or suburban lifestyle. Thus, there are many parts of California where infill activity and development densities are below what theory suggests they should be. For the purposes of analyzing all alternatives, it is assumed that future infill activity and development densities will continue to increase. To the extent that they do not, additional sites will be needed to accommodate projected population growth.

- With respect to the No-Project Scenario, it is assumed that no major changes in transportation accessibility (e.g., new freeways or transit lines, significant improvements in travel time, etc.) will occur. Although it is abundantly clear that California's growing population will need additional transportation infrastructure, it is unclear what the infrastructure should be, where it should go, and how it should be planned and financed. Lacking these specifics, and for the purposes of constructing a No-Project scenario, we assumed no change in transportation technology or facilities beyond what is currently available or included in the No-Project Alternative. The effect of this assumption is to direct additional growth largely to locations already served by transportation infrastructure rather than to new or different areas.

Appendix G

Employment Forecasts by Industry Sector

Appendix G. Employment Forecasts by Industry Sector

Table G.1 Employment Estimate by Industry Grouping
Year 2005 Existing Conditions

Region	Farming	Mining	Construction	Manufacturing	TCU	Wholesale Trade	Retail Trade	FIRE	Services	Government	Total
Alameda	8,426	587	52,136	92,698	49,912	62,029	135,138	72,224	353,661	127,126	953,937
Contra Costa	12,003	1,765	35,399	26,425	21,746	14,423	79,999	69,879	194,725	52,491	**508,854**
San Francisco	3,758	438	25,495	25,418	40,306	22,346	115,445	100,321	336,694	109,138	**779,357**
San Mateo	9,584	327	27,326	33,166	39,994	21,332	70,882	55,872	227,400	36,947	**522,830**
Santa Clara	19,215	633	59,832	236,372	38,208	59,683	178,323	95,739	518,220	117,694	**1,323,920**
Study Area – Bay Area	**52,986**	**3,749**	**200,188**	**414,079**	**190,166**	**179,813**	**579,787**	**394,036**	**1,630,699**	**443,395**	**4,088,898**
Fresno	65,687	402	22,321	29,345	16,743	16,676	64,956	29,734	122,108	67,798	**435,769**
Madera	13,956	133	2,979	4,052	1,744	1,015	7,158	2,948	13,434	9,473	**56,892**
Merced	14,687	63	3,680	11,754	3,027	1,820	14,222	4,526	19,442	14,146	**87,365**
Sacramento	11,002	316	50,892	34,557	27,997	25,950	124,757	78,688	258,932	192,887	**805,978**
San Joaquin	24,952	201	17,238	24,020	17,543	12,344	45,017	19,627	74,798	38,417	**274,155**
Stanislaus	22,734	100	13,385	24,037	8,910	9,759	41,323	13,930	61,870	28,443	**224,491**
Study Area – Central Valley	**153,017**	**1,214**	**110,494**	**127,765**	**75,965**	**67,563**	**297,432**	**149,453**	**550,584**	**351,163**	**1,884,650**
Southern Sacramento Valley	23,496	672	35,876	25,702	18,525	16,841	79,839	42,296	137,730	75,858	**456,834**
Southern San Joaquin Valley	112,116	10,023	25,670	27,893	25,136	16,446	82,911	30,336	135,745	110,659	**576,935**
Southern California	134,414	10,066	445,411	891,553	433,885	507,724	1,439,244	893,749	3,467,334	1,067,460	**9,290,841**
San Diego	41,123	1,158	101,481	122,773	60,648	66,127	285,675	172,543	684,891	358,582	**1,895,002**
Rest of California*	110,438	4,406	142,577	225,106	110,200	117,540	421,947	246,424	960,561	370,778	**2,709,974**
Statewide Total	**627,589**	**31,288**	**1,061,697**	**1,834,872**	**914,524**	**972,053**	**3,186,834**	**1,928,837**	**7,567,544**	**2,777,895**	**20,903,134**

Source: Cambridge Systematics, Inc., 2007.

Table G.2 Employment Forecast by Industry Grouping
Year 2030 No-Project System Alternative

Region	Farming	Mining	Construction	Manufacturing	TCU	Wholesale Trade	Retail Trade	FIRE	Services	Government	Total
Alameda	10,124	481	64,565	92,589	71,038	92,044	145,006	90,013	556,853	124,700	**1,247,413**
Contra Costa	15,531	2,580	53,353	26,639	37,104	19,007	100,791	131,401	303,759	73,281	**763,445**
San Francisco	5,310	433	32,303	19,286	49,366	18,035	152,065	111,806	458,112	129,107	**975,823**
San Mateo	10,457	363	33,630	32,273	50,885	23,743	76,676	68,961	379,510	41,029	**717,526**
Santa Clara	25,251	792	81,335	248,590	54,959	82,741	225,955	119,148	785,617	145,110	**1,769,498**
Study Area – Bay Area	**66,674**	**4,648**	**265,185**	**419,378**	**263,352**	**235,569**	**700,492**	**521,329**	**2,483,851**	**513,227**	**5,473,705**
Fresno	89,163	629	26,278	34,335	19,505	17,212	84,223	34,095	205,186	78,600	**589,226**
Madera	21,484	181	3,533	4,534	2,208	1,089	9,977	4,451	29,105	14,802	**91,364**
Merced	16,981	71	4,080	11,777	3,684	1,825	18,811	5,504	31,909	20,411	**115,054**
Sacramento	15,148	365	72,129	38,557	35,238	26,466	164,779	119,220	490,560	297,331	**1,259,792**
San Joaquin	28,822	212	24,000	26,655	27,393	11,328	60,905	23,945	114,279	51,206	**368,745**
Stanislaus	27,980	119	17,702	27,093	11,601	15,123	57,147	18,351	101,790	39,780	**316,686**
Study Area – Central Valley	**199,578**	**1,576**	**147,722**	**142,950**	**99,630**	**73,044**	**395,841**	**205,567**	**972,828**	**502,130**	**2,740,867**
Southern Sacramento Valley	30,908	762	55,733	35,628	26,452	27,447	129,051	61,442	255,152	106,719	**729,293**
Southern San Joaquin Valley	157,166	13,243	33,952	30,379	28,745	19,543	114,871	37,444	222,377	150,475	**808,196**
Southern California	165,193	12,419	609,079	942,523	580,227	633,457	1,801,205	1,156,033	4,979,096	1,428,949	**12,308,179**
San Diego	51,403	1,479	129,589	149,752	99,985	92,274	369,287	215,569	1,214,279	459,642	**2,783,258**
Rest of California*	143,604	5,427	195,584	251,388	150,553	150,378	544,935	329,692	1,500,836	501,970	**3,774,366**
Statewide Total	**814,525**	**39,555**	**1,436,843**	**1,971,997**	**1,248,945**	**1,231,714**	**4,055,681**	**2,527,075**	**11,628,419**	**3,663,112**	**28,617,864**

Source: Cambridge Systematics, Inc., 2007.

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Table G.3 Employment Forecast by Industry Grouping
Year 2030 Pacheco HST Alternative

Region	Farming	Mining	Construction	Manufacturing	TCU	Wholesale Trade	Retail Trade	FIRE	Services	Government	Total
Alameda	10,149	491	64,961	92,948	72,388	92,843	146,553	90,970	563,026	125,234	**1,259,563**
Contra Costa	15,543	2,582	53,609	26,743	37,773	19,242	101,686	131,845	307,015	73,485	**769,522**
San Francisco	5,312	435	32,790	19,359	50,026	18,400	152,808	112,423	462,727	129,354	**983,634**
San Mateo	10,475	365	33,787	32,454	51,597	24,094	77,594	69,474	382,783	41,214	**723,836**
Santa Clara	25,300	799	81,619	249,194	55,900	83,322	228,820	120,932	793,737	145,556	**1,785,181**
Study Area – Bay Area	66,779	4,673	266,766	420,698	267,683	237,901	707,461	525,643	2,509,288	514,843	**5,521,735**
Fresno	89,620	634	26,839	34,622	21,600	17,878	85,739	34,813	211,220	79,190	**602,155**
Madera	21,600	184	3,658	4,586	2,542	1,159	10,336	5,493	31,586	15,029	**96,173**
Merced	17,113	72	4,345	11,891	4,304	1,930	19,484	6,787	35,725	20,720	**122,373**
Sacramento	15,176	370	72,514	38,730	35,874	27,031	165,999	120,030	495,162	297,804	**1,268,688**
San Joaquin	28,911	213	24,239	26,774	28,042	11,504	61,550	24,329	118,424	51,505	**375,491**
Stanislaus	28,127	120	17,925	27,223	12,252	15,296	57,805	19,378	105,489	40,064	**323,679**
Study Area – Central Valley	200,547	1,594	149,520	143,826	104,613	74,796	400,914	210,831	997,607	504,311	**2,788,558**
Southern Sacramento Valley	30,960	764	55,994	35,720	26,840	27,690	129,631	61,712	256,674	106,919	**732,904**
Southern San Joaquin Valley	158,458	13,323	34,800	30,722	31,091	20,167	117,239	40,707	237,099	151,640	**835,244**
Southern California	165,710	12,528	612,940	946,929	591,215	641,556	1,816,609	1,164,246	5,049,808	1,433,993	**12,435,535**
San Diego	51,517	1,491	130,590	150,696	109,073	93,770	373,284	217,983	1,238,754	461,648	**2,828,806**
Rest of California	144,447	5,446	196,800	251,997	153,575	151,762	548,701	331,101	1,508,878	503,122	**3,795,829**
Statewide Total	**818,416**	**39,819**	**1,447,410**	**1,980,588**	**1,284,091**	**1,247,642**	**4,093,838**	**2,552,224**	**11,798,107**	**3,676,476**	**28,938,611**

Source: Cambridge Systematics, Inc., 2007.

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Table G.4 Employment Forecast by Industry Grouping
Year 2030 Altamont HST Alternative

Region	Farming	Mining	Construction	Manufacturing	TCU	Wholesale Trade	Retail Trade	FIRE	Services	Government	Total
Alameda	10,138	490	64,858	92,874	72,315	92,712	146,162	90,937	562,271	125,136	**1,257,894**
Contra Costa	15,538	2,582	53,562	26,719	37,639	19,227	101,472	131,733	305,622	73,428	**767,522**
San Francisco	5,311	434	32,536	19,342	49,888	18,390	152,703	112,253	460,911	129,299	**981,068**
San Mateo	10,467	364	33,733	32,426	51,661	24,030	77,375	69,524	383,124	41,196	**723,900**
Santa Clara	25,274	797	81,496	249,002	55,688	83,145	228,931	121,219	793,271	145,457	**1,784,281**
Study Area – Bay Area	**66,728**	**4,667**	**266,186**	**420,363**	**267,192**	**237,503**	**706,643**	**525,666**	**2,505,199**	**514,517**	**5,514,664**
Fresno	89,629	634	26,811	34,612	21,404	17,862	85,677	34,773	210,737	79,155	**601,294**
Madera	21,615	185	3,665	4,589	2,558	1,165	10,356	5,512	31,612	15,037	**96,293**
Merced	17,118	72	4,348	11,881	4,255	1,926	19,437	6,519	34,807	20,676	**121,039**
Sacramento	15,178	371	72,512	38,747	36,064	27,057	166,087	120,318	497,101	297,878	**1,271,312**
San Joaquin	28,913	213	24,224	26,812	28,286	11,541	61,738	24,503	121,592	51,654	**379,476**
Stanislaus	28,066	120	17,881	27,265	12,741	15,334	58,172	20,924	111,751	40,370	**332,624**
Study Area – Central Valley	**200,519**	**1,595**	**149,440**	**143,905**	**105,308**	**74,885**	**401,467**	**212,549**	**1,007,600**	**504,769**	**2,802,039**
Southern Sacramento Valley	30,979	765	56,032	35,740	26,973	27,727	129,761	61,780	257,213	106,971	**733,943**
Southern San Joaquin Valley	158,431	13,319	34,727	30,705	30,962	20,127	117,084	40,571	236,475	151,572	**833,976**
Southern California	165,677	12,521	612,557	946,628	590,807	641,198	1,815,734	1,163,611	5,039,324	1,433,629	**12,421,685**
San Diego	51,513	1,492	130,540	150,685	108,235	93,775	373,521	218,161	1,247,373	461,890	**2,837,184**
Rest of California	144,248	5,444	196,725	251,922	153,504	151,693	548,091	330,671	1,505,794	502,942	**3,791,033**
Statewide Total	**818,095**	**39,803**	**1,446,208**	**1,979,950**	**1,282,980**	**1,246,909**	**4,092,301**	**2,553,010**	**11,798,978**	**3,676,290**	**28,934,524**

Source: Cambridge Systematics, Inc., 2007.

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Appendix H

Employment Allocation Within Counties

Appendix H. Employment Allocation Within Counties

Table H.1 Employment Allocation by Subregion

County	Percentage of Year 2030 Total County Employment by Subregion											
	No-Project Alternative				Altamont HST Alternative				Pacheco HST Alternative			
	Station Area	Downtown Area	Infill Area	Other Area	Station Area	Downtown Area	Infill Area	Other Area	Station Area	Downtown Area	Infill Area	Other Area
Alameda	–	–	11%	89%	2%	–	10%	88%	2%	–	10%	88%
Contra Costa	–	–	18%	82%	–	–	18%	82%	–	–	18%	82%
San Francisco*	–	-	–	100%	–	–	–	100%	–	–	–	100%
San Mateo	–	1%	9%	90%	5%	–	10%	85%	5%	–	10%	85%
Santa Clara	–	7%	49%	44%	8%	6%	49%	37%	8%	6%	49%	37%
Fresno	–	1%	12%	88%	0%	1%	17%	83%	0%	1%	17%	83%
Madera	–	–	88%	12%	–	–	84%	16%	–	–	84%	16%
Merced	–	–	100%	–	72%	–	28%	0%	70%	–	30%	–
Sacramento	–	12%	13%	75%	17%	1%	13%	69%	17%	1%	13%	69%
San Joaquin	–	–	84%	16%	35%	–	55%	11%	33%	–	57%	11%
Stanislaus	–	–	1%	99%	10%	–	–	90%	7%	–	–	93%
Total for Core Study Area	–	**4%**	**23%**	**73%**	**8%**	**2%**	**23%**	**67%**	**8%**	**2%**	**23%**	**67%**

*Projected development in "other areas" for San Francisco County is a function of the average densities and uniform analysis process used to calculate employment acreage. Since "greenfield" land is not available in San Francisco County, employment growth will need to be accommodated through further densification and infill rather than through development in "other areas" as implied in this table.

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Appendix I

Land Consumption Allocation by Employment and Residential Components

Appendix I. Land Consumption Allocation by Employment and Residential Components

Table I.1 Increase in Size of Urbanized Area – Year 2002 to 2030
(In Acres)

	Residential Land Uses			Employment Land Uses		
Area	**No Project**	**HST Pacheco**	**HST Altamont**	**No Project**	**HST Pacheco**	**HST Altamont**
Alameda County	25,840	26,886	26,128	19,189	19,268	19,160
Contra Costa County	33,000	33,360	33,175	8,402	8,769	8,646
San Francisco County*	0	0	0	6,736	6,969	6,895
San Mateo County	2,597	2,703	2,841	6,838	6,814	6,833
Santa Clara County	17,031	18,899	20,891	6,321	5,972	5,952
Study Area – Bay Area	**78,469**	**81,848**	**83,035**	**47,485**	**47,792**	**47,486**
Fresno County	39,960	41,301	41,146	13,286	15,296	15,120
Madera County	13,111	14,441	14,420	–	97	103
Merced County	28,743	30,500	29,899	–	–	–
Sacramento County	74,439	75,226	76,352	6,278	5,739	5,792
San Joaquin County	67,462	68,479	69,792	4,064	2,317	2,062
Stanislaus County	12,471	13,254	15,417	6,370	5,499	6,043
Study Area – Central Valley	**236,186**	**243,201**	**247,026**	**29,998**	**28,948**	**29,120**
Core Study Area	314,655	325,049	330,061	77,483	76,740	76,606

Source: Cambridge Systematics, Inc., 2007.

*Projected increases in urbanized area for San Francisco County are a function of the average densities used to calculate employment acreage. Since “greenfield” land is not available in San Francisco County, employment growth will need to be accommodated through densification and infill rather than through increases in urbanized area size implied in this table

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3.4 Noise and Vibration

This section identifies potential noise and vibration impacts on sensitive receptors or receivers, such as people in residential areas, schools, and hospitals, for the No Project and HST Alignment Alternatives[1]. This analysis generally describes the sensitive noise receptors in the region and the methodology for determining the potential noise and vibration impacts on those receptors for each HST Alignment Alternative. The differences in potential impacts among the HST Alignment Alternatives are compared to each other. This comparison considers the potential noise impacts from airplanes, automobiles on intercity highways, and the proposed HST system. The section also discusses the potential noise benefits of adding grade separations[2] for existing railroads in some areas and eliminating noise-generating at-grade crossings. Because this is a program-level environmental document, the analysis of potential noise and vibration impacts broadly compares the relative differences in potential impacts among the alternatives.

3.4.1 Regulatory Requirements and Methods of Evaluation

A. REGULATORY REQUIREMENTS

Noise and vibration are environmental issues evaluated under CEQA and NEPA for a proposed HST project.

Federal Noise Emission Compliance Regulation

The FRA has a regulation governing compliance with the Noise Emission Compliance Regulation adopted by the EPA for noise emissions from interstate railroads. The FRA's Railroad Noise Emission Compliance Regulation (49 CFR Part 210) prescribes minimum compliance regulations for enforcement of the railroad noise emission standards adopted by the EPA (40 CFR Part 201).

California Noise Control Act

At the state level, the California Noise Control Act was enacted in 1973 (Health and Safety Code § 46010 *et seq.*) and provides for the Office of Noise Control in the Department of Health Services to provide assistance to local communities developing local noise control programs and work with the Office of Planning and Research to provide guidance for the preparation of the required noise elements in city and county general plans, pursuant to Government Code § 65302(f). In preparing the noise element, a city or county must identify local noise sources and analyze and quantify, to the extent practicable, current and projected noise levels for various sources, including highways and freeways, passenger and freight railroad operations, ground rapid transit systems, commercial, general, and military aviation and airport operations, and other ground stationary noise sources, these would include HST alignments. Noise-level contours must be mapped for these sources, using both community noise equivalent level (CNEL) and day-night average 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.

1 See Section 3.0, Introduction, for an explanation of how this section fits together with the HST Network Alternatives presented in Chapter 7, as well as for an overview of the information presented in the other chapters.

2 For this analysis, a grade separation is the literal separation, using overpasses or underpasses, of the rail and roadway components of an at-grade crossing. This eliminates the need for trains to blow horns or sound warning devices at the grade separated (previous grade crossing) locations.

B. METHOD OF EVALUATION OF IMPACTS

Assessment of the HST Alignment Alternatives is based on relevant criteria adopted by the FRA (U.S. Department of Transportation 2005), FHWA (U.S. Department of Transportation 1998), and FTA (Federal Transit Administration 2006), each of which has established criteria for assessing noise impacts. The FRA has established criteria for assessment of noise and vibration impacts for high-speed ground transportation projects, with speed over 125 mph, as presented in the FRA High Speed Ground Transportation Noise and Vibration Assessment (U.S. Department of Transportation 2005). The methodology and impact criteria for noise and vibration from this FRA guidance manual have been used in the assessment of the HST Alignment Alternatives in areas with speed over 125 mph. In areas with train speeds under 125 mph, the FTA criteria for assessment of noise and vibration impacts, as found in Transit Noise and Vibration Impact Assessment (Federal Transit Administration 2006), has been used in the assessment of the HST Alignment Alternatives. As described below, each agency's criteria were used to define a screening distance for assessing the potential for noise impact from relevant sources. The FRA and FTA have also established vibration impact criteria related to rail transportation.

Two basic evaluation techniques were used for analysis of the HST: a screening analysis and a more specific analysis of typologies derived from representative HST locations. The representative typologies were used to verify screening-level assumptions and to provide a basis for comparison of HST Alignment Alternatives, including consideration of the potential effectiveness of mitigation and the potential impacts or benefits associated with grade separation of existing rail lines.

Screening Procedure

Transportation noise impacts are assessed according to the number of people and noise-sensitive land uses potentially impacted by new noise sources from a project. However, at the program level (especially before many project-level details of the proposed HST system have been defined) it is not possible to develop a specific measure of the noise impacts. Consequently, a screening method was used to develop a general estimate of the relative potential for noise and vibration impact among HST Alignment Alternatives. Screening distances were applied from the center of alignments to estimate all potentially impacted land uses in noise-sensitive environmental settings. The screening distances used are defined in the statewide program EIR/EIS (California High-Speed Rail Authority and Federal Railroad Administration 2005, Appendix 3.4-A). Based on census data, the number of people and noise-sensitive land uses were estimated within the defined screening distance. The rating methods used to determine these numbers are also described in the statewide program EIR/EIS (California High-Speed Rail Authority and Federal Railroad Administration 2005, Appendix 3.4-A). The method is conservative in that it overestimates the potential for impact. The method identifies all potentially impacted developed lands by type of use within the study area, but subsequent project-level analysis using better-defined system parameters and land use information is likely to indicate lower levels of potential impact. Because potential noise impacts decrease dramatically if a structure or land form blocks the path to the receptor, this is a conservative approach.

Noise screening analyses were performed for the HST Alignment Alternatives based on criteria established by the FRA and FTA for HST and conventional rail. The analyses were accomplished using available GIS data for land use and alignment geometry for each alignment. The number of people potentially affected and the area of noise-sensitive land uses within the screening distance were determined using GIS and census data.

The analyses were subsequently combined to develop an impact rating for each alignment alternative (see Environmental Consequences). The impact rating for each alignment alternative is described as low, medium, or high, as an indication of the potential for noise impact.

Rating the severity of impacts requires an assessment of how many people are exposed to impact-level noise and vibration. Consequently, a metric describing the relative magnitude of impact was developed.

Impact Metric = (Residential Population in the Impact Area/Mile) + 0.3 × (Mixed Use Population in the Impact Area /Mile) + (100 × Number of Hospitals in the Impact Area)/Mile + (250 × Number of Schools in the Impact Area)/ Mile

For this screening study, the impact metrics and impact ratings are defined in Table 3.4-1. The rating scheme is designed to indicate the potential for noise and vibration impacts along the alignment alternatives.

Table 3.4-1
Ratings Used for Noise and Vibration Analysis

Rating	Impact Metric	
	Noise	Vibration
Low	Less than 80	Less than 40
Medium	80–200	40–100
High	Greater than 200	Greater than 100

Application of Screening Method to Conventional Rail and High-Speed Train Modes

Railroad noise and vibration criteria developed by FTA are consistent with criteria adopted by the FRA for HSTs. Criteria for HST noise impact assessment are based on activity interference and annoyance ratings developed by EPA. These criteria, described and presented in graphical form in the statewide program EIR/EIS (California High-Speed Rail Authority and Federal Railroad Administration 2005, Appendix 3.4-A), provide the basis for the rail noise analysis procedures used in the screening and the representative typologies (U.S. Department of Transportation 2005).

The screening procedure used by the FRA takes into account the noise impact criteria, the type of corridor, and the ambient noise conditions in typical communities. Distances within which potential impacts may occur are defined based on operations of a typical HST system. These distances were developed from detailed noise models based on empirical measurements of noise emissions of existing steel-wheel/steel-rail HSTs, expected maximum operation levels and speeds, and residential land use. The width of the potential impact along the length of the HST alignment is the area in which there is potential for noise impact. The FRA screening procedure was developed for HST speeds from 125 to 210 mph (201 to 338 kph). For speeds less than 125 mph (201 kph) and for areas near stations, the FTA screening method was used in concert with the FRA method. The average speed along the HST Alignment Alternatives was used to determine the screen distance. The FRA and FTA screening distances for noise are included in the statewide program EIR/EIS (California High-Speed Rail Authority and Federal Railroad Administration 2005, Appendix 3.4-A).

The screening distances are different for the different types of developed areas along a potential alignment, according to their estimated existing ambient noise. *Urban* and *noisy suburban* areas are grouped together. These areas are assumed to have ambient noise levels greater than 60 dBA L_{dn}. Similarly, *quiet suburban*, *rural,* and *natural open-space* areas are grouped as areas where ambient noise levels are less than 55 dBA L_{dn}. For developed land with L_{dn} between 55 and 60 dBA, the classification depends on other factors, such as proximity of major transportation facilities and density of population. The screening procedure was applied to first allow for the comparison of impacts between alternatives and to identify areas of potential impacts for further consideration in project-level analysis. The screening procedure estimates the affected receptors to ensure that all potential impacts are included at the program level.

Although the screening procedure is based on the type of equipment (technology and power type), operational characteristics of the new services (speeds and frequencies), the type of support structure (aerial or at-grade), and the general ambient noise level, it does not address the horn and bell noise associated with existing passenger and freight trains because these are regarded as part of the existing environment. To develop a relative comparison of the HST Alignment Alternatives, the results of the screening analysis were adjusted to account for noise reductions from the elimination of at-grade crossings on existing rail lines, where the HST Alignment Alternatives would share the rail corridor. The degree of adjustment was based on the representative typologies for similar circumstances and is defined in the following section.

As a final step for those areas rated medium or high for potential impacts, the screening analysis assessed the potential use of noise barriers and other mitigation options to reduce noise impacts. The mitigation analysis is discussed in Section 3.4.5.

The vibration screening procedure was used to compare potential impacts among HST alignments and to provide an estimate of the length of alignments where consideration of vibration attenuation features may be appropriate.

Representative Typologies for High-Speed Trains

To better understand the potential impacts of the HST, several noise impact assessment studies were previously prepared for representative situations of noise- and vibration-sensitive land uses in the statewide program EIR/EIS (Authority and FRA, November 2005). The more detailed General Assessment Method of FTA's and FRA's guidance manuals were used to estimate the potential for noise impacts. These typological studies verified the general results from the screening procedure. Representative situations were chosen to provide a range of potential impact types and levels. This approach provided a means of considering at the program level the potential impacts on communities along any potential proposed HST alignment.

Developed land use categories consist of individual medium- and low-density residential zones, schools, hospitals, parks, and other unique institutional receptors such as museums and libraries. Residential land uses were chosen for the typologies for new and shared corridors that varied in local zoning densities, ambient noise conditions, set back distances from the alignment, and HST operational speeds. Institutional uses, as mentioned above, and parks were individually identified for each focused study. These representative typologies evaluated the topics listed below.

- Verification of screening distances (noise and vibration).
- Effectiveness of noise barriers.
- Benefits from elimination of grade crossings.
- Costs and benefits of a high-speed downtown bypass loop.

Verification of Screening Distances (Noise and Vibration)

The analyses of the representative typologies confirmed that the screening method used an appropriate upper boundary as an indicator of potential for noise impact. Impacts were found to occur in 90% of the cases identified in the screening procedure; in 75% of those studied, consideration of mitigation may be appropriate. Those that would have insignificantly low noise impact were either at outer edges of the screening distance or were shielded sufficiently by other buildings. Shielding by terrain features or buildings is not taken into account in the screening process but would be included in the subsequent project-level analyses of HST segments.

Representative typology studies were also completed that assess the range of the potential vibration impact levels that are likely to be encountered in project-level analyses. The results generally show that the closer buildings would be to a proposed alignment, the greater the likelihood of impact. Where speeds are expected to be low, the vibration potential impacts are confined to within 100 ft (30 m) of the track. At top speeds, the potential impacts extend to 200 ft (61 m). The special typologies generally validate the vibration screening distances that are included in the statewide program EIR/EIS (California High-Speed Rail Authority and Federal Railroad Administration 2005, Appendix 3.4-A).

Effectiveness of Noise Barriers

Noise barriers are used extensively in Europe and Japan to mitigate noise impacts from HST systems. The representative typology studies generally indicated that mitigation by sound barrier walls can be an effective means of reducing the potential impacts by one category, for example, from severe impact (mitigation appropriate) to impact. Noise barrier mitigation is shown to be especially effective for receivers close to the tracks. Although noise barrier walls would not be the only potential mitigation strategy considered, they were used to represent mitigation potential in the statewide program EIR/EIS (California High-Speed Rail Authority and Federal Railroad Administration 2005) and in this Program EIR/EIS.

Benefits from Elimination of Grade Crossings

The representative typology studies were also used to estimate the potential benefit of noise reduction resulting from grade separations. A focused noise study in the Bay Area to Central Valley region (at Charleston Road in Palo Alto) showed the potential benefit of eliminating horn blowing at a typical Caltrain grade crossing on the San Francisco Peninsula. Assessment of noise impact from horns at-grade crossings was performed with FRA's horn noise model and annoyance based criteria. The horn noise model indicated an 81% reduction in the number of people impacted within 0.25 mi (0.40 km) of that intersection by elimination of horn noise from commuter trains. Although the results vary depending on the local population density and proximity of residences and other sensitive land uses at each grade crossing, they illustrate the magnitude of the potential change to be expected if the sounding of horns and bells at existing rail crossings could be eliminated.

Removing all potential remaining horn noise would not eliminate noise impacts, however, because the sound of the trains would remain. The proposed HST would add its own noise to that of other trains using the railroad corridor. Carrying the focused study further, it was found that approximately 75% of the at-grade crossings to be eliminated with the proposed HST system are located adjacent to residential areas with a high potential noise impact rating. Although there would be a clear benefit from the elimination of the horns and warning signals, there would be additional train noise and vibration primarily from the high train speed and frequency of service.

Based on these results, the potential noise impact ratings from screening were adjusted to account for segments where at-grade crossings would be eliminated for existing passenger and freight trains as part of the implementation of HST service along that alignment. A reduction in one impact rating level (high to medium or medium to low) was made only for alignments where HST speeds would be less than 150 mph (241 kph). Where speeds were above that level, no adjustment was made because the noise created by the proposed new service at higher speeds would likely overshadow the reduction in horn and bell noise resulting from the grade separation.

This adjustment was made on the alignments listed below.

- Caltrain Corridor from San Francisco to San Jose.
- Niles subdivision line from south of Oakland to north of Warm Springs.
- UPRR line on the Altamont crossing.
- UPRR and BSNF corridors in the Central Valley.

C. CEQA SIGNIFICANCE CRITERIA

At the programmatic level, the project would cause a significant noise or vibration impact under CEQA if it would result in:

- Potential exposure of persons to or generation of noise levels in excess of standards established by the FRA for high-speed ground transportation and by the FTA for rail projects.
- Potential exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels.
- A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project.
- A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project.

D. METHOD OF EVALUATION OF POTENTIAL IMPACTS ON WILDLIFE

The potential for direct effects of train noise on wildlife in natural areas is not well documented. There are no established criteria relating high-speed train noise and animal behavior. However, some characteristics of high-speed train noise are similar to low overflights of aircraft, and researchers generally agree that high noise levels from aircraft overflights can have a disturbing effect on both domestic livestock and wildlife. Some animals get used to noise exposure, while some do not. Documented effects range from simply taking notice and changing body position to taking flight in panic. Whether these responses represent a threat to survival of animals remains unclear, although panic flight may result in injuries to animals in rough terrain or in predation of unprotected eggs of birds. A limited amount of quantitative noise data relating actual levels to effects provides enough information to develop a screening procedure to identify areas where noise from HST operations could affect domestic and wild animals. The basis for the screening is the interim criteria for HST noise effects on animals shown in Table 3.4-2.

Figure 3.4-1 presents the screening distances at which a train passby with a sound exposure level (SEL) of 100 dBA would occur for different operating speeds. Wildlife in natural areas would be minimally affected by train passbys at speeds of up to 180 mph at distances of 60 ft or more.

Table 3.4-2
Interim Criteria for High Speed Train Noise Effects on Animals

Animal Category	Class	Noise Metric	Noise Level
Domestic	Mammals (livestock)	Sound exposure level	100
	Birds (poultry)	Sound exposure level	100
Wild	Mammals	Sound exposure level	100
	Birds	Sound exposure level	100
Source: High Speed Ground Transportation Noise and Vibration Assessment 2005.			

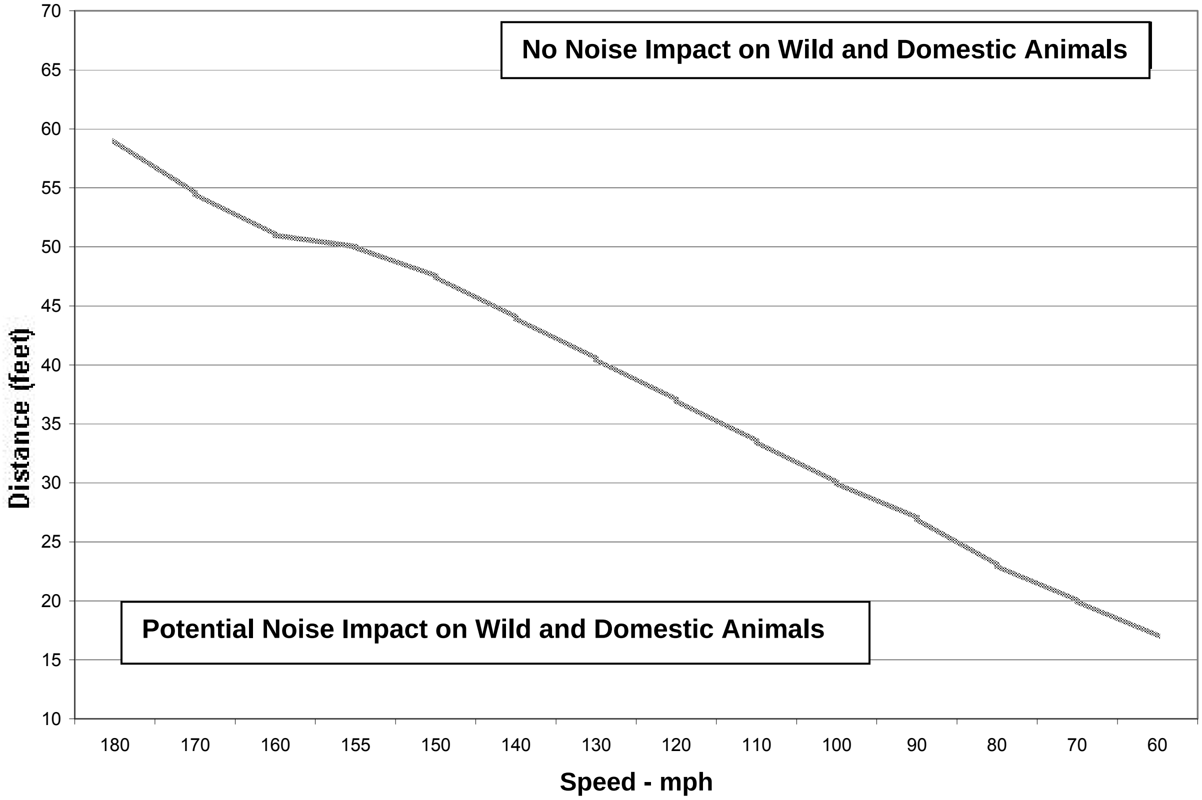

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Figure 3.4-1
Wildlife Impacts at Different Setback Distances and Train Speeds

The HST project's potential noise and vibration impacts on wildlife will be evaluated further at the project level when speed, noise, and vibration may be more precisely calculated and field surveys may be performed to identify potentially affected wildlife.

E. METHOD OF EVALUATION OF POTENTIAL IMPACTS ON PRISTINE OPEN SPACES

Noise thresholds have been selected as a means by which HST noise impacts on pristine areas with very quiet ambient sound levels can be measured. None of these thresholds are associated with a specific FRA, FTA, or other criteria or standards for rail noise; however, they are all considered useful in describing the potential for impact on pristine areas where the existing ambient noise levels are less than 50 dBA. They are based on past experience with the effects of military and civilian aircraft overflights on national parks.

Human cognitive effects of HST operations are interference and annoyance. Interference is the precursor to annoyance, which means something that prevents persons from doing what they want to do; interference is an interruption or distraction. Annoyance means having an emotional reaction to noise interference. Low levels of HST noise can result in interference but not necessarily result in annoyance. The number and frequency of HST operations must exceed a certain level or threshold before it is perceived as annoying. Interference is a short-term occurrence. Annoyance, because of the emotional component is more long lasting. Annoyance is the more appropriate criteria in evaluating the receiver experience in pristine open spaces using the metric Time Audible (TA) – the percentage of time that aircraft sound levels are audible. This metric is used to assess the potential aviation noise annoyance to quiet outdoor areas with frequent human recreation and could be adapted for use at the project level for HST noise.

The other noise metric that could be used to assess potential impacts to pristine areas would be change in exposure (ΔL)—the algebraic difference (in A-weighted decibels) between HST noise levels and baseline ambient sound levels during the daily period when the HSTs operate. Generally, a change in 5 dB is considered noticeable to humans, and an increase of 10 dB is considered twice as loud. However, because the measurement period is 12 hours or longer, the noise level of a single-event HST passby would be much higher than the ambient noise level but would last for less than 15 seconds. As an indication of potential impacts to humans, this metric is not as good as annoyance.

Studies of the effects of military aircraft overflights on recreational uses of national parks have suggested a dose response relationship between percent annoyed and percent time audible (Miller 2001). The following guidelines, taken from this study, are used to assess the different air tour alternatives for parks. The average percent annoyed represent those visitors who felt that the aircraft flyovers interfered with their appreciation of natural quiet. Table 3.4-3 shows the dose response relationship between percent time audible and average percent of visitors annoyed.

Table 3.4-3
Dose Response Relationship between Time Audible and Visitor Annoyance

Percent Time Audible	Average Percent of Visitors Annoyed
10	3–4
20	6–8
30	10–12
40	14–16
50	19–21

Source: Miller 2001

HST operation noise would be limited to the areas that adjoin track alignments. The extent of the potential impacts would be determined by the train speed, number of power units and coaches, topographical features, and the existing ambient noise levels. To quantify these impacts, project-level studies would include detailed graphic plots of noise contours of HST operations in pristine open spaces to determine the area of potential effect.

3.4.2 Affected Environment

A. STUDY AREA DEFINED

The study area for the noise and vibration assessment is defined by the screening distances that are used by the FRA (U.S. Department of Transportation 2005) and FTA (U.S. Department of Transportation 2006) to evaluate rail lines. Study areas are within 1,000 ft (305 m) of the centerline of the alignment options for each alignment.

B. GENERAL DISCUSSION OF NOISE AND VIBRATION

This section describes the characteristics and associated terms and measurements used for transportation-related noise and vibration. When noise from a highway, plane, or train reaches a receptor, whether it is a person outdoors or indoors, it combines with other sounds in the environment (the ambient noise level) and may or may not stand out in comparison. The distant sources may include traffic, aircraft, industrial activities, or sounds in nature. These distant sources create a background noise in which usually no particular source is identifiable and to which several sources may contribute but is fairly constant from moment to moment and varies slowly from hour to hour. Superimposed on this slowly varying background noise is a succession of identifiable noisy events of relatively brief duration. Examples include the passing of a train, the over flight of an airplane, the sound of a horn or siren, or the screeching of brakes. These single events may be loud enough to dominate the noise environment at a location for a short time, and, when added to everything else, can be an annoyance. The descriptors used in the measurement of noise environments are summarized below.

The fundamental measure of noise is the dB, a unit of sound level based on the ratio between two sound pressures—the sound pressure of the source of interest (e.g., the HST) and the reference pressure (the quietest sound that a human can hear). Because the range of actual sound pressures is very large (a painful sound level can be over 1 million times the sound pressure of the faintest sound), the expression of sound is compressed to a smaller range with the use of logarithms. The resulting value is expressed in terms of dB. For example, instead of a sound pressure ratio of 1 million, the same ratio is 120 dB.

The human ear does not respond equally to high- and low- pitched sounds. In the 1930s, acoustical scientists determined how humans hear various sounds and developed response characteristics to represent the sensitivity of a typical ear. One of the characteristics, called the *A-curve*, represents the sensitivity of the ear at sound levels commonly found in the environment. The A-curve has been standardized. The abbreviation dBA is intended to denote that a sound level is expressed as if a measurement has been made with filters in accordance with that standard.

- *Maximum Sound Level (L_{max})*, measured in dBA, is the highest noise level achieved during a noise event.
- *Equivalent Sound Level (L_{eq})*, measured in dBA, describes a receptor's cumulative noise exposure from all noise events that occur in a specified period of time. The hourly L_{eq} is a measure of the accumulated sound exposure over a full hour. The L_{eq} is computed from the measured sound energy averaged over an hour (nothing one would read from moment to

moment on a meter) representing the magnitude of noise energy received in that hour. FHWA uses the peak traffic hour L_{eq} as the metric for establishing highway noise impact.

- *Day-Night Sound Level (L_{dn})* describes a receptor's cumulative noise exposure from all noise events that occur in a 24-hour period, with events between 10 p.m. and 7 a.m. increased by 10 dB to account for greater nighttime sensitivity to noise. The L_{dn} is used to describe the general noise environment in a location, the so-called "noise climate." The unit is a computed number, not one to be read from moment to moment on a meter. Its magnitude is related to the general noisiness of an area. EPA developed the L_{dn} descriptor, and now most federal agencies, including the FRA, use it to evaluate potential noise impacts. Typical L_{dns} in the environment are shown in Figure 3.4-2.
- *CNEL*, a variant of L_{dn}, is used in noise assessments in California. Rather than dividing the day into two periods, daytime and nighttime, CNEL adds a third to account for increased sensitivity to noise in the evening when people are likely to be engaged in outdoor activities around the home. An evening addition of 5 dB is applied to noise events between the 7 and 10 p.m. to reflect the additional annoyance noise causes at that time. In general, the difference between L_{dn} and CNEL is slight, and the two measures will be considered interchangeable for purposes of this noise analysis.
- *Sound Exposure Level (SEL)* is the sound energy from a single event train passby. SEL is a cumulative measure of noise so (1) louder events have greater SELs than do quieter ones, and (2) events that last longer in time have greater SELs than do shorter ones.

The way people react to noise in their environment has been studied extensively by researchers throughout the world. Based on these studies, noise impact criteria have been adopted by the FRA (U.S. Department of Transportation 2005) and other federal agencies to assess the contribution of the noise from a source like the HST to the existing environment. The FRA bases noise impact criteria on the estimated increase in L_{dn} (for buildings with nighttime occupancy) or increase in L_{eq} (for institutional) buildings caused by the project for direct and indirect impacts. Criteria are discussed in Section 3.4.1.

Transportation Noise

Noise from highways, airports, and rail lines tends to dominate the noise environment in its immediate vicinity. Each mode has distinctive noise characteristics in both shape and source levels. Highway and rail noise affects an area that is linear in shape, extending to both sides of the alignment. Airport noise, in contrast, affects a closed area around the facility, with the shape of the closed loop determined by runway orientation.

Conventional and High-Speed Train Noise and Vibration

Although HSTs have some similar noise and vibration characteristics to conventional trains, they also have several unique features resulting from their reduced size and weight, the electrical power, and the higher speed of travel. The proposed HST would be a steel-wheel, steel-rail electrically powered train operating in an exclusive right-of-way. Because there would be no roadway at-grade crossings, the annoying sounds of the train horn and warning bells would be eliminated. The use of electrical power cars would eliminate the engine rumble associated with diesel-powered locomotives. The above factors allow HST to generate lower noise levels than conventional trains at comparable speeds below 100 mph (161 kph). At higher speeds above 150 mph (241 kph), however, HST noise levels would increase over conventional trains due to aerodynamic effects. A mitigating factor is that due to high speeds, HST noise would occur for a relatively short duration compared with conventional trains (a few seconds at the highest speeds versus 10–20 seconds for conventional passenger trains and over 1 minute for freight trains).

For the proposed HST system, higher operating speeds of 150–220 mph (241–354 kph) would occur in the less constrained areas, in terms of alignment (i.e., flat and straight). In contrast, much lower operating speeds (less than 125 mph [201 kph]) would be prevalent in the more developed areas. Figure 3.4-3 illustrates the maximum operating speeds for express service along each of the proposed HST Alignment Alternatives. Local and semi-express services would not necessarily reach these maximum speeds because they would stop and start for more stations.

Noise from a HST is expressed in terms of a source-path-receiver framework (Figure 3.4-4). The source of noise is the train moving on its tracks. The path describes the intervening course between the source and the receptor wherein the noise levels are reduced by distance, topographical and human-made obstacles, atmospheric effects, and other factors. Finally, at each receptor, the noise from all sources combines to make up the noise environment at that location.

The total noise generated by a train is the combination of sounds from several individual noise-generating mechanisms, each with its own characteristics, including location, intensity, frequency content, directivity, and speed dependence. The distribution of noise sources on a typical HST is shown in Figure 3.4-5. These noise sources can be grouped into three categories according to the speed of the train.

For low speeds, below about 40 mph (64 kph), noise emissions are dominated by the propulsion units, cooling fans, and under-car and top-of-car auxiliary equipment, such as compressors and air conditioning units. The HST would be electrically powered and considerable quieter at low speeds than conventional trains, which are usually diesel powered.

In the speed range from 60 mph to about 150 mph (98–241 kph), mechanical noise resulting from wheel-rail interactions and structural vibrations dominate the noise emission from trains. In the existing rail corridors in California, conventional trains seldom exceed 79 mph (127 kph), so this speed range, which represents a medium range for HST, is the top end of noise characteristics for trains with which most people are familiar. Speed has a strong influence on noise in the medium speed range.

Above approximately 170 mph (274 kph), aerodynamic noise sources tend to dominate the radiated noise from the HST. Conventional trains are not capable of attaining such speeds. HST noise in the transition speeds between each of the three foregoing ranges is a combination of the sources in each range.

Noise from HST also depends on the type and configuration of its track structure. Typical noise levels are expressed for HST at grade on ballast and tie track, the most commonly found track system. For trains on elevated structure, HST noise is increased, partially due to the loss of sound absorption by the ground and partially due to extra sound radiation from the bridge structure. Moreover, the sound from trains on elevated structures spreads about twice as far as it does from at-grade operations of the same train because of clearer paths for sound transmission.

Horns are an example of a train noise source that is a dominant noise source at any speed. Audible warnings for at-grade crossings, including train horns and warning bells, are a common feature of conventional trains and a vital safety component of railroad operations. These noise sources often prove to be a source of annoyance to people living near railroad tracks. In the case of HST, however, horn and warning bell noise are absent except in the case of emergencies because at-grade crossings are eliminated. Reduction of horn and bell noise from the elimination of existing at-grade crossings would provide a noise benefit associated with the implementation of HST for alignments along existing rail corridors, but only at locations where grade separations are built that serve both the HST system and existing rail lines.

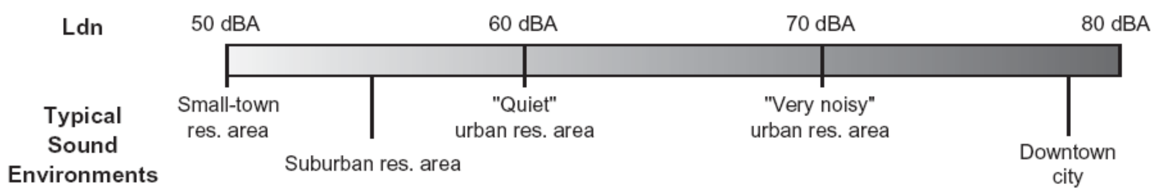

Figure 3.4-2
Typical Day-Night Sound Level Environments

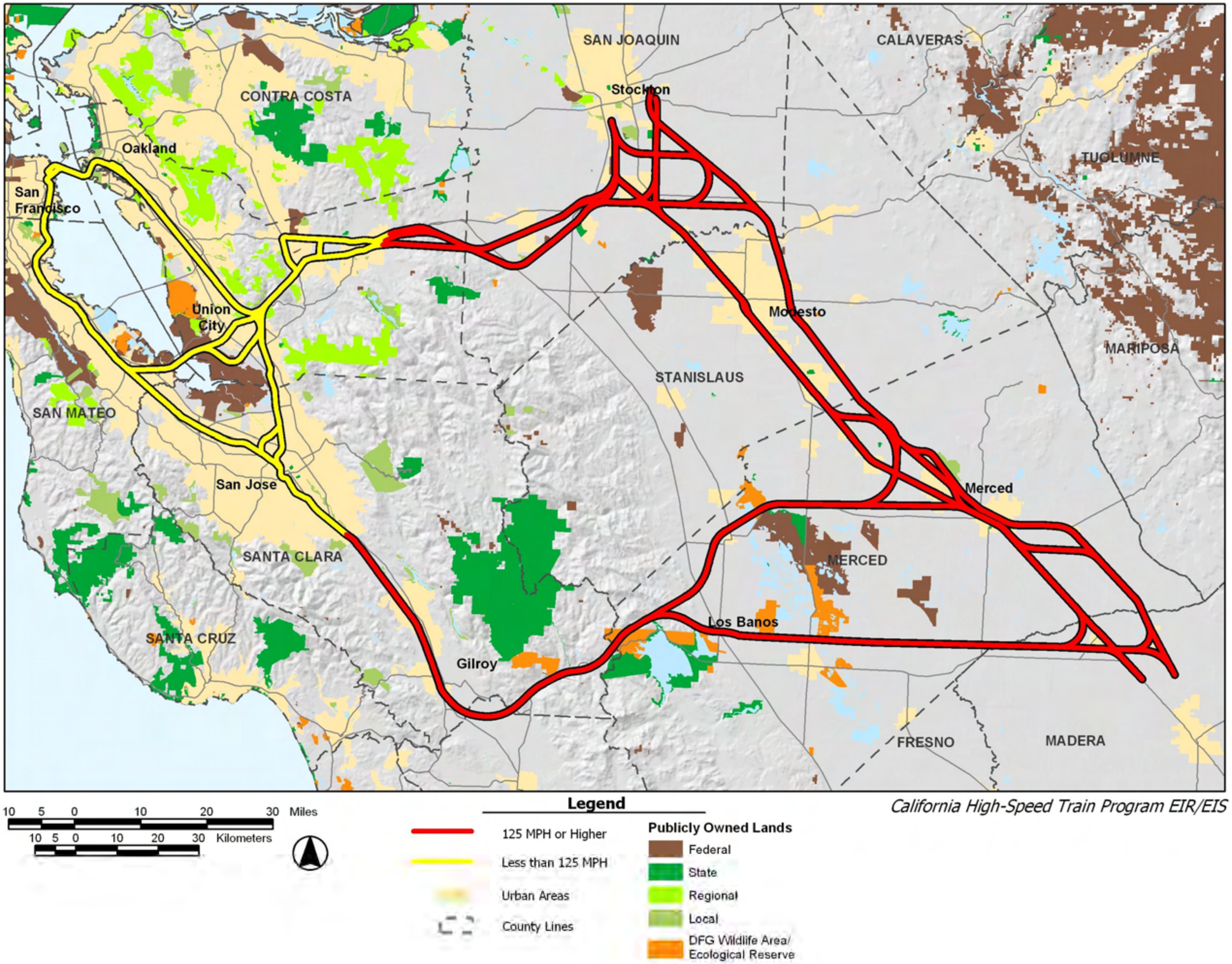

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Figure 3.4-3
Potential Average Operating Speeds

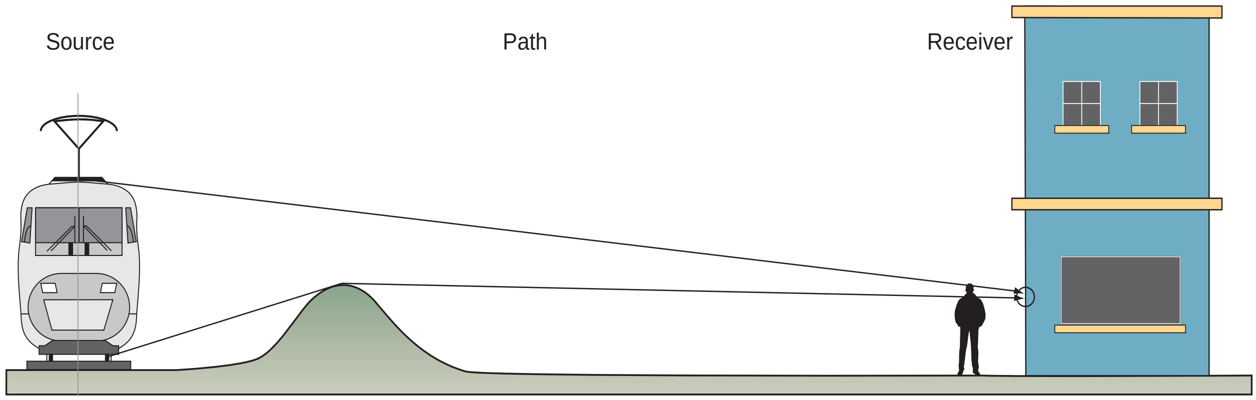

Figure 3.4-4
HST Source Path Receiver Framework

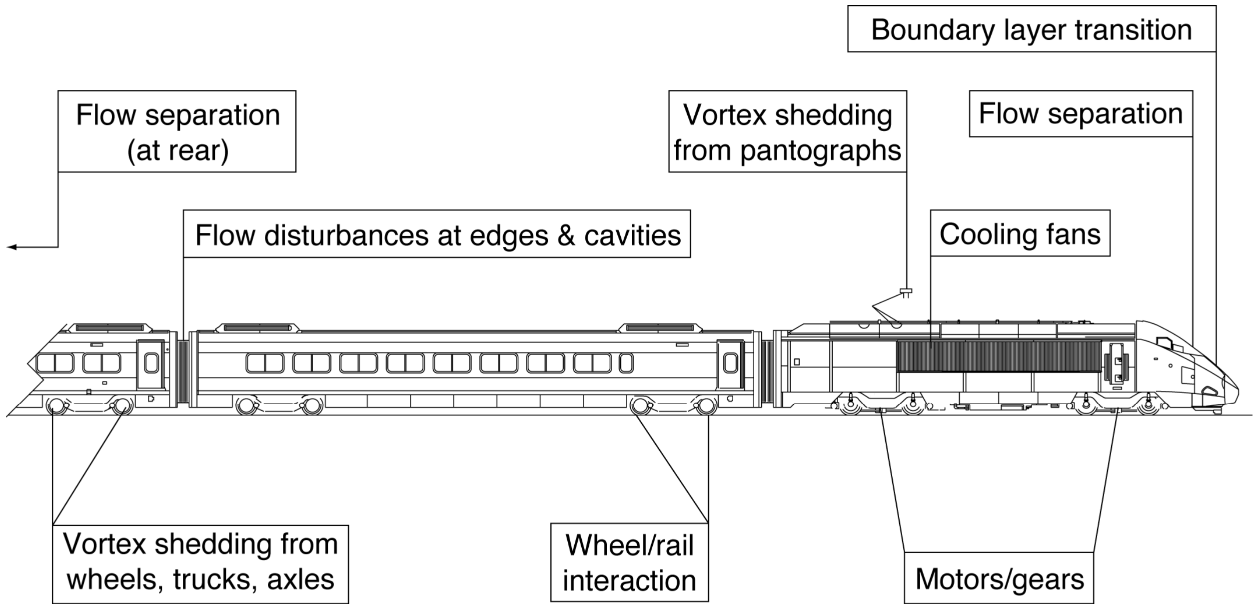

Figure 3.4-5
Noise Sources on HST

Vibration of the ground caused by the pass-by of the HST is similar to that caused by conventional steel wheel/steel rail trains. However, vibration levels associated with the HST are relatively lower than conventional passenger and freight trains due to advanced track technology, smooth track and wheel surfaces, and high maintenance standards required for high-speed operation.

Ground-borne vibration from trains refers to the fluctuating motion experienced by people on the ground and in buildings near railroad tracks. In general, people are not commonly exposed to vibration levels from outside sources that they can feel. Little concern results when a door is slammed and a wall shakes or something heavy is dropped and the floor shakes momentarily. Concern results, however, when an outside source like a train causes homes to shake. The effects of ground-borne vibration in a building located close to a rail line could at worst include perceptible movement of the floors, rattling of windows, shaking of items on shelves or hanging on walls, and rumbling sounds. None of these effects are great enough to cause damage but could result in annoyance if repeated many times daily.

