



8.0 STUDY OUTCOMES

THE REGIONAL RAIL STUDY EXPLORES THREE STUDY OUTCOMES:

1. Regional Rail without High-Speed Rail
2. Regional Rail with High-Speed Rail entering from East (Altamont Pass)
3. Regional Rail with High-Speed Rail entering from South (Pacheco Pass)

8.1 Regional Rail Operating Plan Without High-Speed Rail

This section identifies the recommended services and improvements for the Bay Area Regional Rail Plan that emerged from the evaluation of Alternatives 1 and 2, assuming no high-speed rail. Absent high-speed rail, the recommended regional rail network would have the following key characteristics:

- **BART** — Reinvest in existing system to improve reliability and make the following improvements:
 - Improve Core Capacity by making modifications to vehicles, stations, track and signals as they are replaced or upgraded to accommodate passenger growth over the long term
 - Implement Resolution 3434 extensions to Warm Springs/Santa Clara County and eastern Contra Costa County.

- Implement improvements to connect BART with standard railroad services and regional bus lines in various corridors including a one-station extension to an intermodal with ACE at Isabel/Stanley
- Construct 4th track through Oakland to facilitate throughput and improve transfer convenience between East Bay and Transbay lines
- Develop Infill stations at various locations keyed to local land use opportunities in accordance with BART station planning policies
- Further define “Metro” service plan to increase capacity, coverage and reliability to inner Bay Area including the Oakland - Transbay - San Francisco zone; service plan may provide for new skip stop or expanded mid-line turnback capability.
- In the longer term, pursue construction of a second Bay Crossing with new subway line to improve coverage to San Francisco in the long term (paired with rail tunnel)

The Transbay Tube under San Francisco Bay is the backbone of the system, with a throughput of 24-27 trains in each direction during the peak hour. Baseline improvements would improve service reliability and increase capacity of transbay car fleet with operation on 120-second headways. The Regional Rail Plan includes the provision of a second tube and San Francisco subway to relieve the existing tube.



Regionally, BART currently operates five lines as follows:

- **Pittsburg/Bay Point _ Daly City:** Service is provided on weekdays every 15 minutes early mornings, during peak periods, midday and evenings. Service is provided every 20 minutes late evenings and all day Saturdays and Sundays.
- **Richmond _ Daly City:** Service is provided on weekdays every 15 minutes during peak periods and midday and on Saturdays every 20 minutes during peak periods and midday. No Sunday service.
- **Dublin/Pleasanton _ Millbrae:** Service is provided on weekdays every 15 minutes early mornings, during peak periods, midday and evenings. Service is provided every 20 minutes late evenings and all day Saturdays and Sundays.
- **Fremont _ Daly City:** Service is provided on weekdays every 15 minutes during peak periods and midday and on Saturdays every 20 minutes during peak periods and midday. No Sunday service.
- **Fremont _ Richmond:** Service is provided on weekdays every 15 minutes early mornings, during peak periods, midday and evenings. Service is provided every 20 minutes late evenings and all day Saturdays and Sundays.

The Baseline anticipates reductions in headways to provide 12-minute service on all regional lines. In the longer term, in conjunction with the Regional Rail Plan, BART is considering development of a “Metro” service plan which would further reduce headways in the inner core to as low as 3-5 minutes depending upon the number of routes present.

- **US 101 North** — Implement SMART project; service plan in the early years will have trains operating on 30-minute headways during peak periods with an approximate 90-minute schedule between Larkspur and Cloverdale. Make capacity and operational improvements over the long term to support 20-minute peak headways and higher ridership levels.
- **North Bay** — Preserve corridor in near and intermediate terms and consider as appropriate to develop north-south and east-west services using standard equipment in the long term with service frequencies on each route of approximately 60 minutes throughout the day with timed transfers at key locations.
- **I-80 & East Bay** — Expand the East Bay rail network from San Jose to Sacramento to 3 tracks with 4 track sections from Oakland to Richmond and in Solano County to support operation of standard higher speed railroad rolling stock compatible with freight traffic.