As with noise, ground-borne vibration can be understood as following a source-path-receptor framework (Figure 3.4-4). The source of vibration is the train wheels rolling on the rails. They create vibration energy that is transmitted through the track support system into the track bed or track structure. The path of vibration involves the ground between the source and a nearby building. The receptor of vibration is the building.

C. EXISTING NOISE ENVIRONMENT

Existing noise environments are generally dominated by transportation-related sources, including vehicle traffic on freeways, highways, and other major roads, existing passenger and freight rail operations, and aviation sources, including civilian and military. Existing noise along highway and proposed HST corridors has been estimated using data in the noise element from the general plan for cities and counties in the region, along with general methods provided by FHWA, FRA, and FTA for estimating transportation noise. Ambient noise levels are characterized for below. Ambient vibration conditions are very site-specific in nature and are not characterized as part of the program environmental process.

The study region is central California from the San Francisco Bay Area (San Francisco and Oakland) south to the Santa Clara Valley and east across the Diablo Range to the Central Valley. The ambient noise in the northern portion of the Bay Area to Central Valley region is dominated by motor vehicle traffic in densely populated areas and along freeways. All the regional freeways considered in the No Project Alternative are major contributors to the ambient noise environment. In this region, the HST Alignment Alternatives would primarily follow or parallel existing rail tracks. Along the proposed alignment alternative on the San Francisco Peninsula, the Caltrain passenger service is a major contributor to the ambient noise levels, especially at grade crossings, where horn noise dominates the noise environment within 0.25 mi (0.40 km) of the intersections. Along the proposed East Bay Crossings alignment, existing Amtrak passenger service and freight rail contribute to the ambient noise levels, with horns at grade crossings being a major factor. In southern San Jose and as far as Gilroy to the south, Caltrain, Amtrak, and freight rail are major contributors to the ambient noise levels.

In the urban areas and suburban areas of the East Bay, San Francisco Peninsula, and San Jose, the ambient noise is estimated to range from L_{dn} 57 to 66 dBA. In many of the residential areas close to the international airports at San Francisco (SFO), Oakland (OAK), and San Jose (SJC), the ambient levels exceed L_{dn} 65 dBA. In the more rural areas of the region to the southeast, the ambient noise ranges from 52 to 57 dBA. Henry Coe State Park is characterized by a low ambient noise environment, approximately L_{eq} 40 dBA, because it is in a remote location and removed from transportation noise sources, except in the southern area, which is approximately 5 miles from SR 152.

In areas away from major roadways, noise from local noise sources is estimated using a relationship determined by the EPA. EPA determined that ambient noise can be approximately related to population density in locations away from transportation corridors, such as airports, major roads, and railroad tracks, according to the following relation:

L_{dn} = 22+ 10 log *(p)* (in dBA)

where *p* = population density in people per square mile.

3.4.3 Environmental Consequences

A. NO PROJECT ALTERNATIVE

The No Project Alternative includes programmed and funded transportation improvements that will be implemented and operational by 2030, in addition to the existing conditions. These improvements are not major systemwide capacity improvements (e.g., major new highway construction or widening or additional runways) and will not result in a general improvement of intercity travel conditions across the study region.

For purposes of this analysis, it is assumed that there will be no additional noise and vibration impacts associated with the development of the No Project Alternative, as compared to existing conditions. The potential significant impacts associated with programmed projects would be addressed with mitigation measures in a manner consistent with existing conditions in accordance with the project-level environmental documents and approvals for the projects as prepared by the project sponsors. Although the implementation of the No Project Alternative may result in some increases, any estimate of such increases would be speculative.

B. HIGH-SPEED TRAIN ALIGNMENT ALTERNATIVES

It is assumed that any improvements associated with the HST Alignment Alternatives and stations location options would be in addition to No Project conditions.

The existing Caltrain alignment along the San Francisco Peninsula and the East Bay railroad alignments pass through densely populated communities where there is high potential for noise impacts. The potential noise impacts of the proposed HST service through these areas would result primarily from the greater frequency of trains, since the HST service would be operating at reduced speeds and would create noise levels similar to the existing services. The HST system would be expected to result in the elimination of up to 48 grade crossings on the peninsula and up to 38 grade crossings on the East Bay. Grade separation of existing rail services would result in considerable benefits from the elimination of the warning bells at existing at-grade crossings and the horn blowing of the existing commuter/intercity services along these alignments.

All the options for mountain crossings between the Bay Area and the Central Valley pass through sparsely populated areas but would introduce new noise sources along corridors through wilderness areas where the alignment is at grade or elevated. Along the Pacheco alignment from Diridon to Gilroy, there are 42.4 miles where noise impacts are rated medium to high and vibration impacts are rated medium. Four schools are located along this alignment, with 131 ac of parkland and varying residential populations. Through the Altamont Pass, there are 1.7–9.7 mi of sparsely populated areas where noise and vibration impacts are rated medium to high.

The relative level of potential noise and vibration impact for each HST alternative segment is shown in Table 3.4-4 and Figure 3.4-6. The table includes the length of alignment alternatives, residential population, mixed use population, acreage of parkland, number of schools, and number of hospitals. At a program level of analysis, station locations will not affect the impact rating of the alternative segments, so no data was included in Table 3.4-4. A detailed data table is included in Appendix 3.4-A.

In general the noise and vibration impact ratings are based on the population densities along each of the segments and the proximity of parkland, hospitals, and schools. Segments where trains would operate at higher speeds would have a greater level of impact. The comparison of the alignment alternatives is based on the data presented in Table 3.4-4 and Figure 3.4-6. Appendix 3.4-A provides a comparison of the alternative alignments by segment.

Potential noise and vibration impacts on wildlife and pristine open space from the HST system cannot be analyzed and ranked at the programmatic level of this report. At the programmatic level, the location and density of wildlife is undetermined, as are the types of wildlife along the HST Alignment Alternatives. Areas of pristine open space need to be defined and mapped based on more precise project-specific information. The significance of noise and vibration impacts of the HST Alignment Alternatives on wildlife and on pristine open space is therefore speculative at this time. Future project-level analyses should include a detailed study of the location, type, and density of wildlife in the project area. The boundaries of pristine open space should be defined and mapped during the project level analyses, so that the amount of pristine open space affected by noise and vibration from the HST Alignment Alternatives can be calculated.

San Francisco to San Jose

Although the HST service in the San Francisco to San Jose (Caltrain) corridor would be going through densely populated communities, the alignment alternatives in this corridor were rated as having a medium level of potential noise impacts because the HST would be traveling at reduced speeds and the communities would benefit from grade separation improvements for existing services and electrification of the railroad.

The noise impacts along this corridor are rated low for those alignment alternatives that are either in a tunnel or passing through sparsely populated areas. The remaining alignment alternatives are rated medium because of the higher population density in proximity to the alignment and the existing parkland and two schools. Vibration impacts along the Transbay Transit Center to 4th/Townsend segment are low. The other alignment alternatives have the potential for medium to high vibration impacts because of the proximity of residential structures to the alignment.

Table 3.4-4
Noise and Vibration Impact Summary Data Table for
Alignment Alternatives and Station Location Option Comparisons

Corridor	Possible Alignments	Alignment Alternative	Total Segment (Miles)	Residential Population	Mixed Use Population	Parkland (Acres)	Hospitals	Schools	Noise Impact Rating*	Vibration Impact Rating
San Francisco to San Jose: Caltrain	1 of 1	San Francisco to Dumbarton	28.84	5,509.3	140.1	0.00	0	2	Medium	Medium
	1 of 1	Dumbarton to San Jose	21.61	9,456.3	62.1	5.27	0	0	Medium	High
Station Location Options										
Transbay Transit Center			Ratings are based on alignment alternative that station is on—San Francisco to Dumbarton						Low	Low
4th and King (Caltrain)			Ratings are based on alignment alternative that station is on—San Francisco to Dumbarton						Low	Low
Millbrae/SFO			Ratings are based on alignment alternative that station is on—San Francisco to Dumbarton						Medium	Medium
Redwood City (Caltrain)			Ratings are based on alignment alternative that station is on—San Francisco to Dumbarton						Medium	Medium
Palo Alto (Caltrain)			Ratings are based on alignment alternative that station is on—Dumbarton to San Jose						Medium	High
Oakland to San Jose: Niles/ I-880	1 of 2	West Oakland to Niles Junction	13.6	2,626.7	0.00	0.00	0	1	Medium	High
		12th Street/City Center to Niles Junction	13.56	2,636.5	0.00	0.00	0	1	Medium	High
	1 of 2	Niles Junction to San Jose via Trimble	13.09	1,949.6	87.9	67.44	0	1	Medium	Medium
		Niles Junction to San Jose via I-880	25.55	2,032.9	95.4	67.44	0	1	Medium	Medium

Corridor	Possible Alignments	Alignment Alternative	Total Segment (Miles)	Residential Population	Mixed Use Population	Parkland (Acres)	Hospitals	Schools	Noise Impact Rating*	Vibration Impact Rating
Station Location Options										
West Oakland/7th Street			Ratings are based on alignment alternative that station is on—West Oakland to Niles Junction						Medium	High
12th Street/City Center			Ratings are based on alignment alternative that station is on—12th Street/City Center to Niles Junction						Medium	High
Coliseum/Airport			Ratings are based on alignment alternative that station is on—West Oakland to Niles Junction						Medium	High
Union City (BART)			Ratings are based on alignment alternative that station is on—Niles Junction to San Jose Via Trimble						Medium	Medium
Fremont (Warm Springs)			Ratings are based on alignment alternative that station is on—Niles Junction to San Jose Via Trimble						Medium	Medium
San Jose to Central Valley: Pacheco Pass	1 of 1	Pacheco	70.57	8,029.2	48.4	735.96	0	4	Medium	Medium
	1 of 3	Henry Miller (UPRR Connection)	62.59	0.6	0.6	1,437.29	0	1	Low	Low
		Henry Miller (BNSF Connection)	64.89	0.6	0.6	1,437.29	0	1	Low	Low
		GEA North	51.05	1,496.5	1,361.7	825.92	0	1	Low	Low
Station Location Options										
San Jose (Diridon)			Ratings are based on alignment alternative that station is on—Pacheco						Medium	Medium
Morgan Hill (Caltrain)			Ratings are based on alignment alternative that station is on—Pacheco						Medium	Medium
Gilroy (Caltrain)			Ratings are based on alignment alternative that station is on—Pacheco						Medium	Medium
East Bay to Central Valley: Altamont Pass	1 of 4	I-680/ 580/UPRR	29.99	1,110.1	0.6	94.51	0	1	Low	Low
		I-580/ UPRR	26.54	894.4	0.6	11.61	1	2	Low	Low
		Patterson Pass/UPRR	25.62	2,407.5	0.00	20.40	0	2	Medium	Medium
		UPRR	25.15	2,208.85	0.00	20.40	0	2	Medium	Medium

Corridor	Possible Alignments	Alignment Alternative	Total Segment (Miles)	Residential Population	Mixed Use Population	Parkland (Acres)	Hospitals	Schools	Noise Impact Rating*	Vibration Impact Rating
	1 of 4	Tracy Downtown (BNSF Connection)	50.18	2,596.9	0.00	54.68	0	1	Low	Low
		Tracy ACE Station (BNSF Connection)	50.41	1,005.8	0.00	200.15	0	1	Low	Low
		Tracy ACE Station (UPRR Connection)	29.55	2,693.9	0.00	167.99	0	1	Medium	Low
		Tracy Downtown (UPRR Connection)	33.14	4,258.6	0.00	54.68	0	1	Medium	Low
	2 of 2	East Bay Connections	1.77	1,453.74	4.5	0	0	0	High	High
Station Location Options										
Pleasanton (I-680/Bernal Rd)			Ratings are based on alignment alternative that station is on—Patterson Pass/UPRR						Medium	Medium
Pleasanton (BART)			Ratings are based on alignment alternative that station is on— I-680/ 580/UPRR						Low	Low
Livermore (Downtown)			Ratings are based on alignment alternative that station is on—Patterson Pass/UPRR						Medium	Medium
Livermore (I-580)			Ratings are based on alignment alternative that station is on— I-680/ 580/UPRR						Low	Low
Livermore (Greenville Road/UPRR)			Ratings are based on alignment alternative that station is on—Patterson Pass/UPRR						Medium	Medium
Livermore (Greenville Road/I-580)			Ratings are based on alignment alternative that station is on—I-680/ 580/UPRR						Low	Low
Tracy (Downtown)			Ratings are based on alignment alternative that station is on—Tracy Downtown (UPRR Connection)						Medium	Low
Tracy (ACE)			Ratings are based on alignment alternative that station is on—Tracy ACE Station (UPRR Connection)						Medium	Low

Corridor	Possible Alignments	Alignment Alternative	Total Segment (Miles)	Residential Population	Mixed Use Population	Parkland (Acres)	Hospitals	Schools	Noise Impact Rating*	Vibration Impact Rating
San Francisco Bay Crossings	1 of 2	Trans Bay Crossing – Transbay Transit Center	6.76	0.00	0.00	0.00	0	0	Low	Low
		Trans Bay Crossing – 4th & King	6.5	0.00	0.00	0.00	0	0	Low	Low
	1 of 6	Dumbarton (High Bridge)	18.57	6,848.0	8.9	366.08	0	4	High	High
		Dumbarton (Low Bridge)	18.57	6,848.0	8.9	366.08	0	4	High	High
		Dumbarton (Tube)	18.57	5,267.5	4.5	151.66	0	2	High	High
		Fremont Central Park (High Bridge)	22.29	4,279.9	8.9	572.58	0	3	High	High
		Fremont Central Park (Low Bridge)	22.29	4,279.9	8.9	572.58	0	3	High	High
		Fremont Central Park (Tube)	22.29	3,034.3	8.9	214.42	0	2	Medium	High
Station Location Options										
Union City (Shinn)		Ratings are based on alignment alternative that station is on—Niles Junction to San Jose Via Trimble							Medium	Medium
Central Valley	1 of 6	BNSF – UPRR	86.78	4,000.2	895.5	123.93	1	4	Low	Low
		BNSF	91.29	4,587.5	1052.2	125.57	0	4	Low	Low
		UPRR N/S	87.25	7,401.8	648.7	205.27	2	2	Medium	Low
		BNSF Castle	91.48	7,598.5	1,837.1	494.33	0	7	Medium	Low
		UPRR – BNSF Castle	92.32	11,363.3	2,066.2	699.60	1	6	Medium	Low
		UPRR – BNSF	87.62	7,764.9	1,124.6	329.20	2	3	Medium	Low

Corridor	Possible Alignments	Alignment Alternative	Total Segment (Miles)	Residential Population	Mixed Use Population	Parkland (Acres)	Hospitals	Schools	Noise Impact Rating*	Vibration Impact Rating
Station Location Options										
Modesto (Downtown)			Ratings are based on alignment alternative that station is on—UPRR N/S						Medium	Low
Briggsmore (Amtrak)			Ratings are based on alignment alternative that station is on—BNSF						Low	Low
Merced (Downtown)			Ratings are based on alignment alternative that station is on—UPRR-BNSF Castle						Medium	Low
Castle AFB			Ratings are based on alignment alternative that station is on—BNSF Castle						Medium	Low

*Accounts for Grade Crossing Elimination on alignment segments on or adjacent to existing non-grade separated tracks.

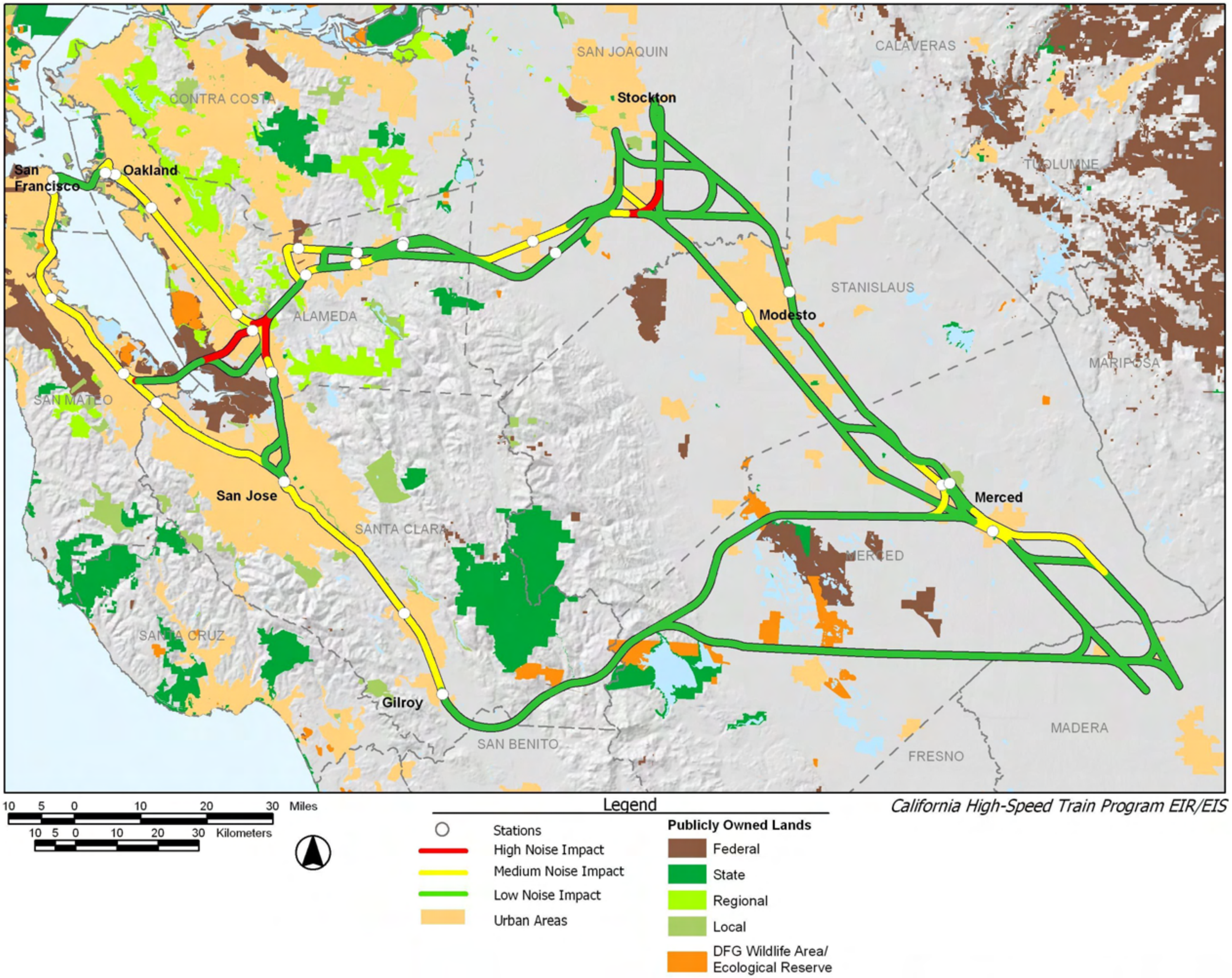

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Figure 3.4-6
Potential Noise Impact Levels

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Oakland to San Jose

Although the HST service in the Oakland to San Jose corridor would be going through densely populated communities, the alignment alternatives in this corridor were rated as having a medium level of potential noise impacts because the HST would be traveling at reduced speeds and the communities would benefit from grade separation improvements for existing services and electrification of the railroad.

The alignment alternatives through Oakland to Niles are rated medium for noise and high for vibration because of the higher population densities and the proximity of a school to the segments. The 12th Street/City Center to Niles Junction alignment alternative would have an additional 4.8 mi of vibration impact rated high than the West Oakland to Niles Junction alternatives because of the segment between 12th Street/City Center to Jack London Square. Noise impacts are the same for these two alternatives.

The alignment alternative from Niles Junction to San Jose via Trimble has 6 mi of noise impacts rated as medium and vibration impacts rated high; the Niles Junction to San Jose via I-880 alignment alternative is similar but has an additional 2.9 mi of medium rated vibration impact.

San Jose to Central Valley

The San Jose to Central Valley corridor is rated as having medium potential for noise impacts. Although the HST system could reach speeds as great as 186 mph (299 kph) through this area, the densities are less than on the San Francisco Peninsula or the East Bay, and the communities would receive considerable benefit from the elimination of up to 24 grade crossings.

Along the Pacheco alignment alternative from Diridon to Gilroy, there are 42.4 miles where noise impacts are rated medium to high and vibration impacts are rated medium. Four schools are located along this alignment, and there are 131 ac of parkland and varying residential populations.

All the alignment alternatives for mountain crossings between the Bay Area and the Central Valley are through sparsely populated areas but would introduce new noise sources along corridors through wilderness areas where the alignment is at grade or elevated.

From San Luis Reservoir to Henry Miller Wye, there are three alignment alternatives. The noise and vibration impacts in the UPRR Connection and BNSF Connection alignment alternatives are rated low. Both these alignment alternatives pass through areas with little to no residential population. The GEA North alignment alternative is located closer to populated areas and the noise and vibration impacts in this alignment alternative are rated medium along the 7.7 miles between GEA Atwater Wye to the BNSF.

Eastbay to Central Valley

In the Eastbay to Central Valley corridor, which extends from Niles Canyon to the County Line through the Altamont Pass, there are four alignment alternatives. The I-680/580/UPRR alignment alternative is rated a medium noise and vibration impact from Sunol to El Charo Road, which is made up of 9.7 mi of sparsely populated residents with 7 ac of parkland. The I-580/UPRR alignment alternative is rated a high impact for noise and vibration along the Pleasanton to El Charo 1.7 mi segment. The Patterson Pass/UPRR alignment alternative has 8.0 mi of noise and vibration impacts rated medium to high from Pleasanton to the Patterson Pass cut off. The UPRR alignment is the same as Patterson Pass/UPRR with similar impacts along the same 8.0 mi length.

Of the four alignments from Tracy to Escaton Wye, the segment from southeast Manteca to the BNSF connection would be ranked the highest in noise and vibration impacts.

In the East Bay alignment alternative, the Niles to Niles Wye segment is rated a high vibration impact through Fremont, and the segment through Union City is rated a low vibration impact. Noise impacts are the same along these segments.

San Francisco Bay Crossings

In the San Francisco Bay Crossings corridor, the Trans Bay Crossing alignment alternative would be through a tunnel and is rated low for noise and vibration impacts. Of the six alignment alternatives from the Dumbarton Wye to Niles Wye, the Dumbarton Tube alignment alternative is rated the highest noise and vibration impact over the greatest distance, approximately 12 mi.

Central Valley

Through the Central Valley, most of the HST Alignment Alternatives are rated as low potential noise impact due generally to the sparseness of residential land use and the extent of open space along most of the length of the options—even though the proposed HST service would be operating at maximum speeds throughout most of the Central Valley. However, there are a number of locations in the Central Valley where the various alignment alternatives pass through populated areas and have high potential noise impact ratings for short segments. Examples include portions of Modesto and Merced that could be exposed to higher noise levels from HST operations.

Through many of the cities in the Central Valley, the HST is proposed to be on aerial structure, primarily to reduce potential conflicts with freight railroad spur tracks or freight railroad yards. The vertical elevation of the aerial structure would allow potential noise impacts to extend further than they would at grade.

Through the Central Valley corridor, from North Stockton to the Henry Miller BNSF Wye, the alignment alternatives with the highest ranked noise impact are the BNSF Castle and UPRR – BNSF Castle alternatives, with 16.8 mi that are rated high noise impact and medium vibration impact.

C. SHORT-TERM CONSTRUCTION NOISE AND VIBRATION

Construction Noise Levels

Noise impacts from construction of the project will be generated by heavy equipment used during major construction periods as close as 50 ft from existing structures along the alignment. Table 3.4-5 shows the estimated maximum noise levels for the different stages of at-grade construction at 100 ft from a receiver.

Table 3.4-5
Estimated Peak Hour Construction Noise Levels

Construction Phase	Loudest Equipment	Noise Level at 100 ft Lmax (dBA)
Clearing and grubbing	Bulldozer, backhoe, haul trucks	86
Earthwork	Scraper, bulldozer	88
Foundation	Backhoe, loader	85
Structures	Crane, loader, haul truck	86
Base preparation	Trucks, bulldozer	88
Paving	Paver, pumps, haul trucks	89
Source: *Transit Noise and Vibration Impact Assessment* (U.S. Department of Transportation 2006).		

Construction Vibration Levels

Common vibration-producing equipment used during at-grade construction activities include jackhammers, pavement breakers, hoe rams, augur drills, bulldozers, and backhoes. Pavement breaking and soil compaction would probably be the activities that produce the highest level of vibration. Table 3.4-6 presents various types of construction equipment measured under a wide variety of construction activities, with an average of source levels reported in terms of velocity levels. Although the table gives one level for each piece of equipment, it should be noted that there is a considerable variation in reported ground vibration levels from construction activities. The data provide a reasonable estimate for a wide range of soil conditions.

Table 3.4-6
Vibration Source Levels for Construction Equipment

Equipment	Peak Particle Velocity at 25 Ft (inches per second)	Approximate Velocity Level at 25 Ft
Pile driver (impact)		
Upper range	1.518	112
Typical	0.644	104
Pile driver (sonic)		
Upper range	0.734	105
Typical	0.170	93
Clam shovel drop (slurry wall)	0.202	94
Hydromill (slurry wall)		
In soil	0.008	66
In rock	0.017	75
Large bulldozer	0.089	87
Caisson drilling	0.089	87
Loaded trucks	0.076	86
Jackhammer	0.035	79
Small bulldozer	0.003	58

Velocity level = Root mean square velocity in decibels (VdB) relative to 1 micro-inch/second.
Source: *Transit Noise and Vibration Impact Assessment* (U.S. Department of Transportation 2006).

3.4.4 Role of Design Practices in Avoiding and Minimizing Effects

Because of the high-speed alignment requirements of the HST system, significant portions of the alignment alternatives are in a tunnel or trench section. For these portions of the system, the potential for noise impacts is mostly eliminated. The tunnel cross sections are designed (per established engineering criteria) to provide sufficient cross-sectional area to avoid potential aerodynamic effects at the tunnel portals caused by trains operating at maximum speed.

At similar speeds, HSTs generate significantly less noise than commuter and freight trains. This is primarily to the result of the use of electric power versus diesel engines, higher quality track interface, and smaller, lighter, more aerodynamic trainsets. The use of electric power units would not have the engine rumble associated with diesel-powered locomotives. Although wheel/track interface is a significant source of train noise, HST track beds and rails are designed and maintained to very high geometric tolerances and standards, which would greatly minimize track noise that is prevalent with commuter/freight tracks throughout the study region.

Another reason HST noise impacts are less than commuter or freight trains is that high speeds would result in short duration noise events compared with conventional trains (a few seconds at the highest speeds versus 10 to 20 seconds for conventional passenger trains and well over 1 minute for freight trains).

The HST system would be fully grade separated from all roadways. In the urban areas, where potential for noise impacts is typically at the highest levels, the HST system would be predominantly in or adjacent to existing rail corridors, and the HST Alignment Alternatives often include the grade separation of the existing tracks. Grade separations completed with the HST system in corridors such as these would eliminate horn sounding and bells at existing grade crossings and would result in noise benefits that would offset much of the HST noise impacts.

3.4.5 Mitigation Strategies and CEQA Significance Conclusions

Based on the analysis above, and considering the design practices described in section 3.4.4, each of the HST Alignment Alternatives would have significant noise and vibration impacts, as detailed in Table 3.4-4. The HST Alignment Alternatives would create significant long-term noise and vibration impacts from introduction of a new transportation system. At the same time, the HST Alignment Alternatives would create some long-term noise reduction benefits because noise sources would be eliminated with grade separation of existing grade crossings. It is possible that at the future project-level of analysis, refined data and information would confirm that some sections of the alignment alternatives would result in less-than-significant noise and vibration impacts (i.e., through the Transbay Tunnel); however, for purposes of the programmatic analysis, the long-term noise and vibration impacts are considered significant for all sections. In addition, the HST Alignment Alternatives would involve significant short-term noise and vibration impacts from construction.

General mitigation strategies are discussed in this program-level review of potential noise impacts associated with proposed alternatives that would reduce the impacts. General vibration mitigation strategies are less predictable at a program level of analysis because of the site-specific nature of vibration transmission through soil along the alignment. More detailed mitigation strategies for potential noise and vibration impacts would be developed in the next stage of environmental analysis. Noise and vibration mitigation measures can generally be applied to the source (train and associated structures), the path (area between train and receiver), and/or the receiver (property or building). An HST system would be designed and developed to meet state-of-the-art technology specifications for noise and vibration, based on the desire to provide the highest-quality train service possible. Trains and tracks would be maintained in accordance with all applicable standards to provide reliable operations.

Treatments, such as sound insulation or vibration controls to affected buildings, may be difficult to implement for the potentially numerous properties adjacent to the right-of-way. Such treatments require protracted implementation procedures and separate design considerations. The most feasible and effective mitigation treatments are typically those involving the path. These mitigation measures can often be applied to the path within the right-of-way, either under or adjacent to the tracks. Potential noise impacts can be reduced substantially by the installation of sound barrier walls constructed to shield receivers from train noise. For vibration mitigation, several track treatments may be considered for reducing train vibrations. Determining the most appropriate treatment would depend on the site-specific ground conditions along the corridor. This program-level analysis has identified areas where future analysis should be given to potential HST-induced vibrations. The type of vibration mitigation and expected effectiveness will be determined as part of the second-tier project-level environmental analyses.

A. NOISE BARRIERS

Noise barriers are often a practical way to reduce noise impacts from the proposed HST system. The representative typologies considered the mitigation potential of noise barriers for certain areas. In most cases the application of appropriately dimensioned noise barriers next to the tracks could reduce potential noise impacts from FRA's severe noise impact category to moderate, and to the no impact category in some locations. The design of noise barriers appropriate for the proposed HST right-of-way line would depend on the location and height of noise-sensitive buildings, as well as the speeds of the trains. Noise barriers 8–10 ft (2–3 m) tall could be installed where speeds are relatively low (i.e., wheel/rail noise dominates). Higher noise barriers of 12–16 ft (4–5 m) might be used to reduce noise to taller buildings or where speeds are high in noise-sensitive areas. In many locations, noise barriers could be installed on one side of the track only because of the location and proximity of noise-sensitive areas.

Application of mitigation to the proposed HST system would result in a considerable reduction of potential noise impacts. The estimates obtained from the results of the representative typologies showed noise barriers to be effective in reducing the potential noise impact rating by one category, for example, from high to medium or from medium to low. Consequently, HST Alignment Alternatives with high rating would be adjusted down to, at most, a medium rating.

The cost of constructing a noise barrier on one side of a rail line is estimated at approximately $1 million per mi ($625,000 per km) for a concrete wall of 12 ft (4 m) in height. Conservatively, a unit cost of $1.5 million per mi ($937,500 per km) was applied to portions of the HST Alignment Alternatives with high potential noise impact ratings. The procedure was repeated for all segments with a medium rating, thereby reducing these HST noise impact ratings to low. This approach was intended to show that mitigation is possible and to provide a rough estimate of potential mitigation costs, recognizing that specific mitigation would be developed as a part of project-level review.

The results in Table 3.4-7 show the potential mitigation costs for the HST Alignment Alternatives. This analysis included noise mitigation (barrier walls) for 1.7 to 42.4 route miles (2.7 to 68.2 route km) of the proposed HST alignments with medium to high noise impacts.

Table 3.4-7
Potential Length and Cost of Noise Mitigation by Alignment

	Noise Mitigation Length in Miles (Km)	Noise Barrier Cost (in millions of dollars)
San Francisco to San Jose: Caltrain		
San Francisco to Dumbarton	26.9 (43.2)	40.3
Dumbarton to San Jose	18.7 (30.1)	28.0
Oakland to San Jose: Niles/I-880		
West Oakland to Niles Junction (1 of 2)	13.6 (21.9)	20.4
12th Street/City Center to Niles Junction (2 of 2)	13.6 (21.9)	20.4
Niles Junction To San Jose via Trimble (1 of 2)	6.0 (9.6)	9.0
Niles Junction to San Jose via I-880 (2 of 2)	6.0 (9.6)	9.0
San Jose to Central Valley: Pacheco Pass		
Pacheco	42.4 (68.2)	63.6
Henry Miller (UPRR Connection) (1 of 3)	0	0
Henry Miller (BNSF Connection) (2 of 3)	0	0
GEA North (3 of 3)	7.7 (12.4)	11.6
East Bay to Central Valley: Altamont Pass		
I-680/I-590/UPRR	9.7 (15.6)	14.6
I-580/UPRR	1.7 (2.8)	2.6

	Noise Mitigation Length in Miles (Km)	Noise Barrier Cost (in millions of dollars)
Patterson Pass/UPRR	8.0 (12.9)	12.0
UPRR	14.8 (23.7)	22.1
Tracy Downtown (BNSF Connection)	3.0 (4.8)	4.4
Tracy ACE Station (BNSF Connection)	8.2 (13.2)	12.3
Tracy ACE Station (UPRR Connection)	20.0 (32.2)	30.0
East Bay Connections	1.8 (2.8)	2.7
San Francisco Bay Crossings		
Trans Bay Crossing – Transbay Transit Center	0 (0)	0
Trans Bay Crossing – 4th & King	0 (0)	0
Dumbarton (High Bridge)	18.6 (29.9)	27.9
Dumbarton (Low Bridge)	18.6 (29.9)	27.9
Dumbarton (Tube)	11.0 (17.6)	16.4
Freemont Central Park (High Bridge)	22.3 (35.6)	33.4
Freemont Central Park (Low Bridge)	22.3 (35.6)	33.4
Freemont Central Park (Tube)	22.3 (35.6)	33.4
Central Valley		
BNSF-UPRR	10.7 (17.2)	16.1
BNSF	10.9 (17.6)	16.4
UPRR N/S	13.1 (21.0)	19.6
BNSF Castle	16.8 (27.0)	25.2
UPRR – BNSF Castle	25.5 (41.1)	38.3
UPRR – BNSF	19.4 (31.3)	29.1

B. VIBRATION MITIGATION

The following mitigation strategies can be refined and applied at the project-specific level and will reduce the vibration impact:

- Specify the use of train and track technologies that minimize ground vibration, such as state-of-the-art suspensions, resilient track pads, tie pads, ballast mats, or floating slabs.
- Phase construction activity, use low impact construction techniques, and avoid use of vibrating construction equipment where possible to avoid vibration construction impacts.

Vibration mitigation is less predictable at a program level of analysis because of the site-specific nature of vibration transmission through soil along the alignment. However, an estimate can be made of the length of corridor where vibration mitigation may need to be considered by totaling the segments with potential vibration impact rating of high. The results are shown in Table 3.4-8 and Figure 3.4-7. The range is 1.7–42.4 mi (2.7 to 68.2 km) to be considered for mitigation, depending on which option is chosen. Although the mitigation measures will reduce vibration impact levels, at the programmatic level it is uncertain whether the reduced vibration levels will be below a significant impact. The type of vibration mitigation and expected effectiveness to reduce the vibration impacts of

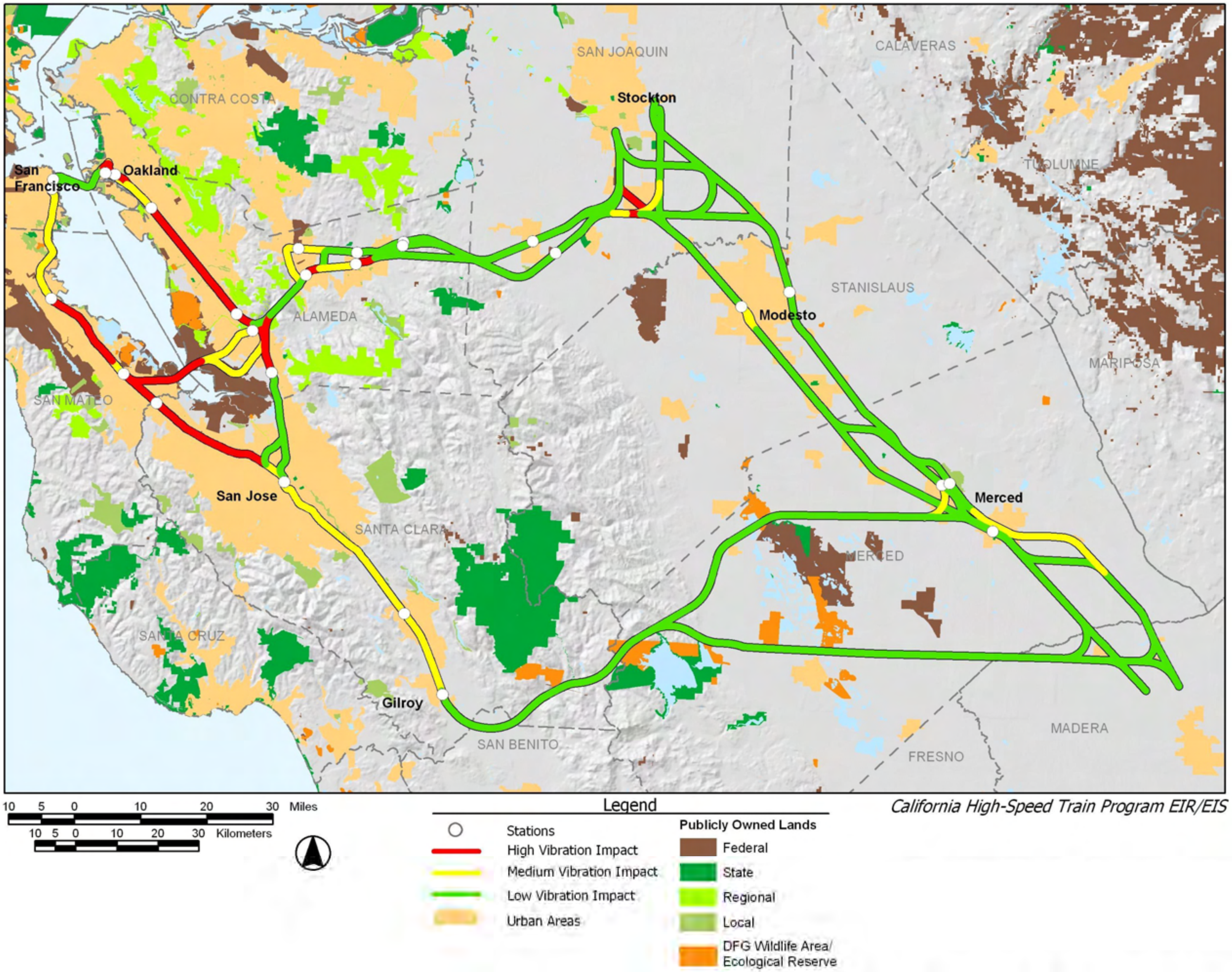

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Figure 3.4-7
Potential Vibration Impact Levels

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the HST Alignment Alternatives to a less-than-significant level will be determined as part of the second-tier project-level environmental analyses.

C. CONSTRUCTION MITIGATION

Potential mitigation strategies for construction noise impacts associated with the HST system are listed below.

- Construction noise could be reduced by using enclosures or walls to surround noisy equipment, installing mufflers on engines, substituting quieter equipment or construction methods, minimizing time of operation, and locating equipment farther from sensitive receptors.
- Construction operations could be suspended between 7:00 p.m. and 7:00 a.m. and/or on weekends and holidays in residential areas.
- Contractors could be required to comply with all local sound control and noise-level rules, regulations, and ordinances.
- Equip each internal combustion engine with a muffler of a type recommended by the manufacturer.

Table 3.4-8
Length of Potential Vibration Impact by Alignment

	Length of Medium Impact in Miles (km)	Length of High Impact in Miles (km)
San Francisco to San Jose		
San Francisco to Dumbarton	16.3 (26.2)	10.6 (17.0)
Dumbarton to San Jose	2.9 (4.7)	18.7 (30.1)
Oakland to San Jose		
West Oakland to Niles Junction (1 of 2)	8.4 (13.6)	5.2 (8.2)
12th Street/City Center to Niles Junction (2 of 2)	3.6 (5.8)	10.0 (16.1)
Niles Junction To San Jose via Trimble (1 of 2)	0 (0)	6.0 (9.6)
Niles Junction to San Jose via I-880 (2 of 2)	2.9 (4.7)	6.0 (9.6)
San Jose to Central Valley: Pacheco Pass		
Pacheco	42.4(68.2)	0 (0)
Henry Miller (UPRR Connection) (1 of 3)	0 (0)	0 (0)
Henry Miller (BNSF Connection) (2 of 3)	0 (0)	0 (0)
GEA North (3 of 3)	7.7 (12.4)	0 (0)
East Bay to Central Valley: Altamont Pass		
I-680/I-590/UPRR	9.7 (15.6)	0 (0)
I-580/UPRR	0 (0)	1.7 (2.8)
Patterson Pass/UPRR	4.1 (6.5)	4.0 (6.4)
UPRR	4.1 (6.5)	4.0 (6.4)
Tracy Downtown (BNSF Connection)	0 (0)	1.1 (1.7)
Tracy ACE Station (BNSF Connection)	0 (0)	1.1 (1.7)
Tracy ACE Station (UPRR Connection)	5.3 (8.5)	1.1 (1.7)
East Bay Connections	0 (0)	0.6 (1.0)

	Length of Medium Impact in Miles (km)	Length of High Impact in Miles (km)
San Francisco Bay Crossings		
Trans Bay Crossing – Transbay Transit Center	0 (0)	0 (0)
Trans Bay Crossing – 4th & King	0 (0)	0 (0)
Dumbarton (High Bridge)	6.8 (11.0)	11.8 (18.9)
Dumbarton (Low Bridge)	6.8 (11.0)	11.8 (18.9)
Dumbarton (Tube)	6.8 (11.0)	11.8 (18.9)
Freemont Central Park (High Bridge)	12.9 (20.8)	9.4 (15.1)
Freemont Central Park (Low Bridge)	12.9 (20.8)	9.4 (15.1)
Freemont Central Park (Tube)	12.9 (20.8)	9.4 (15.1)
Central Valley		
BNSF-UPRR	0 (0)	0 (0)
BNSF	0 (0)	0 (0)
UPRR N/S	0 (0)	6.1 (9.8)
BNSF Castle	16.8 (27.0)	0 (0)
UPRR – BNSF Castle	16.8 (27.0)	6.1 (9.8)
UPRR – BNSF	0 (0)	6.1 (9.8)

Other measures that should be considered include the following:

- Specifying the quietest equipment available would reduce noise by 5–10 dBA.
- Turning off construction equipment during prolonged periods of nonuse would eliminate noise from construction equipment during those periods.
- Requiring contractors to maintain all equipment and train their equipment operators would reduce noise levels and increase efficiency of operation.
- Locating stationary equipment away from noise-sensitive receptors would decrease noise impact from that equipment in proportion to the increased distance.

The above mitigation strategies are expected to reduce the short-term and long-term noise impacts of the HST Alignment Alternatives to a less-than-significant level. Additional environmental assessment would allow a more precise evaluation in the second-tier project-level environmental analyses.

3.4.6 Subsequent Analysis

A. NOISE ANALYSIS

FRA provides guidance for two levels of analysis in project environmental review, a general assessment method to further quantify the potential noise impacts in locations identified by the screening procedure and a detailed analysis procedure for evaluating suggested noise mitigation at locations where further studies show there is potential for significant impacts. The process is designed to focus on problem areas as more detail becomes available during project development. Subsequent analysis would proceed along the following lines.

Ambient noise conditions

The existing ambient noise environment is described by assumptions in the screening procedure. However ambient noise values would be estimated at the project-level analysis based on limited measurements in the general assessment and would be thoroughly measured in the detailed analysis. A measurement program involving both long-term and short-term noise monitoring would be performed at selected locations to document the existing noise environment. Because it would be impractical to measure noise everywhere, the monitoring would be supplemented by estimates of noise environments at locations considered to be typical of others. Guidelines for characterizing the existing conditions are provided by the FRA manual.

Project Noise Conditions

A generic HST is used in the screening procedure, but a more specific train type, speed profile, and operation plan would be available for more refined projections of noise levels in the next stage of environmental analysis.

Noise Propagation Characteristics

The screening procedure assumes flat terrain with noise emanating from a source unhindered by landforms and human-made structures. The next stage of analysis would incorporate topography as well as consideration of shielding by buildings, vegetation, and other natural features in a particular corridor.

Impact Criteria

The screening procedure accounts for all noise-sensitive land use categories that may be exposed to noise levels exceeding the threshold of impact. In the next stage of analysis, assessments using the full, three-level FRA impact criteria would be performed (U.S. Department of Transportation 2005). This more detailed assessment would more specifically identify locations where potential impacts may occur and locations where potentially high impact may occur and would provide for consideration of specific mitigation measures where appropriate.

Mitigation

Noise abatement is discussed generally in the screening procedure, and areas are identified where more detailed analysis should be focused in the future to integrate a proposed HST system into the existing environment. As more detail becomes available in the general assessment phase, there may be many areas that were identified as potentially impacted during screening analysis for which further analysis would not be needed, because they would not be impacted. The detailed analysis would provide information useful for the engineering design of mitigation measures. These measures would be considered in the project-level environmental review, and potential visual and shadow impacts of noise barriers would also be considered.

B. VIBRATION ANALYSIS

The steps involved in the more detailed analysis of ground-borne vibration would be similar to those for noise. The major difference would be the need for study of site-specific ground-borne vibration characteristics. Considerable variation of soil conditions may occur along the corridor, resulting in some locations with significant levels of vibration from the HST and other locations at the same distance from the track with almost imperceptible vibration levels. Determining the potential vibration characteristics in the detailed analysis would involve a measurement program performed according to the method described in the FRA guidance manual (U.S. Department of Transportation 2005). This method would allow for the prediction of vibration levels and frequency spectrum information, which is valuable not only in the assessment of impact but also in the consideration of mitigation measures.

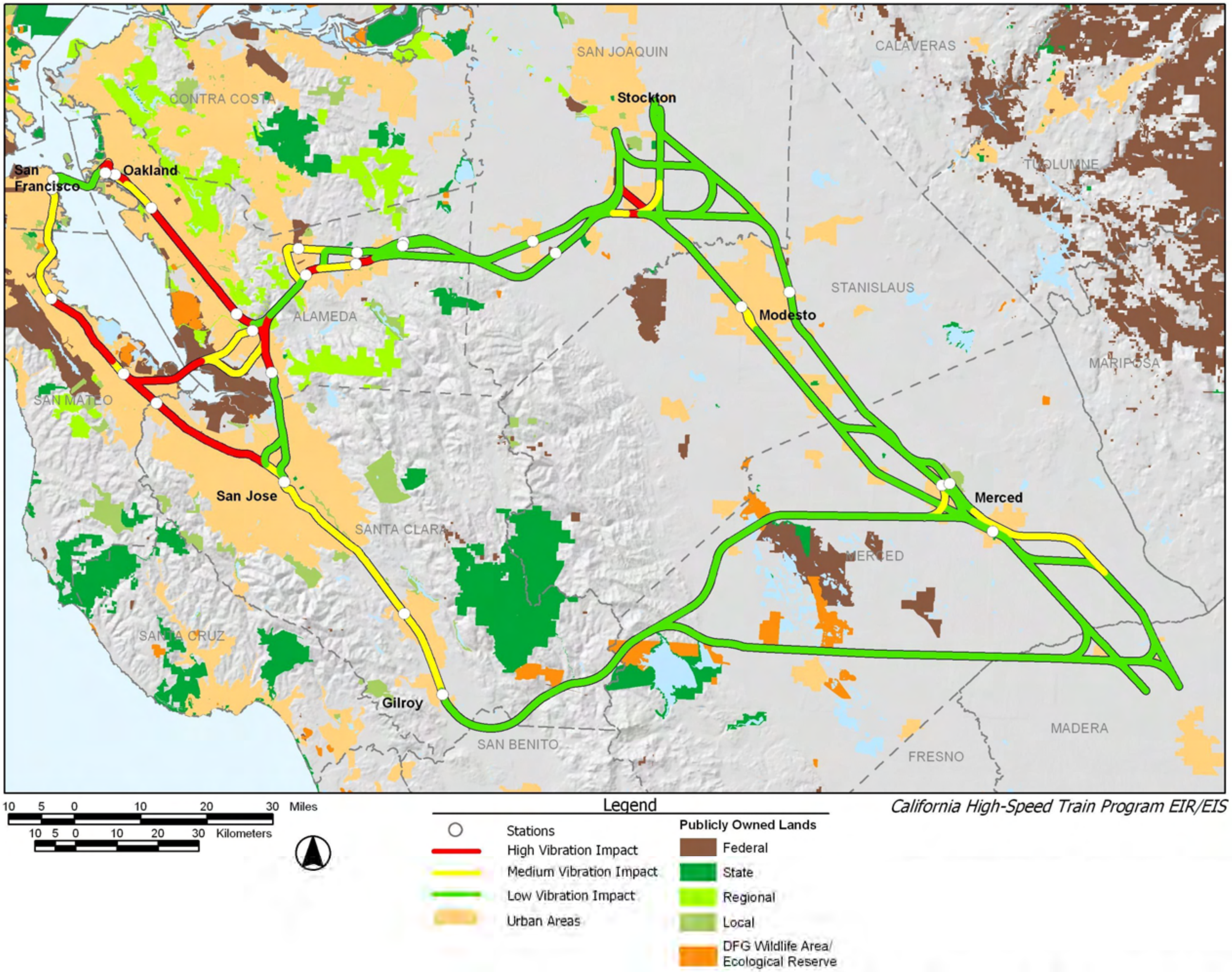
	Noise Mitigation Length in Miles (Km)	Noise Barrier Cost (in millions of dollars)
Patterson Pass/UPRR	8.0 (12.9)	12.0
UPRR	14.8 (23.7)	22.1
Tracy Downtown (BNSF Connection)	3.0 (4.8)	4.4
Tracy ACE Station (BNSF Connection)	8.2 (13.2)	12.3
Tracy ACE Station (UPRR Connection)	20.0 (32.2)	30.0
East Bay Connections	1.8 (2.8)	2.7
San Francisco Bay Crossings		
Trans Bay Crossing – Transbay Transit Center	0 (0)	0
Trans Bay Crossing – 4th & King	0 (0)	0
Dumbarton (High Bridge)	18.6 (29.9)	27.9
Dumbarton (Low Bridge)	18.6 (29.9)	27.9
Dumbarton (Tube)	11.0 (17.6)	16.4
Freemont Central Park (High Bridge)	22.3 (35.6)	33.4
Freemont Central Park (Low Bridge)	22.3 (35.6)	33.4
Freemont Central Park (Tube)	22.3 (35.6)	33.4
Central Valley		
BNSF-UPRR	10.7 (17.2)	16.1
BNSF	10.9 (17.6)	16.4
UPRR N/S	13.1 (21.0)	19.6
BNSF Castle	16.8 (27.0)	25.2
UPRR – BNSF Castle	25.5 (41.1)	38.3
UPRR – BNSF	19.4 (31.3)	29.1

B. VIBRATION MITIGATION

The following mitigation strategies can be refined and applied at the project-specific level and will reduce the vibration impact:

- Specify the use of train and track technologies that minimize ground vibration, such as state-of-the-art suspensions, resilient track pads, tie pads, ballast mats, or floating slabs.
- Phase construction activity, use low impact construction techniques, and avoid use of vibrating construction equipment where possible to avoid vibration construction impacts.

Vibration mitigation is less predictable at a program level of analysis because of the site-specific nature of vibration transmission through soil along the alignment. However, an estimate can be made of the length of corridor where vibration mitigation may need to be considered by totaling the segments with potential vibration impact rating of high. The results are shown in Table 3.4-8 and Figure 3.4-7. The range is 1.7–42.4 mi (2.7 to 68.2 km) to be considered for mitigation, depending on which option is chosen. Although the mitigation measures will reduce vibration impact levels, at the programmatic level it is uncertain whether the reduced vibration levels will be below a significant impact. The type of vibration mitigation and expected effectiveness to reduce the vibration impacts of



FLY CALIFORNIA

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Figure 3.4-7
Potential Vibration Impact Levels

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Ambient noise conditions

The existing ambient noise environment is described by assumptions in the screening procedure. However ambient noise values would be estimated at the project-level analysis based on limited measurements in the general assessment and would be thoroughly measured in the detailed analysis. A measurement program involving both long-term and short-term noise monitoring would be performed at selected locations to document the existing noise environment. Because it would be impractical to measure noise everywhere, the monitoring would be supplemented by estimates of noise environments at locations considered to be typical of others. Guidelines for characterizing the existing conditions are provided by the FRA manual.

Project Noise Conditions

A generic HST is used in the screening procedure, but a more specific train type, speed profile, and operation plan would be available for more refined projections of noise levels in the next stage of environmental analysis.

Noise Propagation Characteristics

The screening procedure assumes flat terrain with noise emanating from a source unhindered by landforms and human-made structures. The next stage of analysis would incorporate topography as well as consideration of shielding by buildings, vegetation, and other natural features in a particular corridor.

Impact Criteria

The screening procedure accounts for all noise-sensitive land use categories that may be exposed to noise levels exceeding the threshold of impact. In the next stage of analysis, assessments using the full, three-level FRA impact criteria would be performed (U.S. Department of Transportation 2005). This more detailed assessment would more specifically identify locations where potential impacts may occur and locations where potentially high impact may occur and would provide for consideration of specific mitigation measures where appropriate.

Mitigation

Noise abatement is discussed generally in the screening procedure, and areas are identified where more detailed analysis should be focused in the future to integrate a proposed HST system into the existing environment. As more detail becomes available in the general assessment phase, there may be many areas that were identified as potentially impacted during screening analysis for which further analysis would not be needed, because they would not be impacted. The detailed analysis would provide information useful for the engineering design of mitigation measures. These measures would be considered in the project-level environmental review, and potential visual and shadow impacts of noise barriers would also be considered.

B. VIBRATION ANALYSIS

The steps involved in the more detailed analysis of ground-borne vibration would be similar to those for noise. The major difference would be the need for study of site-specific ground-borne vibration characteristics. Considerable variation of soil conditions may occur along the corridor, resulting in some locations with significant levels of vibration from the HST and other locations at the same distance from the track with almost imperceptible vibration levels. Determining the potential vibration characteristics in the detailed analysis would involve a measurement program performed according to the method described in the FRA guidance manual (U.S. Department of Transportation 2005). This method would allow for the prediction of vibration levels and frequency spectrum information, which is valuable not only in the assessment of impact but also in the consideration of mitigation measures.

3.7 Land Use and Planning, Communities and Neighborhoods, Property, and Environmental Justice

This section evaluates the potential impacts of the No Project and HST Alignment Alternatives on land use compatibility, communities and neighborhoods, and property.[1] This section also addresses environmental justice in accordance with the provisions of Executive Order (EO) 12898. This evaluation describes how existing conditions compare with the No Project Alternative and how the No Project Alternative compares with the potential impacts of the HST Alignment Alternatives and station location options in the region being studied.

3.7.1 Regulatory Requirements and Methods of Evaluation

A. REGULATORY PROVISIONS

Land Use, Communities and Neighborhoods, and Property

These sections address the potential effects of each of the alignment alternatives on existing and planned land uses. These sections include a discussion of the existing uses in and adjacent to areas where property acquisition may be needed for an alignment alternative, an analysis of the changes to these uses that may occur with an alignment alternative, a discussion of potential inconsistencies with land use plans, and identification of general mitigation strategies. The discussion of potential inconsistencies with planned land uses does not imply that the Authority, a state agency, would be subject to such plans or local ordinances, either directly or through the NEPA or CEQA process. The information is provided to indicate potential land use changes that could result in environmental impacts.

Environmental Justice

EO 12898, known as the federal environmental justice policy, requires federal agencies to address to the greatest extent practicable and permitted by law the disproportionately high adverse human health and environmental effects of their programs, policies, and activities, on minority and low-income populations in the United States. Federal agency responsibilities under this EO also apply to Native American programs. Department of Transportation (DOT) Order 5610.2 on environmental justice defines "disproportionately high and adverse effect on minority and low-income populations" to mean an adverse effect that is predominately borne by a minority population and/or a low-income population or that would be suffered by the minority population and/or low-income population and that is appreciably more severe or greater in magnitude than the adverse effect that would be suffered by the nonminority population and/or non-low-income population (Department of Transportation Order 5610.2, Appendix Definitions, sub.[g]).

The California Government Code defines environmental justice as the "fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies" (California Government Code § 65040.12[e]). There are no specific state procedures prescribed for consideration of environmental justice issues related to the proposed HST Alignment Alternatives.

B. METHODS OF EVALUATION OF IMPACTS

The analysis was conducted using U.S. Census 2000 block group information/data compiled in a geographic information systems (GIS) format, local community general plans or regional plans, and land use information provided by the planning agencies in each of the regions. Existing and future conditions were described for the No Project Alternative by documenting existing information for

[1] See Section 3.0, Introduction, for an explanation of how this section fits together with the HST Network Alternatives presented in Chapter 7, as well as for an overview of the information presented in the other chapters.

existing and planned future land use policy near HST Alignment Alternatives and potential station location options, development patterns for employment and population growth, demographics, communities and neighborhoods, housing, and economics. The No Project Alternative was compared to the planned uses reflected in general plans and regional plans to see if it may result in potential effects on future development. The general and regional plans consulted for this section are listed in Chapter 14, "Sources Used in Document Preparation."

The ranking systems described below were used to evaluate potential impacts for the HST Alignment Alternatives for land use changes, land use compatibility, and property. Potential impacts on communities and neighborhoods were also considered. The presence of minority populations and low-income populations in the study area for an alignment alternative was identified to consider potential environmental justice issues. Because this is a programmatic environmental review, the analysis of these potential impacts was performed on a broad scale to permit a comparison of relative differences among the alignment alternatives. Further evaluation of potential impacts would occur at the project-level environmental review.

Land Use Compatibility

Future land use compatibility is based on information from general plans and other regional and local transportation planning documents. These documents were examined to assess an alignment alternative's potential consistency with the goals and objectives defined therein. An alignment alternative is considered highly compatible if it would be located in areas planned for transportation multi-modal centers or corridor development, redevelopment, economic revitalization, transit-oriented development, or high-intensity employment. Compatibility would be considered low if an alignment alternative would be potentially inconsistent with local or regional planning documents. For example, homes and schools are more sensitive to changes that may result in increased noise and vibration (see Section 3.4, "Noise and Vibration") or increased levels of traffic congestion (see Section 3.1, "Traffic, Transit, Circulation, and Parking"). Industrial uses, however, are typically less sensitive to these types of changes because they interfere less with normal industrial activities. Because in this analysis an area's sensitivity or compatibility is based on the presence of residential properties, low, medium, and high levels of potential compatibility are identified based on the percentage of residential area affected, the proximity of the residential area to facilities included in an alignment alternative, and the presence of local or regional uses (such as parks, schools, and employment centers). For highway corridors (under the No Project Alternative) and for proposed alignment alternatives, land use compatibility was assessed using GIS layers (or aerial photographs where available) to identify proximity to housing and population and to determine whether the alignment alternatives would be within or outside an existing right-of-way in the study area. Potential impacts are considered low if existing land uses within a potential alignment, station, or maintenance facility area are found to be compatible with the land use changes that may result from the alignment alternative. The type of improvement that would be associated with the alignment alternative would also affect the level of potential impact. Improvements such as potential widening of an existing right-of-way or the need for new right-of-way were considered to have a low compatibility with agricultural land. Conversely, if the improvement would be contained within the existing right-of-way or within a tunnel, the alignment alternative was considered compatible with agricultural land.

Table 3.7-1 summarizes the potential compatibility rating of existing and planned land use types with the potential HST Alignment Alternatives and station location options. Therefore, where potential compatibility would be rated low, the potential for adverse impacts would be higher, and where potential compatibility would be rated high, the potential for adverse impacts would be lower.

Table 3.7-1
Compatibility of Land Use Types

Low Compatibility	Medium Compatibility	High Compatibility
Single-family residential, neighborhood and community parks, habitat conservation area, elementary/middle school, agricultural (widened or new right-of-way needed)	Multifamily residential, high schools, low-intensity industrial, hospitals	Business park/regional commercial, multifamily residential, existing or planned transit center, high intensity industrial park, service commercial, commercial recreation, college, transportation/utilities, high-intensity government facilities, airport or train station, agricultural (tunnel or no new right-of-way needed)

Communities and Neighborhoods

A potential impact on a community or neighborhood was identified if an alignment alternative would create a new physical barrier, isolating one part of an established community from another and potentially resulting in a physical disruption to community cohesion. Improvements to existing transportation corridors, including grade separations, would not generally result in new barriers.

Property

Assessment of potential property impacts is based on the types of land uses adjacent to the particular proposed alignment alternative, the amount of right-of-way potentially needed due to the construction type, and the land use sensitivity to potential impacts. Impacts include potential acquisition, displacement and relocation of existing uses, or demolition of properties.

In some instances, relatively minor strips of property would be needed for temporary construction easements or permanent right-of-way for the proposed HST Alignment Alternatives. In other instances, development of proposed facilities could result in acquisition, displacement, and/or relocation of existing structures. The types of property impacts that could occur include displacement of a residence or business or division of a farm or other land use in a way that makes it harder to use. Mitigation may also be required to maintain property access. Potential property impacts were ranked high, medium, or low, as summarized below in Table 3.7-2 (see Table 3.7-A-1 in Appendix 3.7-A for more detail).

Table 3.7-2
Rankings of Potential Property Impacts

Facility Requirements	Type of Development						
	Residential			Nonresidential			
	Rural / Suburban	Suburban / Urban	Urban	Rural Developed	Suburban Industrial / Commercial	Urban Business Parks / Regional Commercial	Rural Undeveloped
No additional right-of-way needed (also applies to tunnel segments for HST Alignment Alternatives)	Low	Low	Low	Low	Low	Low	Low
Widening of existing right-of-way required	Medium	Medium	High	Low	Medium	High	Low
New corridor (new right-of-way required; includes aerial and at-grade arrangements)	High	High	High	Medium	Medium	High	Low to medium

To determine potential property impacts, the land uses within 50 ft (15 m) of either side of the existing corridor or within 50 ft (15 m) of both sides of the centerline for new HST alignments were characterized by type and density of development. Densities of structures, buildings, and other elements of the built environment were generally higher in urbanized areas. *Rural/suburban residential* refers to low-density, single-family homes. *Suburban/urban residential* refers to medium density, multifamily housing, such as townhouses, duplexes, and mobile homes. *Urban residential* refers to high-density multifamily housing, such as apartment buildings. *Rural developed nonresidential* uses typically occur in nonurbanized areas and often include developed agricultural land, such as vineyards and orchards. *Suburban industrial/commercial* refers to medium density nonresidential uses and includes some industrial uses, as well as transportation, utilities, and communication facilities. *Urban business parks/regional commercial* refers to nonresidential uses that occur in urbanized areas and includes such uses as business parks, regional commercial facilities, and other mixed use/built-up uses. *Nonrural undeveloped land* includes cropland, pasture, rangeland, and few structures. The classification of development type was based on land use information provided by the planning agencies in each of the regions.

Environmental Justice

This analysis is based on identifying the presence of minority populations and low-income populations in the study area (0.25 mi [0.40 km] from a potential alignment), and generally in the counties crossed by the alignment alternatives. The assessment was done using U.S. Census 2000 information and alignment information to determine if minority or low-income populations exist within the study areas, and if they do, whether the alignments would be within or adjacent to an existing transportation right-of-way (lower potential for impacts) or a new alignments (higher potential for impacts).

The analysis was used to determine whether:

- At least 50% of the population in the study area may be minority or low income.
- The percentage of minority or low-income population in the study area is at least 10% greater than the average generally in the county or community.

The assessment of potential for impacts on minority and low-income populations considered the size and type of right-of-way needed for the alignment alternatives. For example, if an alignment alternative would be within an existing right-of-way, the potential for adverse impacts would be lower. If the alignment alternative would be on new right-of-way, the potential for adverse impacts may be higher. The potential alignment alternatives, however, have been identified and described to largely use or be adjacent to existing transportation rights-of-way to avoid or reduce potential impacts on natural resources and existing communities to the extent feasible and practicable (see Chapter 2, "Alternatives"). In some cases, the minority and low-income thresholds identified above were met or exceeded, but the geographic area (of the block group) was large and sparsely populated. In these areas, the minority and/or low income populations are distant from the proposed alignment alternative. For these areas, the environmental justice impacts were considered as low, given the distance between the environmental justice populations and the HST line.

Because this is a program-level document, the analysis considers the alternatives on a broad scale. The Statewide Program EIR/EIS concluded that the overall system would not result in a disproportionate impact on minority or low-income populations. Additional analysis would take place during project-level analysis to consider potential localized impacts.

C. CRITERIA FOR DETERMINING CEQA SIGNIFICANCE

Under CEQA, two types of potential impacts are considered in the determination of significance for the land use evaluation; namely, the potential for the project to:

- Physically divide an established community or be incompatible with adjacent land uses in the short or long term.
- Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect.

The evaluation methods described above provide for the review of these types of potential impacts.

3.7.2 Affected Environment

A. STUDY AREA DEFINED

The study area for land use compatibility, communities and neighborhoods, and environmental justice is 0.25 mi (0.40 km) on either side of the centerline of the rail and highway corridors included in the alignment alternatives and the same distance around station location options and other potential HST-related facilities. This is the extent of area where the alignment alternative might result in changes to land use; the type, density, or patterns of development; or socioeconomic conditions. For the property impacts analysis, the study area is narrower—50 ft (15 m) on either side of the alignment centerlines—to better represent the properties most likely to be affected by the improvements in the alignment alternatives. Land uses in the project area are shown in Figure 3.7-1.

The planned land use for all alignment alternatives is generally described by city and county general plans in the area of the alignment alternatives. Several regulatory agencies and special districts also have future development plans that are considered in this analysis for lands the alignment alternatives would cross. Communities have typically recognized and incorporated the existing rail and highway corridors in their general land use plans, and most communities encourage transit-oriented development and transit facilities to relieve highway congestion and improve mobility.

Other resources, such as U.S. Census 2000 data, California Department of Finance data, aerial photos, and field observations, were used to document existing and future (Year 2030) conditions for demographics, communities, and neighborhoods.

B. DISCUSSION OF RESOURCES BY CORRIDOR

This section briefly discusses the land use–related resources by corridor along HST Alignment Alternatives in the study area and vicinity. The following five land use-related resources are addressed: (1) existing and planned land use, (2) population characteristics, (3) income, (4) neighborhood and community characteristics, and (5) housing.

For this discussion, the source of the land use data was local governments and regional agencies, such as metropolitan planning organizations. The source of demographic information (existing population and projects, ethnicity, and income) was primarily U.S. Census 2000 data and the California Department of Finance.

According to the 2000 U.S. Census, minority persons are defined as being nonwhite persons, including those of Hispanic origin. Low-income populations are defined as having a median household income at or below Department of Health and Human Service poverty guidelines.

<u>San Francisco to San Jose Corridor</u>

This corridor extends from the areas on the west side of the San Francisco Bay along the Caltrain rail line from the City of San Francisco to the City of San Jose.

Existing Land Use

San Francisco to Dumbarton: The San Francisco to Dumbarton alignment alternative begins at the Transbay Transit Center located in the San Francisco Financial District and continues along the existing Caltrain rail line to Redwood City. The primary land use in the immediate vicinity of this alignment alternative is the rail right-of-way. Land uses in the downtown San Francisco area of the Caltrain rail line are primarily urban, industrial, and transportation uses, with some retail, live/work loft, residential, and commercial uses. In south San Francisco, land uses are primarily light industrial, with some commercial and residential uses, with mostly open space through the Brisbane lagoon area. The San Bruno area presents a mixture of park/open space and very low-density residential housing with some commercial and light industrial uses.

In Millbrae, the area is designated as "unclassified" and contains low-density central business, planned unit development, with some vacant, underutilized, and industrial uses adjacent to the right-of-way. The San Francisco International Airport is located to the east. In the Burlingame portion of the corridor, land uses include commercial, residential, and light industrial. The tracks pass directly adjacent to Burlingame High School and Washington Park. Land uses adjacent to the Caltrain rail line within the City of San Mateo are commercial, office, a central business district, and single- and multifamily residential, including the San Mateo County Exposition Building and fairgrounds and the Hillsdale Shopping Mall. Within the City of Belmont, the primary land uses are transportation and service commercial with some high-density residential areas. Single-family residential, transportation, and commercial uses are within the City of San Carlos. Land uses in Redwood City are predominately research-oriented and industrial, with some residential.

Dumbarton to San Jose: The Dumbarton to San Jose alignment alternative begins in Atherton and continues along the existing Caltrain rail line to the San Jose/Diridon Station. The primary use in the Town of Atherton is low-density single-family residential. The land use in Menlo Park is general

BNSF Castle: The BNSF Castle alignment alternative would be the same as the BNSF – UPRR alignment except that the alignment would continue just west of Castle AFB before continuing along the existing BNSF rail right-of-way passing through Planada before continuing on to Madera.

UPRR – BNSF Castle: The UPRR – BNSF Castle alignment alternative would affect the same neighborhoods as the UPRR N/S alignment alternative through Turlock and the BNSF Castle alignment alternative north of Winton with the exception of the connection between the UPRR and BNSF corridors just south of the Merced County line where the alignment alternative would not pass through any additional neighborhoods.

UPRR – BNSF: The UPRR – BNSF alignment alternative would affect the same neighborhoods as the UPRR N/S alignment alternative in San Joaquin County, the connection to the BNSF alignment alternative north of Winton, and the BNSF alignment alternative south of the connection.

3.7.3 Environmental Consequences

A. NO PROJECT ALTERNATIVE

Land use and local communities will change between 2006 and 2030 as a result of population growth and changes of economic activity in the study areas for the six corridors studied (see Chapter 5, "Economic Growth and Related Impacts"). The No Project Alternative is based on existing conditions and the funded and programmed transportation improvements that would be developed and in operation by 2030. Although it is expected that the No Project Alternative would result in some changes related to land use compatibility, communities and neighborhoods, property, and environmental justice, it was assumed that projects included in the No Project Alternative would include typical design and construction practices to avoid or minimize potential impacts and would be subject to a project-level environmental review process to identify potentially significant impacts and to include feasible mitigation measures to avoid or substantially reduce potential impacts. Although some changes would be likely, attempting to estimate such changes would be speculative. Therefore, no additional potential impacts were quantified for the No Project Alternative.

B. HIGH-SPEED TRAIN ALIGNMENT ALTERNATIVES

Table 3.7-3 provides a summary comparison of alignment alternatives for the land use evaluations. A review of the land use impacts for each corridor follows the table.

Table 3.7.3.
Land Use Summary Data Table for
Alignment Alternatives and Station Location Option Comparisons

Corridor	Possible Alignments	Alignment Alternative	Land Use Compatibility (H,M,L)	Community Cohesion Impacts (Y/N)	Potential For Property Impacts (H,M,L)	Environmental Justice (EJ) Impacts (H,M,L)
San Francisco to San Jose: Caltrain	1 of 1	San Francisco to Dumbarton	H Compatible with existing Caltrain Corridor.	N	L Corridor would be built mostly within existing Caltrain Corridor.	M Alignment within existing rail right-of-way. Percentages of EJ populations in study area exceed thresholds.

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Corridor	Possible Alignments	Alignment Alternative	Land Use Compatibility (H,M,L)	Community Cohesion Impacts (Y/N)	Potential For Property Impacts (H,M,L)	Environmental Justice (EJ) Impacts (H,M,L)
	1 of 1	Dumbarton to San Jose	H Compatible with existing Caltrain Corridor.	N	L Corridor would be built mostly within existing Caltrain Corridor.	M Alignment within existing rail right-of-way. Percentages of EJ populations exceed thresholds.
Station Location Options						
Transbay Transit Center			H Compatible with transportation and high-density office use.	N	L Station would be located at the current Transbay Terminal.	L Percentages of EJ populations are lower than the thresholds.
4th and King (Caltrain)			H Compatible with existing Caltrain station and surrounding uses.	N	L Station would be located at the current Caltrain station site.	L Percentages of EJ populations are lower than the thresholds.
Millbrae/SFO			H Compatible with existing transportation uses at the Millbrae BART/Caltrain Station area.	N	L Station would be located at the Millbrae BART/ Caltrain Station site.	L Percentages of EJ populations are lower than the thresholds.
Redwood City (Caltrain)			H Compatible with existing Caltrain station and adjacent downtown commercial/service oriented uses. Consistent with plans that promote transit alternatives to the automobile.	N	L Station would be located at the current Caltrain station site.	L Percentages of EJ populations are lower than the thresholds.
Palo Alto (Caltrain)			H Compatible with Caltrain station, multifamily housing, and facilities associated with Stanford University. Consistent with multi-modal transit center.	N	L Station would be located at the current Caltrain station site.	L Percentages of EJ populations are lower than the thresholds.
Oakland to San Jose: Niles/I-880	1 of 2	West Oakland to Niles Junction	H Compatible with existing UPRR right-of-way.	N	L Corridor would be built mostly within existing UPRR right-of-way.	M Alignment within existing rail right-of-way. Percentages of EJ populations exceed thresholds.

Corridor	Possible Alignments	Alignment Alternative	Land Use Compatibility (H,M,L)	Community Cohesion Impacts (Y/N)	Potential For Property Impacts (H,M,L)	Environmental Justice (EJ) Impacts (H,M,L)
		12th Street/City Center to Niles Junction	H Compatible with existing UPRR right-of-way.	N	L Corridor would be built mostly within existing UPRR right-of-way.	M Alignment within existing rail right-of-way. Percentages of EJ populations exceed thresholds.
	1 of 2	Niles Junction to San Jose via Trimble	H Compatible with existing UPRR/I-880 right-of-way.	N	L Corridor would be built mostly within existing UPRR right-of-way.	M Alignment within existing rail right-of-way. Percentages of EJ populations exceed thresholds.
		Niles Junction to San Jose via I-880	H Compatible with existing UPRR/I-880 right-of-way.	N	L Corridor would be built mostly within existing UPRR right-of-way.	M Alignment within existing rail right-of-way. Percentages of EJ populations exceed thresholds.
Station Location Options						
West Oakland/7th Street			H Compatible with existing West Oakland BART Station and transit-oriented district. Consistent with plans for transit oriented district.	N	L Station would be constructed below grade at the existing West Oakland BART Station.	M Station constructed below grade. Percentages of EJ populations within station area exceed thresholds.
12th Street/City Center			H Compatible with 12th Street/City Center BART Station, civic center, and high-intensity commercial uses associated with Downtown Oakland. Consistent with plans for transit oriented district.	N	L Station would be constructed below grade at the existing Oakland City Center/12th Street BART Station.	M Station constructed below grade. Percentages of EJ populations within station area exceed thresholds.
Coliseum/Airport			H Compatible with industrial uses and commercial uses associated with the McAfee Coliseum and ORACLE Arena. Consistent with plans for transit oriented district.	N	L Station would be located south of the Coliseum/Oakland Airport BART Station along UPRR right-of-way.	M Station constructed at existing Coliseum/ Oakland BART Station. Percentages of EJ populations within station area exceed thresholds.
Union City (BART)			H Compatible with Union City BART Station and industrial and	N	L Station would be located near the current Union City BART Station.	M Station constructed near existing Union City BART Station. Percentages of EJ

Corridor	Possible Alignments	Alignment Alternative	Land Use Compatibility (H,M,L)	Community Cohesion Impacts (Y/N)	Potential For Property Impacts (H,M,L)	Environmental Justice (EJ) Impacts (H,M,L)
			commercial uses. Consistent with plans for development of a regional intermodal facility and research and development campus.			populations within station area exceed thresholds.
Fremont (Warm Springs)			H Compatible with existing industrial and transportation uses. Consistent with plans for future BART station.	N	L Potential impacts on undeveloped properties.	H New station constructed outside of existing right-of-way. Percentages of EJ populations within station area exceed thresholds.
San Jose to Central Valley: Pacheco Pass	1 of 1	Pacheco	M Highly compatible with existing Caltrain Corridor between San Jose and Gilroy. Low compatibility with agricultural land and open space, east of Gilroy.	N	L Alignment within existing Caltrain Corridor between San Jose and Gilroy. East of Gilroy, alignment within agricultural and open space.	M Alignment within existing rail right-of-way, north of Gilroy. New alignment east of Gilroy. Although the EJ percentage thresholds are exceeded east of Gilroy, the EJ populations are sparse and distant from the HST line.
	1 of 3	Henry Miller (UPRR Connection)	M Highly compatible with existing Henry Miller Road between Santa Nella and Elgin Avenue. New alignment right-of-way would be incompatible with agricultural uses east of Elgin Avenue.	N	L Alignment would be built through agricultural land. Impacts would be minimal.	L Alignment alternative would create new transportation right-of-way. Although the EJ percentage thresholds are exceeded, the populations are sparse and distant from the HST line.
		Henry Miller (BNSF Connection)	M Highly compatible with existing Henry Miller Road between Santa Nella and Elgin Avenue. New alignment right-of-way would be incompatible with agricultural uses east of Elgin Avenue.	N	L Alignment would be built through agricultural land. Impacts would be minimal.	L Alignment alternative would create new transportation right-of-way. Although the EJ percentage thresholds are exceeded, the populations are sparse and distant from the HST line.

Corridor	Possible Alignments	Alignment Alternative	Land Use Compatibility (H,M,L)	Community Cohesion Impacts (Y/N)	Potential For Property Impacts (H,M,L)	Environmental Justice (EJ) Impacts (H,M,L)
		GEA North	L Incompatible with agricultural uses.	N	L Alignment would be built through agricultural and open space. Impacts would be minimal.	H Alignment alternative would create new transportation right-of-way. Percentages of EJ populations exceed thresholds.
San Jose (Diridon)			H Compatible with San Jose Diridon Caltrain station and industrial uses. Consistent with plans for downtown redevelopment.	N	L Station would be located at the current Caltrain station site.	L Percentage of EJ populations is lower than the thresholds.
Morgan Hill (Caltrain)			H Compatible with Morgan Hill Caltrain station and commercial uses. Consistent with plans for development of multi-modal transit transfer center.	N	L Station would be located at the current Caltrain station site.	L Percentages of EJ populations are lower than the thresholds.
Gilroy (Caltrain)			M Highly compatible with existing Gilroy Caltrain station and commercial uses. Low compatibility with single-family residential use. Consistent with policies for development of a multi-modal transit center.	N	L Station would be located at the current Caltrain station site.	M Station constructed at existing Gilroy Caltrain Station. Percentages of EJ populations within station area exceed thresholds.
East Bay to Central Valley: Altamont Pass	1 of 4	I-680/ 580/UPRR	H Compatible with existing highway/ rail right-of-way.	N	H Potential for high impacts on residential properties and medium impacts on nonresidential properties.	L Percentages of EJ populations are lower than the thresholds.
		I-580/ UPRR	H Compatible with existing highway/ rail right-of-way. Incompatible with single-family uses.	N	M Potential for high impacts on residential properties and low to medium impacts on nonresidential properties.	L Percentages of EJ populations are lower than the thresholds

San Jose to Central Valley Corridor

Land Use Compatibility

Alignment Alternatives

Pacheco: The Pacheco alignment alternative would be highly compatible with the existing Caltrain corridor between San Jose and Gilroy. However, as the alignment alternative veers from the existing right-of-way east of Gilroy, it would potentially be incompatible as it proceeds through agricultural land and parkland. Overall, this alignment alternative would have a medium compatibility with surrounding land uses.

Henry Miller (UPRR Connection): The Henry Miller (UPRR Connection) alignment alternative is compatible with existing land uses as it traverses at-grade along Henry Miller Road between Santa Nella and Elgin Avenue. The alignment alternative becomes highly incompatible with agricultural land uses east of Elgin Avenue and the GEA. Overall, the alignment alternative would have a medium land use compatibility rating.

Henry Miller (BNSF Connection): Land use compatibility for the Henry Miller (BNSF Connection) alignment alternative would be the same as the Henry Miller (UPRR Connection) alignment alternative.

GEA North: The GEA North alignment alternative would be highly incompatible with existing agricultural uses. West of the City of Atwater, alignment alternative segments that would connect with the Central Valley alignment alternative would be highly incompatible with agricultural uses. Overall, this alignment alternative would have a low compatibility with existing land uses.

Station Location Options

San Jose (Diridon): The proposed San Jose (Diridon) station location option would be highly compatible with the existing San Jose Diridon Caltrain station and the surrounding industrial and high-density residential uses. The station location option would be consistent with the *San Jose Downtown Strategy Plan* that promotes redevelopment of the downtown toward the west and closer to the station location option.

Morgan Hill: The Morgan Hill station location option would be highly compatible with the existing Caltrain station and nearby commercial/service oriented and other urban uses. The station location option would be consistent with the *City of Morgan Hill General Plan* policies that support the expansion of alternative transportation systems, as well as the development of a multi-modal transit transfer center.

Gilroy: The Gilroy station location option would be highly compatible with the existing Caltrain station and adjoining commercial uses; however, it would be incompatible with the adjacent single-family residential uses. The proposed station would be consistent with the policies and actions stated in the *Gilroy General Plan* that place a high priority on strengthening and restoring the downtown area, including the development of an active multi-modal transit center. Although the proposed station location option would be incompatible with the existing low-density residential uses, the general plan promotes the future development of higher-density residential and mixed uses in close proximity to the Caltrain station and the multi-modal transit center.

Communities and Neighborhoods

Pacheco: This alignment alternative traverses the dense urban city of San Jose but also travels through small rural cities such as Coyote, Morgan Hill, Gilroy, and San Felipe, which consist of small single-family residential neighborhoods and farmsteads. In northern San Felipe, the alignment alternative has a low potential to impact farmstead; however, there would be no loss of community or neighborhood cohesion as a result. In other locations where this alignment alternative would create a new transportation corridor (east of Gilroy), the alignment alternative would primarily pass through agricultural or open space lands and would not result in community cohesion impacts on neighborhoods.

Henry Miller (UPRR Connection): The Henry Miller (UPRR Connection) alignment alternative primarily passes through agricultural lands and would not result in community cohesion impacts on neighborhoods.

Henry Miller (BNSF Connection): The Henry Miller (BNSF Connection) alignment alternative primarily passes through agricultural lands and would not result in community cohesion impacts on neighborhoods.

GEA North: The GEA North alignment alternative traverses primarily through agricultural lands and would not result in community cohesion impacts on neighborhoods.

Property

Pacheco: Between the proposed Diridon and Gilroy station location options, grade separations along the alignment alternative could entail the conversion of residential and nonresidential property. The proposed San Jose to Central Valley Corridor would require new right-of-way east of the City of Gilroy. Overall, potential for property impacts is low.

Henry Miller (UPRR Connection): Because the Henry Miller (UPRR Connection) alignment alternative would traverse areas with agricultural or open space land uses, it would be expected to result in a low potential for property impacts on homes or buildings.

Henry Miller (BNSF Connection): The potential for property impacts with the Henry Miller (BNSF Connection) alignment alternative would be the same as the Henry Miller (UPRR Connection) alignment alternative.

GEA North: The GEA North alignment alternative would traverse areas with agricultural or open space land uses and would be expected to result in a low potential for property impacts on homes or buildings.

Environmental Justice

The study area for the San Jose to Central Valley corridor includes a variety of neighborhoods and a diverse multiethnic population. All four alignment alternatives have environmental justice populations that exceed the thresholds. Where the alignment alternatives use existing rail rights-of-way (i.e., along the Caltrain Corridor), they would not be expected to result in disproportionate impacts on environmental justice communities. The environmental justice population(s) percentages exceed the thresholds east of Gilroy in the open space and more rural areas, but these populations are sparse and distant from the alignment alternatives.

<u>East Bay to Central Valley Corridor</u>

Land Use Compatibility

Alignment Alternatives

I-680/580/UPRR: The I-680/580/UPRR alignment alternative would be highly compatible with existing land uses because it would primarily pass through existing freeway and rail right-of-way. At the base of the Diablo Mountain Range, the alignment alternative would have a low compatible rating as it crosses through the Castlewood Country Club before continuing north within existing I-680 right-of-way.

I-580/UPRR: The I-580/UPRR alignment alternative would be highly compatible with existing land uses as it proceeds by cut or tunnel through the Altamont Pass and its parkland and open space land uses. The alignment alternative is also compatible as it proceeds through agricultural land uses on

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Federal Railroad Administration

Figure 3.9-8b
Grade Separation at Burlingame Station
Project Simulation

ephemeral drainages within the study area would be temporary and less than 0.2 ac (0.08 ha) of land, a ROWD would not need to be filed.

California Coastal Act

The California Coastal Act requires preparation of a local coastal program (LCP) by local municipalities located in whole or in part in the coastal zone. The LCP consists of a land use plan and its implementing measures (e.g., zoning ordinances). The act requires the incorporation of its policies into local LCPs. Policies relevant to biological resources are listed below.

- Coastal Act Section 30121 defines wetlands as "lands within the coastal zone which may be covered periodically or permanently with shallow water and include saltwater marshes, freshwater marshes, open or closed brackish water marshes, swamps, and mudflats."
- Coastal Act Section 30233 (a) states that the diking, filling, or dredging of wetlands can only be permitted for certain specified activities where there is no feasible less environmentally damaging alternative, and where feasible mitigation measures have been provided to minimize adverse effects.
- Coastal Act Section 30107.5 defines an environmentally sensitive area as "any area in which plants or animal life or their habitats are either rare or especially valuable because of their special nature or role in an ecosystem and which could easily be disturbed or degraded by human activities."
- Coastal Act Section 30240 states that "environmentally sensitive habitat areas shall be protected against any significant disruption of habitat values, and only uses dependent on those resources hall be allowed within those area." This section also states that "development in areas adjacent to environmentally sensitive habitat areas and parks and recreational areas shall be sited and designed to prevent impacts which would significantly degrade those areas and shall be compatible with the continuance of those habitat and recreation areas."

Bay Conservation and Development Commission

The McAteer-Petris Act, passed by the State of California in 1965, established the San Francisco Bay Conservation and Development Commission (BCDC) as the state agency responsible for regulating development in and around San Francisco Bay and mandated the planning effort that resulted in development of the San Francisco Bay Plan (Bay Plan) (Association of Bay Area Governments 1969, as amended). The Bay Plan describes the values associated with the Bay and presents polices and planning maps to guide future uses of the Bay and its shoreline. Under the Bay Plan, priorities for suitable uses of the shoreline include ports, water-related industry, airports, wildlife refuges, and water-related recreation. The Bay Plan also proposes adding land to the Bay refuge system; encourages public access via marinas, waterfront parks, and beaches; and requires the provision of maximum access along the waterfront and certain shorelines, except where public uses conflict with other significant uses or where public use is inappropriate because of safety concerns.

BCDC is responsible for implementing the policies of the Bay Plan. All projects proposing development within the Bay Area are required to apply to BCDC for a San Francisco Bay permit and to demonstrate compliance with the McAteer-Petris Act and the Bay Plan.

The CZMA encourages states to voluntarily develop coastal zone management programs (CZMPs) to preserve and protect the unique features of each coastal area. Partly in response to these federal recommendations, the California Coastal Act of 1976 established the California Coastal Commission (CCC) and recognized the BCDC as the state agency with primary responsibility.

Areas subject to jurisdiction of the BCDC extend to all areas of the Bay that are subject to tidal action, including a 100-foot shoreline band surrounding the Bay from the mean high-water mark. In addition, BCDC's San Francisco Bay jurisdiction includes subtidal areas, intertidal areas, and tidal marsh areas that are between mean high tide and 5 ft (1.5 m) above the mean sea level.

It is necessary to obtain BCDC approval prior to undertaking any of the following activities:

- Filling: Placing solid material, building pile-supported or cantilevered structures, disposing of material, or permanently mooring vessels in the Bay or in certain tributaries of the Bay.
- Dredging: Extracting material from the Bay bottom.
- Shoreline Projects: Nearly all work, including grading, on the land within 100 ft (30 m) of the Bay shoreline.
- Suisun Marsh Projects: Nearly all work, including land divisions, in the portion of the Suisun Marsh below the 10-foot-contour level.
- Other Projects: Any filling, new construction, major remodeling, substantial change in use, or many land subdivisions in the Bay, along the shoreline, in salt ponds, duck hunting preserves, or other managed wetlands adjacent to the Bay.
- Federal Projects: In addition to carrying out its regulatory authority under state law, the federal CZMA allows the BCDC to review federal projects and projects that require federal approval or are supported with federal funds. The BCDC carries out its "federal consistency" responsibilities by reviewing federal projects much like it does permit applications. However, the BCDC cannot require federal agencies to submit permit applications and cannot impose conditions in its federal consistency decisions. Nevertheless, federal agencies and applicants for federal approvals must provide the project details, data, and other material required by the form to ensure that the BCDC has the information it needs to evaluate federal projects. Work on a project needing BCDC authorization cannot begin until the necessary approval has been secured (San Francisco Bay Conservation and Development Commission 2006).

B. METHOD OF EVALUATION OF IMPACTS

Data Collection and Geographic Information System Mapping

The proposed HST Alignment Alternatives would cross a variety of biotic communities and could potentially result in impacts on many plant and wildlife species and many water resources. This discussion of impacts uses the plant taxonomy and nomenclature of Hickman (1993). The scientific nomenclature and common names of wildlife follow those of the most recent Special Animals List (California Department of Fish and Game 2006).

A land cover map was developed using the best available data appropriate for a regional assessment of the study region. The GIS data mapping methods for this project used methods developed for other large projects in the region, including the Land Cover GIS Metadata that were developed to aid in the development of the Pacific Gas & Electric operation and maintenance HCPs currently being prepared for the San Joaquin Valley and the Bay Area. The coverage of these two HCPs overlaps in the study region.

Data from eight sources were used to generate this land cover.

- San Francisco Estuary Institute (SFEI) Baylands Dataset: The SFEI published the Baylands dataset in 1998 as part of EcoAtlas, a digital product that contains both historical and current information about the natural resources around the Bay Area. This dataset contains primarily wetlands that surround the San Francisco Bay and Suisun Marsh. These data support a long-term monitoring effort of baylands and associated habitats. SFEI used a number of sources to produce the Baylands dataset, including high-resolution color infrared photos (San Francisco Estuary Institute 1998).

habitat that possesses the necessary characteristics for the species in question but that is not known to be occupied because of a lack of surveys or reporting.

A habitat model was developed for covered plant species based on correlations among the known physical and biological attributes associated with each land cover type and the known biological and physical conditions that define each species' habitat. Information from known occurrences was used to determine the existing distribution of the species and habitat attributes.

C. CEQA SIGNIFICANCE CRITERIA

The significance criteria for identifying potential impacts on biological resources from proposed projects/actions are based on federal and state guidelines and general indicators of significance, including guidelines or criteria in NEPA, CEQA, CWA, CESA, ESA, and California Fish and Game Code. Site-specific criteria would be applied at the project level of environmental analysis when permits are being sought after a decision is made to proceed with a preferred alignment alternative, following this program-level analysis.

Based on the presence or absence of sensitive resources, an alignment alternative may have a significant impact on biological resources if its implementation would result in any of the following:

- Potential modification or destruction of habitat, movement/migration corridors, or breeding areas for endangered, threatened, rare, or other special-status species described above.
- Potential loss of a substantial number of any species that could affect the abundance or diversity of that species beyond the level of normal variability.
- Potential impacts on or measurable degradation of protected habitats, sensitive natural vegetation communities, wetlands, or other habitat areas plans, policies, or regulations.
- Potential conflict with the provisions of an adopted HCP, NCCP[2], or other approved local, regional, or state HCP.

3.15.2 Affected Environment

A. STUDY AREA DEFINED

The biological resources and wetlands study area for direct impacts is defined as 50 ft (15 m) on each side of the alignment. The study area for indirect impacts is 1,000 ft (305 m) in urban areas and 0.25 mile (0.41 km) in rural areas on each side of the alignment. The study area for direct impacts of stations is the station area, and the indirect impact study area for stations is 1,000 ft (305 m) in urban areas and 0.25 mile (0.41 km) of alignment centerlines and around station and facility areas in undeveloped areas, including biologically sensitive locations.

B. GENERAL DISCUSSION OF BIOLOGICAL RESOURCES AND WETLANDS

The following is a brief description of the resources and land cover types studied. A more detailed description of these resources and the sources of information used to obtain the descriptions are provided in Appendix 3.15-A. In addition, this section discusses HCPs, critical habitat[3] areas, and other conservation plans or areas that could potentially be affected by one or more of the alignments discussed in this document.

[2] The NCCP program of CDFG is an effort by the State of California and many private and public partners that takes a broad-based ecosystem approach to planning for the protection and perpetuation of biological diversity. An NCCP identifies and provides for the regional or areawide protection of plants, animals, and their habitats, while allowing compatible and appropriate economic activity. CDFG and USFWS provide the necessary support, direction, and guidance to NCCP participants in these functions.

[3] Critical habitat refers to areas shown on maps developed by USFWS that provide habitat for threatened and endangered species.

Special-Status Wildlife

A number of special-status wildlife species could occur in the Oakland to San Jose corridor. These include vernal pool tadpole shrimp, California red-legged frog, California horned lizard; northwestern pond turtle; nesting Alameda song sparrow, California black rail, California clapper rail, California least tern, Cooper's hawk, double-crested cormorant, loggerhead shrike, long-eared owl, northern harrier, salt marsh common yellowthroat, short-eared owl, western burrowing owl, white-tailed kite, and yellow warbler; and salt marsh harvest mouse, salt marsh wandering shrew, San Francisco dusky-footed woodrat, and several species of bats.

Special Management Areas

The 30,000-ac (12,140-ha) Don Edwards San Francisco Bay National Wildlife Refuge is the largest urban wildlife refuge in the nation. The refuge is located on the southeast side of the San Francisco Bay and preserves open bay, salt marsh, mud flats, vernal pools, and upland habitats. It is home to millions of shorebirds and waterfowl, with a total of 250 bird species, including the endangered California clapper rail, California least tern, and salt marsh harvest mouse.

Wildlife Movement Corridors

The riparian and stream corridors between the Diablo Range and the San Francisco Bay provide corridors for wildlife movement. The eastern shore of the San Francisco Bay provides movement corridors for small mammals, such as the salt marsh harvest mouse, as well as nesting and foraging birds. The Wilderness Coalition (2000) identified critical linkage corridors along the eastern shore of San Francisco, as well as a corridor linking the bay to the Diablo Range (Figure 3.15-3).

Management Plans

The restoration plan for the Cargill salt properties would be relevant to this corridor. Also, the Presidio clarkia was included in the *Recovery Plan for Serpentine Soil Species of the San Francisco Bay Area*.

<u>San Jose to Central Valley Corridor</u>

The San Jose to Central Valley corridor includes the Santa Clara Valley from San Jose south through Morgan Hill and Gilroy, and east through the Coast Range into the Central Valley. The major geophysical regions include the Santa Clara Valley, the southern reaches of the Diablo Range, and the Central Valley. The major watersheds include the San Francisco Bay watershed, including the Guadalupe River and Coyote Creek, the Pajaro River watershed, and the San Joaquin River watershed. Elevation along the San Jose to Central Valley corridor ranges from 150 ft (46 m) to 1,200 ft (366 m).

Vegetation Communities

Vegetation communities in this corridor include seasonal wetland, agriculture, open water, urban/developed, riparian forest, nonnative annual grasslands, shrubland, Montane hardwood forest, oak woodland/foothill pine, and permanent freshwater wetland.

Water Resources

Following the Cowardin classification system, the water resources that could occur along the San Jose to the Central Valley corridor include lacustrine, palustrine, and riverine systems. Vernal pools may be present, especially on Central Valley terrace deposits.

Special-Status Species

Special-Status Plants

A number of special-status plant species could occur in the San Jose to Central Valley corridor. These include the bent-flowered fiddleneck, alkali milk-vetch, heartscale, brittlescale, San Joaquin spearscale, lesser saltscale, vernal pool smallscale, subtle orache, Tiburon Indian paintbrush, pink creamsacs, Lemmon's jewelflower, coyote ceanothus, Congdon's tarplant, Hoover's spurge, robust spineflower, San Francisco collinsia, hispid bird's-beak, Hoover's cryptantha, Hospital Canyon larkspur, recurved larkspur, dwarf downingia, Santa Clara Valley dudleya, four-angled spikerush, round-leaved filaree, Delta button-celery, fragrant fritillary, Diablo helianthella, Loma Prieta hoita, Contra Costa goldfields, smooth lessingia, arcuate bush mallow, robust monardella, shining navarretia, Colusa grass, San Joaquin Valley orcutt grass, hairy orcutt grass, Metcalf Canyon jewel-flower, most beautiful jewel-flower, showy Indian clover, saline clover, and caper-fruited tropidocarpum.

Special-Status Wildlife

A number of special-status wildlife species could occur in the San Jose to Central Valley corridor. These include the bay checkerspot butterfly, conservancy fairy shrimp, longhorn fairy shrimp, valley elderberry longhorn beetle, vernal pool fairy shrimp, vernal pool tadpole shrimp, California red-legged frog, California tiger salamander, foothill yellow-legged frog, California horned lizard, giant garter snake, San Joaquin whipsnake, southwestern pond turtle; nesting habitat for American peregrine falcon, California horned lark, Cooper's hawk, golden eagle, least Bell's vireo, loggerhead shrike, long-eared owl, northern harrier, prairie falcon, short-eared owl, Swainson's hawk, tricolored blackbird, western burrowing owl, white-tailed kite, willow flycatcher, yellow-breasted chat, and yellow warbler; and American badger, San Joaquin kit fox, and bat species.

Special Management Areas

The Grasslands Ecological Area (GEA), which is located north, east, and south of the city of Los Banos in Merced County, encompasses approximately 240,000 ac (97,125 ha) and is the largest wetland complex in California. It also contains the largest block of contiguous wetlands remaining in the Central Valley.[4] The GEA is a non-jurisdictional, non-regulatory, generally designated area used by the USFWS to identify an area for priority purchase of public easements for wetland preservation and enhancement. The boundary of the GEA encompasses a substantial area that includes two federal wildlife refuges, a state park, state wildlife management areas, and a block of privately managed wetlands. Lands in the GEA managed by public agencies include the Great Valley Grasslands State Park; CDFG North Grasslands Wildlife Area, Los Banos Wildlife Area, and Volta Wildlife Area; and the San Luis National Wildlife Refuge Complex, which includes the San Luis National Wildlife Refuge (includes the Kesterson unit) and Merced National Wildlife Refuge. Also in the GEA are numerous privately owned parcels and a large number of waterfowl hunting clubs. Activities and land uses in the GEA include hunting, fishing and other active and passive recreation, agriculture, and residential and associated land uses. The GEA was designated a wetlands of worldwide importance under the Ramsar Treaty in 2005, one of four sites in California.[5] This region is considered a critical component of the Central Valley wintering habitat for waterfowl and has been recognized as a resource of international significance. The USFWS manages the San Luis National Wildlife Refuge Complex to optimize wetland conditions for thousands of migratory birds that migrate through the Central Valley.

Within the area identified as the GEA is the USFWS Grasslands Wildlife Management Area (WMA), which was established to protect wetlands. Land in the WMA is privately owned and some is protected by conservation easements. The size of this management area as of the last expansion in 2005 is approximately 133,000 acres, with more than 70,000 acres protected through conservation agreements. Daily management of the easement area remains under private landowner control, the majority of the properties being managed for waterfowl hunting, cattle grazing, and agriculture.

[4] Grasslands Water District, Land Use and Economics Study: Grasslands Ecological Area (July 2001), P. 2 (hereafter "Grassland Water District"). The area of the GEA increased from 180,000 ac to 240,000 ac to include the eastward expansion approved by USFWS between the publication of the Draft Program EIR/EIS and the Final Program EIR/EIS.

[5] RAMSAR Report for the Grassland Ecological Area. Accessed at http://www.wetlands.org/reports/output.cfm. 2005.

Henry Coe State Park, which is located northeast of Gilroy, is the largest state park in northern California, encompassing more than 87,000 ac (35,208 ha) and includes the 23,300-ac (9,429-ha) Orestimba Wilderness area. Henry Coe State Park is home to a variety of special-status species and wildlife, including an estimated 675 vascular plants. Other state owned or managed lands within this corridor include the Cañada De Los Osos Ecological Reserve south of Henry Coe State Park, and the San Luis Reservoir State Recreation Area, O'Neill Forebay Wildlife Area, Upper and Lower Cottonwood Creek Wildlife Area, San Luis Reservoir Wildlife Area, and Pacheco State Park located around the San Luis Reservoir.

The Nature Conservancy is pursuing conservation measures to protect more than 780 square mi (2,020 square km) of land in the Diablo Range to safeguard native species and natural habitats. This project was started in 1998 with the largest single private conservation project in northern California history—involving two ranches east of Mount Hamilton totaling 61,000 ac (24,686 ha). The Nature Conservancy's goal is to protect some 200,000 ac (80,937 ha) by 2007. This area would protect the San Joaquin kit fox, the California red-legged frog, valley oak savannas, blue oak woodlands, and native fish and amphibians.

Wildlife Movement Corridors

The natural and agricultural lands located within the Santa Clara Valley provide a movement corridor from the San Francisco Bay Area to natural areas to the south. The Diablo Range provides movement corridors for a number of species between the Santa Clara Valley and the Central Valley. Major drainages, such as Coyote Creek, the Pajaro River, and the Tres Pinos Creek, also provide wildlife movement corridors. On the west side of the Central Valley is a relatively extensive strip of annual (nonnative) grassland that lies between the irrigated fields and orchards of the valley floor and the oak and pine woodlands of the Diablo Range. This strip is about 10 mi (16 km) wide and provides a movement corridor for the San Joaquin kit fox.

Management Plans

The USFWS adopted the *Recovery Plan for Upland Species of the San Joaquin Valley* in 1998. The recovery plan was developed to delineate reasonable actions that would be required to recover and protect listed species found in the San Joaquin Valley. The plan covers 34 species of plants and animal, 11 of which are federally listed species: six plant species and five wildlife species. The remaining 23 species are either candidate species or species of special concern. The ultimate goal of the recovery plan is to delist the 11 listed species and ensure the long-term conservation of the 23 candidate and species of special concern. The California jewelflower has been included in this management plan.

A draft recovery plan has been developed for the least Bell's vireo, which outlines measures to help in the recovery of the species.

The USFWS developed the *Valley Elderberry Longhorn Beetle Recovery Plan* in 1984. The USFWS has also adopted *Conservation Guidelines for Valley Elderberry Longhorn Beetle* (1999).

The USFWS prepared the *Recovery Plan for Vernal Pool Ecosystems in California* (2005), which outlines strategies for the recovery and conservation of vernal pools and the federally listed plant and wildlife species that occur in these ecosystems. The USFWS identified vernal pool regions throughout California that are based on the geography and/or ecology of one or more of the vernal pool species identified in the recovery plan. Within each of the regions, core areas were identified where recovery actions will be focused because they provide the necessary features that are important to the recovery of a species. The hairy orcutt grass, Hoover's spurge, San Joaquin Valley orcutt grass, Colusa grass, and succulent owl's clover have all been listed under this management plan.

The *Recovery Plan for Serpentine Soil Species of the San Francisco Bay Area* would be relevant to this corridor. The coyote ceanothus, Metcalf Canyon jewelflower, and Santa Clara Valley dudleya have been listed under this management plan.

The *Recovery Plan for Coastal Plants* that the USFWS is preparing would be relevant for this corridor. The showy Indian clover is listed under this management plan.

East Bay to Central Valley Corridor

The East Bay to Central Valley corridor includes the East San Francisco Bay near Union City (Alameda County) east to the Livermore Valley (Pleasanton and Livermore), and across Patterson Pass into the Central Valley. The dominant geophysical features traversed by this corridor include the San Francisco Bay, the Diablo Range, and the Central Valley. Major watersheds include the San Francisco Bay watershed, the Las Positas watershed, and the San Joaquin River watershed. Elevation along the East Bay to Central Valley Corridor ranges from 100 ft (30 m) to 1,300 ft (396 m).

Vegetation Communities

Vegetation communities in this corridor include seasonal wetland, agriculture, open water, urban/developed, riparian habitat, grasslands, shrubland, oak woodland/foothill pine, and permanent freshwater wetland.

Water Resources

Following the Cowardin classification system, the water resources that could occur along the East Bay to the Central Valley corridor include estuarine, lacustrine, palustrine, and riverine systems. Vernal pools may be present, especially on Clear Lake soils fringing San Francisco Bay, or on Central Valley terrace deposits.

Special-Status Species

Special-Status Plants

A number of special-status plant species could occur in the East Bay to Central Valley corridor. These include the bent-flowered fiddleneck, Suisun Marsh aster, alkali milk-vetch, heartscale, brittlescale, San Joaquin spearscale, lesser saltscale, big-scale balsamroot, *big tarplant*, Congdon's tarplant, slough thistle, Mt. Hamilton thistle, hispid bird's-beak, palmate-bracted bird's beak, Hospital Canyon larkspur, recurved larkspur, round-leaved filaree, Hoover's button-celery, Delta button-celery, diamond-petaled California poppy, Diablo helianthella, rose-mallow, Contra Costa goldfields, legenere, showy madia, robust monardella, prostrate navarretia, hairless popcorn flower, most beautiful jewel-flower, saline clover, caper-fruited tropidicarpum, and Greene's tuctoria.

Special-Status Wildlife

A number of special-status wildlife species could occur in the East Bay to Central Valley corridor. These include the longhorn fairy shrimp, valley elderberry longhorn beetle, vernal pool fairy shrimp; vernal pool tadpole shrimp, California red-legged frog, California tiger salamander, western spadefoot, Alameda whipsnake, California horned lizard, giant garter snake, northwestern pond turtle, San Joaquin whipsnake; nesting habitat for American peregrine falcon, California horned lark, Cooper's hawk, golden eagle, loggerhead shrike, long-eared owl, northern harrier, prairie falcon, short-eared owl, Swainson's hawk, tricolored blackbird, western burrowing owl, white-tailed kite, and yellow warbler; and American badger, San Joaquin kit fox, and several bat species.

Special Management Areas

The Mount Hamilton Project of The Nature Conservancy encompasses a 1,560-sq-mi (2,511-sq-km) area in this region that extends from south of the Pacheco Pass to north of the Altamont Pass, with large parts of the area protected by conservation easements. The East Bay Regional Park District (EBRPD) encompasses 98,000 ac (39,659 ha) of mostly undeveloped, natural, open space parklands in Alameda and Contra Costa Counties. EBRPD lands include grassland, shrubland, woodland, forest, lake, shoreline, riparian, and wetland environments, which provide habitat for plants and wildlife. The EACCS provide a blueprint for conservation in East Alameda County and streamline the environmental permitting process by providing guidance to project proponents on where and how to focus mitigation efforts to address potential adverse effects on species resulting from future development and infrastructure improvements. The EACCS facilitate ongoing conservation programs by providing a coordinated approach supported by local stakeholders and regulatory agencies.

Wildlife Movement Corridors
On the west side of the Central Valley is a relatively extensive strip of annual (nonnative) grassland that lies between the irrigated fields and orchards of the valley floor and the oak and pine woodlands of the Diablo Range. This strip is about 10 mi (16 km) wide and provides a movement corridor for the San Joaquin kit fox.

Management Plans
The San Francisco Public Utility Commission (SFPUC) is developing the *Alameda Watershed Habitat Conservation Plan* to ensure that its operation activities comply with the ESA. The plan covers 47,800 ac (19,344 ha) in Alameda County, including the entire 36,816 ac (14,898 ha) of land owned by the SFPUC.

San Joaquin County has developed the *San Joaquin County Multi-Species Habitat Conservation Plan*. The purpose of the plan is to provide a strategy to balance for the long-term management of plant, fish, and wildlife species, especially those that are state or federally listed, and the need to accommodate for controlled development.

The USFWS has developed the *Draft Recovery Plan for Chaparral and Scrub Community Species East of San Francisco Bay, California* (2002). Species covered under this recovery plan include the Alameda whipsnake and Berkeley kangaroo rat.

The *Recovery Plan for Upland Species of the San Joaquin Valley* would be relevant to this corridor. The palmate-bracted bird's-beak is listed under this management plan.

The *Valley Elderberry Longhorn Beetle Recovery Plan and Conservation Guidelines for Valley Elderberry Longhorn Beetle* would be relevant to this alignment.

<u>San Francisco Bay Crossings</u>

Existing Conditions
The San Francisco Bay Crossings include the San Francisco Bay Area from San Francisco east to Oakland and the San Francisco Bay Area from North Fair Oaks (San Mateo County) east to Union City. The major geophysical feature traversed is the San Francisco Bay and the major watershed is the San Francisco Bay watershed. Elevation ranges from sea level to 50 ft (15 m)

Vegetation Communities
Vegetation communities related to the Bay crossings include seasonal wetland, agriculture, open water, urban/developed, saline-brackish permanent wetland, nonnative grasslands, shrubland, oak woodland/foothill pine, Montane hardwood forest, salt pond, managed Bay marsh, and unvegetated flats.

Water Resources
Following the Cowardin classification system, the water resources that could occur along the San Francisco Bay Crossing corridor include estuarine and palustrine systems. Vernal pools may be present, especially on Clear Lake soils fringing San Francisco Bay.

Special-Status Species

Special-Status Plants

A number of special-status plant species could occur in the area of the San Francisco Bay Crossings. These include the San Mateo thorn-mint, Franciscan onion, bent-flowered fiddleneck, coastal marsh milk-vetch, alkali milk-vetch, brittlescale, San Joaquin spearscale, big-scale balsamroot, Congdon's tarplant, Presidio clarkia, San Francisco collinsia, Point Reyes bird's-beak, Hoover's button-celery, San Francisco gumplant, Marin western flax, Contra Costa goldfields, Crystal Springs lessingia, Prostrate navarretia, white-rayed pentachaeta, Adobe sanicle, California seablite, saline clover, and San Francisco owl's-clover.

Special-Status Wildlife

A number of special-status wildlife species could occur in the area of the San Francisco Bay Crossings. These include northwestern pond turtle; nesting habitat for Alameda song sparrow, brown pelican, California black rail, California clapper rail, California least tern, Cooper's hawk, double-crested cormorant, long-eared owl, loggerhead shrike, northern harrier, saltmarsh common yellowthroat, short-eared owl, western burrowing owl, white-tailed kite, and yellow warbler; and salt marsh harvest mouse, salt marsh wandering shrew, San Francisco dusky-footed woodrat, and several bat species.

Special Management Areas

The South Bay Salt Pond Restoration Project is a 25-sq-mi (65-sq-km) project to restore the wetlands from the San Mateo Bridge to the southern edge of the Bay. The California Coastal Conservancy, USFWS, and CDFG initiated this project in 2003. The EBRPD encompasses 98,000 ac (39,659 ha) of mostly undeveloped, natural, open space parklands in Alameda and Contra Costa Counties. EBRPD lands include grassland, shrubland, woodland, forest, lake, shoreline, riparian, and wetland environments, which provide habitat for plants and wildlife.

The Don Edwards San Francisco Bay National Wildlife Refuge is located on the southern reaches of the San Francisco Bay. The refuge is 30,000 ac (12,140 ha) of open bay, salt marsh, mud flats, vernal pools, and upland habitats.

Wildlife Movement Corridors

The San Francisco Bay Area provides a migration corridor for a many species of birds and aquatic species, such as Pacific herring, steelhead, Coho salmon, and Chinook salmon.

Management Plans

The restoration plan for the Cargill salt properties would be relevant to the crossings. Also, the *Recovery Plan for Serpentine Soil Species of the San Francisco Bay Area* (1998) would be relevant to this corridor. The Presidio clarkia, fountain thistle, San Mateo woolly sunflower, and white-rayed pentachaeta are listed under this management plan.

<u>Central Valley Corridor</u>

The Central Valley corridor includes the Central Valley from Chowchilla (Madera County) and Merced (Merced County) north through Modesto (Stanislaus County) to Stockton (San Joaquin County). The major geophysical feature traversed by this corridor is the Central Valley. The major watershed traversed by this corridor is the San Joaquin River watershed. Elevation range for the Central Valley alternative ranges from 30 ft (9 m) to 250 ft to (76 m).