Current Capitol Corridor schedules provide 32 daily trains with approximately 40-minute headways during peak periods and shoulders of peak periods with approximately 118-minute running time in the Sacramento - Oakland segment and variable headways (14 trains daily) with approximate 65-minute running time Oakland to San Jose. Baseline improvements will reduce headways on the Sacramento - Oakland segment to approximately 40 minutes with 90-minute headways Oakland - San Jose. Regional rail plan improvements will further reduce aggregate headways Sacramento - Oakland to as low as 15 minutes and will reduce travel time between Sacramento and



San Jose to 149 minutes. Some of the service in the inner East Bay may be provided by shorter distance trains operating between Union City and Hercules.

- **Transbay** — Provide near term investments in BART Core Capacity including provision of higher-capacity cars, track and signaling and operational improvements; in the longer term, provide new transbay tube and San Francisco BART line paired with rail tunnel in long-term future.

Currently, the maximum number of trains operating in the peak hour is 27 or 28. Baseline improvements will support reliable headways of 2 minutes in existing tube. The Regional Rail Plan includes a second tube and San Francisco line to distribute passengers and relieve overcrowding on the existing tube.

- **Peninsula** — Expand Caltrain to 3 or 4 tracks where feasible and operate with lightweight electric multiple-unit equipment to for rapid acceleration and frequent express and local service on the Peninsula.

Current service plan includes a mix of locals, limited stop trains and “Baby Bullet” express trains with aggregate headways of approximately 15 minutes during peak periods and 30 minutes off peak. Locals operate on approximate 95-minute schedules and express trains on approximate 60-minute schedule. Baseline improvements to the service plan will add trains to reduce aggregate headways to 10 minutes peak period and 20 minutes off peak. The Regional Rail plan anticipates the operation of additional trains to resulting in 7-1/2 minute headways during peak periods and 15 minutes off peak.

- **South Counties** — Caltrain currently operates 6 daily trains to Gilroy. Baseline improvements will enable an operating plan with 2-hour headways in the peak period, peak direction of travel. The Regional Rail Plan includes extension of service to Salinas with further expansion of rail services in South Bay cities using standard equipment to provide rail connections to Monterey and Santa Cruz. Approximate hourly service would be provided on all lines with timed transfers at key locations.
- **Dumbarton** — The Baseline service includes approximately two trains per hour operating between Union City and the Peninsula with standard railroad rolling stock. The Regional Rail Plan includes provision of separate passenger-only trackage to Union City in the longer term to support operation of lightweight equipment compatible with Peninsula train operations allowing Dumbarton trains to interline with Peninsula services. Peak period trains would operate at 30-minute headways between Union City and the Peninsula with hourly service throughout the day.
- **Tri Valley / I-680** — The existing ACE schedule includes 8 daily trains between Stockton and San Jose operating westbound in the am and eastbound in the pm. Trains operate on approximate 135 minute schedule. The Baseline improvements assumes the addition of trains resulting in 30 minute headways in peak travel direction only. The Regional Rail Plan would expand the Altamont and Tri Valley corridor lines to improve service reliability by adding trackage to the existing UPRR line and/or putting segments of the abandoned SPRR back in service to support expanded and improved passenger service along the

ACE rail corridor and to accommodate regional freight trains; develop regional bus options in the I-680 corridor. Hourly service would be provided in both directions with 30 minute service for peak period peak direction trains with an approximate 100-minute running time between Stockton and San Jose.

- **Central Valley** — Currently Caltrans Division of Rail and Amtrak provide eight long haul trains daily between Oakland and Bakersfield with four long haul trains daily between Sacramento and Bakersfield. The Division of Rail is currently revising its long range plan. The Regional Rail plan includes expansion of regional service in the Central Valley to provide a regional corridor service between Sacramento and Merced over the long term, interlined with ACE services and complementing the San Joaquin long haul trains. Regional trains would operate on hourly schedules between Merced and Sacramento. Additional trains would operate from Modesto to Oakland or San Jose also on an hourly schedule resulting in 30-minute service over Altamont Pass between the San Joaquin Valley and the Bay Area.