Vegetation Communities

Vegetation communities in this corridor include seasonal wetland, agriculture, open water, urban/developed, riparian habitat, grasslands, shrubland, oak woodland/foothill pine, Montane hardwood forest, Valley oak woodland, and permanent freshwater wetland.

Water Resources
Following the Cowardin classification system, the water resources that could occur along the Central Valley corridor include lacustrine, palustrine, and riverine systems. Vernal pools may be present, especially on Central Valley terrace deposits.

Special-Status Species
Special-Status Plants
A number of special-status plant species could occur in the Central Valley corridor. These include the alkali milk-vetch, heartscale, brittlescale, San Joaquin spearscale, lesser saltscale, vernal pool smallscale, subtle orache, *big tarplant*, Hoover's spurge, hispid bird's-beak, palmate-bracted bird's beak, Hoover's cryptantha, recurved larkspur, dwarf downingia, four-angled spikerush, round-leaved filaree, Delta button-celery, Boggs Lake hedge-hyssop, legenere, shining navarretia, prostrate navarretia, Colusa grass, San Joaquin Valley orcutt grass, hairy orcutt grass, and caper-fruited tropidicarpum.

Special-Status Wildlife
A number of special-status wildlife species could occur in the Central Valley corridor. These include the conservancy fairy shrimp, valley elderberry longhorn beetle, vernal pool fairy shrimp, vernal pool tadpole shrimp, California tiger salamander, giant garter snake, southwestern pond turtle; nesting habitat for California horned lark, Cooper's hawk, loggerhead shrike, northern harrier, short-eared owl, Swainson's hawk, tricolored blackbird, western burrowing owl, and white-tailed kite; and American badger, riparian brush rabbit, riparian woodrat, San Joaquin kit fox, and several bat species.

Wildlife Movement Corridors
The San Joaquin River and its tributaries provide wildlife movement corridors in the Central Valley. The natural and agricultural areas along the eastern side of the Central Valley provide a movement corridor. The USFWS has identified areas where linkage corridors should be established through the acquisition and management of conservation easements, incentive programs to preserve suitable habitat, zoning, acquisition, and other mechanisms to prevent isolation of natural habitats (U.S. Fish and Wildlife Service 1998). These linkage corridors would connect the remaining habitat on the valley floor with habitat in the foothills surrounding the San Joaquin Valley. One such identified linkage corridor is in the vicinity of Sandy Mush Road in Merced County. This linkage corridor would connect the national wildlife refuges and state wildlife areas located in the GSA in Merced County with the northeastern edges of the San Joaquin Valley and with natural areas farther south in Madera and Fresno Counties. In conjunction with the linkage corridor, the USFWS has identified the natural lands and compatible farmlands in eastern Merced County as areas that should be maintained and preserved for San Joaquin kit fox dispersal habitat. These areas encompass a variety of habitats, including grasslands, vernal pool systems, wetlands, oak woodlands, and farmlands.

Management Plans
The *Recovery Plan for Upland Species of the San Joaquin Valley* would be relevant to this corridor. The California jewelflower and palmate-bracted bird's beak are included in this management plan.

The *Recovery Plan for Vernal Pool Ecosystems in California* (2005) would be relevant to this corridor. Hairy orcutt grass, Hoover's spurge, San Joaquin Valley orcutt grass, succulent owl's-clover, and Colusa grass have been included in this management plan.

The *San Joaquin County Multi-Species Habitat Conservation Plan* and the *Valley Elderberry Longhorn Beetle Recovery Plan and Conservation Guidelines for Valley Elderberry Longhorn Beetle* would be relevant to this corridor.

The University of California, Merced, is in the process of developing a management plan to conserve habitat for special-status plant and animal species, while allowing for the development of the university and supporting community. Covered species include succulent owl's clover, Hoover's spurge, Colusa grass, San Joaquin orcutt grass, hairy orcutt grass, Hartweg's golden sunburst, green tuctoria, conservancy fairy shrimp, vernal pool fairy shrimp, vernal pool tadpole shrimp, midvalley fairy shrimp, California tiger salamander, and San Joaquin kit fox.

3.15.3 Environmental Consequences

A. NO PROJECT ALTERNATIVE

The No Project Alternative assumes that, in addition to existing conditions, additional transportation improvements would be developed. The transportation improvements include projects that are programmed or funded to 2030 (as described in Chapter 2).

It was not possible as part of this study to identify or quantify the impacts on biological resources that would occur as a result of the transportation improvements in the No Project Alternative. For existing transportation facilities to be improved, impacts on biological resources have previously been addressed, and only small additional or increased impacts are expected from the future transportation improvement included in the No Project Alternative. In some cases, widening of existing corridors or similar improvements could result in additional impacts on biological resources.

B. HIGH-SPEED TRAIN ALIGNMENT ALTERNATIVES

The proposed HST system would generally be located in or adjacent to existing transportation rights-of-way, such as highways or railroads, or would be in tunnels or elevated through mountain passes and sensitive habitat areas. HST Alignment Alternatives would include tunnels, which could avoid or substantially reduce surface impacts on sensitive biological resources, except at tunnel portal areas. Bridges across water bodies would use materials and designs to minimize the number of piles/columns in the water.

The potential impacts on biological resources and water resources/wetlands that could result from the HST Alignment Alternatives and station location options are summarized in Table 3.15-1. For more detail related to impacts of each alignment alternative segment see Appendix 3.15.

As discussed earlier, all comparisons are based on information available from existing databases. Field surveys, which would be performed during a subsequent environmental review, would provide more detailed information and could indicate an increase or a decrease in the potential impacts on biological resources from a proposed HST system, particularly along alignment alternatives that have not previously been the focus of field surveys or mapping by any of the regulatory agencies (such as CDFG or USFWS).

The discussion of impacts for the alignment alternatives is structured in the following manner: (1) impacts on sensitive vegetation communities/habitats; (2) impacts on special-status species, including marine/anadromous species; (3) impacts on wildlife movement corridors; (3) impacts on wetlands and non-wetland waters; and (4) conflicts with conservation plans or special management plans.

Figure 3.15-1 illustrates the potential locations of special-status species in relation to the HST Alignment Alternatives. Sensitive vegetation communities and those species that are federally or state listed as threatened or endangered would be of special concern because of the protection afforded them under the ESA and CESA. Additionally, species with limited habitats or ranges, such as aquatic species and butterfly species, would also be of special concern because of the adverse effects that even small impacts on their habitat could cause. Several special-status species, including the California red-legged frog and San Joaquin kit fox, would also be affected. Sensitive vegetation communities include seasonal and permanent freshwater wetlands, saline-brackish permanent wetlands, permanent freshwater marsh, riparian, Bay waters, eelgrass habitat, and oak woodlands.

Figure 3.15-2 illustrates the potential locations of non–jurisdictional waters and wetlands in relation to the HST Alignment Alternatives. The alignment alternatives would likely impact wetlands and waters at a level that would require an Individual Permit and Section 404(b)(1) Analysis of Alternatives, which would be addressed in a subsequent environmental review.

The HST Alignment Alternatives would have potential to affect wildlife movement/migration corridors throughout the study area. Figure 3.15-3 illustrates the known wildlife movement corridors throughout the study region and general areas where the movement corridors cross proposed HST alignment alternatives.

There are several HCPs and special management areas that would be affected by the HST Alignment Alternatives, including the Don Edwards National Wildlife Refuge along San Francisco Bay.

During construction, earthwork for the HST Alignment Alternatives would involve excavations and fill construction, producing potential erosion and sedimentation problems if not properly designed, constructed, and maintained. Stockpiles of excavated materials and imported fill, if properly managed, should not be sources of sedimentation. If, however, construction-related erosion and sedimentation were to occur, it could result in impacts on surface water quality and in potential impacts on biological resources. Dewatering operations for excavations could also result in discharge of sediments or pollutants to surface water bodies, thereby degrading water quality and affecting biological resources.

Table 3.15-1. Biological Resource Summary Data Table for Alignments and Station Location Option Comparisons

Corridor	Possible Alignments	Alignment Alternative	Number of Special-Status Plant Species	Number of Special-Status Wildlife Species	Wildlife Movement Corridor	Non-Wetland Waters in Linear Feet	Wetlands in Acres (Hectares)	Marine/ Anadromous Fish Resources
San Francisco to San Jose: Caltrain	1 of 1	San Francisco to Dumbarton	19	29	West side of San Francisco Bay and riparian and stream corridors	590	0.08 (0.03)	Y
	1 of 1	Dumbarton to San Jose	5	19	Riparian and stream corridors	672	-	Y
Station Location Options								
Transbay Transit Center			1	-	West side of San Francisco Bay and riparian and stream corridors	-	-	N
4th and King (Caltrain)			1	-	West side of San Francisco Bay and riparian and stream corridors	-	-	N
Millbrae/SFO			-	-	West side of San Francisco Bay and riparian and stream corridors	-	-	N
Redwood City (Caltrain)			-	-	West side of San Francisco Bay and riparian and stream corridors	-	-	N
Palo Alto (Caltrain)			-	1	Riparian and stream corridors	-	-	N

Corridor	Possible Alignments	Alignment Alternative	Number of Special-Status Plant Species	Number of Special-Status Wildlife Species	Wildlife Movement Corridor	Non-Wetland Waters in Linear Feet	Wetlands in Acres (Hectares)	Marine/ Anadromous Fish Resources
Oakland to San Jose: Niles/I-880	1 of 2	West Oakland to Niles Junction	5	23	East side of San Francisco Bay and riparian and stream corridors	455	0.11 (0.04)	Y
		12th Street/City Center to Niles Junction	6	23	East side of San Francisco Bay and riparian and stream corridors	455	0.11 (0.04)	Y
	1 of 2	Niles Junction to San Jose via Trimble	6	25	East side of San Francisco Bay and riparian and stream corridors	958	1.27 (0.51)	Y
		Niles Junction to San Jose via I-880	5	25	East side of San Francisco Bay and riparian and stream corridors	1,080	1.80 (0.73)	Y
Station Location Options								
West Oakland/7th Street			-	-	East side of San Francisco Bay and riparian and stream corridors	-	-	N
12th Street/City Center			-	-	East side of San Francisco Bay and riparian and stream corridors	-	-	N
Coliseum/Airport			-	-	East side of San Francisco Bay and riparian and stream corridors	482	0.64 (0.26)	Y
Union City (BART)			-	-	East side of San Francisco Bay and riparian and stream corridors	-	-	N

Corridor	Possible Alignments	Alignment Alternative	Number of Special-Status Plant Species	Number of Special-Status Wildlife Species	Wildlife Movement Corridor	Non-Wetland Waters in Linear Feet	Wetlands in Acres (Hectares)	Marine / Anadromous Fish Resources
Fremont (Warm Springs)			-	-	East side of San Francisco Bay and riparian and stream corridors	-	-	N
San Jose to Central Valley: Pacheco Pass	1 of 1	Pacheco	23	27	Between Santa Clara Valley and San Joaquin Valley	1,960	0.11 (0.4)	Y
	1 of 3	Henry Miller (UPRR Connection)	25	34	Along west side of San Joaquin Valley and San Joaquin River	10,588	11.61 (4.7)	N
		Henry Miller (BNSF Connection)	25	34	Along west side of San Joaquin Valley and San Joaquin River	10,312	11.48 (4.65)	N
		GEA North	22	34	Along west side of San Joaquin Valley and San Joaquin River	6,771	17.96 (7.27)	Y
Station Location Options								
San Jose (Diridon)			1	1	Between Santa Clara Valley and San Joaquin Valley	-	-	N
Morgan Hill (Caltrain)			-	-	Between Santa Clara Valley and San Joaquin Valley	-	-	N
Gilroy (Caltrain)			1	-	Between Santa Clara Valley and San Joaquin Valley	-	-	N

Corridor	Possible Alignments	Alignment Alternative	Number of Special-Status Plant Species	Number of Special-Status Wildlife Species	Wildlife Movement Corridor	Non-Wetland Waters in Linear Feet	Wetlands in Acres (Hectares)	Marine / Anadromous Fish Resources
East Bay to Central Valley: Altamont Pass	1 of 4	I-680/ 580/UPRR	24	29	Along west side of San Joaquin Valley; riparian and stream corridors	2,380	0.66 (0.27)	Y
		I-580/ UPRR	24	29	Along west side of San Joaquin Valley; riparian and stream corridors	2,612	5.17 (2.1)	Y
		Patterson Pass/UPRR	20	28	Along west side of San Joaquin Valley; riparian and stream corridors	1,371	2.59 (1)	Y
		UPRR	20	28	Along west side of San Joaquin Valley; riparian and stream corridors	1,152	3.22 (1.3)	Y
	1 of 4	Tracy Downtown (BNSF Connection)	18	27	Along west side of San Joaquin Valley; riparian and stream corridors	6,291	4.36 (1.76)	Y
		Tracy ACE Station (BNSF Connection)	21	27	Along west side of San Joaquin Valley; riparian and stream corridors	7,678	3.63 (1.47)	Y
		Tracy ACE Station (UPRR Connection)	20	27	Along west side of San Joaquin Valley; riparian and stream corridors	5,326	2.60 (1)	Y
		Tracy Downtown (UPRR Connection)	22	27	Along west side of San Joaquin Valley; riparian and stream corridors	7,504	4.16 (1.68)	Y
	2 of 2	East Bay Connections	-	-	East side of San Francisco Bay and riparian and stream corridors	376	1.22 (0.49)	Y

Corridor	Possible Alignments	Alignment Alternative	Number of Special-Status Plant Species	Number of Special-Status Wildlife Species	Wildlife Movement Corridor	Non-Wetland Waters in Linear Feet	Wetlands in Acres (Hectares)	Marine/ Anadromous Fish Resources
Station Location Options								
Pleasanton (I-680/Bernal Rd)			-	-	Along west side of San Joaquin Valley; riparian and stream corridors	-	-	N
Pleasanton (BART)			-	-	Along west side of San Joaquin Valley; riparian and stream corridors	338	-	N
Livermore (Downtown)			-	-	Along west side of San Joaquin Valley; riparian and stream corridors	-	-	N
Livermore (I-580)			-	-	Along west side of San Joaquin Valley; riparian and stream corridors	-	1.02 (0.41)	N
Livermore (Greenville Road/UPRR)			-	-	Along west side of San Joaquin Valley; riparian and stream corridors	-	-	N
Livermore (Greenville Road/I-580)			-	-	Along west side of San Joaquin Valley; riparian and stream corridors	72	1.07 (0.43)	N
Tracy (Downtown)			-	-	Along west side of San Joaquin Valley; riparian and stream corridors	-	-	N
Tracy (ACE)			-	-	Along west side of San Joaquin Valley; riparian and stream corridors	-	0.08 (0.03)	N

Corridor	Possible Alignments	Alignment Alternative	Number of Special-Status Plant Species	Number of Special-Status Wildlife Species	Wildlife Movement Corridor	Non-Wetland Waters in Linear Feet	Wetlands in Acres (Hectares)	Marine / Anadromous Fish Resources
San Francisco Bay Crossings	1 of 2	Trans Bay Crossing – Transbay Transit Center	1	-	West side of San Francisco Bay and riparian and stream corridors	-	22.83 (9.24)	Y
		Trans Bay Crossing – 4th & King	1	-	West side of San Francisco Bay and riparian and stream corridors	-	22.04 (8.92)	Y
	1 of 6	Dumbarton (High Bridge)	15	21	East and west shores of San Francisco Bay	2,361	33.9 (13.7)	Y
		Dumbarton (Low Bridge)	15	21	East and west shores of San Francisco Bay	2,361	33.9 (13.7)	Y
		Dumbarton (Tube)	15	21	East and west shores of San Francisco Bay	2,361	33.9 (13.7)	Y
		Fremont Central Park (High Bridge)	16	23	East and west shores of San Francisco Bay	3,117	55.35 (22.4)	Y
		Fremont Central Park (Low Bridge)	16	23	East and west shores of San Francisco Bay	3,117	55.35 (22.4)	Y
		Fremont Central Park (Tube)	16	23	East and west shores of San Francisco Bay	3,117	55.35 (22.4)	Y

Water Resources/Wetlands
This potential nonwetland jurisdictional waters and wetlands that could be affected by either the West Oakland to Niles Junction or 12th Street/City Center to Niles Junction alignment alternatives would be similar. The Niles Junction to San Jose via I-880 alignment alternative would have slightly greater impacts on waters and wetlands compared to the Niles Junction to San Jose via Trimble alignment alternative.

Conservation Plans
Both the Niles Junction to San Jose via I-880 alignment alternative and the Niles Junction to San Jose via Trimble alignment alternative could negatively impact the Southeast San Francisco Bay core area identified in the *Recovery Plan for Vernal Pool Ecosystems* (U.S. Fish and Wildlife Service 2005).

Special Management Areas
Both the Niles Junction to San Jose via I-880 and the Niles Junction to San Jose via Trimble alignment alternatives could negatively impact the Don Edwards San Francisco Bay National Wildlife Refuge.

<u>San Jose to Central Valley Corridor</u>

Pacheco Alignment Alternative
The Pacheco alignment alternative could have direct impacts on 85.45 ac (34.58 ha) of agricultural lands, 64.04 ac (25.92 ha) of grasslands, 11.55 ac (4.67 ha) of oak woodland/foothill pine, 4.06 ac (1.64 ha) of shrub lands, and 123.91 ac (50.14 ha) of urban/other developed lands. This alignment alternative could have indirect impacts on 4,716.43 ac (1,908.68 ha) of agricultural lands, 3,968.53 ac (1,606.01 ha) of grasslands, 925.92 ac (374.71 ha) of oak and foothill pine woodlands, 32.98 ac (13.35 ha) of open waters, 243.11 ac (98.38 ha) of shrub lands, and 4,689.15 ac (1,897.64 ha) of urban/other developed lands.

Sensitive Vegetation Communities
The sensitive vegetation community in this alignment alternative is oak woodlands.

Special-Status Plants
The Pacheco alignment alternative could adversely affect the habitat of 23 special-status plant species (Table 3.15-1).

Special-Status Wildlife
The Pacheco alignment alternative could adversely affect the habitat of 27 special-status wildlife species, including species of invertebrates, amphibians, reptiles, raptors, and mammals (Table 3.15-1). This alignment alternative also has the potential to impact marine/anadromous species.

Wildlife Movement Corridors
The streams, and associated riparian habitats, flowing from the Diablo Range and the Santa Cruz Mountains that would be crossed by the Pacheco alignment alternative provide movement corridors for fish and wildlife species. The alignment alternative would bisect movement corridors through the Diablo Range. Because the alignment alternative would be elevated over drainages, it is not anticipated to impact the major drainages, such as Coyote Creek, the Pajaro River, Tres Pinos Creek, the Pacheco Creek, and other drainages, which provide wildlife movement corridors.

Water Resources/Wetlands
This alignment alternative has the potential to directly impact approximately 1,960 ft (597 m) of potential nonwetland jurisdictional waters and approximately 0.11 ac (0.04 ha) of wetlands. The Pacheco alignment alternative crosses or is adjacent to a number of water resources, including Coyote Creek, Los Gatos Creek, Miller Slough, and the Pajaro River, and a number of other small streams.

Conservation Plans
The Pacheco alignment alternative could adversely impact designated critical habitat for the Bay checkerspot butterfly and the California tiger salamander. This alignment alternative could also adversely impact the South San Francisco Bay Core Area identified in the *Recovery Plan for the for California Red-Legged Frog* (U.S. Fish and Wildlife Service 2002).

Special Management Areas
The Pacheco alignment alternative would not traverse through the Henry Coe State Park, located northeast of Gilroy, or the Pacheco State Park near San Luis Reservoir, and there are no anticipated impacts on these state parks as a result of this alignment alternative. This alignment alternative would traverse lands that have been protected by the Nature Conservancy as part of its Mount Hamilton Project and could have adverse impacts on these protected lands. It would extend through the CDFG Upper Cottonwood Creek Wildlife Area resulting in adverse impacts where the alignment is not in tunnel. The alignment would be in tunnel approximately 1.1 miles, or about 46%, within the wildlife area as shown on Figure 3.15-4.

Henry Miller (UPRR Connection) Alignment Alternative
The Henry Miller (UPRR Connection) alignment alternative could have direct impacts on 211.90 ac (85.75 ha) of agricultural lands, 121.06 ac (49 ha) of grasslands, 6.25 ac (2.53 ha) of oak woodland/foothill pine, 2.24 ac (0.91 ha) of open waters, 1.34 ac (0.54 ha) of permanent freshwater wetlands, 0.59 ac (0.24 ha) of riparian habitat, 2.32 ac (0.94 ha) of seasonal wetlands, 0.11 ac (0.04 ha) of shrub lands, and 33.97 ac (13.75 ha) of urban/other developed lands. This alignment alternative could have indirect impacts on 11,987.68 ac (4,851.26 ha) of agricultural lands, 6,430.46 ac (2,602.33 ha) of grasslands, 0.15 ac (0.06 ha) of montane hardwood forest, 314.30 ac (127.19 ha) of oak and foothill pine woodlands, 164.36 ac (66.51 ha) of open waters, 121.78 ac (49.28 ha) of permanent freshwater wetlands, 11.03 ac (4.46 ha) of riparian habitat, 134.04 ac (54.24 ha) of seasonal wetlands, 6.96 ac (2.82 ha) of shrub lands, and 1,453.91 ac (588.39 ha) of urban/other developed lands.

Sensitive Vegetation Communities
The sensitive vegetation communities within this alignment alternative are seasonal wetlands, permanent freshwater wetlands, riparian, and oak woodlands.

Special-Status Plants
The Henry Miller (UPRR Connection) alignment alternative could adversely affect the habitat of 25 special-status plant species, including species of invertebrates, amphibians, reptiles, raptors and other birds, and mammals (Table 3.15-1).

Special-Status Wildlife
The Henry Miller (UPRR Connection) alignment alternative could adversely affect the habitat of 34 special-status wildlife species, including species of invertebrates, amphibians, reptiles, raptors and other birds, and mammals (Table 3.15-1). Species with limited habitats or ranges, such as the aquatic invertebrates, and those with limited nesting ranges, such as willow flycatcher and least Bell's vireo, would be of special concern because of the adverse effects that even small impacts on their habitat could cause.

Wildlife Movement Corridors
The Henry Miller (UPRR Connection) alignment alternative would bisect the major San Joaquin kit fox movement corridor between the southern portion of its range and the northern portion of its range along the west side of the San Joaquin Valley. The Henry Miller (UPRR Connection) alignment alternative also crosses the San Joaquin River, which is a movement corridor for fish and bird species.

Water Resources/Wetlands
This alignment alternative has the potential to directly impact approximately 10,590 ft (3,228 m) of potential non-wetland waters and approximately 11.6 ac (4.69 ha) of wetlands. The Henry Miller (UPRR Connection) alignment alternative crosses the San Joaquin River, sloughs, and creeks.

Conservation Plans
Similar to the Pacheco alignment alternative, the Henry Miller (UPRR Connection) alignment alternative could adversely impact the East San Francisco Bay Core Area identified in the *Recovery Plan for the for California Red-legged Frog* (U.S. Fish and Wildlife Service 2002).

Special Management Areas
Similar to the Pacheco alignment alternative, the Henry Miller (UPRR Connection) alignment alternative would traverse lands that have been protected by the Nature Conservancy as part of its Mount Hamilton Project and could have adverse impacts on these protected lands. This alignment alternative would also adversely impact the GEA. The alignment would pass north of the San Luis Reservoir State Recreation Area and O'Neill Forebay Wildlife Area. It would also traverse the area known as the GEA, but it would not result in direct impacts on the CDFG Volta Wildlife Area or the San Luis National Wildlife Refuge Complex as shown on Figure 3.15-4. The Henry Miller alignment alternative would extend immediately adjacent to and elevated above the roadway where it crosses the Los Banos Wildlife Area.

Henry Miller (BNSF Connection) Alignment Alternative
The Henry Miller (BNSF Connection) alignment alternative could have direct impacts on 227.68 ac (92.14 ha) of agricultural lands, 118.84 ac (48.09 ha) of grasslands, 2.54 ac (1.03 ha) of hardwood forests, 7.53 ac (3.05 ha) of oak woodland/foothill pine, 2.43 ac (0.98 ha) of open waters, 1.34 ac (0.54 ha) of permanent freshwater marsh, 0.19 ac (0.08 ha) of riparian habitat, 1.54 ac (0.62 ha) of seasonal wetlands, 0.52 ac (0.21 ha) of shrub lands, and 31.01 ac (12.55 ha) of urban/other developed lands. This alignment alternative could have indirect impacts on 12,428.32 ac (5,028.59 ha) of agricultural lands, 6,649.80 ac (2,691.09 ha) of grasslands, 111.97 ac (45.31 ha) of montane hardwood forest, 431.69 ac (174.7 ha) of oak and foothill pine woodlands, 166.52 ac (67.39 ha) of open waters, 123.61 ac (50.02 ha) of permanent freshwater wetlands, 3.92 ac (1.59 ha) of riparian habitat, 134.18 ac (54.3 ha) of seasonal wetlands, 20.72 ac (8.39 ha) of shrub lands, and 1,358.76 ac (549.87 ha) of urban/other developed lands.

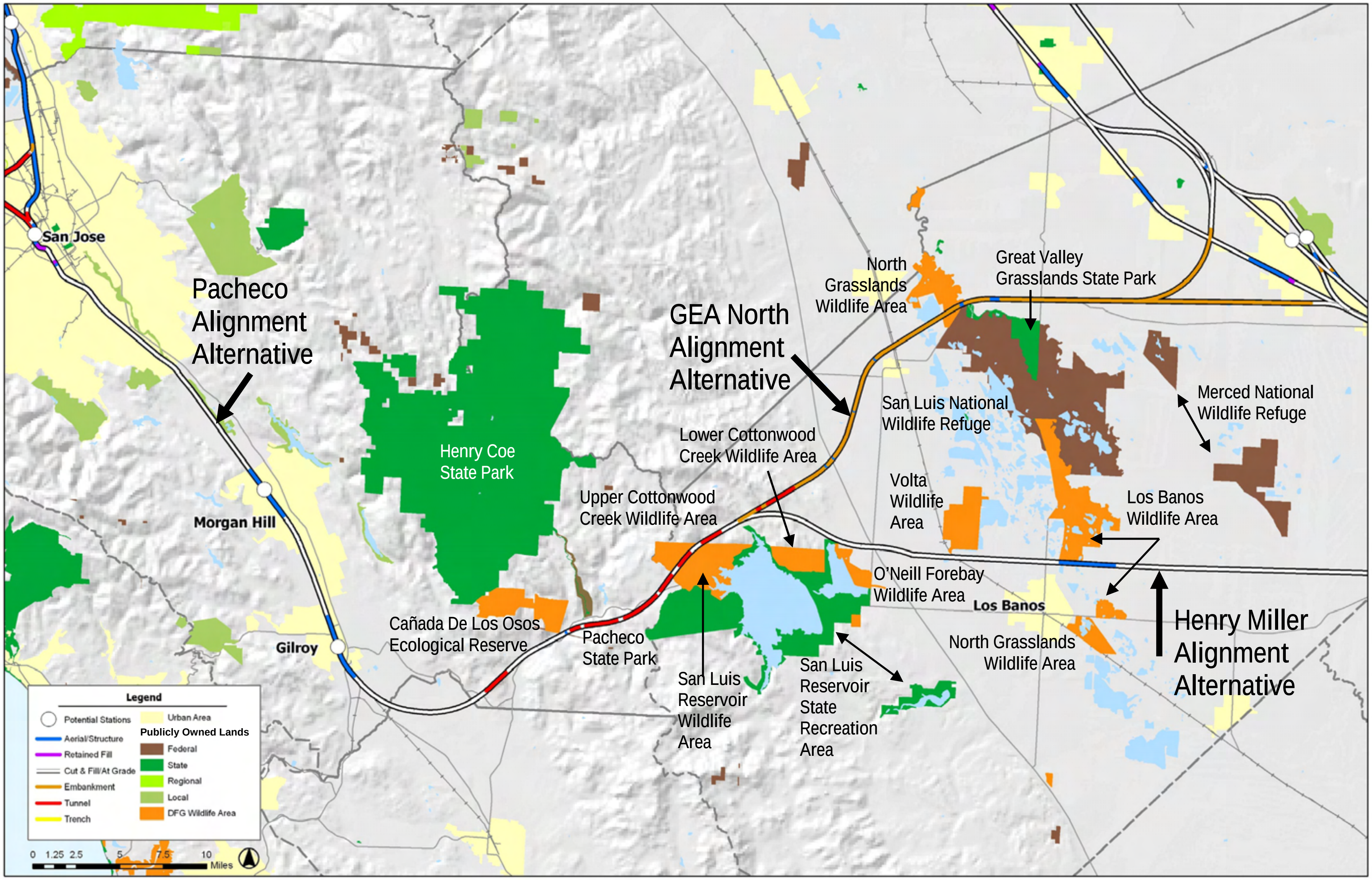
Sensitive Vegetation Communities
The sensitive vegetation communities within this alignment alternative are seasonal wetlands, permanent freshwater wetlands, permanent freshwater marsh, riparian, and oak woodlands.

Special-Status Plants
The Henry Miller (BNSF Connection) alignment alternative could adversely affect the habitat of the same 25 special-status plant species that the Henry Miller (UPRR Connection) alignment alternative could affect.

Special-Status Wildlife
The Henry Miller (BNSF Connection) alignment alternative could adversely affect the habitat of the same 34 special-status wildlife species as the Henry Miller (UPRR Connection) alignment alternative.

Wildlife Movement Corridors
Impacts on wildlife movement corridors from this alignment alternative would be the same as those for the Henry Miller (UPRR Connection) alignment alternative.

Water Resources/Wetlands
Similar to the Henry Miller (UPRR Connection) alignment alternative, this alignment alternative has the potential to directly impact approximately 10,315 ft (3,144 m) of potential non-wetland waters



Source: USBR, BLM, CDPR, CDFG, (former) Teale Data Center, USFS, California GAP Analysis Project, and the Wildlands Conservancy

FLY CALIFORNIA

U.S. Department of Transportation
Federal Railroad Administration

Figure 3.15-4
Public Lands – San Jose to Central Valley Corridor

B004510

and approximately 11.5 ac (4.65 ha) of wetlands. The Henry Miller (BNSF Connection) alignment alternative crosses the San Joaquin River, sloughs, and creeks.

Conservation Plans
Impacts on habitats and species identified in conservation plans from this alignment alternative would be the same as for the Henry Miller (UPRR Connection) alignment alternative.

Special Management Areas
Impacts on special management areas from this alignment alternative would be the same as for the Henry Miller (UPRR Connection) alignment alternative.

GEA North Alignment Alternative
The GEA North alignment alternative could have direct impacts on 200.03 ac (80.95 ha) of agricultural lands, 123.43 ac (49.95 ha) of grasslands, 2.89 ac (1.17 ha) of oak woodland/foothill pine, 1.21 ac (0.49 ha) of open waters, 3.17 ac (1.28 ha) of permanent freshwater marsh, 1.26 ac (0.51 ha) of riparian habitat, and 32.75 ac (13.26 ha) of urban/other developed lands. This alignment alternative could have indirect impacts on 11,631.04 ac (4,707.08 ha) of agricultural lands, 6,385.21 ac (2,584.09 ha) of grasslands, 280.35 ac (113.46 ha) of oak and foothill pine woodlands, 107.41 ac (43.47 ha) of open waters, 131.78 ac (53.33 ha) of permanent freshwater wetlands, 33.71 ac (13.64 ha) of riparian habitat, 16.31 ac (6.60 ha) of seasonal wetlands, 3.10 ac (1.25 ha) of shrub lands, and 1,408.79 ac (570.14 ha) of urban/other developed lands.

Sensitive Vegetation Communities
The sensitive vegetation communities within this alignment alternative are seasonal wetlands, permanent freshwater wetlands, permanent freshwater marsh, riparian, and oak woodlands.

Special-Status Plants
The GEA North alignment alternative could adversely affect the habitat of 22 special-status plant species (Table 3.15-1).

Special-Status Wildlife
The GEA North alignment alternative could adversely affect the habitat of 34 special-status wildlife species, including species of invertebrates, amphibians, reptiles, raptors and other birds, and mammals (Table 3.15-1). Species with limited habitats or ranges, such as the aquatic invertebrates, and those with limited nesting range, such as willow flycatcher and least Bell's vireo, would be of special concern, as would be the California tiger salamander.

Wildlife Movement Corridors
Impacts on wildlife movement corridors from this alignment alternative would be the same as for the Henry Miller (UPRR Connection) alignment alternative.

Water Resources/Wetlands
This alignment alternative has the potential to directly impact approximately 6,771 ft (2,347 m) of potential non-wetland waters and approximately 17.96 ac (7.27 ha) of wetlands, the highest of the alignment alternatives within this corridor. The GEA North alignment alternative crosses the San Joaquin River twice, sloughs, and creeks but is further north of the Henry Miller alignment alternatives and minimizes impacts on water crossings compared to either of the Henry Miller alignment alternatives.

Conservation Plans
The GEA North alignment alternative could adversely affect the GEA. The GEA has been identified as a core area of recovery in the *Recovery Plan for Vernal Pool Ecosystems* (U.S. Fish and Wildlife Service 2005).

The GEA North alignment alternative could adversely impact the East San Francisco Bay Core Area identified in the *Recovery Plan for the California Red-legged Frog* (U.S. Fish and Wildlife Service 2002).

Special Management Areas
Impacts on special management areas from this alignment alternative include the San Luis National Wildlife Area, North Grasslands Wildlife Area, and the Great Valley Grasslands State Park, which provide habitat for a number of special-status plant and wildlife species.

San Jose to Central Valley Corridor Stations

- San Jose-Diridon Station: This station location option could have direct impacts on 13 ac (5.26 ha) of urban/other developed lands. This station location option could have indirect impacts on 0.4 ac (0.16 ha) of grasslands, 0.2 ac (0.08 ha) of open waters, and 191 ac (77.3 ha) of urban/other developed lands. This station location option could adversely affect the habitat of one special-status plant and one wildlife species. Impacts on waters, wetlands, and marine/anadromous species are not anticipated with this station location.
- Morgan Hill Station: This station location option could have direct impacts on 2 ac (0.81 ha) of agricultural land, 2.2 ac (0.89 ha) of grasslands and 2.5 ac (1.01 ha) of urban/other developed lands. This station location option could have indirect impacts on 33 ac (13.35 ha) of agricultural lands, 27 ac (10.93 ha) of grasslands, 98 ac (39.66 ha) of urban/other developed lands. Impacts on special-status plant and wildlife species, waters, wetlands, and marine/anadromous species are not anticipated with this station location.
- Gilroy Station: This station location option could have direct impacts on 3.7 ac (1.5 ha) of agricultural land, 0.1 ac (0.04 ha) of grasslands, and 30 ac (12.14 ha) of urban/other developed lands. This station location option could have indirect impacts on 28 ac (11.33 ha) of agricultural lands, 7 ac (2.83 ha) of grasslands, and 192 ac (77.7 ha) of urban/other developed lands. This station location option could adversely affect the habitat of one special-status plant species. Impacts on special-status wildlife species, waters, wetlands, and marine/anadromous species are not anticipated with this station location.

Summary of San Jose to Central Valley Corridor Impacts
Sensitive Vegetation Communities
The sensitive vegetation communities within this corridor are seasonal wetlands, permanent freshwater wetlands, permanent freshwater marsh, riparian, and oak woodlands.

Special-Status Plants
The Henry Miller alignment alternatives have the potential to impact a greater number of special-status plant species than the GEA North alignment alternative. Both of the Henry Miller alignment alternatives have the potential to impact the same special-status plant species.

Special-Status Wildlife
Both of the Henry Miller alignment alternatives have the potential to impact the same special-status wildlife species. The special-status wildlife species that will be impacted by the Henry Miller and the GEA North alignment alternatives are essentially the same.

Wildlife Movement Corridors
Both the GEA North and the Henry Miller alignment alternatives would bisect the major San Joaquin kit fox movement corridor between the southern portion of its range and the northern portion of its range along the west side of the San Joaquin Valley.

Water Resources/Wetlands
This corridor has the potential to directly impact between approximately 8,731 ft and 12,548 ft of potential non-wetland waters and between approximately 11.7 ac (5.1 ha) and 18.07 ac (7.31 ha) of

wetlands. Both of the Henry Miller alignment alternatives have the potential to affect more jurisdictional waters than the GEA North alignment alternative, but the GEA North alignment alternative has the potential to impact more wetland areas.

Conservation Plans
The GEA North and the Henry Miller alignment alternatives could adversely affect core areas that have been identified for the recovery of the California red-legged frog.

Special Management Areas
The Pacheco alignment alternative would have adverse impacts on the Cottonwood Creek Wildlife Area where it is not in a tunnel. The GEA North and the Henry Miller alignment alternatives would traverse lands that have been protected by the Nature Conservancy as part of its Mount Hamilton Project and could have adverse impacts on these protected lands. Both the GEA North and Henry Miller alignment alternatives would adversely impact the GEA. The Henry Miller alignment alternative would extend immediately adjacent to and elevated above the roadway where it crosses the Los Banos Wildlife Area.

The GEA North alignment alternative would adversely affect special management areas within the GEA, including the San Luis National Wildlife Refuge, North Grasslands Wildlife Area, and the Great Valley Grasslands State Park, which provide habitat for a number of special-status plant and wildlife species.

<u>East Bay to Central Valley Corridor</u>

I-680/I-580/UPRR Alignment Alternative
The I-680/I-580/UPRR alignment alternative could have direct impacts on 0.17 ac (0.07 ha) of agricultural lands, 48.82 ac (19.76 ha) of grasslands, 4.57 ac (1.85 ha) of oak woodland/foothill pine, 0.01 ac (0.004 ha) of shrub lands, and 96.02 ac (38.86 ha) of urban/other developed lands. This alignment alternative could have indirect impacts on 408.03 ac (165.12 ha) of agricultural lands, 4,016.15 ac (1,625.29 ha) of grasslands, 183.89 ac (74.42 ha) of oak and foothill pine woodlands, 4.58 ac (1.85 ha) of open waters, 1.74 ac (0.7 ha) of shrub lands, and 3,275.32 ac (1,325.48 ha) of urban/other developed lands.

Sensitive Vegetation Communities
The sensitive vegetation community within this alignment alternative is oak woodlands.

Special-Status Plants
The I-680/I-580/UPRR alignment alternative could adversely affect the habitat of 24 special-status plant species (Table 3.15-1).

Special-Status Wildlife
The I-680/I-580/UPRR alignment alternative could adversely affect the habitat of 29 special-status wildlife species, including species of invertebrates, amphibians, reptiles, raptors and other birds, and mammals (Table 3.15-1). Species with limited habitats or ranges, such as the aquatic invertebrates, would be of special concern because of the adverse effects that even a small impact to their habitat could cause. This alignment alternative also has the potential to impact marine/anadromous species.

Wildlife Movement Corridors
The I-680/I-580/UPRR alignment alternative would bisect the major San Joaquin kit fox movement corridor between the southern portion of its range and the northern portion of its range along the west side of the San Joaquin Valley.

Water Resources/Wetlands
This alignment alternative has the potential to directly impact approximately 6,290 ft (1,917.19 m) of potential nonwetland jurisdictional waters and approximately 4.4 ac (1.78 ha) of wetlands. The I-

adversely affect the Mt. Hamilton thistle, the recurved larkspur, the rose-mallow, or the showy madia. The UPRR alignment alternative would not adversely affect the palmate-bracted bird's-beak.

Special-Status Wildlife
The I-680/I-580/UPRR and I-580/UPRR alignment alternatives could adversely affect the greatest number of special-status wildlife species. The Patterson Pass/UPRR and UPRR alignment alternatives would not adversely affect potential habitat for longhorn fairy shrimp, but the I-680/I-580/UPRR and I-580/UPRR alignment alternatives could adversely affect this habitat.

The Tracy ACE (BNSF Connection), Tracy ACE (UPRR Connection), Tracy Downtown (UPRR Connection), and Tracy Downtown (BNSF Connection) alignment alternatives could adversely impact the same special-status wildlife species.

Wildlife Movement Corridors
The I-680/I-580/UPRR, I-580/UPRR, Patterson Pass/UPRR, and UPRR alignment alternatives would bisect the major San Joaquin kit fox movement corridor between the southern portion of its range and the northern portion of its range along the west side of the San Joaquin Valley. This also applies to the Tracy ACE Station (BNSF Connection), Tracy ACE Station (UPRR Connection), Tracy Downtown (BNSF Connection), and Tracy Downtown (UPRR Connection) alignment alternatives.

Water Resources
This corridor has the potential to directly impact between approximately 7,075 ft (2,156 m) and 10,660 ft (3,249 m) of potential nonwetland jurisdictional waters and between approximately 4.5 ac (1.82 ha) and 10.8 ac (4.37 ha) of wetlands.

Conservation Plans
The I-680/I-580/UPRR and the I-580/UPRR alignment alternatives could adversely affect the Altamont Hills core area identified in the *Recovery Plan for Vernal Pool Ecosystems*, but the Patterson Pass/UPRR and the UPRR alignment alternatives would not adversely affect this core area. All four of these alignment alternatives could adversely impact the East San Francisco Bay Core Area identified in the *Recovery Plan for the California Red-Legged Frog*.

The Tracy ACE Station (BNSF Connection), Tracy ACE Station (UPRR Connection), Tracy Downtown (BNSF Connection), and Tracy Downtown (UPRR Connection) alignment alternatives are not anticipated to affect habitats or species identified in any conservation plans.

<u>San Francisco Bay Crossings</u>

Trans Bay Crossing – Transbay Transit Center Alignment Alternative
The Trans Bay Crossing – Transbay Transit Center alignment alternative extends in a tube from the Oakland Inner Harbor to the City of San Francisco, crossing San Francisco Bay en route. If this alignment alternative were not constructed as a bored tunnel, it could have direct impacts on 22.1 ac (8.94 ha) of bay waters, 0.11 ac (0.04 ha) of grasslands, 1.6 ac (0.65 ha) of saline-brackish permanent wetlands, and 17.3 ac (7 ha) of urban/other developed lands. This alignment alternative could also have indirect impacts on 1,320.6 ac (534.46 ha) of bay waters, 0.22 ac (0.09 ha) of grasslands, 1.3 ac (0.52 ha) of open waters, 44.3 ac (17.93 ha) of saline-brackish permanent wetlands, and 659 ac (266.69 ha) of urban/other developed lands.

Sensitive Vegetation Communities
The sensitive vegetation community in this alignment alternative is the saline-brackish permanent wetlands. If this alignment alternative were constructed in a tunnel, impacts would likely not occur. Depending on construction technique, this alignment alternative may impact eelgrass habitat in the San Francisco Bay. The habitat for eelgrass is generally located at a depth of 2 m.

Special-Status Plants
The Trans Bay Crossing – Transbay Transit Center alignment alternative could adversely affect the habitat of one special-status plant species, the beach layia. As noted above, and if this alignment alternative were constructed in a tunnel, impacts on this species would likely not occur.

Special-Status Wildlife
This alignment alternative is not anticipated to adversely affect the habitat of special-status wildlife species or impact marine/anadromous species if it were constructed in a tunnel. Other tube construction methods could result in impacts on marine/anadromous species.

Wildlife Movement Corridors
The Trans Bay Crossing – Transbay Transit Center alignment alternative is not anticipated to impact wildlife movement corridors if constructed as a bored tunnel. If constructed as a trench on the floor of San Francisco Bay, sediment disturbance from construction could affect some fish species, including the Pacific herring. This alignment alternative could also adversely impact the movement corridors along the west and east shores of the San Francisco Bay.

Water Resources/Wetlands
This alignment alternative has the potential to directly impact approximately 22.83 ac (9.24 ha) of wetlands. Depending on construction methods, such as trenching, the crossing could result in substantial impacts on Bay waters and wetlands.

Conservation Plans
The Trans Bay Crossing – Transbay Transit Center alignment alternative would not adversely impact areas identified in conservation plans.

Trans Bay Crossing –4th & King Alignment Alternative
Similar to the Trans Bay Crossing – Transbay Transit Center alignment alternative, the Trans Bay Crossing – 4th & King alignment alternative extends in a tube from the Oakland Inner Harbor to the City of San Francisco, crossing San Francisco Bay en route. This alignment alternative could have direct impacts on 20.07 ac (8.12 ha) of bay waters, 0.11 ac (0.04 ha) of grasslands, 1.62 ac (0.66 ha) of saline-brackish permanent wetlands, and 17.75 ac (7.18 ha) of urban/other developed lands. This alignment alternative could have indirect impacts on 1,240.83 ac (502.15 ha) of bay waters, 0.22 ac (0.09 ha) of grasslands, 1.34 ac (0.54 ha) of open waters, 44.34 ac (17.94 ha) of saline-brackish permanent wetlands, and 682.06 ac (276.02 ha) of urban/other developed lands.

Sensitive Vegetation Communities
The sensitive vegetation community in this alignment alternative is the saline-brackish permanent wetlands and eelgrass habitat.

Special-Status Plants
The Trans Bay Crossing – 4th & King alignment alternative could adversely affect the habitat of one special-status plant species, the beach layia (Table 3.15-1).

Special-Status Wildlife
This alignment alternative is not anticipated to adversely affect the habitat of special-status wildlife species or impact marine/anadromous species if the alignment is constructed in a tunnel.

Wildlife Movement Corridors
Similar to the Trans Bay Crossing-Transbay Transit Center Alignment, this alignment alternative is not anticipated to impact wildlife movement corridors if constructed as a bored tunnel. If constructed as a trench on the floor of San Francisco Bay, sediment disturbance from construction could affect some fish species, including the Pacific herring. This alignment alternative could also adversely impact the movement corridors along the west and east shores of the San Francisco Bay.

Water Resources/Wetlands
This alignment alternative has the potential to directly impact approximately 22.04 ac (8.92 ha) of wetlands. Regardless of construction methods, the crossing would still result in substantial impacts on Bay waters and wetlands.

Conservation Plans
The Trans Bay Crossing – 4th & King alignment alternative would not adversely impact areas identified in conservation plans.

Dumbarton (High Bridge, Low Bridge, and Tube) Alignment Alternative
The Dumbarton (High Bridge, Low Bridge, and Tube) alignment alternative could have direct impacts on 3.8 ac (1.54 ha) of bay waters, 6.2 ac (2.51 ha) of grasslands, 1.9 ac (0.77 ha) of oak woodland/foothill pine, 0.7 ac (0.28 ha) of open waters, 14.6 ac (5.91 ha) of saline-brackish permanent wetlands, 5.3 ac (2.14 ha) of salt flats, 4.3 ac (1.74 ha) of seasonal wetlands, 0.16 ac (0.06 ha) of shrub lands, 5.4 ac (2.19 ha) of unvegetated flats, and 70.6 ac (28.57 ha) of urban/other developed lands. This alignment alternative could have indirect impacts on 213.5 ac (86.4 ha) of bay waters, 322.0 ac (130.31 ha) of grasslands, 7.1 ac (2.87 ha) of managed bay marsh, 81.1 ac (32.82 ha) of oak and foothill pine woodlands, 59.4 ac (24.04 ha) of open waters, 599.8 ac (242.73 ha) of saline-brackish permanent wetlands, 416.1 ac (168.39 ha) of salt ponds, 138.6 ac (56.09 ha) of seasonal wetlands, 25.3 ac (10.24 ha) of shrub lands, 215.6 ac (87.25 ha) of unvegetated flats, and 3,145.5 ac (1,272.94 ha) of urban/other developed lands.

Sensitive Vegetation Communities
The sensitive vegetation communities in this alignment alternative include eelgrass habitat in the Bay and oak woodlands, riparian, permanent freshwater marsh, permanent freshwater wetlands, saline-brackish permanent, and seasonal wetlands.

Special-Status Plants
The Dumbarton (High Bridge, Low Bridge, and Tube) alignment alternative could adversely affect the habitat of 15 special-status plant species (Table 3.15-1).

Special-Status Wildlife
The Dumbarton (High Bridge, Low Bridge, and Tube) alignment alternative could adversely affect the habitat of 21 special-status wildlife species, including species of reptiles, shorebirds, and small mammals (Table 3.15-1). This alignment also has the potential to impact marine/anadromous species.

Wildlife Movement Corridors
The Dumbarton (High Bridge, Low Bridge, and Tube) alignment alternative could adversely impact the movement corridors in San Francisco Bay and along the west and east shores of the San Francisco Bay.

Water Resources/Wetlands
This alignment alternative has the potential to directly impact approximately 2,360 ft (719 m) of potential nonwetland jurisdictional waters and approximately 34 ac (13.76 ha) of wetlands. Regardless of type of construction, either bridge or tube, the crossing would still result in substantial impacts on Bay waters and wetlands.

Conservation Plans
The Dumbarton (High Bridge, Low Bridge, and Tube) alignment alternative would not adversely impact areas identified in conservation plans.

Fremont Central Park (High Bridge, Low Bridge, and Tube) Alignment Alternative
The Fremont Central Park (High Bridge, Low Bridge, and Tube) alignment alternative could have direct impacts on 4.48 ac (1.81 ha) of agricultural lands, 3.84 ac (1.55 ha) of bay lands, 3.20 ac (1.29 ha) of grasslands, 4.82 ac (1.95 ha) of open waters, 14.02 ac (5.67 ha) of saline-brackish permanent wetlands, 14.61 ac (5.91 ha) of salt flats, 3.07 ac (1.24 ha) of seasonal wetlands, 0.04 ac (0.02 ha) of shrub lands, 5.39 ac (2.18 ha) of unvegetated flats, and 53.93 ac (21.82 ha) of urban/other developed lands. This alignment alternative could have indirect impacts on 191.21 ac (77.38 ha) of agricultural lands, 213.53 ac (86.41 ha) of bay waters, 130.82 ac (52.94 ha) of grasslands, 7.10 ac (2.87 ha) of managed bay marsh, 267.81 ac (108.38 ha) of open waters, 615.21 ac (248.97 ha) of saline-brackish permanent wetlands, 903.90 ac (365.80 ha) of salt ponds, 104.39 ac (42.25 ha) of seasonal wetlands, 0.17 ac (0.07 ha) of shrub land, 215.24 ac (87.10 ha) of unvegetated flats, and 2,300.08 ac (930.81 ha) of urban/other developed lands.

Sensitive Vegetation Communities
The sensitive vegetation communities in this alignment alternative include eelgrass habitat in the Bay and oak woodlands, riparian, permanent freshwater marsh, permanent freshwater wetlands, saline-brackish permanent wetlands, and seasonal wetlands.

Special-Status Plants
The Fremont Central Park (High Bridge, Low Bridge, and Tube) alignment alternative could adversely affect the habitat of 16 special-status wildlife species (Table 3.15-1).

Special-Status Wildlife
The Fremont Central Park (High Bridge, Low Bridge, and Tube) alignment alternative could adversely affect the habitat of 23 special-status wildlife species, including species of aquatic invertebrates, amphibians, reptiles, shorebirds, and small mammals (Table 3.15-1). Species with limited habitats or ranges, such as the aquatic invertebrates, would be of special concern because of the adverse effects that even a small impact to their habitat could cause. This alignment alternative also has the potential to impact marine/anadromous species.

Wildlife Movement Corridors
The Fremont Central Park (High Bridge, Low Bridge, and Tube) alignment alternative could adversely impact the movement corridors in San Francisco Bay and along the west and east shores of the San Francisco Bay.

Water Resources/Wetlands
This alignment alternative has the potential to directly impact approximately 3,120 ft (951 m) of potential nonwetland jurisdictional waters and approximately 55.4 ac (22.42 ha) of wetlands. Similar to the Dumbarton alignment alternative, both the bridge and tube crossing would result in substantial impacts on Bay waters and wetlands.

Conservation Plans
The Fremont Central Park (High Bridge, Low Bridge, and Tube) alignment alternative would not adversely impact any areas identified in conservation plans.

Special Management Areas
The Fremont Central Park alignment alternative could adversely impact areas of the Don Edwards San Francisco Bay National Wildlife Refuge.

Summary of San Francisco Bay Crossings Impacts
Sensitive Vegetation Communities
Both of the Transbay Crossing alignment alternatives have the potential to impact Bay waters, saline-brackish permanent wetlands, and eelgrass habitat. As noted above, and if these alignment alternatives are constructed in a tunnel, impacts would likely not occur.

The sensitive vegetation communities within the Dumbarton and Freemont Central Park alignment alternatives include eelgrass, oak woodlands, riparian, permanent freshwater marsh, permanent freshwater wetlands, saline-brackish permanent, and seasonal wetlands

Special-Status Plants and Wildlife
The Trans Bay Crossing alignment alternatives could adversely affect the habitat of one special-status plant species. If either of these alignment alternatives were constructed in a tunnel, impacts on this species would likely not occur. These alignment alternatives are not anticipated to adversely affect the habitat of special-status wildlife species if constructed in a tunnel.

The Fremont Central Park alignment alternatives would have a greater direct and indirect impact to the natural areas on the east side of San Francisco Bay than the Dumbarton alignment alternatives. These natural areas include Bay lands, saline-brackish permanent wetlands, salt flats, salt ponds, and unvegetated flats. These habitats are crucial for a number of special-status plant and wildlife species that occur around the San Francisco Bay, including salt marsh harvest mouse and California clapper rail. The Fremont Central Park alignment alternatives could also adversely affect habitat for vernal pool tadpole shrimp and California tiger salamander, while the Dumbarton alignment alternatives would not.

Wildlife Movement Corridors
The Trans Bay Crossing alignment alternatives and the Dumbarton and Fremont Central Park alignment alternatives could adversely affect the wildlife movement corridors along the west and east shores of the San Francisco Bay as well as the Bay itself.

Water Resources/Wetlands
The Trans Bay Crossing – Transbay Transit Center alignment alternative has the potential to directly affect slightly more wetlands than the Trans Bay Crossing – 4^{th} & King alignment alternative. Regardless of construction methods such as trenching, either crossing could result in substantial impacts on Bay waters and wetlands.

The Freemont Central Park alignment alternative would result in higher potential impacts to Bay waters and wetlands than the Dumbarton alignment alternative.

Conservation Plans
The Trans Bay Crossing alignment alternatives and the Dumbarton and Fremont Central Park alignment alternatives are not anticipated to adversely impact any areas identified in conservation plans. Each of these alignment alternatives would be subject to BCDC requirements and be coordinated with on-going Bay planning efforts.

Special Management Areas
The Fremont Central Park alignment alternative could have negative impacts on the Don Edwards San Francisco Bay National Wildlife Refuge, while the Dumbarton alignment alternatives would not.

Central Valley Corridor

BNSF – UPRR Alignment Alternative
The BNSF – UPRR alignment alternative could have direct impacts on 190.89 ac (77.25 ha) of agricultural lands, 69.27 ac (28.03 ha) of grasslands, 2.00 ac (0.81 ha) of open waters, 0.13 ac (0.05 ha) of permanent freshwater marsh, 0.67 ac (0.27 ha) of riparian habitat, 0.20 ac (0.08 ha) of seasonal wetlands, and 262.51 ac (106.23 ha) of urban/other developed lands. This alignment could have indirect impacts on 15,115.94 ac (6,116.01 ha) of agricultural lands, 4,353.57 ac (1,761.83 ha) of grasslands, 114.42 ac (46.30 ha) of open waters, 17.88 ac (7.24 ha) of permanent freshwater wetlands, 69.75 ac (28.22 ha) of riparian habitats, 27.13 ac (10.98 ha) of seasonal wetlands, and 8,353.92 ac (3,380.73 ha) of urban/other developed lands.

Special-Status Plants
The UPRR-BNSF alignment alternative would have the potential to impact the greatest number of special-status plants. The BNSF Castle alignment alternative would have the potential to impact the least number of special-status plants.

Special-Status Wildlife
The BNSF, BNSF-UPRR, BNSF Castle, UPRR-BNSF Castle, and UPRR-BNSF alignment alternatives all have the potential to impact the same special-status wildlife species, including San Joaquin kit fox. The UPRR N/S alignment alternative is the only alignment that does not have the potential to impact the San Joaquin kit fox.

Wildlife Corridor
All of the alignment alternatives in this corridor would bisect a major linkage corridor between the natural lands of the Sacramento Valley (GEA and associated wildlife refuges) and the natural lands along the eastern side of the San Joaquin Valley.

Water Resources
This corridor has the potential to directly impact between approximately 7,160 ft (2,182 m) and 10,530 ft (3,210 m) of potential nonwetland jurisdictional waters and between approximately 2.4 ac (0.97 ha) and 3.8 ac (1.54 ha) of wetlands.

Conservation Plans
None of the alignment alternatives in this corridor is anticipated to adversely impact areas identified in conservation plans.

3.15.4 Role of Design Practices in Avoiding and Minimizing Effects

The Authority is committed to pursuing agreements with existing owners/rail operators to place the HST alignment within existing rail rights-of-way, which would avoid or minimize potential impacts on biological resources. A large percentage of the HST system would be either within or adjacent to a major existing transportation corridor (existing railroad or highway right-of-way). These existing transportation corridors, along which the HST system would be placed, have already impacted biological resources, so additional impacts would be minimized. Moreover, portions of the HST system would be on aerial structures or in tunnels. A smaller portion of the HST system would be in new at-grade rail corridors (not on aerial structure or in tunnel) and not within or adjacent to an existing transportation right-of way). It is in these areas where there would be the greatest potential to impact biological resources. To lessen the effects on biological resources at these locations, culverts would be constructed at regular intervals to allow for the movement of wildlife species, such as San Joaquin kit fox, mountain lion, and deer. The alignment alternatives located in the mountain passes would include tunnels, which would avoid or substantially reduce surface impacts on sensitive biological resources, except at the tunnel portal areas. The HST system would be placed on bridges or elevated railways across water bodies or sensitive natural communities. The new bridges would replace older bridges whenever possible, and the new bridges would use materials and designs to minimize the number of piles/columns in the water. Additionally, the HST right-of-way width could also be reduced in constrained areas to minimize impacts on biological resources.

3.15.5 Mitigation Strategies and CEQA Significance Conclusions

Constructing the proposed HST has many environmental advantages over constructing a roadway in the same corridor, including the following.

- The track-bed is constructed so that water drains away, which maintains a dry environment that prevents unwanted vegetation from establishing.

- The track-bed has a porous, stable base that prevents runoff from concentrating, which keeps erosion to a minimum and filters out particulates and chemical pollutants.
- A service road, or other narrow access strip running alongside the track-bed, prevents spoils from shifting beyond the toe of the track-bed slope.
- Drainage ditches parallel to the track-bed prevent uncontrolled erosion, act as sediment traps, filter railway runoff, and insulate adjoining lands from uncontrolled channel flow.
- HST construction usually has a significantly smaller footprint than road construction.
- HST corridors are narrower than a road, so animals are more willing to cross under them.
- It is more feasible to elevate a HST system on a pile-supported structure than to elevate a road.

However, based on the analysis above, and considering the design practices described in Section 3.15.4, each of the HST Alignment Alternatives would have significant impacts on biological resources. Direct and indirect impacts on biological resources, including wetlands and other sensitive natural communities and special-status plant and wildlife species would be expected with each alignment alternative and at some of the station location options, although the extent of the impacts differs, as described in the text and Table 3.15-1.

The HST Alignment Alternatives could also pose a significant barrier to the movement of wildlife in areas where it severs wildlife movement corridors, such as those in the East Bay to Central Valley and the San Jose to Central Valley corridors.

The HST Alignment Alternatives could also conflict with conservation and restoration plans and special management areas.

At this programmatic level of analysis, it is not possible to know precisely the location, extent, and particular characteristics of biological resources that would be affected or the precise impacts on those resources. The impacts are therefore considered significant for each alignment alternative and all but 12 of the station location options. Mitigation strategies, as well as the design practices discussed above, would be implemented to reduce the impacts.

Mitigation of potentially major impacts on biological resources would be based first on avoidance. The strategy that would be followed early in the conceptual design stage of the project would be to avoid sensitive biological resources wherever feasible. Where potential impacts on biological resources are unavoidable, the strategy would focus on reducing the potential impact.

Resource agencies have expressed interest in helping to develop and participate in a mitigation planning and monitoring program to determine impacts and mitigation effectiveness for sensitive species in the lagoon areas. This approach could include site-specific baseline conditions, monitoring mitigation effectiveness as various HST elements are constructed, and adjusting mitigation measures as needed based on effectiveness and compatibility with lagoon restoration programs.

Because specific biological resource impacts cannot be predicted with certainty at this program level of analysis, specific mitigation measures also cannot be developed at this time. However, mitigation strategies are described below from which specific mitigation measures can be developed once the extent of direct and indirect biological resource impacts has been determined at the project level.

The following mitigation strategies would be applied at the project level for potential impacts on biological resources, when such strategies where appropriate and feasible, as determined by project-level analysis.

- **Plant Communities:** Mitigation strategies for affected plant communities include construction monitoring, onsite and/or offsite revegetation/restoration, and purchase of credits from an existing mitigation bank. Mitigation ratios will vary, depending on the quality of the plant community affected and whether it provides habitat for sensitive plant or wildlife species. Regulatory agencies will be consulted to determine appropriate mitigation ratios. Onsite mitigation will be preferred to offsite mitigation whenever possible. Offsite mitigation will be located in the same watershed or in proximity to the impact area, where feasible.

- **Biological Resources Management Plans:** Biological Resources Management Plans (BRMP) specify the design and implementation of biological resources mitigation measures, including habitat replacement and revegetation, protection during construction, performance (growth) standards, maintenance criteria, and monitoring requirements. The USFWS, CDFG, and USACE will review draft BRMPs.

  The primary goal of a BRMP is to ensure the long-term perpetuation of the existing diversity of habitats in the project area and adjacent urban interface zones. BRMPs will contain the following information.

  a. Specific measures for the protection of sensitive amphibian, mammal, bird, and plant species during construction.

  b. Identification and quantification of habitats to be removed, along with the locations where these habitats are to be restored or relocated.

  c. Procedures for vegetation analyses of adjacent protected habitats to approximate their relative composition, site preparation (clearing, grading, weed eradication, soil amendment, topsoil storage), irrigation, planting (container plantings, seeding), and maintenance (weed control, irrigation system checks, replanting). This information will be used to determine the requirements of the revegetation areas.

  d. Sources of plant materials and methods of propagation.

  e. Specific parameters for the determination of the amount of replacement habitat for temporary disturbance areas.

  f. Specification of parameters for maintenance and monitoring of re-established habitats, including weed control measures, frequency of field checks, and monitoring reports for temporary disturbance areas.

  g. Specification of performance standards for growth of re-established plant communities and cut-and-fill slopes.

  h. Remedial measures to be taken if performance standards are not met.

  i. Methodologies and requirements for monitoring of the restoration/replacement efforts.

  j. Measures to preserve topsoil and control erosion control.

  k. Design of protective fencing around environmentally sensitive areas (ESAs) and the construction staging areas.

  l. Specification of location and quantities of gallinaceous guzzlers (catch basin/artificial watering structures, if needed); specification of monitoring of water levels in guzzlers.

  m. Location of trees to be protected as wildlife habitat (roosting sites) and locations for planting of replacement trees.

  n. Specification of the purpose, type, frequency, and extent of chemical use for insect and disease control operations as part of vegetative maintenance within sensitive habitat areas.

o. Specific construction monitoring programs for sensitive species.

p. Specific measures for the protection of sensitive habitats to be preserved. These measures may include (i.e., are not limited to) erosion and siltation control measures, protective fencing guidelines, dust control measures, grading techniques, construction area limits, and biological monitoring requirements.

q. Provisions for biological monitoring during construction activities to ensure compliance and success of protective measures. The monitoring procedures would (1) identify specific locations of wildlife habitat and sensitive species to be monitored, (2) identify the frequency of monitoring and the monitoring methodology (for each habitat and sensitive species to be monitored), (3) list required qualifications of biological monitor(s), and (4) identify reporting requirements.

- **Sensitive Plant Species:** Mitigation strategies for sensitive plant communities include preconstruction focused surveys, construction monitoring, relocation of plants, seed collection, plant propagation, outplanting to a suitable mitigation site, and participation in an existing HCP. Prior to construction, focused surveys will be conducted for sensitive plant species identified as occurring in the study area. Locations of sensitive plant species observed will be mapped on construction drawings. Research must be conducted on appropriate methods to use on a species-by-species basis. Some plant species may require transplantation, whereas others may germinate from seed, and still others may need to be propagated in a greenhouse prior to planting on an appropriate mitigation site. Also, see reference to BRMP, above.
- **Weed Prevention:** Specific mitigation measures will be developed to minimize or avoid the spread of weeds during construction and operation. Preventive measures during construction include identification of areas with existing weed problems and measures to control traffic moving out of those areas (e.g., cleaning construction vehicles, limiting movement of fill). Mitigation for operational impacts would also be developed.
- **Sensitive Wildlife Species:** Mitigation strategies for sensitive wildlife species include preconstruction focused surveys, construction monitoring, restoration of suitable breeding and foraging habitat, purchase of credits from an existing mitigation bank, and participation in an existing HCP. Prior to construction, focused surveys will be conducted for sensitive wildlife species identified as occurring in the study area. Locations of sensitive wildlife species observed will be mapped on construction drawings. Construction could be phased around the breeding season for sensitive wildlife species. Also, see reference to BRMP, above.
- **Wildlife Movement/Migration Corridors:** Wildlife crossings would be of a design, shape, and size to be sufficiently attractive to encourage wildlife use. Overcrossings and undercrossings for wildlife would be appropriately vegetated to afford cover and other species requirements. Functional corridors would be established to provide connectivity to protected land zoned for uses that provide wildlife permeability. The following process would be used in design of corridors:
  - Identify the habitat areas the corridor is designed to connect.
  - Select several species of interest from the species present in these areas.
  - Evaluate the relevant needs of each selected species.
  - For each potential corridor, evaluate how the area will accommodate movement by each selected species.
  - Draw the corridors on a map.
  - Design a monitoring program.
- **Jurisdictional Waters and Wetlands:** The amount of mitigation required will be assessed on an acreage basis, with ratios depending on the nature and condition of the jurisdictional areas

located in the impact areas. When appropriate, onsite mitigation will be preferred. Offsite mitigation will be located in the same watershed or as close to the area of impact as possible. Mitigation options for unavoidable impacts on state and federal jurisdictional waters will include onsite or offsite restoration, creation, or enhancement; mitigation banking; or in-lieu fee payments, as described below.

- Restoration—To return degraded habitat to a preexisting condition.
- Creation—To convert a persistent nonwetland habitat into wetland (or other aquatic) habitat. The created habitat may be self-sustaining or dependent on artificial irrigation.
- Enhancement—To increase one or more functions through activities, such as planting or eradicating nonnative vegetation.
- Passive Revegetation—To allow a disturbed area to naturally revegetate without plantings.
- Mitigation banking—To purchase units of wetland or waters habitat that have been restored or enhanced in a larger managed conservation area. The units are typically known as *credits* and are usually sold on an acreage basis.
- In-Lieu Fee Program—A monetary payment made to an agency-approved entity that provides habitat conservation or restoration. For instance, the Nature Conservancy may receive in-lieu fee payments for impacts in all watersheds.

Current federal and state policy emphasizes a "no net loss" of wetlands habitats policy, which is usually achieved through restoration of areas subject to temporary impacts or creation of wetlands to offset permanent impacts. However, the January 27, 2003, Special Public Notice for Mitigation and Monitoring Guidelines states that the USACE favors the use of approved mitigation banks or in-lieu fee programs in cases where they result in more regional or watershed benefit than onsite compensatory mitigation. Approved mitigation and in-lieu fee programs would include measures that ensure the no net loss of wetlands policy is met.

Site-specific impacts would need to be assessed and evaluated in a project-level environmental review, and specific mitigation measures for impacts on biological resources would be considered, such as preparing a wetland delineation; compensating for impacts on wetlands; conducting protocol-level surveys for listed species, surveys for nesting birds, and species-specific surveys; and compensating for temporary and permanent impacts on listed species. Site-specific mitigation measures will be developed through consultation with state and federally resource agencies. During project-level review, where the agencies determine that mitigation is required to address site-specific impacts from the HST system, one strategy may be to purchase easements to preserve habitat for sensitive biological resources. The Authority will coordinate with private land preservation trusts, local programs, and mitigation banks to help identify needs for habitat protection. The Authority will also coordinate with resource agencies to identify additional measures to limit impacts on, or otherwise protect, biological resources.

The feasibility of any mitigation strategy would have to be evaluated at the project-specific level and would depend on such factors as an assessment of the habitat impacted, the number of voluntary participants in local or regional programs, and the cost of acquiring easements. Possible mitigation strategies for severance of wildlife movement corridors could include alternative access, HST realignment, or overcrossings at select locations.

The above mitigation strategies are expected to substantially lessen or avoid impacts on biological resources in many circumstances. Sufficient information is not available at this programmatic level, however, to conclude with certainty that the above mitigation strategies will reduce impacts on biological resources to a less-than-significant level in all circumstances. This document, therefore, concludes that impacts on biological resources would remain significant, even with the application of mitigation strategies. Additional environmental assessment will allow a more precise evaluation in the second-tier project-level analysis.

As indicated earlier, the above analysis does not provide a parcel-specific potential impact analysis for impacts on biological resources. Subsequent project-level analysis would address local issues once the potential alignment alternatives are defined in more detail. Subsequent project-level environmental documentation would include more detailed information on existing habitat conditions, the presence/absence of special-status plant and wildlife species, the presence of sensitive natural communities, and the acreage of wetlands affected.

In order to address the impacts of the project on the unique assemblage of migratory birds, sensitive species, wetlands and habitat values within the approximately 240,000 ac (97,125 ha) designated as the GEA, this Final EIR/EIS indicates that certain measures are necessary to mitigate impacts identified at the program-level and the Authority would commit to the measures listed below in its decision documents. These measures have also been developed to address the following goals:

- Satisfy the future requirements of the resource agencies (e.g., USFWS, CDFG, and USACE) at the project level to offset impacts to wetlands, sensitive plant and animal species, and other biological resources in and around the GEA;
- Anticipate future pressures for growth in and around the GEA and provide a mechanism to prevent further impacts by forestalling that growth and preserving the habitat and scenic open space values in and around the GEA; and
- Provide assurance that project-level impacts on the GEA will be evaluated at the appropriate level of detail in the project-level EIR/EIS.

The following specific measures are necessary to mitigate program level impacts:

a. An appropriate field survey of biological resources within areas of the GEA directly affected by proposed HST tracks or facilities, including San Joaquin kit fox, giant garter snake and important waterfowl nesting and breeding habitat to be included in the project-level environmental analysis.

b. Project-level evaluation of the potential impacts to biological resources in the GEA from HST construction, operation and maintenance, including, but not limited to, ecosystem fragmentation impacts, impacts to wildlife movement corridors, impacts to waterfowl flight patterns, noise impacts, startle and vibration impacts, collision impacts, electrocution impacts, glare impacts, water quality and water flow impacts, impacts on waterfowl nesting and breeding, impacts on migratory habits, impacts from construction traffic, impacts of equipment storage and laydown areas, impacts from blasting and pile-driving, and impacts from temporary disruption of water supply deliveries.

c. Minimize the footprint of necessary HST facilities to the extent feasible in the HST alignment crossing the GEA.

d. In consultation with the CDFG, the USFWS, and the Grassland Water District, an evaluation in the project-level environmental analysis of the timing of construction activities within the GEA and measures to minimize disturbance during nesting and flooding seasons.

e. In consultation with the CDFG, the USFWS, and the Grassland Water District, an evaluation in the project level environmental analysis of non-glare and directed lighting and appropriate measures to avoid disturbance impacts to sensitive species in areas of the GEA directly affected by proposed HST facilities.

f. Acquisition from willing sellers by the Authority, or by other entities designated and supported by the Authority, of agricultural, conservation and/or open space easements encompassing at least 10,000 ac (4,047 ha) and generally located along or in the vicinity of the HST alignment and within or adjacent to the designated GEA. This measure would reduce impacts to and support conservation of wetlands and sensitive ecological areas, as well as limit urban encroachment in the vicinity of the HST through the GEA. The focus for these easements would be in areas undergoing development pressures, such as the areas around Los Banos and Volta, and/or areas that would be most appropriate for ecological conservation or restoration. The eventual locations and total acreage for these easements would be determined in conjunction with the project-level environmental analysis and decisions addressing the Gilroy to Merced portion of the HST system and in consultation with the CDFG, the USFWS, and the Grassland Water District.

3.17 Cumulative Analysis

3.17.1 Purpose and Content of This Section

The purpose of this section is to summarize the potential cumulative physical and growth-related environmental consequences associated with the HST Network Alternatives.[1] The analysis focuses on regional scenarios and programmatic estimates of potential impacts; therefore, the magnitude of impacts reported in this document is likely to be considerably larger than the actual impacts that would be expected from the HST system in the study area.

Refer to Chapter 3, "Affected Environment, Environmental Consequences, and Mitigation Strategies," and Chapter 7, "High-Speed Train Network and Alignment Alternatives Comparisons," for a presentation of potential environmental consequences in each environmental resource area.

This section is organized into the following sections:

- Regulatory requirements and methods of evaluation.
- Cumulative projects and growth projections.
- Analysis of cumulative impacts by environmental resource area.

3.17.2 Regulatory Requirements and Methods of Evaluation

A. REGULATORY REQUIREMENTS

National Environmental Policy Act (NEPA)

Under NEPA, a cumulative impact is the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR § 1508.7).

A cumulative impact includes the total effect on a natural resource, ecosystem, or human community attributable to past, present, or reasonably foreseeable future activities or actions of federal, nonfederal, public, and private entities. Cumulative impacts also may include the effects of natural processes and events, depending on the specific resource in question. Cumulative impacts include the total of all impacts on a particular resource that have occurred, are occurring, and will likely occur as a result of any action or influence, including the direct and indirect impacts of a federal activity. Accordingly, there may be different levels of cumulative impacts on different environmental resources.

California Environmental Quality Act (CEQA)

Under CEQA, cumulative impacts are defined as two or more individual effects that, when considered together, are considerable or compound or increase other environmental impacts. The cumulative impact from several projects is the change in the environment that results from the incremental impact of the project when added to other closely related past, present, and reasonably foreseeable probable future projects. Cumulative impacts can result from individually minor but collectively significant projects taking place over a period of time (State CEQA Guidelines Section 15355).

[1] See Section 3.0, Introduction, for an explanation of how this section fits together with the HST Network Alternatives presented in Chapter 7, as well as for an overview of the information presented in the other chapters.

A project's contribution to a cumulative impact may be considered less than significant if it is implementing a plan or program designed to avoid the cumulative impact (State CEQA Guidelines Section 15064[h]) or if it will implement or fund its fair share of a mitigation measure designed to alleviate the cumulative impact (State CEQA Guidelines Section 15130[a]).

Under CEQA, the discussion of cumulative impacts should reflect the severity of the impacts and their likelihood of occurrence, but the discussion may be less detailed than the analysis of the project's individual effects. The discussion should be guided by the standards of practicality and reasonableness and should focus on the cumulative impact to which the identified other projects contribute, rather than the attributes of the other projects that do not contribute to the cumulative impact (State CEQA Guidelines Section 15130[b]).

As further defined under State CEQA Guidelines Section 15130(b), the following elements are necessary in an adequate discussion of significant cumulative impacts:

(1) Either:

  (A) A list of past, present, future, and probably future projects producing related or cumulative impacts, including, if necessary, those projects outside the control of the agency, or

  (B) A summary of projections contained in an adopted general plan or related planning document, or in a prior environmental document which has been adopted or certified, which described or evaluated regional or areawide conditions contributing to the cumulative impact. Any such planning document shall be referenced and made available to the public at a location specified by the lead agency.

(2) When utilizing a list, factors to consider when determining whether to include a related project should include the nature of each environmental resource being examined, the location of the project and its type.

(3) Lead agencies should define a geographic scope of the area affected by the cumulative effect and provide a reasonable explanation for the geographic limitation used.

(4) A summary of the expected environmental effects to be produced by those projects with specific reference to additional information stating where that information is available; and

(5) A reasonable analysis of the cumulative impacts of the relevant projects. An EIR shall examine reasonable, feasible options for mitigating or avoiding the project's contribution to any significant cumulative effects.

Both CEQA and NEPA allow the scope of a cumulative impact analysis to be limited through the use of tiering (40 CFR 1508.28, State CEQA Guidelines 15130). Tiering can be used when cumulative impacts have been addressed adequately in a previous document certified for a programmatic plan and the current project is consistent with the plan. The statewide program EIS/EIR evaluated cumulative impacts using a list of major projects for consideration in the cumulative impact analysis. Although the statewide program EIS/EIR analysis helped identify cumulative projects for this project, the cumulative analysis contained herein is not tiered off the previous statewide document because it is also programmatic and relates just to the Bay Area to Central Valley study area. This section includes an analysis of cumulative impacts resulting from transportation, land use, redevelopment, and other projects that have the potential to affect similar resources in the vicinity of the proposed project.

B. METHODS OF EVALUATION OF IMPACTS

Because of the broad regional nature of the proposed HST project and the programmatic nature of this document, the cumulative impact analysis uses both the list and projections approach to evaluate potential cumulative impacts of the project. The discussion below identifies the methods employed to identify the cumulative scenario.

The cumulative projects list incorporates reasonably foreseeable, relevant projects and focuses on those that, when combined with the proposed HST Network Alternatives, could contribute to cumulative impacts. Projects considered in the cumulative impacts analysis were identified through (1) telephone conversations with respective city planners and engineers and (2) review of projects identified under applicable Bay Area and Central Valley regional transportation improvement plans (RTIP) as part of the State Transportation Improvement Plan (STIP). Based on information provided by the local jurisdictions and the STIP, the cumulative projects list was prepared; the list identifies projects in the same geographic area as the proposed HST project, including projects for which development is underway, for which applications have been filed, or that have recently been approved but not yet constructed. The following criteria were used to narrow the list of projects considered in the analysis:

- Projects that are under active consideration.
- Projects that have recently completed or are in some active stage of completing project-level environmental documentation.
- Projects that would be completed or operational within the timeframe being considered for the HST project and in the same vicinity.
- Projects in proximity and of a size/scale that, in combination with the HST Network Alternatives, have the potential to affect the same resources.

To consider the cumulative scenario relative to planned development not identified under the cumulative projects list, projections for population, employment, and urbanization were used.

In accordance with State CEQA Guidelines (Section 15130[b]), the analysis of cumulative effects is qualitative. Both cumulative impacts associated with future projects and future regional growth are identified. The cumulative projects are discussed in detail in Appendix 3.17-A, and growth inducement and indirect effects from growth are described in Chapter 5, "Economic Growth and Related Impacts."

3.17.3 Cumulative Projects and Growth Forecasts

A. CUMULATIVE PROJECTS LIST

The HST Network Alternatives represent different ways to implement the HST system between the Bay Area and Central Valley along combinations of HST Alignment Alternatives and station location options (refer to Chapter 7, "High-Speed Train Network and Alignment Alternatives Comparisons"). The HST system would continue outside the study area to the major metropolitan areas in the state, as described in the statewide program EIR/EIS (Authority and FRA November 2005). The network alternatives are grouped into three route options: Altamont Pass, Pacheco Pass, and Pacheco Pass with Altamont Pass (local service). The following route options contain 21 network alternatives:

Altamont Pass Network Alternatives	Pacheco Pass Network Alternatives	Pacheco Pass with Altamont Pass (local service) Network Alternatives
• San Francisco & San Jose Termini • Oakland & San Jose Termini • San Francisco, Oakland & San Jose Termini • San Jose Terminus • San Francisco Terminus • Oakland Terminus • Union City Terminus • San Francisco & San Jose—via San Francisco Peninsula • San Francisco, San Jose, Oakland—no Bay Crossing • Oakland & San Francisco—via Transbay Tube • San Jose, Oakland, & San Francisco—via Transbay Tube	• San Francisco & San Jose Termini • Oakland & San Jose Termini • San Francisco, Oakland, & San Jose Termini • San Jose Terminus • San Jose, San Francisco & Oakland—via Transbay Tube • San Jose, Oakland & San Francisco—via Transbay Tube	• San Francisco & San Jose Termini • Oakland & San Jose Termini • San Francisco, Oakland, & San Jose Termini (without Dumbarton Bridge) • San Jose Terminus

The cumulative projects included in this analysis are those that are either close to the HST Network Alternatives or of a size/scale that could affect regional resources. One of the major projects currently underway is the San Francisco Bay Area Regional Rail Plan (Plan) being prepared by the MTC, BART, Caltrain, and the Authority. The Regional Rail Plan will look at improvements and extensions of railroad, rapid transit, and high-speed rail services for the near term (5–10 years), intermediate term (10–25 years), and long term (beyond 25 years). Given the close coordination between the two projects, their similar nature, and in some cases the same rights-of-way and stations, the Plan is discussed below. Other cumulative projects are discussed in detail in Appendix 3.17-A. This information represents the most up-to-date and accurate information available as of the date of publication of this document.

Table 3.17-1 summarizes the locations of the cumulative projects relative to the HST Network Alternatives. The locations of the cumulative projects in relation to the HST Network Alternatives are also illustrated in Figure 3.17-1.

Regional Rail Plan for the San Francisco Bay Area

The MTC, BART, Caltrain, and the Authority, along with a coalition of rail passenger and freight operators, prepared the Regional Rail Plan for the San Francisco Bay Area per the specifications of Regional Measure 2 (RM2), approved in 2004. RM2 specified and provided funding for the preparation of a comprehensive master plan for Bay Area rail (MTC 2007). The Plan completed the unfinished work of the 1957 Rail Plan and addressed new opportunities. The Plan also established a long-range vision to create a Bay Area rail network that addresses the anticipated growth in transportation demand and meets that demand. The Plan examined ways to incorporate expanded passenger train services into existing rail systems, improve connections to other trains and transit, expand the regional rapid transit network, increase rail capacity, coordinate rail investment around

Key

AA San Francisco Bay Regional Rail Plan (see Figure 3.17-2)
A South Hayward BART/Mission Boulevard Concept Design Plan
B Hayward Cannery Area Development Plan
C Avenue 64 Apartments Project
D Bay Street Site B
E Christie Park Towers
F Redevelopment of Amtrak Station in Emeryville
G Marketplace Expansion Project
H Powell Undercrossing Project
J Infrastructure Improvements
K Proposed Retail Center
L Proposed Retail Center (2)
M State Route 99/233 Interchange
O Chowchilla Other Projects
P El Rancho San Benito
Q Transbay Program-Transbay Transit Center
R Redevelopment Plan for the Transbay Redevelopment Project Area
S Visitacion Valley/Schlage Lock Master Plan
T Redwood City Downtown Precise Plan
U Millbrae Station Area Specific Plan
V San Carlos
W San Bruno
X Central Core Redevelopment Project
Y Salida Community Plan
Z Modesto Redevelopment Area Master Plan
1 Modesto Condominium Complex
2 Turlock Northwest Triangle Specific Plan
3 Turlock Southeast Area Feasibility Study
4 UC Merced
5 Campus Parkway
6 University Community Plan
7 Capitol Corridor South Hayward Rail Improvements
STP-1 Union City Intermodal Station
STP-2 Emeryville Intermodal Transfer Station Parking
STP-3 Madera Gateway & UPRR Bike/Pedestrian UC
STP-4 Caltrans Madera Amtrak Station Relocation
STP-5 4th Street Widening, City of Madera
STP-6 Robertson Boulevard Improvements (Palm Parkway to 15th Street), Chowchilla
STP-7 Caltrain Downtown Extension to Transbay Terminal
STP-8 BART Seismic Retrofit (Embarcadero, 16th St, SF station platforms)
STP-9 US 101 Aux Lanes from 3rd Avenue San mateo to Millbrae Avenue, Millbrae
STP-10 Capitol Corridor-San Jose-Santa Clara Fourth Main
STP-11 Sunnyvale - Borregas Avenue Bike/pedestrian Bridges
STP-12 Passing Lanes - Near Gilroy (State Route 152 Expressway)
STP-13 Truck Climbing Lanes - Near Gilroy (State Route 152 Expressway)
STP-14 State Route 152/SR-156 Interchange Improvements
STP-15 Sunol Grade Southbound HOV Lane Phase 3
STP-16 Tilton and Poplar Grade Separations in San Mateo
STP-17 US 101/Willow Road Interchange Reconstruction
STP-18 US 101 Auxiliary Lanes - Santa Clara Co. Line to San Mateo County
STP-19 Stockton ACE Northwest Track Connection
STP-20 Tracy Downtown Multimodal Station
STP-21 Lathrop Road Grade Separation with UPRR
STP-22 San Joaquin Regional Rail Commission - Stockton Southern Pacific Depot Restoration
STP-23 BART Oakland Airport Connector
STP-24 Virgina Corridor Rails to Trails in Modesto
STP-25 State Route 132 Expressway
STP-26 State Route 132 East Infill Project
STP-27 State Route 152 Los Banos Bypass

Legend

Projects
NOTE: Project Locations are approximate
Proposed Alignment (March 2007)

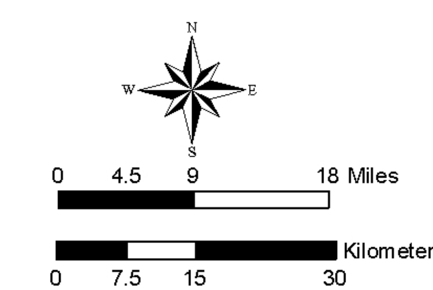


Figure 3.17-1
Cumulative Projects

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Table 3.17-1. Cumulative Projects Associated with HST Network Alternatives

Cumulative Project Code	Cumulative Project	Altamont Pass Network Alternatives: San Francisco & San Jose Termini	Altamont: Oakland & San Jose Termini	Altamont: San Francisco, Oakland & San Jose Termini	Altamont: San Jose Terminus	Altamont: San Francisco Terminus	Altamont: Oakland Terminus	Altamont: Union City Terminus	Altamont: San Francisco & San Jose - via SF Peninsula	Altamont: San Francisco, San Jose, Oakland – no Bay Crossing	Altamont: Oakland & San Francisco – via Transbay Tube	Altamont: San Jose, Oakland, & San Francisco via Transbay Tube	Pacheco Pass Network Alternatives: San Francisco & San Jose Termini	Pacheco: Oakland & San Jose Termini	Pacheco: San Francisco, Oakland, & San Jose Termini	Pacheco: San Jose Terminus	Pacheco: San Jose, San Francisco & Oakland-via Transbay Tube	Pacheco: San Jose, Oakland & San Francisco-via Transbay Tube	Pacheco Pass with Altamont Pass (local service): San Francisco & San Jose Termini	Pacheco with Altamont: Oakland & San Jose Termini	Pacheco with Altamont: SF, Oak, & SJ Termini (without Dumbarton Bridge)	Pacheco with Altamont: San Jose Terminus
AA	San Francisco Bay Area Regional Rail Plan	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
A	South Hayward BART/Mission Blvd. Concept Design Plan		X	X			X			X	X	X		X	X			X		X	X	
B	Hayward Cannery Area Development Plan		X	X			X			X	X	X		X	X			X		X	X	
C	Avenue 64 Apartments Project		X	X			X			X	X	X		X	X			X		X	X	
D	Bay Street Site B		X	X			X			X	X	X		X	X			X		X	X	
E	Christie Park Towers		X	X			X			X	X	X		X	X			X		X	X	
F	Redevelopment of Amtrak Station in Emeryville		X	X			X			X	X	X		X	X			X		X	X	
G	Marketplace Expansion Project		X	X			X			X	X	X		X	X			X		X	X	
H	Powell Undercrossing Project		X	X			X			X	X	X		X	X			X		X	X	
I	Inter-Modal Station Passenger Rail Project		X	X			X	X		X	X	X		X	X			X		X	X	
J	UPRR Infrastructure Improvements - Madera	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
K	Proposed Retail Center	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
L	Proposed Retail Center (2)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
M	State Route 99/233 Interchange	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
O	Chowchilla Other Projects	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
P	El Rancho San Benito												X	X	X	X	X	X	X	X	X	X
Q	Transbay Program-Transbay Transit Center	X		X		X			X	X	X	X	X		X		X	X	X		X	
R	Redevelopment Plan for the Transbay Redevelopment Project Area	X		X		X			X	X	X	X	X		X		X	X	X		X	
S	Visitacion Valley/Schlage Lock Master Plan	X		X		X			X	X			X		X		X		X		X	
T	Redwood City Downtown Precise Plan	X	X	X	X	X	X	X	X	X	X	X	X		X		X		X		X	
U	Millbrae Station Area Specific Plan	X	X	X	X	X	X	X	X	X	X	X	X		X		X				X	
V	San Carlos	X	X	X	X	X	X	X	X	X	X	X	X		X		X		X		X	
W	San Bruno	X	X	X	X	X	X	X	X	X	X	X	X		X		X		X		X	
X	Central Core Redevelopment Project	X	X	X	X	X	X	X	X	X	X	X	X				X		X		X	
Y	Salida Community Plan	X	X	X	X	X	X	X	X	X	X	X							X	X	X	X
Z	Modesto Redevelopment Area Master Plan	X	X	X	X	X	X	X	X	X	X	X							X	X	X	X
1	Modesto Condominium Complex	X	X	X	X	X	X	X	X	X	X	X							X	X	X	X
2	Turlock Northwest Triangle Specific Plan	X	X	X	X	X	X	X	X	X	X	X							X	X	X	X
3	Turlock Southeast Area Feasibility Study	X	X	X	X	X	X	X	X	X	X	X							X	X	X	X
4	UC Merced	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5	Campus Expressway	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
6	Capitol Corridor South Hayward Rail Improvements		X	X			X			X	X	X		X	X			X		X	X	
7	Merced County University Community Plan	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Table 3.17-1. Continued

Cumulative Project Code	Cumulative Project	Altamont Pass Network Alternatives											Pacheco Pass Network Alternatives						Pacheco Pass with Altamont Pass (local service)			
		San Francisco & San Jose Termini	Oakland & San Jose Termini	San Francisco, Oakland & San Jose Termini	San Jose Terminus	San Francisco Terminus	Oakland Terminus	Union City Terminus	San Francisco & San Jose - via SF Peninsula	San Francisco, San Jose, Oakland – no Bay Crossing	Oakland & San Francisco – via Transbay Tube	San Jose, Oakland, & San Francisco via Transbay Tube	San Francisco & San Jose Termini	Oakland & San Jose Termini	San Francisco, Oakland, & San Jose Termini	San Jose Terminus	San Jose, San Francisco & Oakland-via Transbay Tube	San Jose, Oakland & San Francisco-via Transbay Tube	San Francisco & San Jose Termini	Oakland & San Jose Termini	SF, Oak, & SJ Termini (without Dumbarton Bridge)	San Jose Terminus
STP-1	Union City Intermodal Station		X	X			X	X		X	X	X		X	X			X		X	X	
STP-2	Emeryville Intermodal Transfer Station Parking		X	X			X			X	X	X		X	X			X		X	X	
STP-3	Madera Gateway & UPRR Bike/Pedestrian UC	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
STP-4	Caltrans Madera Amtrak Station Relocation	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
STP-5	4th Street Widening, City of Madera	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
STP-6	Robertson Boulevard Improvements (Palm Parkway to 15th Street), Chowchilla	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
STP-7	Caltrain Downtown Extension to Transbay Transit Center	X		X		X		X	X			X										
STP-8	BART Seismic Retrofit (Embarcadero, 16th St, SF station platforms)	X		X		X		X	X			X										
STP-9	US 101 Aux Lanes from 3rd Avenue San mateo to Millbrae Avenue, Millbrae	X		X		X		X	X			X										
STP-10	Capitol Corridor-San Jose-Santa Clara Fourth Main	X	X	X	X				X	X		X	X	X	X	X	X	X	X	X	X	X
STP-11	Sunnyvale - Borregas Avenue Bike/pedestrian Bridges								X	X			X		X		X		X		X	
STP-12	Passing Lanes - Near Gilroy (State Route 152 Expressway)												X	X	X	X	X	X	X	X	X	X
STP-13	Truck Climbing Lanes - Near Gilroy (State Route 152 Expressway)												X	X	X	X	X	X	X	X	X	X
STP-14	State Route 152/SR-156 Interchange Improvements												X	X	X	X	X	X	X	X	X	X
STP-15	Sunol Grade Southbound HOV Lane Phase 3	X	X	X	X					X		X		X	X			X		X	X	X
STP-16	Tilton and Poplar Grade Separations in San Mateo	X		X		X			X	X			X		X		X		X		X	
STP-17	US 101/Willow Road Interchange Reconstruction	X		X		X			X	X			X		X		X		X		X	
STP-18	US 101 Auxiliary Lanes – Santa Clara Co. Line to San Mateo County								X	X			X		X		X		X		X	
STP-19	Stockton ACE Northwest Track Connection	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
STP-20	Tracy Downtown Multimodal Station	X																				
STP-21	Lathrop Road Grade Separation with UPRR	X																				
STP-22	San Joaquin Regional Rail Commission – Stockton Southern Pacific Depot Restoration	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
STP-23	BART Oakland Airport Connector		X	X			X			X	X	X		X	X			X		X	X	
STP-24	Virginia Corridor Rails to Trails in Modesto	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
STP-25	State Route 132 Expressway	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
STP-26	State Route 132 East Infill Project	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
STP-27	State Route 152 Los Banos Bypass Project												X	X	X	X	X	X	X	X	X	X

transit-friendly communities and businesses, and identify functional and institutional consolidation opportunities. The plan also included a detailed analysis of potential high-speed rail routes between the Bay Area and the Central Valley that are consistent with the HST Network Alternatives in this environmental document. As noted above, the Plan looked at improvements for the near term, intermediate term, and long term. The Plan's network and services are intended to:

- Address the combined challenges of moving people and goods.
- Link people with commercial, employment, and residential centers.
- Expand capacity for goods movements to support the regional economy.
- Serve as the backbone of an integrated regional transit network with seamless connections at key transit hubs to local transit services.
- Accommodate development of statewide high-speed rail and enable operation of regional services along high-speed lines, and vice-versa.
- Include policies and incentives to encourage local governments to create well-designed, walkable communities with a mix of services near transit.
- Explore a governance structure that can develop regional system improvements and deliver coordinated, customer-oriented services.

Core Elements
There are five core elements of the Plan:

- BART.
- Railroad-based regional passenger services, e.g., Capitol Corridor, Caltrain, ACE, etc.
- High-Speed Rail.
- Accommodation of increased rail freight movements attributable to economic growth.
- Long-term land use, including the impact of "smart growth" policies.

Following full technical analysis of alternatives, the study will designate the most promising systemwide alternatives, both for scenarios without high-speed rail and for scenarios that include high-speed rail from either the east (Altamont Pass) or south (Pacheco Pass).

Evaluation of systemwide alternatives will consider travel performance, cost, and impacts for two horizon years (2030 and 2040/50). Corridor-level evaluation and phasing considerations will distinguish the Year 2030 plan from the Year 2050 plan; the Year 2030 plan would be developed from the Resolution 3434 network.[2] The Plan base case or No Project Alternative includes the existing financially constrained MTC RTP and the ten rail extensions (as well as service improvements to ACE, Caltrain, and the Capitol Corridor) identified in MTC Resolution 3434. The ten rail extensions identified in MTC's Resolution 3434 are:

1. BART/East Contra Costa Rail (eBART)
2. ACE Increased Services
3. BART/I-580 Rail Right-of-Way Preservation
4. Dumbarton Bridge Rail Service
5. BART/Fremont–Warm Springs to San Jose Extension

[2] For more information please see the MTC website at: www.mtc.ca.gov

6. Caltrain/Rapid Rail/Electrification & Extension to Downtown San Francisco/Transbay Transit Center
7. Caltrain Express Service
8. SMART (Sonoma-Marin Rail)
9. Capitol Corridor/Increased Services
10. BART/Oakland Airport Connector

Themes and Alternatives
Different themes for each of the five major Plan elements are explored in the Plan and systemwide alternatives:

High-Speed Rail—Regional Rail Overlay
The study of high-speed rail in the Plan is consistent with the HST Network Alternatives described in this Draft Program EIR/EIS. As the HST system involves major infrastructure investment, the Plan identified and evaluated options for providing overlay services (use of the HST infrastructure for regional rail service with additional investments in facilities and compatible rolling stock).

Regional overlay operations on HST lines could provide service to additional local stations along the HST lines. Such local stops typically would be developed as four-track sections with a pair of outside platforms for regional trains and two express tracks (no platforms) in the center. The extent of the four-track sections would depend on the prevailing speed of the line for statewide service as well as the spacing and location of the local stops. The regional overlay services would be operated with compatible equipment, but the average speeds and overall travel times would be greater than the HST because of the additional stops. As additional investment would be necessary to provide the infrastructure for such regional overlay services, these additional regional services need to be evaluated for cost-effectiveness.

BART
The following three themes are considered for expansion of BART:

1. BART is extended and expanded beyond the Resolution 3434 base case to become a system providing regional service throughout the Bay Area counties similar to the original BART plan.
2. BART is not extended, but infill stations are constructed and service is concentrated to provide mass transit service in dense areas with express service and/or skip-stop service being used to provide adequate travel times for longer length trips.
3. The BART system remains largely as is with improvements focused on core capacity needs; alternative technologies are used to extend coverage except where short extensions of the BART technology would provide the most beneficial solution.

Railroad-Based Passenger Services
Different levels of improvement to passenger rail services along existing conventional rail lines are explored. At the highest level of improvement, infrastructure would be similar to the HST infrastructure. With HST implementation, overlay service in the HST corridors would substitute for the railroad-based passenger service. High, low, and hybrid themes are explored for passenger rail services:

1. High: existing conventional rail lines are upgraded ultimately to provide 115 mph (185 kph) service operating throughout the region on separate electrified grade-separated trackage along principal line segments; passenger service is withdrawn from existing freight tracks along principal lines, thereby improving capacity for goods movement.

2. Low: appropriate capacity and operational improvements, including signaling, passing tracks and/or multi-tracking and route alignments, are constructed along shared lines to accommodate the projected increases in combined passenger and freight demand in shared freight/passenger corridors using FRA-compliant equipment with higher speeds. With HST implementation, the HST would be on separate trackage without an overlay service.
3. Hybrid: a combined strategy is pursued in which an appropriate vehicle technology and infrastructure solution is selected on a corridor-by-corridor basis, considering adjacent corridors and other systems (e.g., BART and the HST) so that a consistent, workable systemwide plan results.

Freight
Different scenarios for freight movements are considered including maintaining existing practices with some improvements to accommodate traffic growth. A second scenario considers a coordinated and optimized operation of freight and passenger trains with infrastructure improvements. A third scenario considers consolidating portions of the regional rail network under public ownership and controlling from a consolidated passenger–freight dispatch center with major infrastructure improvements and rerouting of freight traffic.

Land Use
The Plan considers the linkage between land use and transportation in a framework for Plan implementation and explores three significantly different development patterns:

1. Urban Infill "Core" Development—Concentration of growth in existing urban areas by focusing growth on vacant or underutilized lands.
2. Urban-Suburban "Hub and Spoke" Development—Combination of urban infill and continued suburbanization along spokes of residential-intensive communities surrounding the inner Bay Area.
3. Regional "Web" Development—Growth of outlying areas serving clusters of employment and housing tied to local industry geography.

Principal Corridors
The Plan study area was divided into geographically distinct corridors connecting major population centers that also reflect the logic of rail infrastructure. Within the overall Plan study area bounded by Cloverdale and Auburn to the northwest and northeast and by Monterey and Merced to the southwest and southeast are 12 distinct transportation corridors (Figure 3.17-2):

1. BART System (all lines)
2. US 101 North Corridor (Marin – Sonoma)
3. North Bay Corridor (Marin – Sonoma)
4. I-80 Corridor (Auburn – Oakland)
5. East Bay Corridor (Oakland – San Jose)
6. Transbay Corridor (San Francisco – Oakland)
7. Peninsula Corridor (San Francisco – San Jose)
8. South Counties Corridor (Santa Cruz , Monterey, San Benito)
9. Dumbarton Corridor (Redwood City – Union City)
10. I-680 & Tri-Valley Corridor (Contra Costa & Southern Alameda)
11. Central Valley Corridor (Sacramento – Merced)

12. Grade Crossings and Grade Separations (all lines)

San Francisco Bay Area Regional Rail Plan Conclusions
This Regional Rail Plan Revised Draft Report was prepared in response to input received from the public. In August 2007, a series of regional rail workshops were held to solicit input on a Draft Summary Report of the Regional Rail Plan, which was first presented and reviewed by a steering committee in July 2007. A final report of the Regional Rail Plan for the San Francisco Bay Area was prepared and was adopted by MTC in September 2007. The final report includes a "Regional Rail Vision" and has three scenario outcomes: 1) without High-Speed Rail; 2) with High-Speed Rail via Altamont Pass; and 3) with High-Speed Rail via Pacheco Pass. For each of these three outcomes, improvements were recommended for the 12 corridors.

Regional Rail Vision
The executive summary of the final Regional Rail Plan presents the Regional Rail Vision as follows (pg ES-3):

- Ring the Bay with Rail: A long-term vision of many in the region is to ring the Bay, connecting the three major Bay Area cities (San Francisco, Oakland, and San Jose), with fast, frequent and integrated passenger rail network.
- The Right Technology Should Be Used With the Right Corridor: A broad range of rail technologies, including BART and conventional passenger trains like Amtrak, are considered in this plan. Emerging technologies such as non-Federal Railroad Administration compliant Electric Multiple Unit (EMU) trains are also explored.
- The BART & Caltrain Systems Are the Backbone: The BART and Caltrain systems serve as the backbone of the regional rail network and it is clear there will be capacity constraints and renovation needs for the existing systems. This reinvestment should be a top regional priority over the next few decades.
- The BART System's Outward Expansion Is Nearly Complete: While BART will always remain at the core of the region's rail system, its outward expansion potential is limited. Once the extension to San Jose is completed, and the existing lines are brought to logical terminals in Livermore, Santa Clara, and East Contra Costa County, no additional outward extensions of the BART technology are contemplated. Higher-speed express trains would better serve outlying suburban markets. Instead, BART will evolve toward a higher-frequency, highly productive metro system.
- The Bay Area Needs a Regional Rail Network: As the BART system becomes more of a high-frequency, close stop spacing urban subway system, it needs to be complemented with a larger regional express network serving longer-distance trips. These trains would run largely on existing tracks, some shared with freight and others in their own rights-of-way with specialized signaling and dispatch systems.
- Rail Infrastructure Must Be Expanded to Accommodate Growth in Passenger and Freight Traffic: To allow the region's economy to continue growing while meeting increased passenger needs, the freight and passenger rail systems must be increasingly accommodated. Certain freight corridors require additional mainline tracks to support high-frequency freight and passenger services.
- High-Speed Rail Provides Opportunities to Enhance and Accelerate Regional Rail Improvements: High-speed rail complements and supports the development of regional rail—a statewide high-speed train network would enable the operation of fast, frequent regional services along the high-speed lines and should provide additional and accelerated funding where high-speed and regional lines are present in the same corridor.

Study Corridors

LEGEND:

1 US 101 North Corridor (Marin ↔ Sonoma)
2 I-80 Corridor (Auburn ↔ Oakland)
3 North Bay Corridor (Marin ↔ Solano)
4 Peninsula Corridor (San Francisco ↔ San Jose)
5 South Counties Corridor (Santa Cruz, Monterey, San Benito)
6 East Bay Corridor (Oakland ↔ San Jose)
7 Transbay Corridor (San Francisco ↔ Oakland)
8 Dumbarton Corridor (Redwood City ↔ Union City)
9 Central Valley Corridor (Sacramento ↔ Merced)
10 I-680 and Tri-Valley Corridor (Contra Costa & Southern Alameda)

Not Shown:

BART System (all lines)

Grade Crossings and Grade Separations (all lines)

Source: Regional Rail Plan for the San Francisco Bay Area, September 2007.

U.S. Department of Transportation
Federal Railroad Administration

Figure 3.17-2
Regional Rail Plan Corridors Map

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Regional Rail without High-Speed Rail
The Plan for Regional Rail without High-Speed Rail includes:

- BART: Improve core capacity, implement Resolution 3434 extensions; extend BART to Livermore; construct fourth track through Oakland; develop infill stations; increase capacity; and in the longer term pursue a second Bay crossing (between San Francisco and Oakland).
- US 101 North: Implement non-electric SMART project (in the early years with 30-minute headways).
- North Bay: Corridor preservation and consideration of standard non-electric rail services.
- I-80 & East Bay: Expand East Bay non-electric standard rail network from San Jose to Sacramento to three tracks with some four-track sections.
- Transbay: Provide near-term investments in BART Core Capacity (higher-capacity cars, improved signaling, etc.); in the long term, provide new transbay tube and San Francisco BART Line paired with rail tunnel.
- South Counties: Extend non-electric conventional rail service to Salinas, with further expansion to provide rail connections to Monterey and Santa Cruz.
- Peninsula: Expand Caltrain to three or four tracks and operate with lightweight electric multiple-unit equipment.
- Dumbarton: In the near term, implement service between Union City and Redwood City with standard railroad equipment; in the long term, develop separate passenger-only trackage from Redwood City to Union City to support lightweight equipment compatible with Caltrain Peninsula operations.
- Tri-Valley/I680: Add trackage to support improved non-electric conventional passenger service along the ACE rail corridor and to accommodate regional freight trains for approximate 100-minute operating time between Stockton and San Jose. Develop regional bus options in the I-680 corridor.
- Central Valley: Provide a non-electric conventional regional corridor service between Sacramento and Merced over the long term, interlined with ACE services and complimenting the San Joaquin long haul trains.

The estimated total capital cost of the Regional Rail Plan is about $45 billion (2006 dollars). Funding for Regional Rail investments beyond current Resolution 3434 commitments will likely come from multiple sources, including federal, state, regional, local, and public/private partnerships, and other sources.

Regional Rail with High-Speed Rail
The Plan analysis identified numerous opportunities to operate regional "overlay" services across high-speed lines within northern California. Implementation of these services would require provision of four tracks at the regional stations as well as approaching and departing the regional stations. Regardless of which Altamont or Pacheco alignment alternatives would be developed, an initial phase of investment would be on the San Francisco Peninsula between San Jose and San Francisco to make the Caltrain corridor "high-speed rail ready" for operation as a grade-separated, higher speed alignment suitable for use of electric, multiple-unit equipment. The Plan with HST is very similar to the Plan without HST, except that HST would provide a higher level of service and additional and accelerated funding where HST and regional rail lines are in the same corridor.

The Plan concluded that both the Altamont Pass and Pacheco Pass alignments have similar total costs, and that to accommodate regional services on HST infrastructure would add about $1 billion. The Plan states, "if either Altamont or Pacheco were selected as the sole option, 4-track sections would be needed at regional stations as well as approaching and departing regional stops. These

During the construction mobilization phase, the contractor would set up construction yards to receive equipment and products, prepare sources (i.e. quarries and borrow pits) for aggregate and embankment materials, and cut pioneer roads as necessary to reach remote work sites (e.g., tunnel portals and shafts, bridge piers). The contractor would also remove or relocate any conflicting improvements (buildings, utilities, roads, track) that remain on the right-of-way.

Heavy Civil Construction

Construction of the high speed rail system would reshape a strip of land 40 to 100 ft wide to create a trackbed meeting the system's horizontal and vertical alignment requirements. (The width of the strip of land would be greater at special locations such as passenger stations or vehicle maintenance facilities.) The trackbed would be grade separated—meaning that other facilities, such as existing or future roads, tracks, or cattle paths, would cross the alignment above or below the high speed rail tracks. Where the terrain is too severe, or the crossing roadways and other tracks too numerous, bridges or tunnels would carry the trackbed over or under the terrain.

Reshape the earth means that the contractor would remove the existing vegetation and topsoil, excavate farther down (below the topsoil), or bring in embankment material and construct engineered fill as necessary to reach the design subgrade elevation, and cap the subgrade with compacted crushed aggregate subballast. The contractor would construct drainage ditches or subdrains on either side of the alignment. The contractor would also construct discharges from the ditches and subdrains at appropriate points.

In any of these grade separation cases, the contractor would build grade separation structures and roadwork or trackwork on or though the structures during the heavy civil construction phase. If the structure carries the high speed rail alignment over the crossing road or track, the structure would be constructed prior to the trackbed. If the structure carries the crossing road or track over the high speed rail alignment, the structure could be constructed either before or after the trackbed. Grade separation construction would sometimes include the modification of existing or construction of new traffic signal systems.

To construct a grade separation bridge, the contractor would remove the existing vegetation and topsoil under the future structure, construct foundations under piers and bridge abutments, construct piers and abutments, construct the bridge superstructure (girders and deck), and install finish elements such as approach slabs, metal railings, or solid concrete parapets. The foundations and superstructure types for any bridge would be selected in the design phase based on site-specific conditions from menus of likely foundations and superstructures. The foundation menu includes:

- Spread footings.
- Driven or drilled piling covered with a pile cap.
- Cast-in-drilled-hole (CIDH) piers.

The superstructure menu includes:

- Steel or precast concrete girders supporting a deck slab.
- A cast-in-place or precast concrete box with a deck slab integrated into the main girder.

Precast concrete girders would also be prestressed; cast-in-place concrete boxes may be prestressed or reinforced without prestress.

4 COSTS AND OPERATIONS

4.1 INTRODUCTION

This chapter summarizes the estimated capital and operations and maintenance (O&M) costs for each HST Alignment Alternative evaluated in this Program EIR/EIS.

4.2 CAPITAL COSTS

Capital costs for HST Alignment Alternatives and station location options were estimated in 2006 dollars. The costs are associated with HST-related infrastructure improvements and do not include the costs associated with the No Project Alternative. The programmed and funded improvements included under the No Project Alternative are assumed to have been implemented by 2020, regardless of proposed HST implementation.

Capital costs were estimated for all proposed HST Alignment Alternatives and station location options evaluated in this Program EIR/EIS (Tables 4.2-1 and 4.2-2). Costs also were aggregated for each representative network alternative, as identified in Chapter 2 and compared in Chapter 7. Some alignments (horizontal and vertical) and station configurations previously considered have evolved since preparation of the statewide program EIR/EIS, and therefore costs also have changed. The proposed alignment alternatives and station location options selected in this program review would be further evaluated at the project level to identify cost savings through application of value engineering practices.

The capital costs are representative of all aspects of implementation of the proposed HST system, including construction, right-of-way, environmental mitigation, and design and management services. The construction costs include procurement and installation of line infrastructure (e.g., tracks, bridges, tunnels, grade separations, and power distribution); facilities (e.g., passenger stations and storage and maintenance facilities); systems (e.g., communications and train control); and removal or relocation of existing infrastructure (e.g., utilities and rail tracks). The right-of-way costs include the estimated costs to acquire properties needed for construction of the HST infrastructure. The environmental mitigation costs include a rough estimate of the proportion of the capital cost required for mitigating environmental impacts, based on similar completed highway and rail line construction projects. No specific mitigation costs are identified at this program level of review. Agency costs associated with administration of the program (e.g., design, environmental review, and management) are estimated in terms of add-on percentages to construction costs.

The estimated total capital costs for each individual alignment alternative are presented in Appendix 4-A. The individual station location costs are presented in Appendix 4-B.