Fig. 11 2050 Regional Rail Without High-Speed Rail

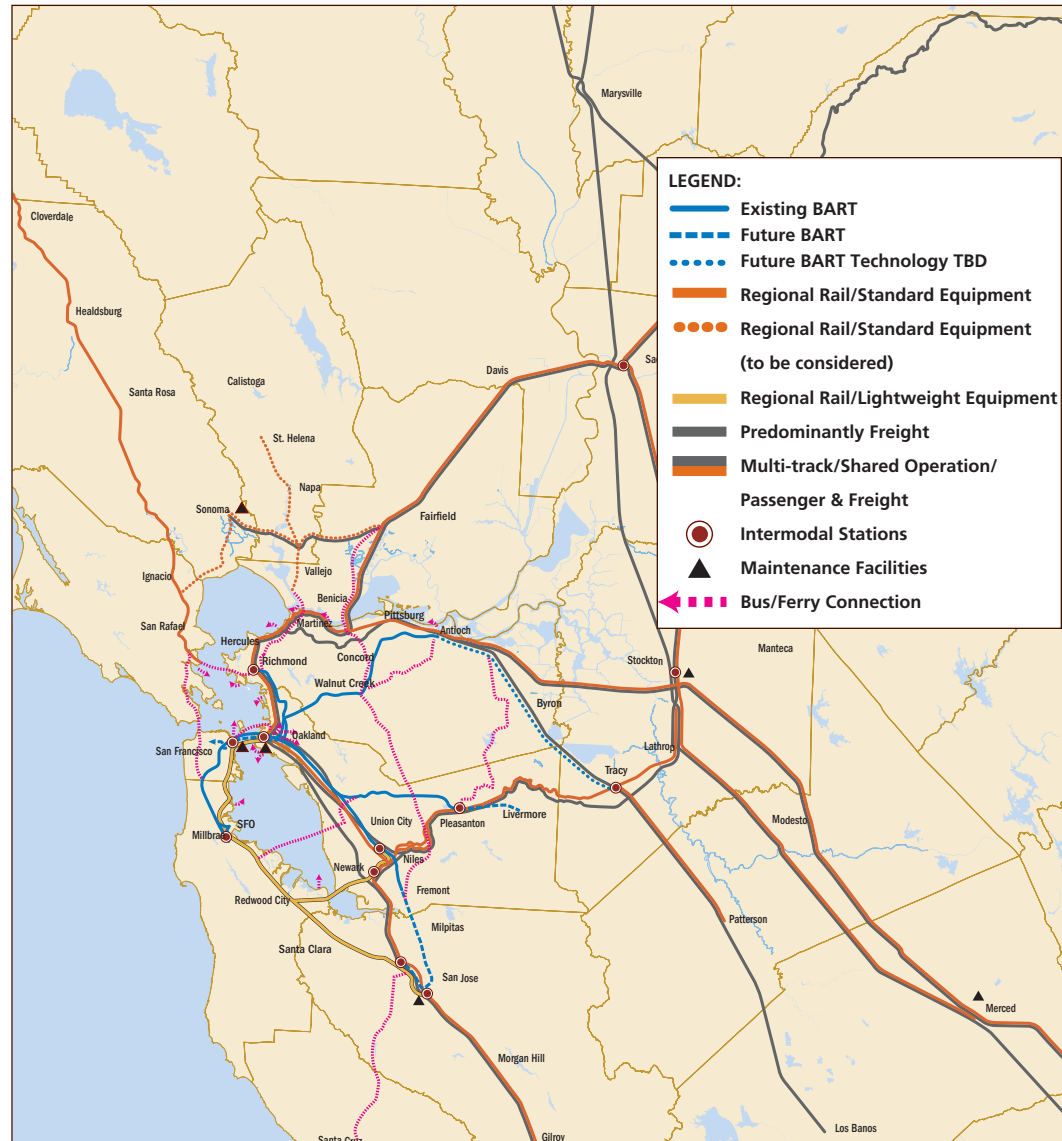




Fig. 12 2050 Regional Rail Without High-Speed Rail (BART System)