Table 4.2-1
High-Speed Train Alignment Alternatives Capital Cost (in 2006 dollars), Including Contingencies and Program Implementation Cost

Alignment Alternative by Corridor and Segment	Length		Average Cost (in dollars)		Cost (in dollars)
	Km	Miles	Per Km	Per Mile	
San Francisco to San Jose Corridor: Caltrain					
San Francisco to Dumbarton	**44.58**	**27.70**	**49,175,138**	**79,139,713**	**2,192,227,640**
Transbay Transit Center to 4th/Townsend (Caltrain 1)	2.50	1.55	159,522,378	256,726,381	398,805,944
4th/Townsend to Millbrae/SFO (Caltrain 2)	22.58	14.03	45,352,477	72,987,737	1,024,058,938
Millbrae/SFO to Redwood City (Caltrain 3)	18.75	11.65	37,489,586	60,333,640	702,929,734
Redwood City to Caltrain (Caltrain 4)	0.75	0.47	88,577,366	142,551,453	66,433,025
Dumbarton to San Jose	**34.40**	**21.38**	**39,358,880**	**63,341,977**	**1,353,945,475**
Caltrain Dumbarton Wye (Caltrain 5)	1.62	1.01	24,593,435	39,579,297	39,865,958
Dumbarton Wye to Palo Alto (Caltrain 6)	5.23	3.25	49,783,239	80,118,357	260,316,558
Palo Alto to Santa Clara (Caltrain 7)	22.55	14.01	26,212,143	42,184,355	591,083,820
Santa Clara to Diridon Station (Caltrain 8)	5.00	3.11	92,535,828	148,921,979	462,679,139
Station Location Options					
Transbay Transit Center (Terminal Option)					786,262,418
4th and King (Caltrain) (Terminal Option)					791,939,278
Millbrae/SFO					29,076,600
Redwood City (Caltrain)					67,516,558
Palo Alto (Caltrain)					67,516,558
Oakland to San Jose Corridor: Niles/I-880					
West Oakland to Niles Junction	**44.64**	**27.74**	**35,744,748**	**57,525,595**	**1,595,717,028**
West Oakland to Jack London Square (Niles/I-880 1A)	6.72	4.18	77,055,201	124,008,325	517,810,948
Jack London Square to Oakland Coliseum (Niles/I-880 2)	3.95	2.45	55,088,733	88,656,721	217,600,493
Oakland Coliseum to Union City (BART) (Niles/I-880 3A)	10.52	6.54	76,504,832	123,122,593	804,983,844
Union City (BART) to Niles Junction (Niles/I-880 4A)	23.45	14.57	2,359,136	3,796,662	55,321,742
12th Street/City Center to Niles Junction	**43.02**	**26.73**	**34,949,176**	**56,245,246**	**1,503,583,436**
12th Street/City Center to Jack London Square (Niles/I-880 1B)	5.10	3.17	83,466,148	134,325,745	425,677,356
Jack London Square to Oakland Coliseum (Niles/I-880 2)	3.95	2.45	55,088,733	88,656,721	217,600,493
Oakland Coliseum to Union City (BART) (Niles/I-880 3A)	10.52	6.54	76,504,832	123,122,593	804,983,844

Alignment Alternative by Corridor and Segment	Length		Average Cost (in dollars)		Cost (in dollars)
	Km	Miles	Per Km	Per Mile	
Union City (BART) to Niles Junction (Niles/I-880 4A)	23.45	14.57	2,359,136	3,796,662	55,321,742
Niles Junction to San Jose via Trimble (Structure)	**27.43**	**17.04**	**66,893,831**	**107,655,186**	**1,834,964,679**
Niles Junction to Niles Wye (S) (Niles/I-880 5A)	3.65	2.27	45,726,749	73,590,069	166,902,634
Niles Wye (S) to Warm Springs (Niles/I-880 5B)	8.45	5.25	16,691,618	26,862,555	141,044,170
Warm Springs to Trimble Rd (Niles/I-880 6)	2.33	1.45	214,189,581	344,704,717	499,275,914
Trimble Rd. Option (Structure) (Niles/I-880 7B)	8.00	4.97	70,632,853	113,672,558	565,062,822
Santa Clara to Diridon Station (Caltrain 8)	5.00	3.11	92,535,828	148,921,979	462,679,139
Niles Junction to San Jose via Trimble (Tunnel)	**29.95**	**18.61**	**65,132,060**	**104,819,890**	**1,950,900,589**
Niles Junction to Niles Wye (S) (Niles/I-880 5A)	3.65	2.27	45,726,749	73,590,069	166,902,634
Niles Wye (S) to Warm Springs (Niles/I-880 5B)	8.45	5.25	16,691,618	26,862,555	141,044,170
Warm Springs to Trimble Rd (Niles/I-880 6)	2.33	1.45	214,189,581	344,704,717	499,275,914
Trimble Rd. Option (Tunnel) (Niles/I-880 7B)	10.52	6.54	64,721,415	104,159,021	680,998,732
Santa Clara to Diridon Station (Caltrain 8)	5.00	3.11	92,535,828	148,921,979	462,679,139
Niles Junction to San Jose via I-880	**26.10**	**16.22**	**48,553,043**	**78,138,548**	**1,267,234,412**
Niles Junction to Niles Wye (S) (Niles/I-880 5A)	3.65	2.27	45,726,749	73,590,069	166,902,634
Niles Wye (S) to Warm Springs (Niles/I-880 5B)	8.45	5.25	16,691,618	26,862,555	141,044,170
Warm Springs to Trimble Rd (Niles/I-880 6)	2.33	1.45	214,189,581	344,704,717	499,275,914
I-880—Trimble Rd. to Diridon (Niles/I-880 7A)	11.67	7.25	39,421,689	63,443,059	460,011,694
Niles Junction to Altamont	**13.13**	**8.16**	**55,263,716**	**88,938,329**	**725,723,114**
Niles Junction to Niles Wye (S) (Niles/Dumbarton XN)	4.25	2.64	35,018,018	56,356,037	148,966,648
Niles Wye (S) to Warm Springs (Niles/Dumbarton XS)	8.88	5.52	64,964,684	104,550,525	576,756,466
Station Location Options					
West Oakland/7th Street					611,197,055
12th Street/City Center					611,197,055
Coliseum/Airport					61,735,853
Union City (Bart)					69,853,070
Fremont (Warm Springs)					156,875,180

Alignment Alternative by Corridor and Segment	Length		Average Cost (in dollars)		Cost (in dollars)
	Km	Miles	Per Km	Per Mile	
San Jose to Central Valley Corridor: Pacheco Pass					
Pacheco	**92.50**	**57.48**	**38,800,727**	**62,443,717**	**3,589,067,255**
Diridon to Morgan Hill (Pacheco 1)	32.50	20.19	20,366,713	32,777,047	661,918,165
Morgan Hill to Gilroy (Pacheco 2)	16.00	9.94	23,730,117	38,189,921	379,681,864
Gilroy to San Luis Reservoir (Pacheco 3)	44.00	27.34	57,896,982	93,176,161	2,547,467,226
Henry Miller (UPRR Connection)	**100.89**	**62.69**	**13,489,349**	**21,709,003**	**1,360,872,958**
San Luis Reservoir to Valley Floor (Pacheco 4)	15.45	9.60	27,554,846	44,345,226	425,722,369
Western Valley to Henry Miller UP Wye (HM-1)	58.05	36.07	10,870,134	17,493,785	630,967,784
Henry Miller UP North Wye to UP South Wye (HM-2)	8.19	5.09	11,200,428	18,025,342	91,720,307
Henry Miller Wye North to UPRR (HM/UP-XN)	11.25	6.99	11,845,555	19,063,573	133,262,493
Henry Miller Wye South to UPRR (HM/UP-XS)	7.95	4.94	9,962,265	16,032,711	79,200,005
Henry Miller (BNSF Connection)	**104.70**	**65.06**	**13,324,586**	**21,443,843**	**1,395,030,861**
San Luis Reservoir to Valley Floor (Pacheco 4)	15.45	9.60	27,554,846	44,345,226	425,722,369
Western Valley to Henry Miller UP Wye (HM-1)	58.05	36.07	10,870,134	17,493,785	630,967,784
Henry Miller UP North Wye to UP South Wye (HM-2)	8.19	5.09	11,200,428	18,025,342	91,720,307
Henry Miller UP South Wye to BNSF Wyes (HM-3)	4.62	2.87	11,920,369	19,183,975	55,012,505
Henry Miller Wye North to BNSF (HM/BN-XN)	8.70	5.40	13,137,656	21,143,007	114,245,054
Henry Miller Wye South to BNSF (HM/BN-XS)	9.70	6.03	7,975,551	12,835,405	77,362,843
GEA North	**80.25**	**49.87**	**16,775,455**	**26,997,477**	**1,346,230,241**
San Luis Reservoir to Atwater Wye (GEA-1A)	47.70	29.64	12,125,069	19,513,408	578,365,814
GEA Wye to Atwater (GEA-1B)	9.30	5.78	7,483,268	12,043,153	69,594,395
GEA Wye to Arena (SR-99) (GEA XN-1)	10.85	6.74	13,768,794	22,158,725	149,350,104
Arena (SR-99) to Ballico West (GEA XN-2)	8.57	5.33	10,530,597	16,947,353	90,247,214
Arena (SR-99) to Ballico North (GEA XN-3)	9.40	5.84	22,965,148	36,958,823	215,941,283
GEA Atwater Wye South to Merced UP (GEA-UPRR XS)	11.10	6.90	27,186,344	43,752,180	301,768,423
Station Location Options					
San Jose (Diridon)					185,051,790
Morgan Hill (Caltrain)					284,985,295
Gilroy (Caltrain)					148,256,045

Alignment Alternative by Corridor and Segment	Length		Average Cost (in dollars)		Cost (in dollars)
	Km	Miles	Per Km	Per Mile	
East Bay to Central Valley Corridor: Altamont Pass					
I-680/580/UPRR	**49.43**	**30.71**	**48,015,427**	**77,273,339**	**2,373,258,499**
Niles Canyon to Sunol (UPRR-2A/2B)	6.27	3.90	99,895,152	160,765,663	626,342,602
Sunol to Dublin/Pleasanton BART (I-680/580/UPRR-1)	11.72	7.28	43,125,032	69,403,012	505,382,254
Dublin/Pleasanton BART to El Charo Road (I-680/580/UPRR-2)	4.09	2.54	37,877,905	60,958,579	154,996,386
El Charo Road to Livermore (I-580) (I-680/580/UPRR-3)	5.32	3.31	37,708,288	60,685,606	200,608,090
Livermore (I-580) to Greenville (I-680/580/UPRR-4)	8.11	5.04	36,480,045	58,708,941	295,853,163
Greenville to Altamont Pass (I-680/580/UPRR-5)	8.66	5.38	61,995,084	99,771,416	536,567,450
Altamont Pass to County Line (UPRR-9)	5.26	3.27	10,170,795	16,368,308	53,508,554
I-580/UPRR	**43.96**	**27.32**	**45,493,874**	**73,215,293**	**1,999,973,946**
Niles Canyon to Sunol (UPRR-2A/2B)	6.27	3.90	99,895,152	160,765,663	626,342,602
Sunol to Pleasanton (UPRR-3)	3.30	2.05	44,840,606	72,163,960	147,876,695
Pleasanton to El Charo (UPRR-4)	2.59	1.61	26,405,269	42,495,161	68,510,055
UPRR to I-580 Connector (Pleasanton X)	4.45	2.77	15,878,585	25,554,105	70,707,337
El Charo Road to Livermore (I-580) (I-680/580/UPRR-3)	5.32	3.31	37,708,288	60,685,606	200,608,090
Livermore (I-580) to Greenville (I-680/580/UPRR-4)	8.11	5.04	36,480,045	58,708,941	295,853,163
Greenville to Altamont Pass (I-680/580/UPRR-5)	8.66	5.38	61,995,084	99,771,416	536,567,450
Altamont Pass to County Line (UPRR-9)	5.26	3.27	10,170,795	16,368,308	53,508,554
Patterson Pass/UPRR	**41.19**	**25.60**	**41,847,512**	**67,347,043**	**1,723,804,068**
Niles Canyon to Sunol (UPRR-2A/2B)	6.27	3.90	99,895,152	160,765,663	626,342,602
Sunol to Pleasanton (UPRR-3)	3.30	2.05	44,840,606	72,163,960	147,876,695
Pleasanton to El Charo (UPRR-4)	2.59	1.61	26,405,269	42,495,161	68,510,055
El Charo to Livermore (UPRR-5)	6.41	3.98	7,350,429	11,829,368	47,082,729
Livermore to Patterson Pass cut off (UPRR-6)	3.55	2.21	20,957,133	33,727,236	74,412,071
Patterson Pass	19.07	11.85	39,822,791	64,088,570	759,579,915
UPRR	**41.62**	**25.86**	**40,377,726**	**64,981,651**	**1,680,501,168**
Niles Canyon to Sunol (UPRR-2A/2B)	6.27	3.90	99,895,152	160,765,663	626,342,602
Sunol to Pleasanton (UPRR-3)	3.30	2.05	44,840,606	72,163,960	147,876,695
Pleasanton to El Charo (UPRR-4)	2.59	1.61	26,405,269	42,495,161	68,510,055
El Charo to Livermore (UPRR-5)	6.41	3.98	7,350,429	11,829,368	47,082,729

Alignment Alternative by Corridor and Segment	Length		Average Cost (in dollars)		Cost (in dollars)
	Km	Miles	Per Km	Per Mile	
Livermore to Patterson Pass cutoff (UPRR-6)	3.55	2.21	20,957,133	33,727,236	74,412,071
Patterson Pass cut off to Greenville (UPRR-7)	2.99	1.86	18,265,628	29,395,678	54,614,227
Greenville to Altamont Pass (UPRR-8)	11.25	6.99	54,058,154	86,998,166	608,154,234
Altamont Pass to County Line (UPRR-9)	5.26	3.27	10,170,795	16,368,308	53,508,554
Tracy Downtown (BNSF Connection)	**86.22**	**53.58**	**17,787,134**	**28,625,617**	**1,533,677,808**
County Line to Tracy Downtown (UPRR-10)	12.84	7.98	23,802,574	38,306,529	305,553,641
Tracy Downtown to I-205 (UPRR-11	7.34	4.56	15,988,833	25,731,533	117,358,035
I-205 to S. UPPRR (UPRR-12)	8.31	5.16	14,955,715	24,068,890	124,281,993
I-205 to Lathrop—Northern (UPRR-13)	13.14	8.16	18,113,361	29,150,629	238,009,562
Southwestern Manteca (MC-1)	1.46	0.91	27,687,372	44,558,506	40,340,501
Southeastern Manteca (MC-2)	1.83	1.14	25,102,875	40,399,161	45,963,364
Northern Escaton Wye to BNSF (MC-5)	4.30	2.67	23,422,722	37,695,217	100,717,704
Southern Escaton Wye to BNSF (part 1) (MC-6)	22.84	14.19	8,972,327	14,439,561	204,945,893
Southern Escaton Wye to BNSF (part 2) (MC-7)	14.17	8.80	25,164,616	40,498,524	356,507,116
Tracy ACE Station (BNSF Connection)	**86.87**	**53.98**	**18,877,113**	**30,379,768**	**1,639,835,922**
County Line to South of Tracy (S UPRR-1)	2.09	1.30	13,128,290	21,127,935	27,398,741
South of Tracy to Tracy ACE Station (S UPRR-2)	15.51	9.64	25,499,265	41,037,089	395,493,599
Tracy ACE Station to I-205 (S UPRR-3)	7.14	4.44	11,856,678	19,081,474	84,656,684
I-205 to Southeast of Manteca (S UPRR-4)	6.46	4.02	15,269,787	24,574,340	98,673,364
I-205 to Lathrop—Southern (S UPRR-5)	11.07	6.88	25,750,831	41,441,946	285,138,957
Southwestern Manteca (MC-1)	1.46	0.91	27,687,372	44,558,506	40,340,501
Southeastern Manteca (MC-2)	1.83	1.14	25,102,875	40,399,161	45,963,364
Northern Escaton Wye to BNSF (MC-5)	4.30	2.67	23,422,722	37,695,217	100,717,704
Southern Escaton Wye to BNSF (part 1) (MC-6)	22.84	14.19	8,972,327	14,439,561	204,945,893
Southern Escaton Wye to BNSF (part 2) (MC-7)	14.17	8.80	25,164,616	40,498,524	356,507,116
Tracy ACE Station (UPRR Connection)	**47.93**	**29.78**	**29,956,447**	**48,210,228**	**1,435,902,370**
County Line to South of Tracy (S UPRR-1)	2.09	1.30	13,128,290	21,127,935	27,398,741
South of Tracy to Tracy ACE Station (S UPRR-2)	15.51	9.64	25,499,265	41,037,089	395,493,599
Tracy ACE Station to I-205 (S UPRR-3)	7.14	4.44	11,856,678	19,081,474	84,656,684
I-205 to Southeast of Manteca (S UPRR-4)	6.46	4.02	15,269,787	24,574,340	98,673,364

Alignment Alternative by Corridor and Segment	Length		Average Cost (in dollars)		Cost (in dollars)
	Km	Miles	Per Km	Per Mile	
Southwestern Manteca (MC-1)	1.46	0.91	27,687,372	44,558,506	40,340,501
Southeastern Manteca (MC-2)	1.83	1.14	25,102,875	40,399,161	45,963,364
Eastern Manteca UPRR South to BNSF (MC-3)	9.17	5.70	74,962,364	120,640,230	687,254,951
Manteca to Escaton Wye (MC-4)	4.28	2.66	13,118,552	21,112,263	56,121,166
Tracy Downtown (UPRR Connection)	**58.36**	**36.26**	**27,670,588**	**44,531,495**	**1,614,883,212**
County Line to Tracy Downtown (UPRR-10)	12.84	7.98	23,802,574	38,306,529	305,553,641
Tracy Downtown to I-205 (UPRR-11)	7.34	4.56	15,988,833	25,731,533	117,358,035
I-205 to S. UPPRR (UPRR-12)	8.31	5.16	14,955,715	24,068,890	124,281,993
I-205 to Lathrop—Northern (UPRR-13)	13.14	8.16	18,113,361	29,150,629	238,009,562
Southwestern Manteca (MC-1)	1.46	0.91	27,687,372	44,558,506	40,340,501
Southeastern Manteca (MC-2)	1.83	1.14	25,102,875	40,399,161	45,963,364
Eastern Manteca UPRR South to BNSF (MC-3)	9.17	5.70	74,962,364	120,640,230	687,254,951
Manteca to Escaton Wye (MC-4)	4.28	2.66	13,118,552	21,112,263	56,121,166
East Bay Connections	**13.13**	**8.16**	**55,263,716**	**88,938,329**	**725,723,114**
Niles to Union City—Niles Wye (E) to Niles Wye (N) (Dumbarton/Niles XN)	4.25	2.64	35,018,018	56,356,037	148,966,648
Niles to Fremont—Niles Wye (E) to Niles Wye (S) (Dumbarton/Niles XS)	8.88	5.52	64,964,684	104,550,525	576,756,466
Station Location Options					
Pleasanton (I-680/Bernal Rd)					72,639,578
Pleasanton (BART)					316,675,328
Livermore (Downtown-At Grade)					73,297,263
Livermore (Downtown-Aerial)					314,667,658
Livermore (I-580)					151,769,468
Livermore (Greenville Road/UPRR)					72,639,578
Livermore (Greenville Road/I-580)					160,180,913
Tracy (Downtown)					310,150,400
Tracy (ACE)					314,667,658

Alignment Alternative by Corridor and Segment	Length		Average Cost (in dollars)		Cost (in dollars)
	Km	Miles	Per Km	Per Mile	
San Francisco Bay Crossings Corridor					
Transbay Crossing—Transbay Transit Center	**11.71**	**7.28**	**338,317,199**	**544,468,754**	**3,961,694,398**
Transbay Transit Center tube to SF Bay (TB-1)	2.48	1.54	252,855,279	406,931,126	627,081,091
SF Bay to West Oakland (TB-3)	9.23	5.74	361,279,882	581,423,610	$3,334,613,307
Transbay Crossing—4th & King	**11.06**	**6.87**	**343,054,247**	**552,092,294**	**3,794,179,969**
4th/Townsend tube to SF Bay (TB-2)	1.83	1.14	251,129,323	404,153,470	459,566,662
SF Bay to West Oakland (TB-3)	9.23	5.74	361,279,882	581,423,610	3,334,613,307
Dumbarton (High Bridge)	**30.67**	**19.06**	**63,990,228**	**102,982,290**	**1,962,452,322**
Dumbarton Wye North to Caltrain (Dumbarton-XN)	2.20	1.37	73,361,640	118,064,116	161,395,609
Dumbarton Wye South to Caltrain (Dumbarton-XS)	0.96	0.60	13,082,432	21,054,134	12,559,135
Dumbarton Bay Crossing to Don Edwards (Dumbarton-1 [High Bridge])	10.01	6.22	88,615,763	142,613,246	886,866,552
Dumbarton Bay Crossing to Don Edwards (Dumbarton-2 [High Bridge])	13.00	8.08	60,644,584	97,597,998	788,379,595
Shinn to Niles Canyon (UPRR-1)	4.50	2.80	25,166,985	40,502,336	113,251,431
Dumbarton (Low Bridge)	**32.21**	**20.01**	**47,523,861**	**76,482,241**	**1,530,743,565**
Dumbarton Wye North to Caltrain (Dumbarton-XN)	2.20	1.37	73,361,640	118,064,116	161,395,609
Dumbarton Wye South to Caltrain (Dumbarton-XS)	0.96	0.60	13,082,432	21,054,134	12,559,135
Dumbarton Bay Crossing to Don Edwards (Dumbarton-1 [Low Bridge])	11.55	7.18	53,574,758	86,220,216	618,788,460
Dumbarton Bay Crossing to Don Edwards (Dumbarton-2 [Low Bridge])	13.00	8.08	48,057,610	77,341,226	624,748,930
Shinn to Niles Canyon (UPRR-1)	4.50	2.80	25,166,985	40,502,336	113,251,431
Dumbarton (Tube)	**30.67**	19.06	**75,782,552**	**121,960,196**	**2,324,099,311**
Dumbarton Wye North to Caltrain (Dumbarton-XN)	2.20	1.37	73,361,640	118,064,116	161,395,609
Dumbarton Wye South to Caltrain (Dumbarton-XS)	0.96	0.60	13,082,432	21,054,134	12,559,135
Dumbarton Bay Crossing to Don Edwards (Dumbarton-1 [Tube])	10.01	6.22	100,498,996	161,737,456	1,005,793,953
Dumbarton Bay Crossing to Don Edwards (Dumbarton-2 [Tube])	13.00	8.08	79,315,322	127,645,637	1,031,099,183
Shinn to Niles Canyon (UPRR-1)	4.50	2.80	25,166,985	40,502,336	113,251,431
Fremont Central Park (High Bridge)	**32.36**	**20.11**	**84,449,717**	**135,908,645**	**2,732,623,930**
Dumbarton Wye North to Caltrain (Dumbarton-XN)	2.20	1.37	73,361,640	118,064,116	161,395,609
Dumbarton Wye South to Caltrain (Dumbarton-XS)	0.96	0.60	13,082,432	21,054,134	12,559,135

Alignment Alternative by Corridor and Segment	Length		Average Cost (in dollars)		Cost (in dollars)
	Km	Miles	Per Km	Per Mile	
Dumbarton Bay Crossing to Don Edwards (Dumbarton-1 [High Bridge])	10.01	6.22	88,615,763	142,613,246	886,866,552
Fremont Central Park (Fremont Central Park [High Bridge])	19.19	11.92	87,118,428	140,203,519	1,671,802,634
Fremont Central Park (Low Bridge)	**34.94**	**21.71**	**64,246,458**	**103,394,652**	**2,244,771,247**
Dumbarton Wye North to Caltrain (Dumbarton-XN)	2.20	1.37	73,361,640	118,064,116	161,395,609
Dumbarton Wye South to Caltrain (Dumbarton-XS)	0.96	0.60	13,082,432	21,054,134	12,559,135
Dumbarton Bay Crossing to Don Edwards (Dumbarton-1 [Low Bridge])	11.55	7.18	53,574,758	86,220,216	618,788,460
Fremont Central Park (Fremont Central Park [Low Bridge])	20.23	12.57	71,775,978	115,512,240	1,452,028,043
Fremont Central Park (Tube)	**34.94**	**21.71**	**88,556,605**	**142,518,041**	**3,093,990,660**
Dumbarton Wye North to Caltrain (Dumbarton-XN)	2.20	1.37	73,361,640	118,064,116	161,395,609
Dumbarton Wye South to Caltrain (Dumbarton-XS)	0.96	0.60	13,082,432	21,054,134	12,559,135
Dumbarton Bay Crossing to Don Edwards (Dumbarton-1)	10.01	6.22	100,498,996	161,737,456	1,005,793,953
Don Edwards to Niles Wye (E) via Fremont Central Park (Fremont Central Park [Tube])	21.77	13.53	87,930,269	141,510,051	1,914,241,964
Station Location Option					
Union City (Shinn)					310,150,400
Central Valley Corridor					
BNSF—UPRR	**149.65**	**92.99**	**15,891,685**	**25,575,188**	**2,378,190,686**
North Stockton South to UPRR Connection (BNSF N/S-1)	17.50	10.87	8,362,619	13,458,330	146,345,827
BNSF Parallel to UPRR Tracks (BNSF N/S-2)	3.50	2.17	8,090,264	13,020,018	28,315,925
Parallel tracks South through Escaton (BNSF N/S-3)	13.55	8.42	13,929,771	22,417,794	188,748,403
Escaton South to Amtrak Briggsmore (BNSF N/S-4)	13.85	8.61	18,871,199	30,370,251	261,366,107
Amtrak Briggsmore to UPRR/BNSF Connection (BNSF N/S-5)	39.85	24.76	15,645,491	25,178,977	623,472,816
UPRR/BNSF Connection to Atwater (BNSF N/S-6)	6.30	3.91	16,322,332	26,268,248	102,830,695
Atwater to Downtown Merced (BNSF N/S-7)	17.00	10.56	25,661,185	41,297,674	436,240,142
Merced South to BNSF Connection (BNSF N/S-8)	4.75	2.95	32,162,740	51,760,913	152,773,015
BNSF Connection South to Henry Miller Wye (BNSF N/S-9)	17.45	10.84	8,686,037	13,978,822	151,571,352
BNSF Henry Miller Wye (BNSF N/S-10)	15.90	9.88	18,020,529	29,001,230	286,526,405
BNSF	**161.55**	**100.38**	**15,203,210**	**24,467,194**	**2,456,078,506**
North Stockton South to UPRR Connection (BNSF N/S-1)	17.50	10.87	8,362,619	13,458,330	146,345,827
BNSF Parallel to UPRR tracks (BNSF N/S-2)	3.50	2.17	8,090,264	13,020,018	28,315,925

Alignment Alternative by Corridor and Segment	Length		Average Cost (in dollars)		Cost (in dollars)
	Km	Miles	Per Km	Per Mile	
Parallel tracks South through Escaton (BNSF N/S-3)	13.55	8.42	13,929,771	22,417,794	188,748,403
Escaton South to Amtrak Briggsmore (BNSF N/S-4)	13.85	8.61	18,871,199	30,370,251	261,366,107
Amtrak Briggsmore to UPRR/BNSF Connection (BNSF N/S-5)	39.85	24.76	15,645,491	25,178,977	623,472,816
UPRR/BNSF Connection to Atwater (BNSF N/S-6)	6.30	3.91	16,322,332	26,268,248	102,830,695
Atwater to Downtown Merced (BNSF N/S-7)	17.00	10.56	25,661,185	41,297,674	436,240,142
Merced South to UPRR Connection (BNSF N/S-8)	8.00	4.97	32,682,285	52,597,039	261,458,279
UPRR Connection East to Castle Connection (BNSF N/S-9)	17.66	10.97	9,825,892	15,813,240	173,495,771
Castle Connection to Henry Miller Wye (BNSF N/S-10)	13.44	8.35	10,838,922	17,443,554	145,707,628
Henry Miller Wye (BNSF N/S-11)	10.90	6.77	8,082,286	13,007,178	88,096,913
UPRR N/S	**134.95**	**83.85**	**18,862,722**	**30,356,608**	**2,545,524,294**
French Camp to Lathrop (UPRR N/S-1)	8.00	4.97	13,627,270	21,930,965	109,018,159
Lathrop through Manteca (UPRR N/S-2)	8.70	5.41	21,359,159	34,374,234	185,824,683
Manteca South to BNSF/UPRR (UPRR N/S-3)	3.30	2.05	7,761,402	12,490,765	25,612,626
BNSF/UPRR South to Modesto (UPRR N/S-4)	18.50	11.50	15,559,246	25,040,179	287,846,051
UPRR Modesto South—Western Option (UPRR N/S-5a*)	4.20	2.61	84,115,056	135,370,061	353,283,237
South Modesto to BNSF Connection (UPRR N/S-6)	20.90	12.99	21,150,677	34,038,714	442,049,140
BNSF Connection South to Merced (UPRR N/S-7)	33.25	20.66	16,572,019	26,670,079	551,019,624
Merced South to BNSF Connection (UPRR N/S-8)	4.75	2.95	32,162,740	51,760,913	152,773,015
BNSF Connection South to Henry Miller Wye (UPRR N/S-9)	17.45	10.84	8,686,037	13,978,822	151,571,352
BNSF Henry Miller Wye (UPRR N/S-10)	15.90	9.88	18,020,529	29,001,230	286,526,405
BNSF Castle	**148.74**	**92.42**	**14,323,359**	**23,051,212**	**2,130,413,453**
North Stockton South to UPRR Connection (BNSF N/S-1)	17.50	10.87	8,362,619	13,458,330	146,345,827
BNSF Parallel to UPRR tracks (BNSF N/S-2)	3.50	2.17	8,090,264	13,020,018	28,315,925
Parallel tracks South through Escaton (BNSF N/S-3)	13.55	8.42	13,929,771	22,417,794	188,748,403
Escaton South to Amtrak Briggsmore (BNSF N/S-4)	13.85	8.61	18,871,199	30,370,251	261,366,107
Amtrak Briggsmore to UPRR/BNSF Connection (BNSF N/S-5)	39.85	24.76	15,645,491	25,178,977	623,472,816
From BNSF Southeast to Castle AFB (BNSF Castle-1)	17.60	10.94	9,100,491	14,645,821	160,168,647
Castle AFB South to BNSF Connect (BNSF Castle-2)	10.52	6.54	22,904,277	36,860,860	240,998,798
BNSF South of Castle to UPRR Connect (BNSF Castle-3)	8.02	4.98	30,814,309	49,590,824	247,192,389
Castle Connection to Henry Miller Wye (BNSF N/S-10)	13.44	8.35	10,838,922	17,443,554	145,707,628

Alignment Alternative by Corridor and Segment	Length		Average Cost (in dollars)		Cost (in dollars)
	Km	Miles	Per Km	Per Mile	
Henry Miller Wye (BNSF N/S-11)	10.90	6.77	8,082,286	13,007,178	88,096,913
UPRR—BNSF Castle	**139.24**	**86.52**	**17,417,257**	**28,030,358**	**2,425,126,621**
French Camp to Lathrop (UPRR N/S-1)	8.00	4.97	13,627,270	21,930,965	109,018,159
Lathrop through Manteca (UPRR N/S-2)	8.70	5.41	21,359,159	34,374,234	185,824,683
Manteca South to BNSF/UPRR (UPRR N/S-3)	3.30	2.05	7,761,402	12,490,765	25,612,626
BNSF/UPRR South to Modesto (UPRR N/S-4)	18.50	11.50	15,559,246	25,040,179	287,846,051
UPRR Modesto South—Western Option (UPRR N/S-5a*)	4.20	2.61	84,115,056	135,370,061	353,283,237
South Modesto to BNSF Connection (UPRR N/S-6)	20.90	12.99	21,150,677	34,038,714	442,049,140
North South Connection East of Stockton (South Portion) (UPRR-BNSF X-2)	15.15	9.41	9,196,591	14,800,478	139,328,349
From BNSF Southeast to Castle AFB (BNSF Castle-1)	17.60	10.94	9,100,491	14,645,821	160,168,647
Castle AFB South to BNSF Connect (BNSF Castle-2)	10.52	6.54	22,904,277	36,860,860	240,998,798
BNSF South of Castle to UPRR Connect (BNSF Castle-3)	8.02	4.98	30,814,309	49,590,824	247,192,389
Castle Connection to Henry Miller Wye (BNSF N/S-10)	13.44	8.35	10,838,922	17,443,554	145,707,628
Henry Miller Wye (BNSF N/S-11)	10.90	6.77	8,082,286	13,007,178	88,096,913
UPRR—BNSF	**140.15**	**87.09**	**19,071,736**	**30,692,985**	**2,672,903,854**
French Camp to Lathrop (UPRR N/S-1)	8.00	4.97	13,627,270	21,930,965	109,018,159
Lathrop through Manteca (UPRR N/S-2)	8.70	5.41	21,359,159	34,374,234	185,824,683
Manteca South to BNSF/UPRR (UPRR N/S-3)	3.30	2.05	7,761,402	12,490,765	25,612,626
BNSF/UPRR South to Modesto (UPRR N/S-4)	18.50	11.50	15,559,246	25,040,179	287,846,051
UPRR Modesto South—Western Option (UPRR N/S-5a*)	4.20	2.61	84,115,056	135,370,061	353,283,237
South Modesto to BNSF Connection (UPRR N/S-6)	20.90	12.99	21,150,677	34,038,714	442,049,140
North South Connection East of Stockton (South Portion) (UPRR-BNSF X-2)	15.15	9.41	9,196,591	14,800,478	139,328,349
UPRR/BNSF Connection to Atwater (BNSF N/S-6)	6.30	3.91	16,322,332	26,268,248	102,830,695
Atwater to Downtown Merced (BNSF N/S-7)	17.00	10.56	25,661,185	41,297,674	436,240,142
Merced South to BNSF Connection (BNSF N/S-8)	4.75	2.95	32,162,740	51,760,913	152,773,015
BNSF Connection South to Henry Miller Wye (BNSF N/S-9)	17.45	10.84	8,686,037	13,978,822	151,571,352
BNSF Henry Miller Wye (BNSF N/S-10)	15.90	9.88	18,020,529	29,001,230	286,526,405

Alignment Alternative by Corridor and Segment	Length		Average Cost (in dollars)		Cost (in dollars)
	Km	Miles	Per Km	Per Mile	
Station Location Options					
Modesto (Downtown)					71,428,053
Briggsmore (Amtrak)					71,428,053
Merced (Downtown)					71,428,053
Castle Air Force Base					71,428,053
* *Option 5B more expensive by $26,806,470.*					

Table 4.2-2
High-Speed Train Passenger Station Cost Summary

Station		Quantity	Cost (in 2006 dollars)
	Terminal Station		
S1	4th & King Station (Caltrain1-2, Caltrain Urban Tunnel)	Each	791,939,278
S2	Transbay Transit Center Station (Caltrain1-TB1, Urban—Tunnel)	Each	786,262,418
S3	West Oakland/7th Street Station (Niles/I-880 1A, Urban—Tunnel)	Each	611,197,055
S4	12th Street/City Center Station (Niles/I-880 1B, Urban—Tunnel)	Each	611,197,055
	Intermediate Station		
S5	San Jose Diridon Station (Caltrain 8-Pacheco 1, Urban—Aerial)	Each	185,051,790
S6	Millbrae/SFO Station (Caltrain 2-3, Urban—At Grade)	Each	29,076,600
S7	Redwood City Station (Caltrain 3-4, Urban—At Grade)	Each	67,516,558
S8	Palo Alto (Caltrain 6-7, Urban—At Grade)	Each	67,516,558
S9	Coliseum/Airport Station (Niles/I-880 2-3, Urban—At Grade)	Each	61,735,853
S10	Union City (BART) Station (Niles/I-880 3-4, Urban—Aerial)	Each	69,853,070
S11	Union City (Shinn) Station (Niles/I-880 4-5, Urban—Aerial)	Each	310,150,400
S12	Fremont (Warm Springs) Station (Niles/I-880 5-6, Suburban—Aerial)	Each	156,875,180
S13	Newark Station (Caltrain 2-3, Suburban—Aerial)	Each	310,150,400
S14	Pleasanton (BART) Station (I-680/580/UPRR 1-2, Suburban—Aerial)	Each	316,675,328
S15	Pleasanton (I-680/Bernal) Station (UPRR 3-4, Suburban—At Grade)	Each	72,639,578
S16	Livermore 1 (I-580) Station (I-680/580/UPRR 3-4, Undeveloped—Aerial)	Each	151,769,468
S17	Livermore 2 (Downtown) Station (UPRR 5-6, Urban—At Grade)	Each	73,297,263
S18	Livermore 2 (Downtown) Station (UPRR 5-6, Urban—Aerial)	Each	314,667,658
S19	Livermore (Greenville Road/I-580) Station (I-680/580/UPRR 4-5, Undeveloped—Aerial)	Each	160,180,913
S20	Livermore (Greenville Road/UPRR) Station	Each	72,639,578
S21	Tracy 1 (Downtown) Station (UPRR 10-11, Urban—Aerial)	Each	310,150,400
S22	Tracy 2 (Existing ACE) Station (SUPRR 2-3, Suburban—Aerial)	Each	314,667,658
S23	Gilroy (Caltrain) Station (Pacheco 2-3, Urban—Aerial)	Each	148,256,045
S24	Morgan Hill (Caltrain) Station (Pacheco 1-2, Suburban—Aerial)	Each	284,985,295
S25	Modesto Downtown Station (UPRR N/S 4-5A/B, Urban—At Grade)	Each	71,428,053
S26	Briggsmore (Amtrak) Station (BNSF N/S 4-5, Suburban—At Grade)	Each	71,428,053
S27	Merced Downtown Station (UPRR N/S 7-8, BNSF N/S 7-8, Urban—At Grade)	Each	71,428,053
S28	Castle Air Force Base Station (BNSF N/S 6-7, BNSF Castle 1-2, Suburban—At Grade)	Each	71,428,053
	Intermediate Station (Local Service Option)		
S29	Union City (Shinn) Station (Niles/I-880 4-5, Urban—Aerial)	Each	300,146,665
S30	Newark Station (Caltrain 2-3, Suburban—Aerial)	Each	300,146,665
S31	Pleasanton (BART) Station (I-680/580/UPRR 1-2, Suburban—Aerial)	Each	297,325,543
S32	Pleasanton (I-680/Bernal) Station (UPRR 3-4, Suburban—At Grade)	Each	58,118,585
S33	Livermore 1 (I-580) Station (I-680/580/UPRR 3-4, Undeveloped—Aerial)	Each	132,402,375
S34	Livermore 2 (Downtown) Station (UPRR 5-6, Urban—At Grade)	Each	58,758,963
S35	Livermore 2 (Downtown) Station (UPRR 5-6, Urban—Aerial)	Each	300,146,665
S36	Livermore (Greenville Road/I-580) Station (I-680/580/UPRR 4-5, Undeveloped—Aerial)	Each	140,813,820
S37	Livermore (Greenville Road/UPRR) Station	Each	58,118,585
S38	Tracy 1 (Downtown) Station (UPRR 10-11, Urban—Aerial)	Each	300,146,665
S39	Tracy 2 (Existing ACE) Station (SUPRR 2-3, Suburban—Aerial)	Each	300,146,665

As defined in Chapter 2, the HST Network Alternatives represent different ways to combine HST Alignment Alternatives and station location options to implement the HST system in the study region. The estimated capital costs for each network alternative are presented in Table 4.2-3. The breakdown of these costs by the alignment alternatives and alignment segments that comprise each network alternative are presented in Appendix 4-C.

Because of the variations in alignment alternatives and station location options being considered in the Program EIR/EIS process, there is a potential range of capital costs associated with any given network alternative.

The capital costs have been categorized into discrete cost elements. In general, the capital costs were estimated by determining the appropriate unit costs for the identified cost elements and the cost element quantities from conceptual alignment alternative and station location option plans prepared for each alignment alternative (Appendices 2-E, 2-F, and 2-G). Each cost element is defined in Appendix 4-D, along with the methods, assumptions, and description of the unit cost applied in each case.

The unit costs were reviewed as part of previous studies by HST owners, operators, and manufacturers, various agencies, and consultants. Formal peer reviews of the Authority's Corridor Evaluation were also conducted. Application of these unit costs and assumptions is consistent with past studies for the HST, including the Business Plan, and provides sufficient detail for the comparison of alignment alternatives and station location options at this program level. The unit costs for all individual elements are presented in Table 4.2-4. The unit costs were adjusted to account for inflation from September 2003 to November 2006, based on the *Engineering News Record Construction Cost Index Report* (McGraw-Hill Construction ENR 2007). Unit costs for the Oakland to San Francisco transbay tube, Dumbarton rail bridge (high-bridge and low-bridge options), and Dumbarton tube were obtained from MTC as part of the *Regional Rail* planning studies.

Table 4.2-3
High-Speed Train Network Alternatives Cost Summary (in 2006 dollars)

		Stations	Segment Length		Average Total Cost (dollars)		Cost (dollars)		
No.	**Network Alternative**		**Km**	**Miles**	**Per Km**	**Per Mile**	**Segment**	**Station**	**Total**
A	ALTAMONT PASS								
1	San Francisco and San Jose Termini	S2, S5, S6, S7, S12, S15, S21, S25, S27	327.24	203.34	38,880,394	62,571,929	10,972,862,793	1,750,428,628	12,723,291,421
2	Oakland and San Jose Termini	S3, S5, S9, S10, S15, S21, S25, S27	293.17	182.16	34,208,979	55,054,015	8,575,425,642	1,453,483,850	10,028,909,492
3	San Francisco, Oakland, and San Jose Termini	S2, S3, S5, S6, S7, S9, S10, S15, S21, S25, S27	388.12	241.16	38,787,079	62,421,753	12,717,546,470	2,336,339,425	15,053,885,895
4	San Jose Terminus	S5, S12, S15, S21, S25, S27	257.78	160.18	29,863,432	48,060,536	6,830,741,966	867,573,053	7,698,315,019
5	San Francisco Terminus	S2, S6, S7, S11, S15, S21, S25, S27	308.27	191.55	35,729,340	57,500,799	9,295,774,550	1,718,652,058	11,014,426,607
6	Oakland Terminus	S3, S9, S10, S15, S21, S25, S27	274.97	170.86	29,700,584	47,798,456	6,898,337,399	1,268,432,060	8,166,769,459
7	Union City Terminus	S10, S15, S21, S25, S27	254.16	157.93	23,423,990	37,697,258	5,357,942,113	595,499,153	5,953,441,266
8	San Francisco, and San Jose—via SF Peninsula	S2, S5, S6, S8, S11, S15, S21, S25, S27	343.27	213.30	36,606,277	58,912,092	10,662,279,160	1,903,703,848	12,565,983,007
9	San Francisco, San Jose, and Oakland—with no San Francisco Bay Crossing	S2, S3, S5, S6, S7, S9, S10, S15, S21, S25, S27	393.81	244.70	36,713,165	59,084,112	12,121,598,757	2,336,339,425	14,457,938,182
10	Oakland, and San Francisco—via Transbay Tube	S2, S3, S9, S10, S15, S21, S25, S27	289.11	179.64	44,670,632	71,890,413	10,860,031,797	2,054,694,478	12,914,726,275
11	San Jose, Oakland and San Francisco—via Transbay Tube	S2, S3, S5, S9, S10, S15, S21, S25, S27	320.44	199.11	46,114,588	74,214,235	12,537,120,041	2,239,746,268	14,776,866,308
P	PACHECO PASS								
1	San Francisco and San Jose Termini	S2, S5, S6, S8, S23, S26, S27	430.55	267.53	28,771,881	46,303,853	11,028,569,783	1,359,019,515	12,387,589,298
2	Oakland and San Jose Termini	S3, S5, S9, S10, S23, S26, S27	413.40	256.87	27,973,967	45,019,736	10,345,348,109	1,218,949,918	11,564,298,026

		Stations	Segment Length		Average Total Cost (dollars)		Cost (dollars)		
No.	Network Alternative		Km	Miles	Per Km	Per Mile	Segment	Station	Total
3	San Francisco, Oakland and San Jose Termini	S2, S3, S5, S6, S8, S9, S10, S23, S26, S27	498.26	309.60	32,098,678	51,657,815	13,891,521,223	2,101,805,493	15,993,326,716
4	San Jose Terminus	S5, S23, S26, S27	343.04	213.15	23,200,433	37,337,478	7,482,396,668	476,163,940	7,958,560,608
5	San Jose, San Francisco and Oakland—via Transbay Tube	S2, S3, S5, S6, S7, S23, S26, S27	444.69	276.31	38,140,438	61,381,085	14,990,264,181	1,970,216,570	16,960,480,751
6	San Jose, Oakland and San Francisco—via Transbay Tube	S2, S3, S5, S9, S10, S23, S26, S27	427.54	265.66	38,154,198	61,403,229	14,307,042,507	2,005,212,335	16,312,254,842
PA	PACHECO PASS WITH ALTAMONT PASS (LOCAL SERVICE)								
1	San Francisco and San Jose Termini	S2, S5, S6, S8, S23, S25, S27, S29, S32, S38	545.83	339.16	33,558,079	54,006,494	16,299,474,324	2,017,431,430	18,316,905,754
2	Oakland and San Jose Termini	S3, S5, S9, S10, S23, S25, S27, S32, S38	512.50	318.45	31,135,039	50,106,988	14,379,523,442	1,577,215,168	15,956,738,609
3	San Francisco, Oakland and San Jose Termini (with Dumbarton Bridge)	S2, S3, S5, S6, S8, S9, S10, S23, S25, S27	629.32	391.04	34,942,461	56,234,439	19,888,148,879	2,101,805,493	21,989,954,371
4	San Francisco, Oakland and San Jose Termini (without Dumbarton Bridge)	S2, S3, S5, S6, S8, S9, S10, S23, S25, S27, S32, S38	580.81	360.90	35,098,797	56,486,038	17,925,696,556	2,460,070,743	20,385,767,299
5	San Jose Terminus	S5, S12, S23, S25, S27, S32, S38	460.34	286.04	29,237,801	47,053,679	12,467,937,131	991,304,370	13,459,241,501

Table 4.2-4
High-Speed Train Unit Cost (in November 2006 Dollars)

Cost Elements		Unit	Unit Cost (dollars)
Alignment Cost			
Track Items			
	Double Track Section—Total	Kilometers	
1	Double Track Section—At Grade	Kilometers	993,167
2	Double Track Section—On Structure	Kilometers	1,878,243
3	Double Track Section—In Tunnel or Subway	Kilometers	1,878,243
4	Double Track Section—In Trench	Kilometers	1,878,243
	Single Track Section—Total	Kilometers	
5	Single Track Section—At Grade	Kilometers	496,583
6	Single Track Section—On Structure	Kilometers	939,121
7	Single Track Sections—In Tunnel or Subway	Kilometers	939,121
8	Single Track Section—In Trench	Kilometers	939,121
9	Freight Double Track—At Grade	Kilometers	993,167
10	Freight Single Track—At Grade	Kilometers	496,583
Earthwork Items			
1	Site Preparation—Undeveloped	Hectares	12,081
2	Total Cut	$Meters^3$	9
3	Total Fill	$Meters^3$	9
4	Borrow	$Meters^3$	13
5	Spoil	$Meters^3$	0
4	Landscape/Erosion Control	Hectares	8,075
5	Security Fencing (Both Sides of R/W)	Kilometers	101,733
6	Special Drainage Facilities	5% of Earthwork Cost	
Structures, Tunnels, Walls			
1	Standard Structure	Kilometers	13,733,933
2	High Structure	Kilometers	16,480,720
3	Long Span Structure	Kilometers	37,577,568
4	Waterway Crossing—Primary	Kilometers	28,876,734
5	Waterway Crossing—Secondary (Irrigation/Canal Crossing)	Kilometers	23,119,226
6	Twin Single Track Drill & Blast (<6 Miles)	Kilometers	75,040,254
7	Twin Single Track TBM (<6 Miles)	Kilometers	55,464,535
8	Twin Single Track TBM w/3rd Tube (>6 Miles)	Kilometers	78,846,643
9	Double Track Drill & Blast	Kilometers	83,740,573
10	Double Track Mined (Soft Soil)	Kilometers	96,247,282
11	Seismic Chamber (Drill & Blast/Mined)	Each	94,803,899
12	Crossovers	Each	94,803,899
13	Cut & Cover Double Track Tunnel	Kilometers	48,123,641
14	Trench Short	Kilometers	49,668,587
15	Trench Long	Kilometers	39,272,836
16	Mechanical & Electrical for Tunnels	Kilometers	1,931,362
17	Retaining Walls	Kilometers	4,399,945
18	Containment Walls	Kilometers	1,500,559
19	Single Track Cut and Cover Subway	Kilometers	30,077,276
Grade Separations			
1	Street Overcrossing HSR—(Urban)	Each	17,167,417
2	Street Overcrossing HSR—(Suburban)	Each	6,485,469
3	Street Overcrossing HSR—(Undeveloped)	Each	1,093,628
4	Street Undercrossing HSR—(Urban)	Each	17,930,413
5	Street Undercrossing HSR—(Suburban)	Each	6,866,967

Cost Elements		Unit	Unit Cost (dollars)
6	Street Undercrossing HSR—(Undeveloped)	Each	1,157,211
7	Street Bridging HSR Trench	Each	
8	Minor crossing closures	Each	178,032
Rail and Utility Relocation			
1	Single Track Relocation (Temporary)	Kilometers	1,271,661
2	Single Track Relocation (Permanent)	Kilometers	1,271,661
3	Single Track Removal	Kilometers	63,372
4	Major Utility Relocations—Dense Urban	Kilometers	890,162
5	Major Utility Relocations—Urban	Kilometers	680,338
6	Major Utility Relocations—Dense Suburban	Kilometers	476,873
7	Major Utility Relocations—Suburban	Kilometers	273,407
8	Major Utility Relocations—Undeveloped	Kilometers	13,988
Right–of-Way Items			
1	Right-of-Way Required for Each Segment		
	Dense Urban	Hectares	4,106,412
	Urban	Hectares	2,737,608
	Dense Suburban	Hectares	1,368,804
	Suburban	Hectares	479,081
	Undeveloped	Hectares	342,201
Environmental Mitigation			
Environmental Mitigation		3% of Line Cost	
System Elements			
1	Signaling (ATC)	Kilometers	845,654
2	Communications (w/Fiber Optic Backbone)	Kilometers	699,413
3	Wayside Protection System	Kilometers	67,144
Electrification Items			
1	Traction Power Supply	Kilometers	432,365
2	Traction Power Distribution	Kilometers	806,233
Program Implementation Costs (per screening)			
Program Implementation Costs		25.5% of Total Cost and Procurement	
Contingencies (per screening)			
Contingencies		25% of Total Construction Cost	
Total Construction			
Total Construction and Right-of-Way (includes environmental mitigation)			
Grand Total			

4.3 OPERATIONS AND MAINTENANCE COSTS

O&M costs were developed for each of the HST Network Alternatives for comparative purposes. The annual O&M costs of the HST Alignment Alternatives and Network Alternatives are based on daily train miles, operating speed, travel time, station configuration, maintenance and storage facilities, and assumed operating frequencies. Daily train miles, operating speeds, and travel times are all outputs of the California high-speed rail simulation model as documented in the operations report prepared as part of the statewide Program EIR/EIS. (Parsons Brinckerhoff 2003.)

A. OPERATING SPEEDS

For the HST system, higher operating speed (150–220 mph [241–354 kph]) are proposed for areas where the alignment is less constrained, and lower operating speeds (less than 125 mph [201 kph]) are proposed in the more heavily developed areas. Local and semi-express services would not necessarily reach the maximum speeds on a given segment. Figure 4.3-1 shows the maximum speeds that could be attained on the various alignment alternatives.

B. TRAVEL TIMES

Table 4.3-1 shows the optimal express trip times between several example city pairs. These times represent the estimated travel times between city pairs without interference from other trains or stops at intermediate stations. A complete listing of station-to-station travel times is included as Appendix 4-E. Express travel times are possible on the proposed HST system because all intermediate stations would have four tracks, with two through-tracks for express service.

Table 4.3-1
Optimal Express Trip Times between City Pairs (220 mph [350 kph] maximum speed)

ALTAMONT Travel Time (hh:mm) / PACHECO Travel Time (hh:mm)	SAN FRANCISCO	OAKLAND	SAN JOSÉ	SACRAMENTO	FRESNO	LOS ANGELES	SAN DIEGO	
San Francisco	N/A	N/A	N/A	01:06	01:18	02:36	03:54	San Francisco
Oakland	N/A	N/A	N/A	00:53	01:04	02:23	03:40	Oakland
San José	00:30	00:22	N/A	00:49	01:01	02:19	03:37	San José
Sacramento	01:47	01:38	01:18	N/A	00:59	02:17	03:35	Sacramento
Fresno	01:20	01:12	00:51	00:53	N/A	01:24	02:42	Fresno
Los Angeles	02:38	02:30	02:09	02:11	01:24	N/A	01:18	Los Angeles
San Diego	03:56	03:48	03:27	03:29	02:42	01:18	N/A	San Diego
	San Francisco	Oakland	San Jose	Sacramento	Fresno	Los Angeles	San Diego	N/A

N/A Not Applicable; Altamont Pass Test Alignment; Pacheco Pass Test Alignment

Note: Based on Altamont Pass Test Alignment B (I-580/UPRR) and Pacheco Pass Test Alignment B (Caltrain/Gilroy/Henry Miller/UPRR).

C. MAINTENANCE FACILITIES AND STORAGE YARDS

The train sets used for the HST system would need to be maintained at several points along the HST corridor. To estimate maintenance costs, it was assumed that the overall statewide HST system would have four maintenance facilities. Three of these facilities would be the primary locations for cleaning, servicing, inspecting, and maintaining the vehicles, as well as storing the trains overnight. A fourth facility would serve as a heavy maintenance facility. In addition to these maintenance facilities, each of the terminal stations would have some light maintenance and cleaning capabilities. The cost of these support facilities is not included in specific segments or network alternatives. These costs are considered in total for the HST system.

D. CONCEPTUAL OPERATING PLAN

The service levels tested in the ridership demand model were 124 trains per day in each direction (i.e., north and south) (248 total), assuming 1,175 seats per train. The service type and stopping patterns are summarized below.

- Express (16 trains per day in each direction): Trains running from Sacramento, San Jose, or San Francisco to Los Angeles and San Diego with one intermediate stop between origin and destination.
- Semi-Express (34 trains per day in each direction): Trains running between similar endpoints as the express, with a limited number of intermediate stops.
- Suburban-Express (33 trains per day in each direction): Trains running express between major metropolitan regions but stopping frequently in these regions.
- Local (36 trains per day in each direction): Trains stopping at all intermediate stops, with potential for skipping stops to improve service, depending on demand.
- Regional (5 trains per day in each direction): Trains running locally that begin or end in the Central Valley, operating mostly during commute hours.

Many HST Network Alternatives studied in this document involve dividing points, such as just north of San Jose for the Pacheco route to serve both sides of the Bay Area, or east of Pleasanton for the Altamont route to serve San Francisco, San Jose, and/or Oakland. Other dividing points exist in the HST system, including one in the Merced area and one south of Los Angeles Union Station. The conceptual HST operating plan assumes separate and distinct trains operating on all defined routes. This would mean that some trains from Los Angeles or Sacramento would go to San Francisco and some to San Jose, while others might go to Oakland. Although it is possible to create long multiunit trains and physically separate the units at specific points on the route to serve more than one terminus from a single origin, this is considered undesirable for the reasons discussed below. Additionally, it is unlikely that the application of such operational practices would benefit one alignment alternative over another.

Some HST systems physically separate trainsets ("splitting and joining trains") at some point on the route. However, the percentage of HST trains actually using this practice worldwide is very small. In France, about 10% of the TGV trainsets are physically split, whereas in Japan the percentage is even smaller. HST trainsets generally are not split during peak hours or at peak traffic points. For example, the TGVs that split in southwest France have already served the major Paris-Bordeaux market, and do not add time to the passengers on this critical city-pair. The Paris-Bordeaux passengers in the other direction also do not lose time waiting for the trains to be combined into one, since they board after consolidation. The mini-Shinkansen that splits to Yamagata, does so after the major stations at Fukushima and Sendai. The Thalys HST does not split until after Brussels passengers get off. The HST splits are generally done in places where the traffic demands are low—not on the main trunk line between the major markets.

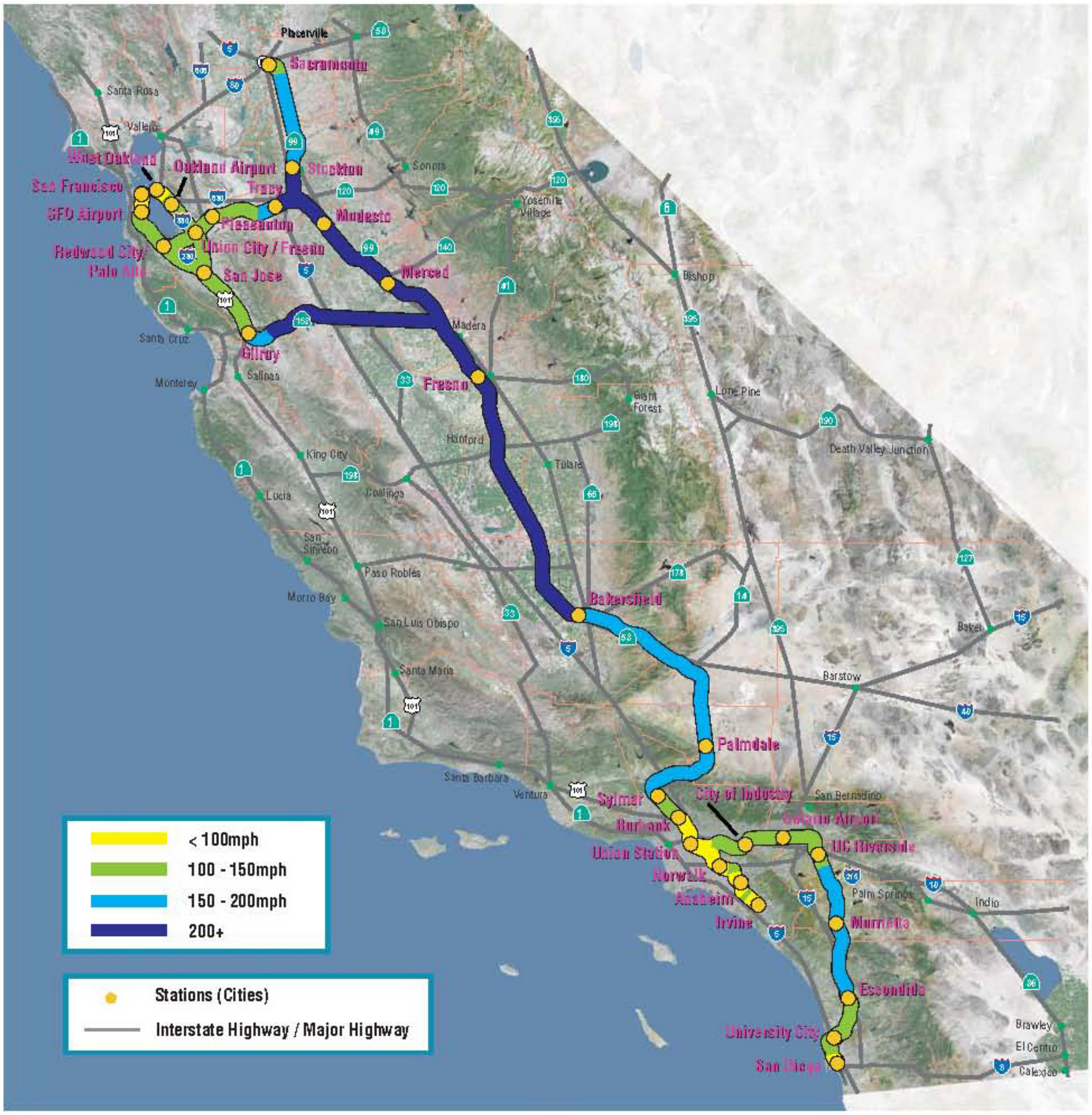

Figure 4.3-1
Maximum Speeds Attained on Alignment Alternatives

It is unlikely that the application of splitting and joining trains would benefit one alignment alternative over the other. Practically, only one such train split could be accomplished for each scheduled train operation. Limited and appropriate splitting of trainsets could be used for either the Altamont Pass or Pacheco Pass alternatives (at Fresno or Los Angeles for example). A key operational benefit of the Pacheco Pass is that it minimizes the number of HST network branches and splits.

E. OPERATIONS AND MAINTENANCE ANNUAL COSTS

The HST projected annual O&M costs are based on the train miles and frequencies assumed in the ridership forecasting analysis (as described in Chapter 2) (Cambridge Systematics 2007) and the unit costs applied in the statewide Program EIR/EIS (California High-Speed Rail Authority and Federal Railroad Administration 2005). A cost estimation method and unit costs were developed for the previous corridor evaluation study to provide an order of magnitude cost estimate for HST service on particular alignments. This method was peer reviewed by the operators of several HST systems, as discussed above in Section 4.2, and found to be adequate for this level of analysis. The same method has been applied in this analysis. Table 4.3-2 presents the operating and maintenance costs on a per-train-mile and per-train-kilometer basis summarized by each operating and maintenance cost element.

Table 4.3-3 summarizes the systemwide operations and maintenance costs according to the alignment alternatives and station location options included in each network alternative. The costs are based primarily on length and frequency of service.

Table 4.3-2
Annual Operating and Maintenance Costs (in 2006 dollars)

Item	Dollars per Train Mile	Annual Cost (million dollars)
Station Services	0.83	24.6
Insurance	2.02	60.1
General Support	1.45	43.3
Maintenance of Way	4.31	128.5
Train Operations	10.05	299.5
Equipment Maintenance	11.79	351.2
Marketing and Reservations	2.12	63.0
Power	7.11	211.9
Total per Year		1.182
Source: Parsons Brinckerhoff 2007.		

Table 4.3-3
Annual Costs of Operating and Maintaining High-Speed Train Infrastructure (in 2006 dollars)

		Network Alternative Length		Systemwide O&M Costs (dollars)
		Km	Miles	
A	**ALTAMONT PASS**			
1	San Francisco and San Jose Termini	327.24	203.34	1,099,301,000
2	Oakland and San Jose Termini	293.17	182.16	1,085,313,000
3	San Francisco, Oakland, and San Jose Termini	388.12	241.16	1,097,940,000
4	San Jose Terminus	257.78	160.18	1,076,391,000
5	San Francisco Terminus	308.27	191.55	1,124,271,000
6	Oakland Terminus	274.97	170.86	1,092,689,000
7	Union City Terminus	254.16	157.93	1,072,954,000
8	San Francisco and San Jose—via SF Peninsula	343.27	213.30	1,115,288,000
9	San Francisco, San Jose, and Oakland—with no San Francisco Bay Crossing	393.81	244.70	1,122,869,000
10	Oakland and San Francisco—via Transbay Tube	289.11	179.64	1,106,098,000
11	San Jose, Oakland and San Francisco—via Transbay Tube	320.44	199.11	1,092,654,000
P	**PACHECO PASS**			
1	San Francisco and San Jose Termini	430.55	267.53	1,182,186,000
2	Oakland and San Jose Termini	413.40	256.87	1,165,923,000
3	San Francisco, Oakland, and San Jose Termini	498.26	309.60	1,174,114,0000
4	San Jose Terminus	343.04	213.15	1,099,200,000
5	San Jose, San Francisco, and Oakland—via Transbay Tube	444.69	276.31	1,195,595,000
6	San Jose, Oakland, and San Francisco—via Transbay Tube	427.54	265.66	1,179,332,000
PA	**PACHECO PASS WITH ALTAMONT PASS (LOCAL SERVICE)**			
1	San Francisco and San Jose Termini	545.83	339.16	1,171,052,000
2	Oakland and San Jose Termini	512.50	318.45	1,139,579,000
3	San Francisco, Oakland, and San Jose Termini (without Dumbarton Bridge)	580.81	360.90	1,179,011,000
4	San Jose Terminus	460.34	286.04	1,130,210,000

5 ECONOMIC GROWTH AND RELATED IMPACTS

5.1 Introduction

Transportation investments can lead to reduced travel time and cost, improved accessibility to regions or parts of regions, and reduced accidents or air pollution. These effects contribute to economic growth by allowing time and money previously spent on travel to be used for other purposes, attracting businesses and residents to places with increased accessibility or improved quality of life, and reducing overall costs to society. The population and employment growth that result make up the *growth-inducing effects* of transportation investments. Growth can contribute to additional effects on human and natural resources beyond those directly attributable to the changes in the transportation system. These effects are known as *indirect impacts*.

This chapter presents an analysis of the potential growth-inducing effects and related indirect impacts of the alternatives considered in the Bay Area to Central Valley Program EIR/EIS. The intent of the analysis is to understand the extent of potential statewide, regional, and local growth effects in terms of population and employment change and land consumption associated with these changes. This section identifies and describes the following.

- Existing population and employment conditions both for the Bay Area to Central Valley study area and the entire state.
- Methodology and data sources used to assess potential growth-induced effects.
- Potential employment and population changes associated with each system alternative.
- Urban area size needed to accommodate projected population and employment growth associated with each alternative.
- Potential impacts related to growth and development, and potential strategies for managing these impacts;
- Potential for employment and population concentration in the vicinity of HST stations.
- Differences between the HST alignment and station options in the Bay Area to Central Valley study area.

5.2 Affected Environment

5.2.1 Existing Conditions

Over the last 30 years, California's population has grown from 20 million to more than 36 million people. At the same time, more than 10 million additional jobs have been created in California. Starting with the gold rush in 1849, California has been continuously experiencing rapid population and economic growth. Distance from eastern urban areas, location on the Pacific Rim, an abundance of natural resources, a desirable climate, and many other factors have contributed to California's growth into the most populous state in the nation.

California's economy is one of the most diverse in the world. Manufacturing, wholesale and retail trade, services, and government each account for more than 10% of total employment, and together have consistently made up more than three-quarters of total employment over the past 30 years. California's economy, like the nation's, has become less focused on production of goods and more focused on services, entertainment, and trade. Three service-sector industries—business, social, and legal—are among the 10 fastest-growing industries in California, with business services' contribution to gross state product (GSP) growing by 1,400% since 1977. The overall services sector has grown by more than 800% since 1977. The finance, insurance, and real estate (FIRE) sectors and services sector have accounted for nearly one-half of the growth in GSP since 1977, with the combined contribution of these groups growing from 33% to 46% of the total economy in California.

As of 2005, California was estimated to have about 36.1 million people and 20.9 million jobs. Table 5.2-1 lists year 2005 population and employment totals, as well as an estimate of current urbanization magnitudes for select locations in 2002. Data are presented for major regions in California as well as individual counties in the Bay Area to Central Valley corridor. As expected, the inner Bay Area counties, Sacramento County, and Southern California have the highest levels of land considered to be urbanized, while less than 10% of land in most other counties is at urbanized densities.

Table 5.2-1
Existing Population, Employment, and Urbanized Densities

County	Population Year 2005	Employment Year 2005	Acreage of Land at Urbanized Densities for Employment and/or Population Year 2002	Percent of Land Area at Urbanized Densities Year 2002
Alameda County	1,451,065	953,937	141,654	30
Contra Costa County	1,017,644	508,854	142,467	31
San Francisco County	741,025	779,357	23,277	78
San Mateo County	701,175	522,830	70,869	25
Santa Clara County	1,705,158	1,323,920	184,481	22
Study Area—Bay Area	***5,616,067***	***4,088,898***	***562,748***	***29***
Fresno County	878,089	435,769	96,977	3
Madera County	142,530	56,892	23,255	2
Merced County	242,249	87,365	31,712	3
Sacramento County	1,363,423	805,978	157,101	25
San Joaquin County	664,796	274,155	74,250	8
Stanislaus County	505,492	224,491	55,426	6
Study Area—Central Valley	***3,796,579***	***1,884,650***	***438,721***	***12***
Core Study Area	***9,412,646***	***5,973,548***	***1,001,469***	***22***
Southern Sacramento Valley	658,108	456,834	116,980	4
Southern San Joaquin Valley	1,311,579	576,935	189,603	2
Southern California	16,843,742	9,290,841	1,530,221	25
San Diego County	2,936,609	1,895,002	340,837	13
Rest of California	4,991,463	2,709,974	3,105,348	6
Statewide Total	36,154,147	20,903,134	**6,284,458**	**6**

Sources: U.S. Bureau of the Census (population data); MTC/California High-Speed Rail Travel Demand Model (employment data); and *Economic Growth Effects of the System Alternatives for the Program Environmental Impact Report/Environmental Impact Statement*, California High-Speed Rail Authority, July 2003.

5.2.2 Study Area and Alternatives

For the purposes of the growth inducement analysis, California's 58 counties were grouped into seven geographic regions that would contain components of the statewide HST system[1]:

- Core Study Area—Bay Area
  - Alameda County
  - Contra Costa County
  - San Francisco County
  - San Mateo County
  - Santa Clara County
- Core Study Area—Central Valley
  - Fresno County
  - Madera County
  - Merced County
  - Stanislaus County
  - San Joaquin County
  - Sacramento County
- Southern San Joaquin Valley: Kern, Kings, and Tulare Counties
- Southern California: Los Angeles, Orange, Riverside, and San Bernardino Counties
- San Diego County
- Southern Sacramento Valley: El Dorado, Placer, Sutter, Yolo, and Yuba Counties
- Rest of California: Remaining 34 counties not included in any of the other 15 regions.

The regions reflect the economic interdependence among some counties and relate to widely recognized geographic regions in California. The five counties that compose the core study area in the Bay Area (Alameda, Contra Costa, San Francisco, San Mateo, and Santa Clara) were kept as separate economic modeling regions in order to better simulate the population and employment growth effects for each system alternative. A similar process was followed for the six counties that compose the core study area in the Central Valley. The counties grouped into Southern Sacramento Valley, Southern San Joaquin Valley, Southern California, and San Diego regions were gathered based on economic relationships between the counties; with the exception of the Southern Sacramento Valley, all of these regions were identified for direct HST service in the Final Statewide Program EIR/EIS. The counties gathered as *rest of California* would not be directly served by any of the HST Network Alternative. The county groupings that compose these regions are displayed in Figure 5.2-1.

This analysis of potential induced growth and indirect impacts considered two HST Network Alternatives as described in Chapter 2, "Alternatives." The analysis considered the No Project/No Action (No Project) Alternative, which represents the region's (and state's) transportation system (highway, air, and conventional rail) as it is today and with implementation of programs or projects that are in regional transportation plans and have identified funds for implementation by 2030, and two HST Network Alternatives (one each for Pacheco and Altamont).

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[1] All counties that would have an improvement under the HST Alternative were grouped into one of the 15 core regions. *Rest of California* includes all counties without an improvement under the HST Alternative.

Quantitative analysis of induced growth and secondary impacts was performed on two specific HST Network Alternatives, one for the Altamont Pass and one for Pacheco Pass. For both HST Network Alternatives, quantitative modeling was performed using the alignments shown in Table 2.5-1 for the San Francisco and San Jose Termini because prior studies conducted by the HSRA suggested that these termini are likely to produce the highest system ridership, and hence the highest potential for induced growth and secondary impacts. Within the core study area, the following HST stations were included in the Network Alternatives used for quantitative modeling:

- Pacheco Pass: Transbay Transit Center; Millbrae-SFO; Redwood City; San Jose (Diridon Station); Morgan Hill; Gilroy; Merced (SP Downtown); and Modesto (Amtrak Briggsmore).
- Altamont Pass: Transbay Transit Center, Millbrae-SFO, Redwood City, Fremont (Warm Springs), San Jose (Diridon Station), Pleasanton (I-680/Bernal Road), Tracy (SP), Modesto (SP Downtown), and Merced (SP Downtown).

The potential induced growth effects and secondary impacts of other alignment and station options were assessed qualitatively by comparing travel demand model results, reviewing comparable results from the Final Statewide Program EIR/EIS[2], and professional experience.

5.2.3 Analysis Years

The growth-inducement analysis was conducted for the year 2030, which provides a long time horizon to consider full market response after completion of the proposed HST Network Alternatives, as well as a better basis for understanding the full range of possible secondary impacts.

The extent of potential growth-inducing effects in any given year is sensitive to the length of time over which changes in economic conditions are assumed to occur. In terms of this analysis, the number of jobs or people that would be generated in an area in 2030 is sensitive to the year in which HST service is assumed first to be available in that area. For both HST Network Alternatives, HST service along a trunk line between the Bay Area and LAUS was assumed to begin on January 1, 2016. Service to Irvine, San Diego and Sacramento was assumed to begin on January 1, 2019 for all alignment options.

5.3 Potential Growth-Inducing Effects

5.3.1 Methodology and Data Sources

The potential economic growth stimulus of a transportation investment can be measured not only in terms of its *overall magnitude* (number of new jobs and people), but also in terms of its *relative distribution* (location of new jobs and people) among different geographic areas. In economic terms, this distinction is the generative (i.e., creates growth) versus distributive (i.e., redistributes existing population and infrastructure) dimension of growth. Transportation investments, such as airports, highways, transit, and HST, compose just one of many factors that determine how much growth will occur and whether it will be generative or distributive in nature. Other major growth factors, such as education level of residents, housing affordability, and land availability, interact in complex and sometimes unpredictable ways for communities, regions, and states. Land use planning and zoning, enterprise development zones, and infrastructure funding also can influence both the magnitude and the distribution of economic growth.

[2] *Economic Growth Effects of the System Alternatives for the Program Environmental Impact Report/Environmental Impact Statement*, California High-Speed Rail Authority, July 2003.

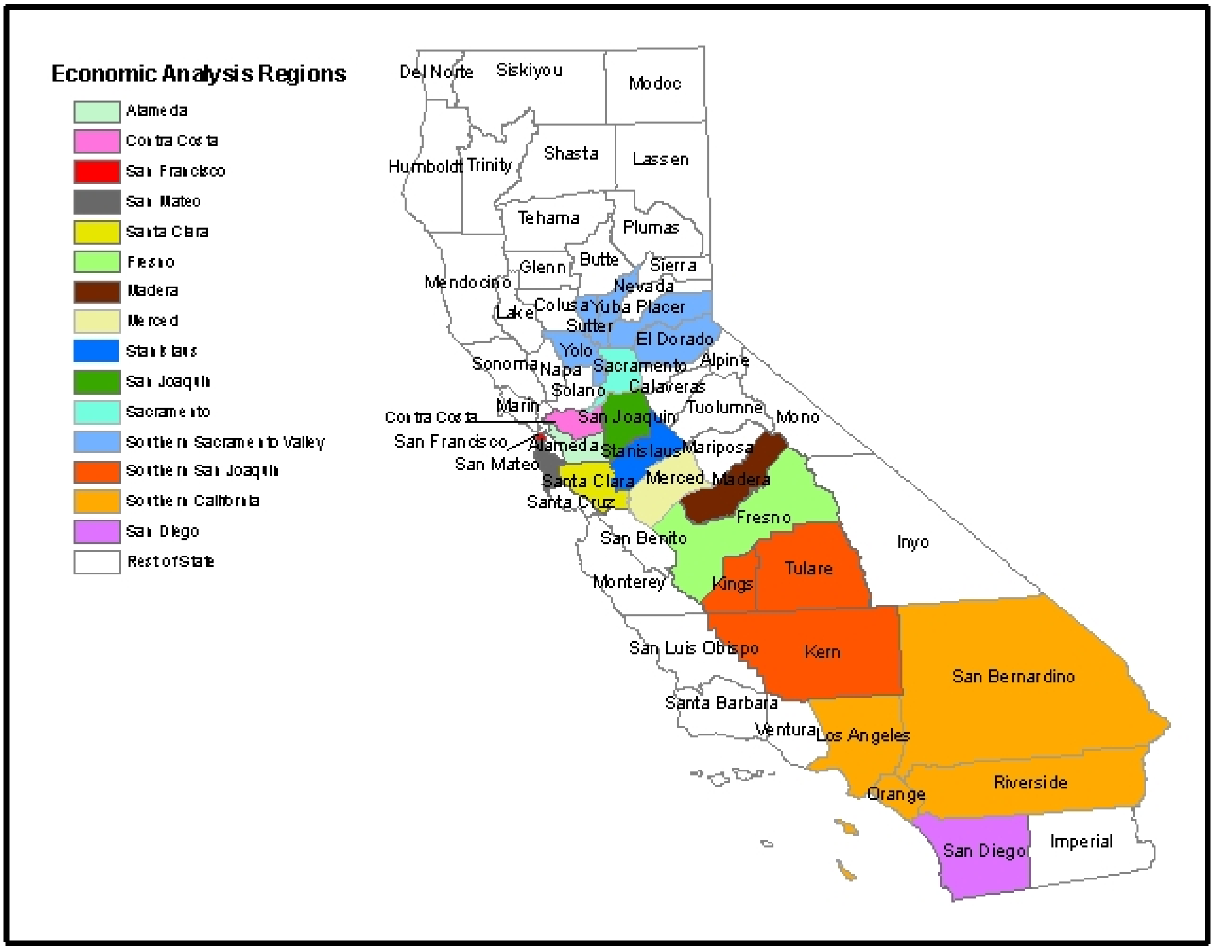

Figure 5.2-1
Regions and Counties

A. SCOPE OF ANALYSIS

The growth inducement results presented in this section were developed using the TREDIS[3] macroeconomic simulation model, which estimates the economic impact of transportation investments on business output, business attraction, employment, and population. Transportation demand, travel times and costs by mode for each system alternative were assembled by the newly developed California Statewide High-Speed Rail Travel Demand Model, with additional transportation performance information synthesized from the Final Statewide Program EIR/EIS.

The analysis process considered the potential effects that changes in transportation congestion and delay between existing conditions and future years would have on the state's economic growth. The process also modeled several dimensions of growth and spatial reallocation that could occur under any of the alignment alternatives and considered many possible impacts of the proposed HST Alignment Alternatives on jobs, population, and land development, including the following:

- Increased employment because of attraction of new businesses to California, or expansion of businesses already located in the state.
- Reallocation of employment because of changes in location of businesses already located in California.
- Population growth associated with business attraction, expansion, and spatial shift.
- Shift in residential population between counties (with fixed employment location) as a result of changed accessibility because of the Modal or HST Network Alternatives (i.e., long-distance commutes).
- Shift in employment for retail and personal service establishments that follow shifts in residential location.
- Changes in densification and development patterns both with and without the presence of a HST station.
- Allocation of population and employment between currently developed and undeveloped areas in each county.
- Consumption of currently undeveloped land to house projected population and employment growth.

B. KEY DATA SOURCES

The growth-inducement analysis required a baseline forecast of future population and employment for the 2030 year. This baseline forecast represented the No Project Alternative for the analysis year, and was also used as an economic modeling input to estimate incremental population and employment changes of the HST Network Alternatives. The analysis of potential induced growth and indirect effects necessitated that county-level population and employment forecasts be developed for 2030, with employment forecasts broken out by one-digit standard industrial classification (SIC) codes. Baseline population forecasts for each county were taken from the California Department of Finance. Baseline employment forecasts were taken from the *California Statewide High-Speed Rail Travel Demand Model* and aggregated to the county level.

[3] The Transportation Economic Development Impact System (TREDIS) model is designed specifically to evaluate the full economic development impacts of multimodal transportation investments. For this analysis, TREDIS was run in conjunction with the ReDYN economic modeling system to capture full dynamic economic feedback.

C. METHODOLOGY OVERVIEW

The analytical process to estimate the growth-inducing effects of the alternatives required significant modeling tools and data. Nonetheless, the entire process, depicted in Figure 5.3-1, can be summarized in a few key steps.

- Define transportation investments: This analysis considers the HST Network Alternatives described in Chapter 2. For this analysis, the future baseline conditions are assumed to represent the No Project Alternative, and the economic modeling process is used to forecast the incremental changes associated with the implementation of the Altamont and Pacheco network alternatives.
- Estimate transportation benefits: Using results from the California Statewide High-Speed Rail Travel Demand Model, benefits such as reduced travel times and/or costs of each alternative for air, highway, and conventional rail trips were estimated using travel demand model results. Congestion, pollution, and crash reduction benefits as well as accessibility benefits were directly estimated using travel demand model results for the two HST Network Alternatives in comparison to the No Project Alternative. Mode shift benefits arising from the introduction of HST service were estimated by scaling benefits calculated for the statewide program EIR/EIS using HST ridership and other output from the current travel demand model[4].
- Estimate direct economic impacts: Direct economic impacts, which are generated from the transportation benefits of each alternative, generally fall into one of three categories.
  - Business cost savings: Reductions in travel time and/or cost for long-distance business travelers and commuters benefiting from the transportation improvements.
  - Business attraction effects: New and relocated firms taking advantage of market accessibility improvements provided through transportation investments.
  - Amenity (quality of life) changes: Non-business travel time and/or cost benefits and other societal benefits improve the attractiveness of a region.
- Determine total regional economic impacts for regions and counties: The direct economic impacts all have the potential to create additional multiplier effects on the regional and statewide economies of California. Total regional impacts were estimated using the TREDIS-ReDyn macroeconomic simulation model. For this analysis, total economic impacts include population and industry-specific employment, with impacts forecasted for the 11 counties in the core study area and the remaining five multi-county regions.
- Forecast land consumption: County-level population and employment were allocated throughout each county to determine the infill potential and magnitude of land needed to accommodate population and employment growth for each alternative. This analysis, which was conducted for the 11 counties in the core study area, was driven by three key pieces of information.
  - Local land use, zoning, and employment data.
  - National and international experience with station-area development trends related to HST and fixed guideway transit.
  - County-level industry employment and population estimates.
- Assess Potential for Secondary Impacts: The population, employment, and land consumption forecasts for each system alternative were reviewed to characterize the nature and magnitude of potential secondary impacts on the human and natural environment. For resource topics in

[4] *Economic Growth Effects of the System Alternatives for the Program Environmental Impact Report/Environmental Impact Statement*, California High-Speed Rail Authority, Appendix F, July 2003.

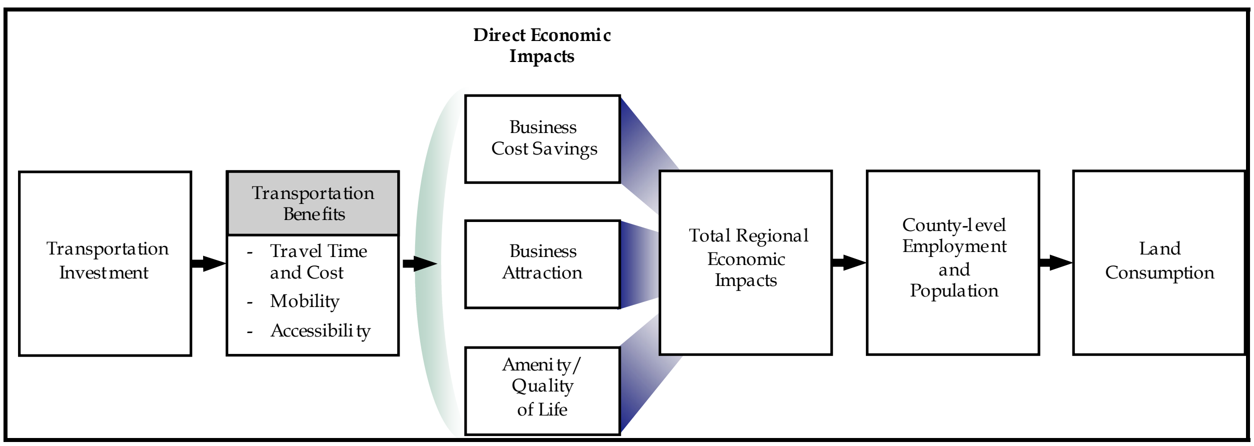

Figure 5.3-1
Methodology Overview

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which specific spatial information was available, a GIS-based analysis was conducted to estimate the quantity of resources in each of the 11 core study area counties that could be affected by future urbanization patterns for each system alternative.

Essentially, this land consumption analysis provided an estimate of the population and employment growth that can fit within the currently urbanized areas of each county (i.e., infill potential), and additional acreage of currently undeveloped land that would need to be converted to urbanized densities to accommodate any remaining growth. Estimates of land needed to accommodate employment uses were developed using a statistical analysis based on current development patterns in California, adjusted to reflect expected densification trends over time.[5] The California Urbanization and Biodiversity Analysis (CURBA) model was used to allocate population growth to various locations in each county and to predict land consumption resulting from residential construction.

5.3.2 Financing of Alternatives

In any analysis of proposed public investments, it is important to consider the potential sources of public financing and how they may affect future public revenue needs (i.e., government expenditures) and consumer spending. The HST Network Alternative is projected to have significant capital costs in excess of the costs needed to fund the No Project Alternative. For the purposes of this analysis, it was assumed that the total cost of the HST Network Alternative would be funded through revenue sources that would not require direct tax increases or significant diversion of general fund revenues. Examples of these revenue sources include general obligation bonds,[6] federal grants or loans, existing airport user fees and passenger facility charges, private sector participation, local funds (from existing sources), and existing state transportation revenue sources (e.g., gas tax, sales tax on gas). The net effect of this assumption is that the induced growth and secondary impacts presented in this chapter are in no way influenced by whatever financing plan is eventually established for a potential HST system.

5.3.3 Statewide Comparison of Alternatives

A. POPULATION

Statewide population is expected to grow by about 33% between 2005 and 2030 under the No Project Alternative (Table 5.3-1). Compared to the No Project Alternative, population growth under the Pacheco and Altamont network alternatives will not have a significant difference between them, with Pacheco growing an additional 1.4% and Altamont growing an additional 1.3%. Outside the core study area, the Southern San Joaquin Valley and San Diego County exhibit noticeable increases in population growth rates between the No Project and HST Network Alternatives, with an additional 5% of growth for the HST Network Alternatives in both regions. Population growth rates are very similar between the two HST Network Alternatives outside of the core area, and are nearly indistinguishable on a statewide level.

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[5] Because this analysis was conducted at the county level, it does not explicitly reflect potential land designation or policy constraints that are included in each jurisdiction's general plan. Rather, the analysis reflects market forces that currently exist and are projected to exist in the future for counties of similar location, size, development intensity, and potential HST service. The densities that are allowed under zoning and general plan designations are implicitly included in the analysis to the extent that existing development patterns and market forces have been influenced by past zoning and general plan decisions.

[6] The debt service on General Fund State Revenue bonds often is paid through a commitment of the general fund revenue with no additional tax or other revenue source. A preliminary analysis by the project team suggests that the annual debt service on a $10 billion bond may be within the range of the state's historical and future bonding patterns. While this source of funding does not directly increase taxes, it does divert state expenditures from budget items to debt service. Nevertheless, this diversion is not assumed in this analysis to result in any significant reduction in state expenditures.

Table 5.3-1
Projected Population Growth Rate by Region

Area	Year 2005 Population	Growth Rate (Year 2005 to 2030) (%)		
		No Project Alternative	HST Network Alternative	
			Pacheco	Altamont
Alameda County	1,451,065	40.5	41.4	41.6
Contra Costa County	1,017,644	51.6	52.3	51.9
San Francisco County	741,025	7.4	9.3	8.1
San Mateo County	701,175	16.1	17.1	17.9
Santa Clara County	1,705,158	26.3	28.1	28.8
Study Area—Bay Area	***5,616,067***	***30.8***	***32.0***	***32.2***
Fresno County	878,089	47.8	49.7	49.5
Madera County	142,530	54.2	61.1	61.0
Merced County	242,249	80.8	86.7	84.7
Sacramento County	1,363,423	68.2	69.1	69.8
San Joaquin County	664,796	85.0	86.7	88.7
Stanislaus County	505,492	47.3	50.0	55.1
Study Area—Central Valley	***3,796,579***	***63.9***	***66.0***	***67.1***
Core Study Area	***9,412,646***	***44.1***	***45.7***	***46.3***
Southern Sacramento Valley	658,108	65.7	66.0	66.2
Southern San Joaquin Valley	1,311,579	51.7	56.2	56.1
Southern California	16,843,742	23.8	24.6	24.4
San Diego County	2,936,609	36.4	41.2	40.7
Rest of California	4,991,463	32.5	32.6	32.5
Statewide Total	**36,154,147**	**33.1**	**34.5**	**34.4**

Sources: U.S. Bureau of the Census; California Department of Finance; Cambridge Systematics 2007.

In the core study area, population growth rates are very similar among the system alternatives for the five Bay Area counties. The HST Network Alternatives have higher population growth rates than the No Project Alternative for all five counties, and the Altamont network alternative has the highest project growth rate for three of the five counties. The six Central Valley counties in the core study area all have population growth rates that greatly exceed the statewide average under the No Project Alternative. All six counties have noticeably higher population growth rates for the HST Network Alternatives, with Merced and Madera Counties showing the largest numeric difference in growth rates between the No Project and HST Network Alternatives; this result also holds for Stanislaus County in the Altamont network alternative. As a group, the population growth rate in these Central Valley counties is highest for the Altamont network alternative, although Fresno, Madera, and Merced Counties actually have slightly higher growth rates for the Pacheco network alternative.

The greatest population increase is projected between 2005 existing conditions and the 2030 No Project Alternative, with relatively small differences in population growth occurring between the No Project and HST Network Alternatives. Compared to the No Project Alternative, the population growth rates shown in Table 5.3-1 equate to an additional 502,000 people for the Pacheco network alternative and 495,000 people for the Altamont network alternative.

B. EMPLOYMENT

Statewide and regional employment growth patterns are projected to be very similar to the population patterns. Employment growth under either the Pacheco or Altamont network alternative will be an additional 1.5% over the No Project Alternative. Outside the core study area, the Southern San Joaquin Valley exhibits noticeable increases in employment growth rates between the No Project and HST Network Alternatives, with an additional 5% of growth for the HST Network Alternatives. Employment growth rates are very similar between the two HST Network Alternatives outside the core area and are nearly indistinguishable on a statewide level.

Statewide employment is forecasted to grow by 37% under the No Project Alternative, with an additional increase of 1.53% under the Pacheco network alternative and 1.52% under the Altamont network alternative, as shown in Table 5.3.2. All five Bay Area Counties in the core study areas exhibit employment growth rates under the HST Network Alternatives that are about 1% more than under the No Project Alternative, with the Pacheco network alternative showing the highest growth rate for three of the counties.

Table 5.3-2
Projected Employment Growth Rate

Area	Year 2005 Employment	Growth Rate (Year 2005 to 2030) (%)		
		No Project Alternative	HST Network Alternative	
			Pacheco	Altamont
Alameda County	953,937	30.8	32.0	31.9
Contra Costa County	508,854	50.0	51.2	50.8
San Francisco County	779,357	25.2	26.2	25.9
San Mateo County	522,830	37.2	38.4	38.5
Santa Clara County	1,323,920	33.7	34.8	34.8
Study Area—Bay Area	***4,088,898***	***33.9***	***35.0***	***34.9***
Fresno County	435,769	35.2	38.2	38.0
Madera County	56,892	60.6	69.0	69.3
Merced County	87,365	31.7	40.1	38.5
Sacramento County	805,978	56.3	57.4	57.7
San Joaquin County	274,155	34.5	37.0	38.4
Stanislaus County	224,491	41.1	44.2	48.2
Study Area—Central Valley	***1,884,650***	***45.4***	***48.0***	***48.7***
Core Study Area	***5,973,548***	***37.4***	***39.1***	***39.2***
Southern Sacramento Valley	456,834	59.6	60.4	60.7
Southern San Joaquin Valley	576,935	40.1	44.8	44.6
Southern California	9,290,841	32.5	33.8	33.7
San Diego County	1,895,002	46.9	49.3	49.7
Rest of California	2,709,974	39.3	40.1	39.9
Statewide Total	**20,903,134**	**36.9**	**38.4**	**38.4**

Source: MTC/California High-Speed Rail Travel Demand Model; Cambridge Systematics 2007.

The six Central Valley counties in the core study area have a wide variation in employment growth rates under the No Project Alternative with values ranging between 31% and 60%. All six counties have noticeably higher employment growth rates for the HST Network Alternatives, with Merced and Madera Counties showing the largest numeric difference in growth rates between the No Project and HST Network Alternatives; this result also holds for Stanislaus County in the Altamont network alternative. The population growth rate in these Central Valley counties as a group is highest for the Altamont network alternative, with the Altamont network alternative having the highest growth rate in four of the six counties.

Compared to the No Project Alternative, the employment growth rates shown in Table 5.3-2 equate to an additional 320,000 jobs under the Pacheco network alternative and 316,000 jobs under the Altamont network alternative in the year 2030. As with population growth, however, this level of difference between the No Project and HST Network Alternatives is very small compared to the overall level of growth represented by the No Project Alternative relative to the 2005 conditions.

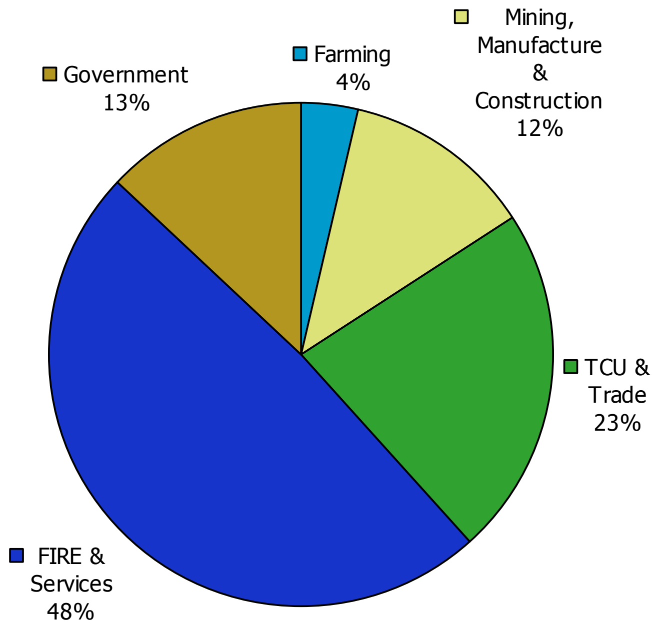
The No Project Alternative is projected to continue historical patterns of employment growth across a diverse range of industry sectors, while also following recent trends toward increases in services and trade. As shown in Figure 5.3-2, nearly one-half of the employment growth for the No Project Alternative is projected in the FIRE (Finance, Insurance and Real Estate) and services sectors, while nearly one-quarter is in TCU (transportation, communications, and utilities), retail trade, and wholesale trade. The incremental employment growth under the HST Network Alternatives does not completely follow this historical pattern. Both HST Network Alternatives show a much greater propensity to job growth in the FIRE, services, TCU, wholesale trade, and retail trade categories.

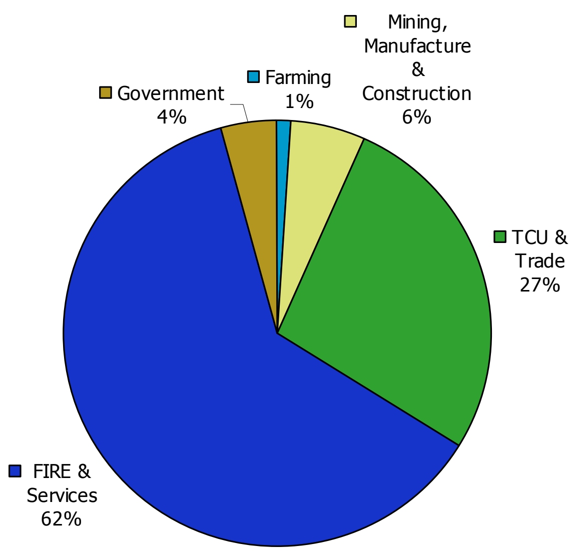
The Pacheco and Altamont network alternatives exhibit subtle differences in the types of jobs they are projected to attract to different regions. Table 5.3-3 depicts the percentage of growth by major industry group for the increment of jobs that may be "induced" by these two alternatives (i.e., job growth above and beyond that of the No Project Alternative). While the patterns are generally similar, the Altamont network alternative shows a greater propensity for generating jobs in the FIRE and Services sectors in the Central Valley and in San Diego, and in the TCU and trade sectors in the "rest of California." The Pacheco network alternative shows a greater propensity for generating jobs in the TCU and trade sectors in the Central Valley and in San Diego, and in the FIRE and services sectors in the "rest of California." The FIRE and Services sectors tend to be the most compatible for location in higher density settings, such as near potential HST sites where offices and retail development could be expected.

C. URBANIZATION

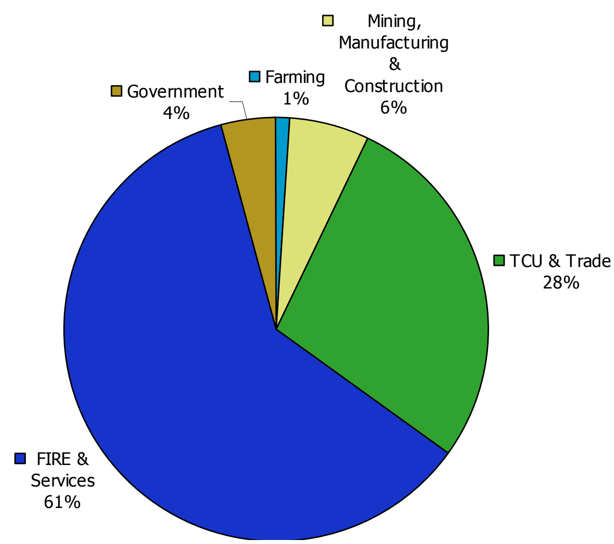
Urbanized areas in the core study area are expected to grow by about 40% between 2005 and 2030 under the No Project Alternative, as shown in Table 5.3-4. This growth would represent an increase of about 400,000 ac (162,000 ha) over today's 1.0 million ac (0.4 million ha) within the core analysis counties. Compared to urbanized area growth under the No Project Alternative, urbanized area growth is expected to be 0.9% (9,000 ac [3,650 ha]) higher under the Pacheco network alternative and 1.4% (14,000 ac [5,670 ha]) more under the Altamont network alternative. As with the population and employment growth, the level of difference between alternatives for urbanized area size is small compared to the overall level of growth represented by the No Project Alternative relative to the 2002 existing conditions. Noticeable differences in these general patterns can be seen for Madera and Merced Counties, both of which are projected to have sizable urbanization increases for the HST Network Alternatives compared to the No Project Alternative.

No Project Alternative—Growth Compared to Year 2002 Conditions





Altamont HST Alternative
Incremental Growth Compared
to No Project Alternative



Pacheco HST Alternative
Incremental Growth Compared
to No Project Alternative

Source: Cambridge Systematics 2007.

Figure 5.3-2
Employment Growth by Industry Sector

Table 5.3-3
Percent of Incremental Growth by Industry

	Farming and Mining		**Construction and Manufacturing**		**TCU and Trade**		**FIRE and Services**		**Government**	
Incremental Growth Rate for Induced Employment (Year 2005 to 2030)	**Pacheco HST**	**Altamont HST**	**Pacheco HST**	**Altamont HST**	**Pacheco HST**	**Altamont HST**	**Pacheco HST**	**Altamont HST**	**Pacheco HST**	**Altamont HST**
Study Area—Bay Area	0	0	6	5	28	29	62	63	3	3
Study Area—Central Valley	2	2	6	4	25	21	63	68	5	4
Subtotal—Core Study Area	***1***	***1***	***6***	***5***	***27***	***25***	***62***	***66***	***4***	***4***
Southern Sacramento Valley	1	2	10	9	34	33	50	52	6	5
Southern San Joaquin Valley	5	5	4	4	20	19	66	67	4	4
Southern California	0	1	6	7	27	29	62	60	4	4
San Diego	0	0	4	3	32	26	59	66	4	4
Rest of California	4	4	9	10	38	45	44	36	5	6
Statewide Total	**1**	**1**	**6**	**5**	**28**	**27**	**61**	**62**	**4**	**4**

Source: Cambridge Systematics 2007.

Table 5.3-4
Increase in Urbanized Area Acreage

Area	Year 2002 Urbanized Area Acreage	Growth Rate (Year 2002 to 2030) (%)		
		No Project Alternative	HST Network Alternative	
			Pacheco	Altamont
Alameda County	141,654	31.8	32.6	32.0
Contra Costa County	142,467	29.1	29.6	29.4
San Francisco County	23,277	28.9	29.9	29.6
San Mateo County	70,869	13.3	13.4	13.7
Santa Clara County	184,481	12.7	13.5	14.6
Study Area—Bay Area	***562,748***	***22.4***	***23.0***	***23.2***
Fresno County	96,977	54.9	58.4	58.0
Madera County	23,255	56.4	62.5	62.5
Merced County	31,712	90.6	96.2	94.3
Sacramento County	157,101	51.4	51.5	52.3
San Joaquin County	74,250	96.3	95.3	96.8
Stanislaus County	55,426	34.0	33.8	38.7
Study Area—Central Valley	***438,721***	***60.7***	***62.0***	***62.9***
Core Study Area	***1,001,469***	**39.2**	**40.1**	**40.6**

Sources: *Economic Growth Effects of the System Alternatives for the Program Environmental Impact Report/Environmental Impact Statement*, California High-Speed Rail Authority, July 2003; Cambridge Systematics 2007.

5.3.4 Detail for No Project Alternative

On a statewide basis, population is projected to increase between 2005 and 2030 by about 12 million (33%), which averages to about 480,000 more people each year. The long-term growth rate averages to about 1.1% annually, which is lower than California's 1.8 % annual population growth rate between 1970 and 2005 but consistent with long-term population forecasts by California Department of Finance. Employment growth rates are similar, with jobs increasing by 8 million (37%) between 2005 and 2030; this increase equates to average annual growth of about 320,000 jobs. The long-term growth rate averages about 1.3% per year, which is one-half of the 2.6% annual employment growth rate since 1970.

For the 11 counties in the core study area, population and employment growth under the No Project Alternative are expected to require approximately an additional 400,000 ac (162,000 ha) of urbanized land in 2030 than the current estimated urbanized area of approximately 1.0 million ac (1,271,523 ha).[7] Urbanization of land in these core counties is projected to occur at slightly lower rates than overall population and employment growth, reflecting a number of factors:

- A reduction in availability of land for development in some Bay Area counties, creating higher land costs and market forces for denser development.
- Slight increases in infill and redevelopment, as seen recently in many urban communities, and blighted areas that receive new development.

[7] Estimates of current urbanized area are based on urban land cover data provided by the California Farmland Mapping and Monitoring Program (CFMMP), a division of the California Department of Conservation.

- An increase in marginal residential densities that has occurred over recent years.[8]

5.3.5 Detail for HST Network Alternatives

As noted earlier, statewide population and employment forecasts for the HST Network Alternatives are similar to those for the No Project Alternative. For Year 2030, the Pacheco network alternative is projected to add about 502,000 (1.4%) more people and 320,000 (1.5%) more jobs compared to the No Project Alternative. The Altamont network alternative is projected to add about 495,000 (1.3%) more people and 316,000 (1.5%) more jobs compared to the No Project Alternative. The incremental effect of both HST Network Alternatives is to add the equivalent of about 1 year's population and employment growth to California by year 2030.

Land consumption for both HST Network Alternatives is projected to be of the same magnitude because of the predominant effect of population growth. In the 11 core area counties, the Altamont network alternative is projected to consume an additional 5,000 ac (0.5%) of land for urbanized densities compared to the Pacheco network alternative. This increment compares to a total of 1.4 million ac of urbanized land projected for these 11 counties in the No Project Alternative. The HST Network Alternatives are able to accommodate population and employment growth at a larger rate than urbanized area growth because of stronger employment growth in the services and FIRE sectors and market forces supporting denser station-area development for office-style facilities.

5.3.6 Study Area Effects

Each of the HST Network Alternatives has varied effects on different parts of the state. Part of this difference is in terms of overall population, employment, and urbanization projections. Another part of the difference is related to the type of industries that are projected to experience employment growth under each alternative.

Table 5.3-5 presents population and employment projections for each county and region analyzed. Values are provided for Year 2005 existing conditions, and year 2030 projections are provided for the No Project Alternative and the two HST Network Alternatives. On an absolute basis, the areas currently most populous are projected to exhibit the largest increases in population and employment from 2005 to 2030. San Diego County and Southern California are together projected to add about 5 million people and 4 million jobs during this period. The five Bay Area counties in the core study area are projected to add about 1.7 million people and 1.4 million jobs during this period. The six counties in the Central Valley study area are projected to add about 2.4 million people and 0.9 million jobs.

A. POPULATION GROWTH RATES

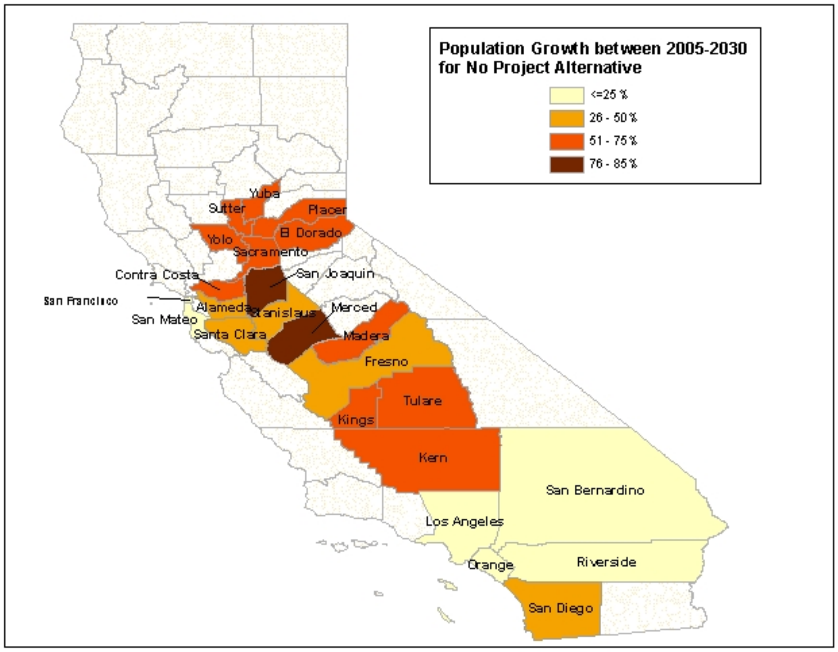
A relative comparison of county-level population growth rates is depicted graphically in Figures 5.3-3 through 5.3-5. Figure 5.3-3 displays the relative change in population for each analysis region from 2005 to 2030 under the No Project Alternative. These data illustrate that Merced and San Joaquin Counties are projected to exhibit the largest population growth rates, followed by Southern Sacramento Valley, Southern San Joaquin Valley, and Contra Costa County. The lowest relative population growth rates are projected to occur in the core areas of the Bay Area and Southern California.

[8] California's housing plan update (*Raising the Roof: California Housing Development Projections and Constraints, 1997–2020*; California Department of Housing and Community Development; May 2000; Exhibit 17) analyzed changes in gross population densities between 1984 and 1986. This analysis included data for 11 of the 21 counties in the study area (see Section 5.2). In 9 of these 11 counties, the density of new residential development that occurred between 1984 and 1996 was between 50% and 585% higher than the average residential density that existed in 1984.

Table 5.3-5
Year 2030 Employment and Population: County and Regional Totals

Region	Employment				Population			
	2005 Conditions	2030			2005 Conditions	2030		
		No Project	Pacheco Alternative	Altamont Alternative		No Project	Pacheco Alternative	Altamont Alternative
Alameda County	953,937	1,247,413	1,259,563	1,257,894	1,451,065	2,038,482	2,051,196	2,054,014
Contra Costa County	508,854	763,445	769,521	767,521	1,017,644	1,543,053	1,549,526	1,546,206
San Francisco County	779,357	975,823	983,634	981,068	741,025	796,208	809,680	801,192
San Mateo County	522,830	717,526	723,835	723,899	701,175	814,065	821,063	826,885
Santa Clara County	1,323,920	1,769,498	1,785,181	1,784,281	1,705,158	2,152,963	2,183,649	2,196,405
Study Area—Bay Area	***4,088,898***	***5,473,705***	***5,521,734***	***5,514,663***	***5,616,067***	***7,344,771***	***7,415,114***	***7,424,702***
Fresno County	435,769	589,226	602,155	601,294	878,089	1,297,476	1,314,824	1,312,891
Madera County	56,892	91,364	96,173	96,293	142,530	219,832	229,648	229,492
Merced County	87,365	115,054	122,374	121,040	242,249	437,880	452,166	447,409
Sacramento County	805,978	1,259,792	1,268,687	1,271,311	1,363,423	2,293,028	2,305,071	2,314,484
San Joaquin County	274,155	368,745	375,491	379,476	664,796	1,229,757	1,241,285	1,254,281
Stanislaus County	224,491	316,686	323,679	332,624	505,492	744,599	758,256	783,839
Study Area—Central Valley	***1,884,650***	***2,740,867***	***2,788,559***	***2,802,038***	***3,796,579***	***6,222,572***	***6,301,250***	***6,342,396***
Core Study Area	***5,973,548***	***8,214,572***	***8,310,293***	***8,316,701***	***9,412,646***	***13,567,343***	***13,716,364***	***13,767,098***
Southern Sacramento Valley	456,834	729,293	732,903	733,942	658,108	1,090,299	1,092,658	1,093,615
Southern San Joaquin Valley	576,935	808,196	835,245	833,977	1,311,579	1,989,111	2,048,889	2,047,375
Southern California	9,290,841	12,308,179	12,435,533	12,421,683	16,843,742	20,844,795	20,988,962	20,950,544
San Diego County	1,895,002	2,783,258	2,828,805	2,837,183	2,936,609	4,005,624	4,147,239	4,132,577
Rest of California	2,709,974	3,774,366	3,795,828	3,791,032	4,991,463	6,613,499	6,618,328	6,614,836
Statewide Total	**20,903,134**	**28,617,864**	**28,938,605**	**28,934,518**	**36,154,147**	**48,110,671**	**48,612,439**	**48,606,045**

Sources: U.S. Bureau of the Census; MTC/California High-Speed Rail Travel Demand Model; Cambridge Systematics 2007



Source: Cambridge Systematics 2007.

Figures 5.3-4 and 5.3-5 display county-level population growth rates compared to the No Project Alternative for the Pacheco and Altamont network alternatives, respectively. For Pacheco, incremental population growth is highest in Madera County, followed by Merced County, San Diego County, and the Southern San Joaquin Valley; incremental growth rates are lowest in Southern California (except San Diego County) and areas from San Joaquin County northward. For Altamont, incremental population growth is highest in Madera and Stanislaus Counties, followed by Merced County, San Diego County, and the Southern San Joaquin Valley; incremental growth rates are lowest in Southern California (except San Diego County) and areas from Sacramento County northward.

B. EMPLOYMENT GROWTH RATES

Figures 5.3-6 through 5.3-8 graphically depict county-level employment growth rates. Figure 5.3-6 displays the relative change in employment for each county from Year 2005 to Year 2030 under the No Project Alternative. These data illustrate that Madera, Sacramento, Contra Costa, and San Diego Counties and the Southern Sacramento Valley are projected to exhibit the largest employment growth rates. The lowest relative employment growth rates are projected to occur in the San Francisco, Alameda, and Merced Counties and Southern California.

Figures 5.3-7 and 5.3-8 display county-level employment growth rates compared to the No Project Alternative for the Pacheco and Altamont network alternatives, respectively. For Pacheco, incremental employment growth is highest in Madera and Merced Counties, followed by Fresno and Stanislaus Counties and the Southern San Joaquin Valley; incremental growth rates are lowest in Southern California (except San Diego County), the Bay Area, and the greater Sacramento area. For Altamont, incremental employment growth is highest in Madera, Merced, and Stanislaus Counties, followed by San Joaquin County and the Southern San Joaquin Valley; incremental growth rates are lowest in Southern California (except San Diego County), the Bay Area, and the greater Sacramento area.

The Northern Central Valley region historically has exceeded statewide averages for government and farming jobs while lagging in all other industry groups. This general pattern is projected to change slightly under the No Project Alternative, with employment shifts from government into farming, and from manufacturing, trade, and TCU into FIRE and services. Incremental job growth under the HST Network Alternatives is projected to have incremental job growth that is oriented much more heavily toward FIRE and services (about 62% of total), with trade, and TCU accounting for about 27% of incremental growth. This is the largest shift in the nature of employment for any region and suggests that either HST Network Alternative could be a strong influence in attracting higher-wage jobs to the Central Valley.

Taken together, the population and employment results suggest that the additional population growth under the HST Network Alternatives is driven by internal job growth (i.e., job growth that occurs in the same county as opposed to population growth) related to initiation of HST service, rather than by potential population shifts from the Bay Area and Southern California and associated long-distance commuting. For the six Central Valley Counties in the core study area, each new job generated between 2005 and 2030 (No Project) is projected to be accompanied by about 2.8 new people. However, each job induced by one of the HST Network Alternatives is projected to be accompanied by only 1.6 new people. Hence, the HST Network Alternatives are projected to induce proportionately more jobs than people in the Central Valley.