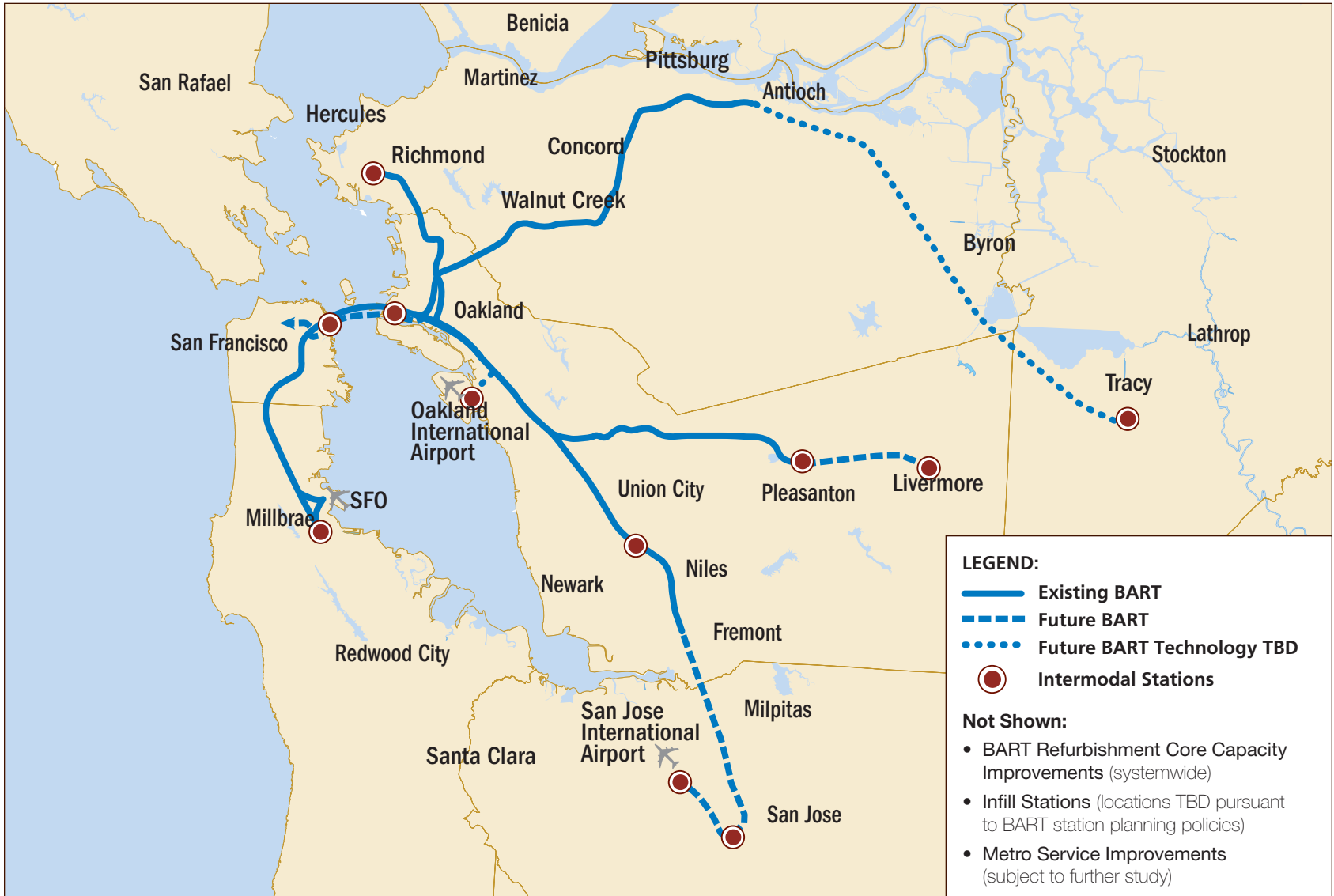




Fig. 13 2050 Regional Rail Without High-Speed Rail (North)

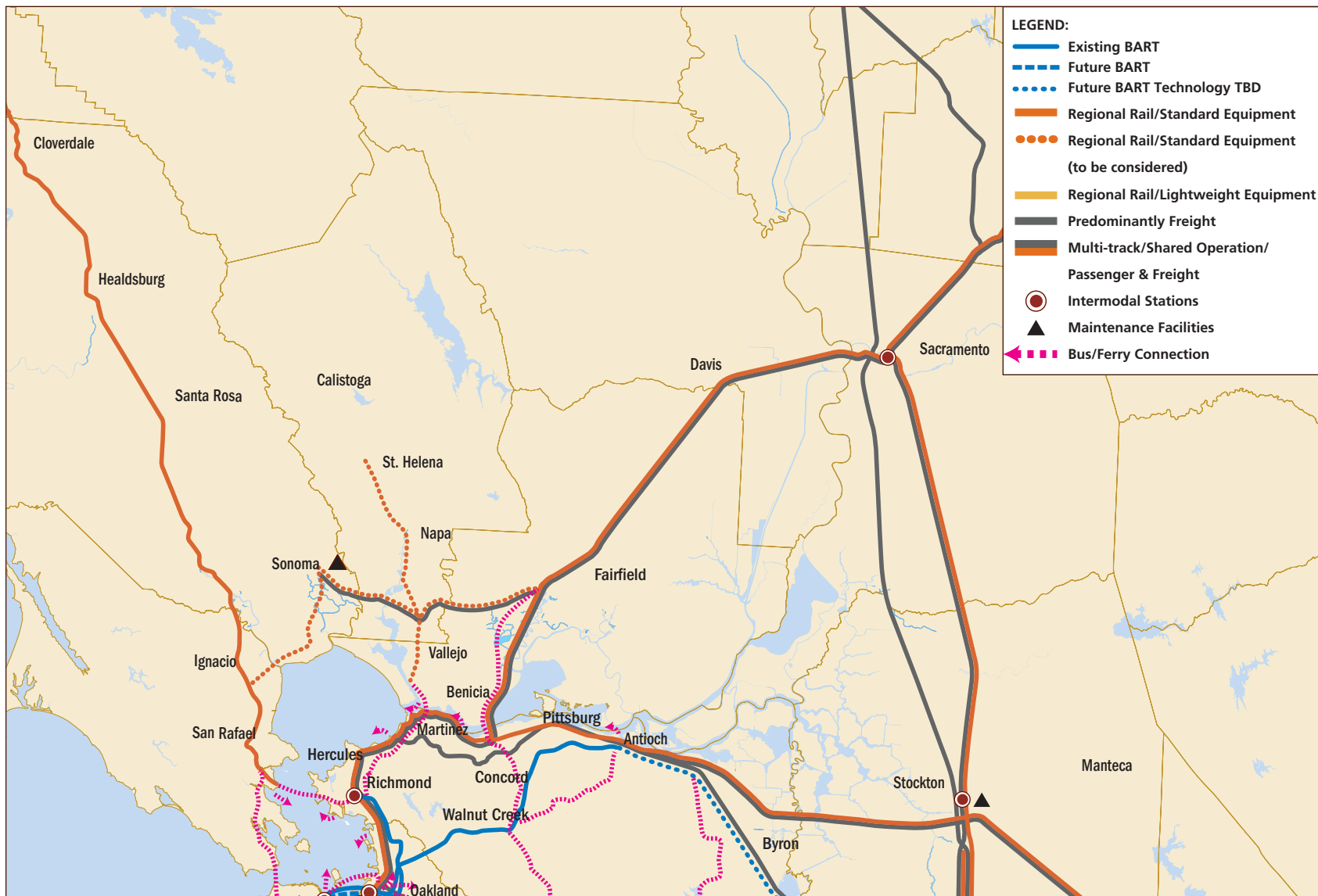




Fig. 14 2050 Regional Rail Without High-Speed Rail (Central)