C. URBANIZATION

Table 5.3-6 presents projections for increases in urbanized areas for the 11 counties in the core study area. While population and employment increases were projected to be concentrated in the counties that currently are most populous, urbanization patterns do not follow this trend. Although the six

Central Valley Counties are projected to account for 38% of the job growth for the No Project Alternative, they are projected to account for 68% of the urbanization increase in the core study area. Among all 11 core area counties, Sacramento, San Joaquin, and Fresno Counties are projected to experience by far the largest absolute increases in urbanized acreage for the No Project Alternative.

This pattern changes somewhat for the HST Network Alternatives. The six Central Valley Counties account for about one-half of the total incremental job growth in the core study area, but their share of the urbanization increase drops to 60% (from the 68% under the No Project Alternative). Absolute increases in urbanization for the HST Network Alternatives are largest in Santa Clara County (for Altamont), Stanislaus County (for Altamont), and Fresno County (both HST Network Alternatives).

Table 5.3-6
Year 2030 Size of Urbanized Area by Alternative

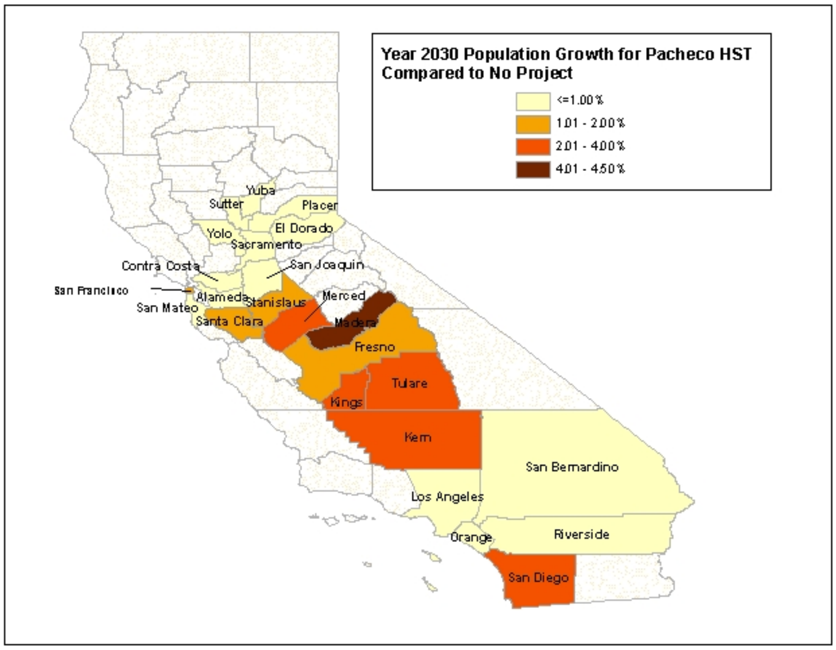
Area	Year 2002 Urbanized Area Acreage	Year 2030 Urbanized Area (Acres)		
		No Project Alternative	HST Network Alternative	
			Pacheco	Altamont
Alameda County	141,654	186,683	187,808	186,942
Contra Costa County	142,467	183,869	184,596	184,288
San Francisco County	23,277	30,013*	30,246*	30,172*
San Mateo County	70,869	80,304	80,386	80,543
Santa Clara County	184,481	207,833	209,352	211,324
Study Area—Bay Area	***562,748***	***688,702***	***692,388***	***693,269***
Fresno County	96,977	150,223	153,574	153,243
Madera County	23,255	36,366	37,793	37,778
Merced County	31,712	60,455	62,212	61,611
Sacramento County	157,101	237,818	238,066	239,245
San Joaquin County	74,250	145,776	145,046	146,104
Stanislaus County	55,426	74,267	74,179	76,886
Study Area—Central Valley	***438,721***	***704,905***	***710,870***	***714,867***
Core Study Area	**1,001,469**	**1,393,607**	**1,403,258**	**1,408,136**

*Note: Projected increases in urbanized area for San Francisco County are a function of the average densities used to calculate employment acreage. Because "greenfield" land is not available in San Francisco County, employment growth will need to be accommodated through densification and infill rather than through increases in urbanized area size implied in this table.

Source: Cambridge Systematics 2007.

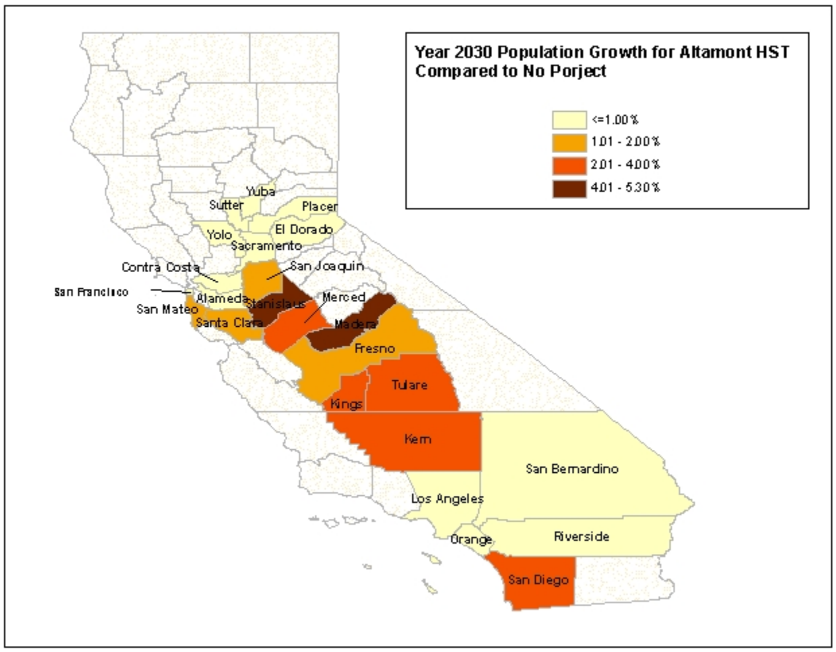
5.3.7 Summary of Effects

Overall, the system alternatives exhibit very similar levels of growth-inducing effects in terms of population, employment, and urbanization patterns. The additional effect of either HST Network Alternative relative to the No Project Alternative is small compared to the difference between the No Project Alternative and existing conditions.



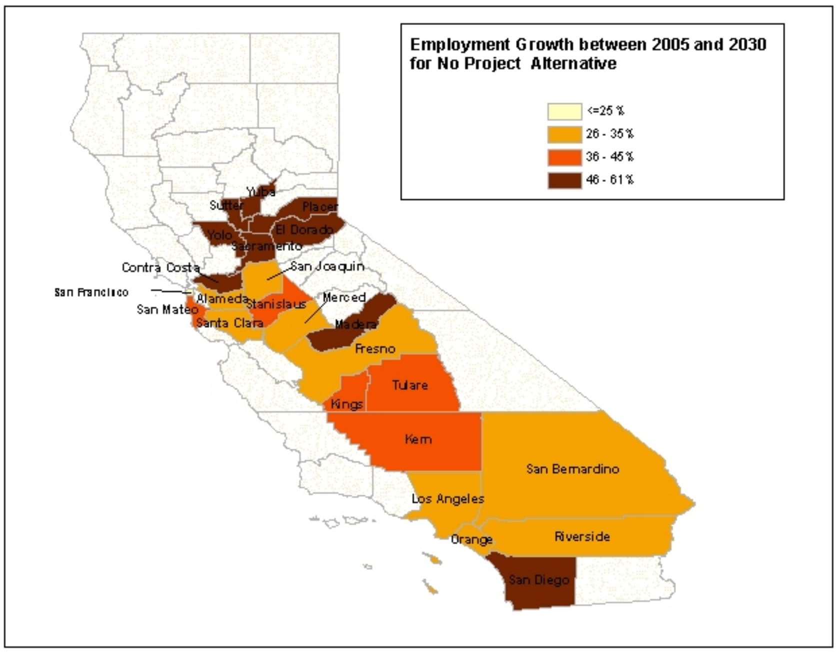
Source: Cambridge Systematics 2007.

Figure 5.3-4
County-Level Population Growth under the Pacheco Network Alternative



Source: Cambridge Systematics 2007.

Figure 5.3-5
County-Level Population Growth under the Altamont Network Alternative



Source: Cambridge Systematics 2007.

Figure 5.3-6
County-Level Employment Growth under the No Project Alternative

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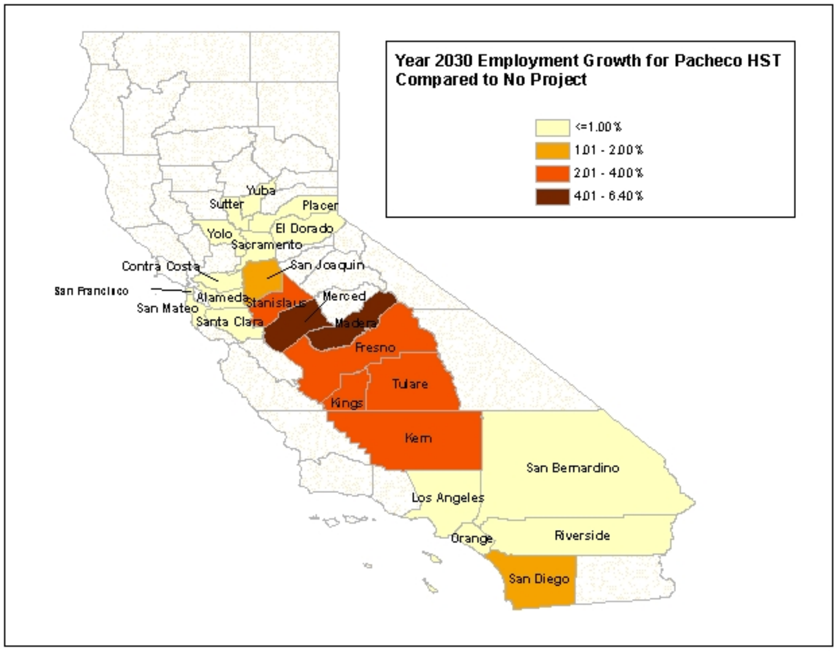
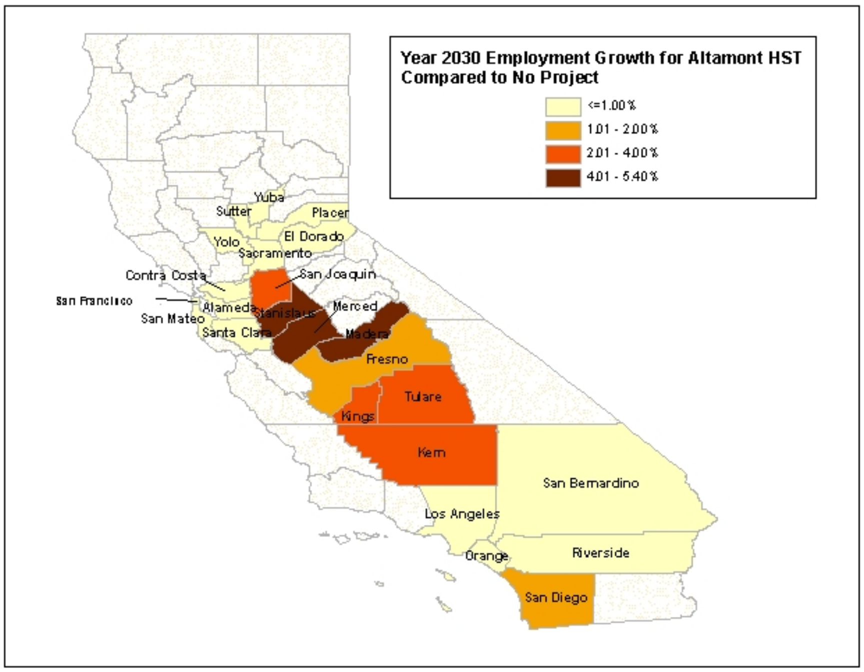


Source: Cambridge Systematics 2007.

Figure 5.3-7
County-Level Employment Growth under the Pacheco Network Alternative



Source: Cambridge Systematics 2007.

Figure 5.3-8
County-Level Employment Growth under the Altamont Network Alternative

B004676

The HST Network Alternatives would stimulate additional growth relative to the No Project Alternative in many Central Valley counties between Sacramento and Fresno. The incremental employment effect is much larger than the incremental population effect in all Central Valley counties, suggesting that the HST Network Alternatives might be more effective at distributing employment throughout the state. Also, this result suggests that the HST Network Alternatives would not stimulate large shifts in residential location from the Bay Area into the Central Valley.

Experiences in other countries have shown that HST systems can provide a location advantage to those areas that are near an HST station, while at the same time facilitating broader economic expansion for a much wider geographic region. The HST Network Alternatives would contribute to a potential economic boost in two ways.

- An HST system would provide user benefits (travel-time savings, cost reductions, accident reductions) and accessibility improvements for California's citizens; in addition to HST travelers, travelers on other modes of transportation can accrue these user benefits, as trips are diverted from highways and airports, resulting in reduced congestion.
- An HST system would improve accessibility to labor and customer markets, thereby potentially improving the competitiveness of the state's industries and the overall economy. With this second effect, businesses that locate close to an HST station could operate more efficiently than businesses that locate elsewhere. Experience from overseas suggests that this competitive advantage may be quite pronounced in high-wage employment sectors that are frequently in high demand in many communities. This second effect would be much stronger under the proposed HST than under the No Project Alternative.

One of the most telling summary statistics comes from combining population and employment growth projections with land consumption forecasts, providing a measure of "land consumed per new job and resident." Essentially, this calculation tells us how efficient each network alternative is at accommodating the projected growth. Because the alternatives have similar levels of overall growth, the efficiency by which that growth would be accommodated becomes more important. Table 5.3-7 provides the relevant data for each alternative; lower values suggest greater efficiency. The results indicate that the Pacheco network alternative is the most efficient of the alternatives, providing an incremental development density that is 1.3% more efficient than the No Project Alternative, while the Altamont network alternative is 0.8% more efficient than the No Project Alternative. The efficiency gains for both HST Network Alternatives are achieved in conjunction with higher population and employment projections than under the No Project Alternative.

Table 5.3-7
Potential Land Consumption Efficiencies in the Core Study Area

	No Project Alternative	Pacheco HST Network Alternative	Altamont HST Network Alternative
Land Consumption (thousands of acres)	392.1	402	407
Job Growth (thousands of jobs)	2,241	2,337	2,343
Population Growth (thousands of people)	4,155	4,304	4,354
Acres Consumed per New Job and Resident*	***0.0613***	***0.0605***	***0.0608***
Efficiency Gain/Loss Relative to No Project Alternative	-	+1.3%	+0.8%

* Value found by dividing land consumption by the sum of job growth and population growth.
Source: Cambridge Systematics 2007.

5.4 Potential Indirect Impacts of Induced Growth

This section explores the potential indirect impacts related to incremental population and employment growth and associated changes in urbanization. Potential indirect impacts are described for the Altamont and Pacheco network alternatives, with the No Project Alternative used as the reference point.

As described above, both HST Network Alternatives may have positive, albeit relatively small, statewide effects on population and employment growth compared to the No Project Alternative. At the sub-state level, San Joaquin Valley counties are projected to experience population and employment growth rates that are noticeably higher than the statewide average, with the Altamont network alternative experiencing higher growth rates in areas north of Fresno County and the Pacheco network alternative experience higher growth rates from Fresno County southward.

Despite the relatively small magnitude of this additional population and employment growth compared to under the No Project Alternative, these changes could contribute to indirect impacts on the human or natural environment in addition to the direct impacts created by construction and operation of an HST. Many of these impacts may derive from the increased urbanization needed to accommodate the additional population and employment. In 2030, the total size of urbanized areas in the study area would be virtually the same under the proposed HST Network Alternatives as under the No Project Alternative, although the HST Network Alternatives will lead to increased urbanization in Fresno, Madera, Merced, and Santa Clara Counties.

Much of the potential incremental growth associated with each alternative is likely to focus around HST stations because these are the locations that receive the highest accessibility benefit with HST service. While county and regional effects may differ only slightly between alternatives, the localized effects could be larger near these proposed HST stations compared to under the No Project Alternative.

5.4.1 Transportation

This section discusses the potential impacts of induced growth on traffic conditions for highways, roadways, passenger transportation services (bus, rail, air, intermodal), goods movement, parking, and transit facilities in the study area.

Currently, the study area highway and roadway corridors considered in this analysis represent some of the worst traffic conditions in the nation. Traffic conditions throughout the study area are expected to worsen. Vehicle V/C ratios are projected to deteriorate between Years 2005 and 2030, and there would be more level of service F segments under the No Project Alternative compared to existing conditions. When compared to this projected degradation in traffic conditions under the No Project Alternative, the traffic conditions projected for the HST Network Alternatives would improve throughout the study area, despite the approximate 1.2% increase in study area population and employment under the proposed HST Network Alternative. The potential impacts of the induced growth, to the degree that they can be detected, would be most apparent around urban HST stations where the additional traffic generated by induced growth is expected to be concentrated.

The largest increase in population and employment would occur in Madera and Merced Counties for the Pacheco network alternative, and in Madera, Merced, and Stanislaus Counties for the Altamont network alternative. This increase has the greatest potential to generate impacts from traffic accessing the potential HST station sites. Most of these communities have considerable capacity on roadways and intersections in areas surrounding potential downtown or outlying HST station sites. The potential traffic generation impacts of the projected 4% to 6% more residents and employees, such as that projected for Madera County, would be unlikely to have measurable impacts on roadway and intersection levels of service.

As an overall conclusion, the potential transportation impacts of induced growth under the HST Network Alternatives are likely to concentrate around proposed HST station sites. Because the Altamont network alternative is projected to experience higher population and employment growth than the Pacheco network alternative for nearly all counties north of Fresno County, the secondary transportation impacts could be expected to be proportionately larger for the Altamont network alternative. Project-level environmental studies would be expected to provide the appropriate opportunity to investigate more localized impacts.

5.4.2 Air Quality

Section 3.3, "Air Quality," describes the potential impact of induced growth on air pollution. Under high-end assumptions, the HST Network Alternatives annually would accommodate an estimated 95 million travelers that would otherwise use the roadways and airports. This diversion to HST could lead to a projected 5% statewide VMT reduction on the highway system, with VMT reductions of between 7% and 12% in Bay Area and Central Valley Counties. Thus, the HST Network Alternatives are projected to decrease the amount of mobile-source air quality pollutants in the study area and the state as compared to the No Project Alternative. The additional increase in population and employment in each county from induced growth generally would be expected to increase traffic and mobile-source air pollutants by an amount proportional to that growth. Even with induced growth, mobile-source air emissions under all HST Network Alternatives would be lower than No Project emissions in all counties because the projected VMT reduction is larger than the projected population and employment growth.

At the local level, the HST Network Alternatives have somewhat more potential to affect air quality because of expected increases in local traffic near HST station locations. It is expected that the induced growth could concentrate near HST stations, and thus the direct and indirect air quality effects could be larger around the station areas. The severity of these local impacts, however, cannot be reliably quantified without local and detailed traffic modeling and impact analysis, which is outside the scope of analysis for this Program EIR/EIS. Project-level environmental studies would be expected to provide the appropriate opportunity to investigate more localized impacts.

5.4.3 Noise and Vibration

Increased population and employment related to induced growth would not increase the likelihood or levels of potential noise and vibration impacts. Therefore, no indirect impacts from induced growth are expected in the areas of noise and vibration.

5.4.4 Energy

There would not be any significant differences in potential energy use among the alignment alternatives resulting from general population and employment growth projections because the magnitude of the incremental statewide population and employment growth is expected to be similar, regardless of which alternative is chosen. However, the expected propensity of the proposed HST Network Alternatives to concentrate employment and population near HST stations, and the resulting incremental development density benefit, would tend to reduce the number and length of vehicle trips for work, leisure, and commerce compared to the No Project Alternative. Such an effect would decrease the amount of energy directly used for transportation. The potential increased density in the vicinity of proposed HST station sites also would limit the amount of energy required for construction of and access to future infrastructure projects by reducing the distance between structures and reducing the number of structures that would be required to serve new population and employment growth. In addition, higher density would reduce demand for the large-volume transportation-related infrastructure projects required for a highly automobile-oriented transportation network. Finally, if growth around HST stations occurs at higher densities than would occur with more dispersed growth under the No Project Alternative, savings in building-related energy use also could be realized because multi-unit and multi-story structures tend to require less energy per square foot for heating and cooling needs.

The projected population and employment distributive effect of the project could create the need for some change in the incremental development of overall energy and electricity generation and/or transmission capacity among regions. For example, Madera, Merced, and Stanislaus Counties would exhibit the largest relative increase in both population and employment with implementation of the HST Network Alternatives. Relatively high incremental growth is also expected in other counties in the Central Valley. The Southern San Joaquin Valley and San Diego County also would exhibit induced employment and population growth that is above the statewide average. These differences in growth rates among counties potentially would require more incremental production and/or transmission capacity to be developed in some areas with implementation of the HST Network Alternatives as compared to the No Project Alternative. Regional differences in production and transmission needs may also be seen among the HST Network Alternatives, with the Altamont network alternative exhibiting more energy use in areas north of Fresno County and the Pacheco network alternative exhibiting more energy use from Fresno County southward (including Southern California).

5.4.5 Electromagnetic Frequency and Electromagnetic Interference

Increased population or employment related to induced growth would not increase the likelihood or potential severity of EMF and EMI associated with operation of the proposed HST Network Alternatives. Therefore, no indirect impacts from induced growth are expected in the areas of EMF/EMI.

5.4.6 Land Use, Communities and Neighborhoods, Property, and Environmental Justice

This section describes the potential impacts of induced growth attributable to the HST Network Alternatives on land use compatibility, communities and neighborhoods, property, environmental justice, and socioeconomics.

A. COMPATIBILITY WITH EXISTING LAND USE AND FUTURE LAND USE PLANS

The analysis results indicate that employment is projected to increase under the HST Network Alternatives, with employment potentially available for a broad range of education or job skills. Increased employment opportunities generally lead to personal income growth. The relationship between employment, income growth, and the socioeconomic composition of a community is complex. Increases in employment and income opportunities, however, would tend to make a community more attractive to a broader range of individuals. Because induced growth under the HST Network Alternatives would be relatively small (compared to the growth under the No Project Alternative), it is expected that socioeconomic changes also would be small.

The HST Network Alternatives are projected to push employment growth in the study area 1.2% higher than under the No Project Alternative, with the Altamont network alternative experiencing higher growth in the Central Valley and the Pacheco network alternative experiencing higher growth in the Bay Area. The development pressures associated with the HST Network Alternatives would be concentrated in the service and FIRE industries, which generally occupy office developments and have been shown to have a higher propensity to locate close to transit stations. Increased residential growth might also be expected in HST station areas and adjacent communities.

The HST Network Alternatives include potential station location options that were identified through consultation with local planning agencies and selected to be compatible to the extent possible with future planned land uses. Recent trends among local jurisdictions show a growing consideration of land use policies that are intended to encourage high-density, mixed-use development in downtowns and other areas in which HST stations may be located. Section 3.7, "Land Use and Planning, Communities and Neighborhoods, Property, and Environmental Justice," describes community plans in the various HST station area options and assesses the level of compatibility of an HST with these plans. Overall, most station locations for the proposed HST Network Alternatives would be highly compatible with local and regional plans, which generally support rail systems and transit-oriented development. Potential inconsistencies were noted for a few stations, including Livermore (Greenville Road/I-580), Tracy (ACE), Union City (Shinn), Briggsmore (Amtrak), Merced (Downtown), and Castle AFB. As induced growth may lead to intensified development in HST station areas, secondary land use impacts are possible with these same potential station locations. However, it is possible that some of these inconsistencies will be addressed through further land use planning that occurs at the local level.

B. COMMUNITIES AND NEIGHBORHOODS

The induced growth associated with either HST Network Alternative would have some modest potential to increase office/commercial development densities around HST station sites and residential growth in adjacent communities. In general, this growth would not be expected to create new barriers within neighborhoods or reduce community cohesion because the growth would generally follow existing transportation corridors and rights-of-way. In some cases, growth could provide positive community and neighborhood benefits by helping to fill in vacant or underutilized areas with higher-intensity uses that generate and encourage pedestrian activity. Any induced development that does occur would be expected to be consistent with locally adopted land use plans and developed through a public process that considers both positive and negative community and neighborhood impacts.

C. PROPERTY

The induced population and employment growth that would be attributable to the HST Network Alternatives is not projected to create the need for any additional right-of-way for wider highways, new interchanges, additional runways, or other auto or air travel infrastructure.

The highest potential for secondary property impacts under the HST Network Alternatives would be expected to occur near the HST stations, where the transportation accessibility benefits of HST are expected to lead to increased land values and development pressures. Increased land values would represent a benefit to property owners near stations. As a result of the accessibility benefits of HST access, more and denser development would be expected to occur near HST stations. While some of this development might represent a net increase in development in the region (as a result of induced population and employment growth), other development simply might be shifted from an alternative location (e.g., near an outlying highway interchange). Therefore, some properties in other parts of the region, not near HST stations, might not experience the same development pressure that they would have under the No Project Alternative. These effects are likely to be very dispersed and minor from a regional perspective, and any specific locations that might be affected outside of HST station areas cannot be predicted. Furthermore, any induced development that occurs (whether inside or outside HST station areas) would be expected to be consistent with locally adopted land use plans that reflect community input into preferred development patterns. The planning policies and general plans of most jurisdictions in which potential HST station sites would be located are directing present and future development into their urban centers and to infill sites independent of possible future HST implementation.

D. ENVIRONMENTAL JUSTICE

The induced growth attributable to the HST Network Alternatives should not have disproportionate impacts on minority and low-income populations. The induced growth from the HST Network Alternatives would have the potential to offer improved employment opportunities to local communities. These opportunities may arise from more diversified regional economies and robust employment growth in regions that would not benefit in the same way under the No Project Alternative.

Section 3.7, "Land Use and Planning, Communities and Neighborhoods, Property, and Environmental Justice," identifies the extent to which environmental justice populations are present in potential HST station areas. Stations with such populations identified include West Oakland/7th Street, 12th Street/City Center, Coliseum/Airport, Union City (BART), Fremont (Warm Springs), Gilroy (Caltrain), Union City (Shinn), Merced (Downtown), and Castle AFB. Impacts in specific station areas and adjacent communities could be both positive and negative—positive to property owners as a result of increased property values and to workers as a result of increased job opportunities, but potentially negative to non-property owners if rising property values reduce housing affordability. It would be speculative to attempt to further characterize potential impacts at the program level without more specific information about what development impacts might occur.

The consequence of growing employment in the service industries would be a diversification in the Central Valley away from agriculture and into more non-agricultural jobs. The impact of these new jobs (and the population growth and new development that it would stimulate) on minority and low-income populations in each county cannot be identified in this Program EIR/EIS. In general, FIRE and service job growth would tend to be attracted to station areas and adjacent communities under the HST Network Alternatives. The extent to which this development would potentially use land occupied by minority and low-income populations would deserve consideration at the project-level review of potential environmental justice issues. The growth in FIRE and service sector employment would tend to offer more jobs to high-skilled members of the work force than to low-skilled workers. Many service-sector jobs, however, would be accessible to low-skilled workers, and any increase in employment generally would have multiplier effects that tend to generate indirect and induced job growth across many occupations. Lower-skilled workers could also benefit from the additional job opportunities in building construction and related industries as a result of induced employment and population growth that occurs in the region. As with many of the resource areas, there are potential regional differences in these opportunities between the HST Network Alternatives because of differences in the pattern of induced population and employment growth. In northern San Joaquin Valley counties, more employment opportunities would be expected for environmental justice populations with the Altamont network alternative. In other San Joaquin Valley and Southern California counties, more employment opportunities would be expected with the Pacheco network alternative. Opportunities may be relatively similar between the HST Network Alternatives in the Bay Area.

5.4.7 Farmland and Agriculture

The urbanization forecasts that were developed for the analysis of potential growth inducement resulted in conceptual urbanization footprints showing the potential future locations of developed areas in the 11 core study area counties. The footprints show the areas that would be the most likely to become urbanized in the future, based on the levels of projected population and employment growth, current development patterns, land accessibility, and local regulations and policies. These urbanization footprints were combined with GIS-based information used in Chapter 3 showing the location of lands in agricultural use to produce estimates of the extent to which farmland might be converted to urbanized areas.

Table 5.4-1 provides estimates of farmland acreage that could be converted to urbanized land uses for the No Project and HST Network Alternatives. Results are presented separately for categories of prime farmland, farmland of statewide importance, unique farmland, and farmland of local importance. The difference between the No Project and HST Network Alternatives provides an estimate of the indirect impact of induced growth on farmland and agriculture.

Table 5.4-1 Farmland Resources Potentially Affected by Future Urbanization

Area	Acreage of Resource Potentially Affected by Future Urbanization* (Percent Change from No Project Alternative)		
		HST Network Alternatives	
	No Project Alternative	Pacheco	Altamont
Prime Farmland			
Alameda County	3,062	3,089 (1%)	3,062 (0%)
Contra Costa County	8,108	8,607 (6%)	8,394 (4%)
San Francisco County	0	0	0
San Mateo County	398	398 (0%)	398 (0%)
Santa Clara County	4,935	4,952 (0%)	5,113 (4%)
Study Area—Bay Area	***16,502***	***17,045 (3%)***	***16,966 (3%)***
Fresno County	29,092	31,694 (9%)	31,563 (8%)
Madera County	2,899	2,955 (2%)	2,955 (2%)
Merced County	15,073	16,035 (6%)	15,587 (3%)
Sacramento County	163	163 (0%)	163 (0%)
San Joaquin County	25,113	24,496 (-2%)	25,136 (0%)
Stanislaus County	12,420	12,333 (-1%)	13,776 (11%)
Study Area—Central Valley	***84,760***	***87,675 (3%)***	***89,180 (5%)***
Core Study Area	**101,261**	**104,721 (3%)**	**106,147 (5%)**
Farmland of Statewide Importance			
Alameda County	835	890 (7%)	835 (0%)
Contra Costa County	2,743	2,733 (0%)	2733 (0%)
San Francisco County	0	0	0
San Mateo County	0	0	0
Santa Clara County	813	815 (0%)	870 (7%)
Study Area—Bay Area	***4,391***	***4,438 (1%)***	***4,438 (1%)***
Fresno County	3,754	4,248 (13%)	4,043 (8%)
Madera County	1,497	1,527 (2%)	1,512 (1%)
Merced County	3,729	4,060 (9%)	3,912 (5%)
Sacramento County	32,746	32,793 (0%)	33,320 (2%)
San Joaquin County	23,991	23,851 (-1%)	24,164 (1%)
Stanislaus County	2,716	2713 (0%)	3,593 (32%)
Study Area—Central Valley	***68,433***	***69,192 (1%)***	***70,544 (3%)***
Core Study Area	**72,824**	**73,630 (1%)**	**74,982 (3%)**
Unique Farmland			
Alameda County	588	657 (12%)	588 (0%)
Contra Costa County	1,184	1,176 (-1%)	1,176 (-1%)
San Francisco County	0	0	0
San Mateo County	156	156 (0%)	156 (0%)
Santa Clara County	91	91 (0%)	91 (0%)
Study Area—Bay Area	***2,019***	***2,081 (3%)***	***2,011 (0%)***

Area	Acreage of Resource Potentially Affected by Future Urbanization* (Percent Change from No Project Alternative)		
		HST Network Alternatives	
	No Project Alternative	Pacheco	Altamont
Fresno County	3,818	4,038 (6%)	4,055 (6%)
Madera County	3,430	4,260 (24%)	4,260 (24%)
Merced County	3,195	3,361 (5%)	3,361 (5%)
Sacramento County	1,878	1,878 (0%)	1,900 (1%)
San Joaquin County	2,861	2,861 (0%)	2,864 (0%)
Stanislaus County	974	974 (0%)	1,100 (13%)
Study Area—Central Valley	***16,156***	***17,372 (8%)***	***17,540 (9%)***
Core Study Area	**18,175**	**19,452 (7%)**	**19,551 (8%)**
Farmland of Local Importance			
Alameda County	7	7 (0%)	7 (0%)
Contra Costa County	9,543	9,640 (1%)	9,585 (0%)
San Francisco County	0	0	0
San Mateo County	126	126 (0%)	143 (14%)
Santa Clara County	1,100	1,129 (3%)	1,161 (6%)
Study Area—Bay Area	***10,776***	***10,902 (1%)***	***10,897 (1%)***
Fresno County	3,630	3,660 (1%)	3,637 (0%)
Madera County	1,623	1,767 (9%)	1,767 (9%)
Merced County	3,884	4,013 (3%)	4,013 (3%)
Sacramento County	13,467	13,494 (0%)	13,554 (1%)
San Joaquin County	10,277	10,285 (0%)	10,336 (1%)
Stanislaus County	106	106 (0%)	168 (58%)
Study Area—Central Valley	***32,989***	***33,325 (1%)***	***33,475 (1%)***
Core Study Area	**43,765**	**44,227 (1%)**	**44,373 (1%)**
All Farmland Lost			
Alameda County	4,492	4,643 (3%)	4,492 (0%)
Contra Costa County	21,577	22,155 (3%)	21,889 (1%)
San Francisco County	0	0	0
San Mateo County	680	680 (0%)	697 (3%)
Santa Clara County	6,939	6,988 (1%)	7,235 (4%)
Study Area—Bay Area	***33,688***	***34,466 (2%)***	***34,313 (2%)***
Fresno County	40,293	43,639 (8%)	43,298 (7%)
Madera County	9,449	10,509 (11%)	10,495 (11%)
Merced County	25,882	27,468 (6%)	26,873 (4%)
Sacramento County	48,255	48,329 (0%)	48,937 (1%)
San Joaquin County	62,243	61,492 (-1%)	62,500 (0%)
Stanislaus County	16,215	16,126 (-1%)	18,637 (15%)
Study Area—Central Valley	***202,337***	***207,564 (3%)***	***210,739 (4%)***
Core Study Area	**236,025**	**242,030 (3%)**	**245,052 (4%)**

Area	Acreage of Resource Potentially Affected by Future Urbanization* (Percent Change from No Project Alternative)		
		HST Network Alternatives	
	No Project Alternative	Pacheco	Altamont

* Values in the table indicate the resource acreage that is located in areas that are projected to become urbanized between the years 2002 and 2030 under each alternative. Each alternative, including the No Project Alternative, is projected to have a unique urbanization footprint; therefore, values are presented for each alternative.
Source: Cambridge Systematics and Parsons Brinckerhoff 2007.

The potential induced growth associated with the HST Network Alternatives is projected to affect about 6,000 to 9,000 ac (2,429 to 3,652 ha) more of farmland for the core study area than the No Project Alternative, with the larger impacts being for the Altamont network alternative because of the overall higher amount of urbanization under this alternative. These impacts include an additional 3 to 5% more prime farmland, 1 to 3% farmland of statewide importance, 7 to 8% unique farmland, and 1% local farmland compared to the No Project Alternative. Fresno County is expected to experience the greatest absolute loss, about 3,000 ac (1,215 ha) under either HST Network Alternative, or one-third to one-half of the total impact. Madera and Merced Counties both will experience impacts of 1,000 ac (405 ha) or more under either HST Network Alternative, while Stanislaus County will experience impacts of 2,400 ac (972 ha) under the Altamont network alternative. On the other hand, Stanislaus and San Joaquin Counties could experience slight gains in farmland under the Pacheco network alternative. The already highly urbanized counties of the Bay Area are expected to experience minimal farmland impacts.

Projected farmland losses beyond the No Project Alternative would include 3,500 to 4,900 ac (1,417 to 1,984 ha) of prime farmland across the core study area, 800 to 2,200 ac (324 to 891 ha) of farmland of statewide interest, 1,300 to 1,400 ac (526 to 567 ha) of unique farmland, and 500 to 600 ac (202 to 243 ha) of farmland of local importance. Impacts on each category would be greater under the Altamont network alternative than the Pacheco network alternative.

5.4.8 Aesthetics and Visual Resources

Aesthetics and visual resources refer to the natural and human-made features of a landscape that characterize its form, line, texture, and color. The character of the existing landscape takes shape and would change in each region over time as a result of land uses, development, and urban growth that may occur under any of the alternatives. Increased population or employment related to induced growth could contribute to these impacts, as could the redirection of growth into HST station areas and adjacent communities. Whether these impacts are viewed as positive or negative depends on the specific nature and design of the growth that does occur as well as the subjective opinions of different viewers. In general, however, community land use plans and policies increasingly are emphasizing more compact development patterns as a preferred alternative to dispersed, low-density development. To the extent that the HST Network Alternatives encourage more compact and focused development in station areas, and support the preservation of undeveloped land elsewhere in the study area, this could represent a positive aesthetic and visual benefit. However, it would be speculative to attempt to characterize potential changes at the program level without more specific information about what might be built.

5.4.9 Utilities and Public Services

Utilities and public services include electrical transmission lines, natural gas facilities, and wastewater treatment facilities. The capacity and extent of these utilities and services would be expected to expand gradually or in increments to accommodate the growth in population, employment, and urbanized land area expected to occur in California between now and 2030. Because the additional population, employment, and land consumption related to growth potentially induced by the HST Network Alternatives are relatively small compared to the total growth from existing conditions under the No Project Alternative, no considerable impacts are expected in the areas of utilities and public services. As with many of the resource areas, there are potential county-level differences between the HST Network Alternatives as a result of patterns of induced population and employment growth. In northern San Joaquin Valley counties, utility and public service needs may be greater under the Altamont network alternative. In other San Joaquin Valley and Southern California counties, utility and public service needs may be greater under the Pacheco network alternative. Utility and public service needs may be relatively similar for the HST Network Alternatives in the Bay Area.

To the extent that the HST Network Alternatives encourage more compact growth patterns, however, the costs of providing utilities and public services potentially could be reduced compared to the costs of serving a more dispersed pattern of development. Costs also might be reduced to the extent that specific alignments and station locations encourage development in existing, developed areas versus areas that currently are undeveloped.

5.4.10 Hazardous Materials and Wastes

Increased population or employment related to growth potentially induced by either HST Network Alternative would not be expected to increase the likelihood or potential severity of exposure to hazardous materials and wastes. No indirect impacts from induced growth are expected in the areas of hazardous materials and wastes.

5.4.11 Cultural and Paleontological Resources

Future growth is expected to result in large areas of land within and outside of cities being developed to urban density levels. However, it would be speculative to identify the likelihood or extent of potential impacts of development on prehistoric archaeological sites, historic archaeological sites, traditional cultural properties, historic structures, and paleontological resources at the program level without knowledge of the precise locations where development projects may be built. In general, both HST Network Alternatives are projected to have similar urbanization patterns as the No Project Alternative, with increased population and employment growth under the HST Network Alternatives offset by higher development density potential in the HST station areas.

Increased population or employment related to growth potentially induced by either HST Network Alternative would not increase the likelihood or extent of potential impacts on cultural or paleontological resources. No indirect impacts from induced growth are expected in the areas of cultural and paleontological resources.

5.4.12 Geology and Soils

Increased population or employment related to growth potentially induced by either HST Network Alternative would not increase the likelihood or extent of potential impacts related to geologic formations, seismic hazards, slope stability, oil and gas fields, or mineral resources. No indirect impacts from induced growth are expected in the areas of geology and soils.

5.4.13 Hydrology and Water Resources

The urbanization forecasts that were developed for the analysis of potential growth inducement resulted in conceptual urbanization footprints showing the potential future locations of developed areas in the 11 core study area counties. The footprints show the areas that would be the most likely to become urbanized in the future, based on the levels of projected population and employment growth, current development patterns, land accessibility, and local regulations and policies. These urbanization footprints were combined with GIS-based maps showing general waterway locations to identify waterways that would be located in areas of future urbanization. Table 5.4-2 provides estimates of the miles of waterways that are in future growth areas and that, in turn, could be affected by this future growth. The difference between the No Project and the HST Network Alternatives provides an estimate of the potential indirect impact of induced growth on hydrology and water resources.

Induced growth associated with the HST Network Alternatives is projected to affect about 22 to 30 mi (35 to 48 km) more of waterways (2 to 3%) across the core study area than the No Project Alternative. Higher impacts are expected under the Altamont network alternative than the Pacheco network alternative because of the greater amount of urbanization projected under this alternative. The Bay Area would experience 9 to 10 mi (14 to 16 km) of waterway impacts, and the Central Valley would experience 13 to 20 mi (21 to 32 km) of impacts. The greatest impacts on an individual county level would be 8 mi in Santa Clara County under the Altamont network alternative, and 8 mi in Fresno County under the Pacheco network alternative.

Table 5.4-2 Hydrology and Water Resources Potentially Affected by Future Urbanization

	Waterways in Areas of Projected Urbanization*, in Miles (Percent Change from No Project Alternative)		
		HST Network Alternatives	
Area	**No Project Alternative**	**Pacheco**	**Altamont**
Prime Farmland			
Alameda County	215	218 (2%)	215 (0%)
Contra Costa County	84	86 (2%)	85 (1%)
San Francisco County	0	0	0
San Mateo County	51	51 (1%)	51 (1%)
Santa Clara County	77	80 (4%)	84 (10%)
Study Area—Bay Area	***426***	***435 (2%)***	***436 (2%)***
Fresno County	115	123 (7%)	121 (5%)
Madera County	34	35 (5%)	35 (4%)
Merced County	53	58 (9%)	56 (6%)
Sacramento County	135	135 (0%)	139 (3%)
San Joaquin County	191	190 (0%)	193 (1%)
Stanislaus County	54	54 (-1%)	60 (10%)
Study Area—Central Valley	***583***	***596 (2%)***	***603 (3%)***
Core Study Area	**1,009**	**1,031 (2%)**	**1,040 (3%)**

* Values in the table indicate the resource acreage that is located in areas that are projected to become urbanized between the years 2002 and 2030 under each alternative. Each alternative, including the No Project Alternative, is projected to have a unique urbanization footprint; therefore, values are presented for each alternative.

Source: Cambridge Systematics and Parsons Brinckerhoff 2007.

5.4.14 Biological Resources

The urbanization forecasts that were developed for the analysis of potential growth inducement resulted in conceptual urbanization footprints showing the potential future locations of developed areas in the 11 core study area counties. The footprints show the areas that would be the most likely to become urbanized in the future, based on the levels of projected population and employment growth, current development patterns, land accessibility, and local regulations and policies. These urbanization footprints were combined with GIS-based maps showing general locations of habitats in which threatened and endangered species may be found, to identify biological resources that could be affected by areas of future urbanization. Table 5.4-3 provides estimates of the acreage of potential habitat for threatened and endangered species that could be affected by this projected future growth. The difference between the No Project and the HST Network Alternatives provides an estimate of the indirect impact of induced growth on biological resources.

Induced growth associated with the HST Network Alternatives is projected to affect about 2,600 to 3,600 ac (1,053 to 1,457 ha) more of threatened and endangered habitat (2–3%) across the core study area than the No Project Alternative. Impacts are expected to be greater under the Altamont network alternative than the Pacheco network alternative. The largest increases (1,300–1,500 ac [526–607 ha) are expected to occur in the Bay Area—particularly Alameda, Contra Costa, and Santa Clara Counties—representing an increase in affected land area of 4% across all five counties. In the Central Valley, about 650 ac (263 ha) are expected to be affected under the Altamont network alternative, with little or no net impact under the Pacheco network alternative. Fresno and Madera Counties are not expected to experience additional impacts under either HST Network Alternative.

Table 5.4-3 Biological Resources Potentially Affected by Future Urbanization

	Habitat of Threatened and Endangered Species in Areas of Projected Urbanization*, in Acres (Percent Change from No Project Alternative)		
		HST Network Alternatives	
Area	**No Project Alternative**	**Pacheco**	**Altamont**
Prime Farmland			
Alameda County	17,297	17,675 (2%)	17,557 (2%)
Contra Costa County	11,372	11,826 (4%)	11,639 (2%)
San Francisco County	0	0	0
San Mateo County	3,002	3,015 (0%)	3,022 (1%)
Santa Clara County	4,356	4,828 (11%)	5,288 (21%)
Study Area—Bay Area	***36,027***	***37,344 (4%)***	***37,506 (4%)***
Fresno County	7,225	7,225 (0%)	7,225 (0%)
Madera County	40	40 (0%)	40 (0%)
Merced County	1,290	1,334 (3%)	1,334 (3%)
Sacramento County	9,442	9,459 (0%)	9,699 (3%)
San Joaquin County	32,714	32,687 (0%)	32,848 (0%)
Stanislaus County	5,098	5,041 (-1%)	5,313 (4%)
Study Area—Central Valley	***55,809***	***55,786 (0%)***	***56,459 (1%)***
Core Study Area	**127,863**	**130,474 (2%)**	**131,471 (3%)**

* Values in the table indicate the resource acreage that is located in areas that are projected to become urbanized between the years 2002 and 2030 under each alternative. Each alternative, including the No Project Alternative, is projected to have a unique urbanization footprint; therefore, values are presented for each alternative.

Source: Cambridge Systematics and Parsons Brinckerhoff 2007.

5.4.15 Wetlands

The urbanization footprints described above in the discussion of farmland and agriculture were combined with GIS-based maps showing general wetland locations to identify wetlands that could be affected by areas of future urbanization. (See Section 3.15, Biological Resources and Wetlands.) Table 5.4-4 shows estimates of the wetland acreage that could be affected by this future growth. The difference between the No Project and the HST Network Alternatives provides an estimate of the potential indirect impact of induced growth on wetlands.

In total, induced growth associated with the HST Network Alternatives is projected to affect about 72 to 111 ac (29 to 45 ha) more of wetlands across the core study area than the No Project Alternative. This represents less than 0.5% of total study area wetlands. Under the Altamont network alternative, just over 100 ac (40 ha) are expected to be affected, primarily in Sacramento County. Under the Pacheco network alternative, the greatest impacts are expected to be in the Bay Area, particularly Alameda County (44 ac [18 ha]). Merced County is also projected to experience impacts of 15–17 ac (6– 7 ha), and Stanislaus County would see impacts of 12 ac (5 ha) under the Pacheco network alternative. Impacts in other counties would be no more than 5 ac (2 ha).

Table 5.4-4 Wetlands Potentially Affected by Future Urbanization

	Wetlands Within Areas of Projected Urbanization* (Acres) (Percent Change from No Project Alternative)		
		HST Network Alternatives	
Area	**No Project Alternative**	**Pacheco**	**Altamont**
Prime Farmland			
Alameda County	8,305	8,350 (1%)	8,305 (0%)
Contra Costa County	608	613 (1%)	608 (0%)
San Francisco County	0	0	0
San Mateo County	2,540	2,540 (0%)	2,540 (0%)
Santa Clara County	4,460	4,460 (0%)	4,465 (0%)
Study Area—Bay Area	***15,914***	***15,963 (0%)***	***15,919 (0%)***
Fresno County	1,050	1,048 (0%)	1,050 (0%)
Madera County	294	297 (1%)	297 (1%)
Merced County	418	435 (4%)	432 (4%)
Sacramento County	3,153	3,158 (0%)	3,225 (2%)
San Joaquin County	1,626	1,626 (0%)	1,631 (0%)
Stanislaus County	324	324 (0%)	336 (4%)
Study Area—Central Valley	***6,865***	***6,887 (0%)***	***6,971 (2%)***
Core Study Area	**22,778**	**22,850 (0%)**	**22,889 (0%)**

* Values in the table indicate the resource acreage that is located in areas that are projected to become urbanized between the years 2002 and 2030 under each alternative. Each alternative, including the No Project Alternative, is projected to have a unique urbanization footprint; therefore, values are presented for each alternative.

Source: Cambridge Systematics and Parsons Brinckerhoff 2007.

5.4.16 Section 4(f) and 6(f) Resources (Public Parks and Recreation)

Increased population or employment related to induced growth would not increase the likelihood or extent of potential impacts on or uses of Section 4(f) and 6(f) resources, including publicly owned land from parks, recreation lands, wildlife and waterfowl refuges, and historic sites. No indirect impacts from induced growth are expected on Section 4(f) and 6(f) resources.

5.5 Growth Inducement and Secondary Impact Differences among HST Alignment Alternatives and Station Location Options

The discussion of induced growth secondary impacts compares the general nature of impacts associated with the HST Network Alternatives to the No Project Alternative. Although quantitative employment and population impacts were not generated for every alignment and station location option, qualitative distinctions nevertheless can be made among these options.

For this discussion, the difference in impacts will be most significant between the two general choices of the Altamont and Pacheco network alternatives. In the primary study area of this environmental analysis, the Altamont network alternative would be expected to have a greater influence on all secondary impact areas than the Pacheco network alternative for two reasons. First, the Altamont network alternative is projected to induce about 6,000 more jobs and 50,000 more residents than the Pacheco network alternative in the Bay Area to Central Valley study area. Second, the Altamont network alternative is likely to have more stations in total than the Pacheco network alternative, leading to more geographic locations that could experience secondary impacts on local and regional traffic, air quality, energy, land use, and related ecological resources.

Madera and Merced Counties are likely to experience the greatest magnitude of secondary impacts among all study area counties for both HST Network Alternatives. Based on projected levels of induced growth, Stanislaus County is likely to exhibit an equally high magnitude of secondary impacts with the Altamont network alternative; under the Pacheco network alternative, Stanislaus County's secondary impacts are likely to be much lower.

All of the Altamont HST Alignment Alternatives are likely to create equal magnitudes and spatial patterns of secondary impacts because all alignments offer relatively similar travel time and station location options in the Bay Area.

The two Pacheco HST Alignment Alternatives, Henry Miller and GEA North, also are likely to produce similar patterns of induced growth and secondary impacts for all counties in the core study area. Although these two Pacheco alignment alternatives provide noticeably different HST travel times between the Bay Area and northern Central Valley, there are equally noticeable, yet opposite, travel time differences between the Bay Area and locations south of Merced County. The net effect is that the slight congestion reduction and HST ridership benefits provided by the Henry Miller alignment offset the accessibility benefits (between the Bay Area and northern Central Valley) provided by the GEA North alignment.

Adding, dropping or changing station locations will lead to changes in potential secondary impacts at the station in question as well as in the HST system as a whole. In individual counties, the most notable situation is in Merced County, where the SP Downtown station could be on either the Sacramento or Southern California HST lines depending upon the alignment followed west of Merced; the Castle AFB station, on the other hand, always would be served by HST service between the Bay Area and Sacramento. In Stanislaus County, the Amtrak Briggsmore station could lead to the urbanization of 1,000 more acres in the county than the SP Downtown station site[9], leading to additional indirect impacts; this difference between station sites accounts for about 35% of the difference in urbanized area size between the Altamont and Pacheco network alternatives noted in Table 5.3-6 for Stanislaus County. In the East Bay, HST stations that interface with the BART system may induce larger overall growth and secondary impacts attributable to improved regionwide accessibility. On the San Francisco Peninsula, all proposed HST stations offer the opportunity for intermodal transfers with Caltrain, and all proposed station sites have substantial station-area activity of one form or another. The most likely location for differences in

[9] *Economic Growth Effects of the System Alternatives for the Program Environmental Impact Report/Environmental Impact Statement*, California High-Speed Rail Authority, Section 5.2, July 2003.

areawide growth inducement and secondary impacts is with the San Francisco station location. The Transbay Transit Center offers better access than the 4th/Townsend site to the high density employment and activity center in Downtown San Francisco; this improved accessibility is likely to lead to the potential for additional growth inducement and secondary impacts.

Alternative station locations in the same general vicinity may have different localized secondary impacts, but overall impacts throughout the study area are likely to be similar. Different areawide impacts will arise from adding or dropping an HST station for a community or subarea as a whole. For example, not providing an HST station in the Tri-Valley or Tracy areas likely would lower overall growth inducement and secondary impacts because job accessibility and business attraction benefits throughout the study area would be lower. A similar situation would occur for the Pacheco network alternative if a station were not provided in Gilroy or Morgan Hill; in such a situation, access to the HST system from Monterrey, San Benito, and Santa Cruz Counties would be reduced.

The extent of secondary impacts may not be directly proportional to the amount of induced growth. It will depend in part on the specific form of induced development in the study area, which in turn will depend on local land use plans and policies. For example, alignment and station locations that serve existing urban and community centers, rather than less-developed outlying areas, would be expected to result in lower ecological and natural resource impacts, but higher community and social impacts, because development would be concentrated in existing built-up areas. The community and social effects are likely to be both positive and negative because additional growth in existing communities could bring benefits such as jobs, increased property values, and enhancements to the community environment.

5.6 Managing Growth-Inducing and Indirect Effects

In general, HST station areas would offer a more attractive market for commercial and office development than the No Project Alternative. Research and analysis conducted for the Statewide Program EIR/EIS[10] of urban rail systems in North America and high-speed rail systems in Europe and Asia support this conclusion. This research found that industries needing many highly skilled and specialized employees are the most attracted to rail-station area development, and that a noticeable densification pattern would be likely to emerge in the vicinity of potential HST stations in response to real estate and market forces.

The research and analysis further indicated that an HST station is a considerably stronger draw for business development than a conventional intercity rail station or freeway interchange. This draw can encourage more compact development patterns, which have the potential to help avoid or minimize indirect impacts. These development patterns would likely offer many businesses a competitive advantage in their industry, because of proximity to ancillary industries (i.e., industry clustering) and access to a well-educated labor force. These advantages, known as economies of agglomeration, have emerged around the French and Japanese HST stations.

The research also found that regulatory-style efforts by cities to encourage increased density and a mix of land uses near rail stations have been effective in attracting higher-density development. A Central Valley city, for example, would have an easier time redirecting new development to downtown sites adjacent to their HST station site than the outlying real estate markets created by freeway interchanges under the No Project Alternative. Furthermore, the strong real estate markets around HST stations are likely to attract development that otherwise would locate throughout a dispersed suburban region. Thus, development around HST stations potentially would consist of both consolidation of currently projected

[10] *Economic Growth Effects of the System Alternatives for the Program Environmental Impact Report/Environmental Impact Statement*, California High-Speed Rail Authority, Section 3.3, July 2003.

growth (under the No Project Alternative) and new regional employment and population associated with either HST Network Alternative.

The potential effect of regulatory style land-use strategies was tested in the Statewide Program EIR/EIS[11]. Results suggested that even a modest strategy focused on the immediate station areas could reduce the potential statewide urbanized acreage by an additional 30,000 ac (12,141 ha) (0.6% of total urbanized acreage in study area) under an HST Network Alternative. These results represent a low-end estimate of the possible densification effects of regulatory strategies in combination with the market forces likely to occur following the introduction of HST service. The research suggested that other jurisdictions have had some success in implementing more aggressive and regionwide regulatory-style strategies[12] in conjunction with high-capacity intercity and urban transit services. Experience in these areas suggests that more aggressive strategies might be more attractive to policy makers because HST could offer an economic rationale to developers to cluster new commercial, industrial, and residential development to provide easy access to the HST stations. In general, the No Project Alternative does not have the potential for such market incentive.

In short, either HST Network Alternative provides a strong incentive for directing urban growth and minimizing a variety of impacts that are frequently associated with growth. This outcome would be seen in results for resource topics such as farmland, hydrology, and wetlands, where the indirect effects of either HST Network Alternative are in some cases less than the No Project Alternative, even with more population and employment expected with the HST Network Alternative. Additional land use strategies, which would be highly compatible with either HST Network Alternative, could be considered to further reduce development impacts on sensitive natural resources; provide further concentration of employment in central areas that tend to be more readily accessible to minority and low-income populations; and provide further concentration of a wide variety of activities, making local transit options more feasible and possibly reducing local automobile travel.

[11] *Economic Growth Effects of the System Alternatives for the Program Environmental Impact Report/Environmental Impact Statement*, California High-Speed Rail Authority, Section 5.1.3, July 2003.

[12] Examples of these strategies include urban growth boundaries, maximum parking requirements, jobs-housing balance, more diversity of land uses, higher densities, and higher service levels of mass transit.