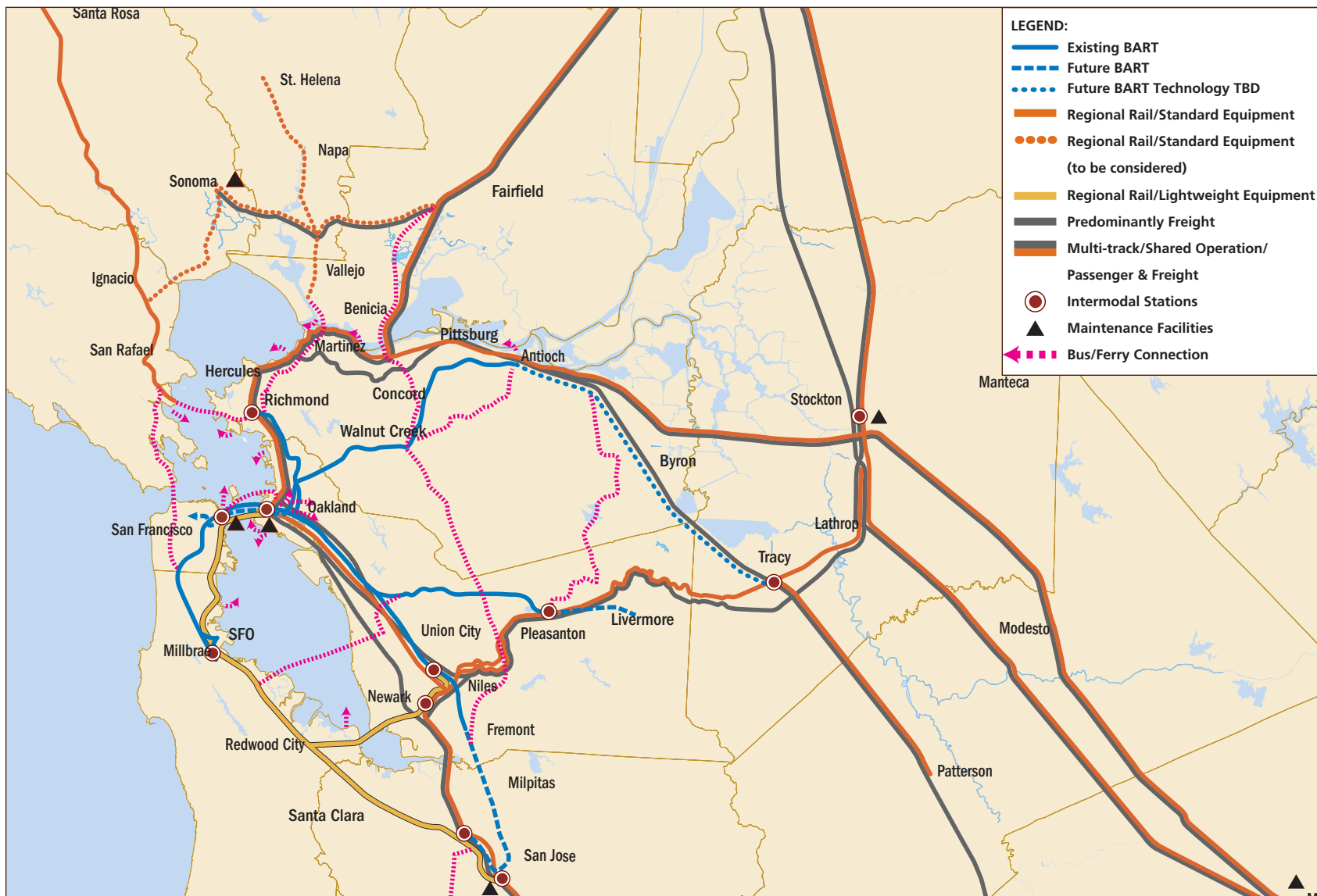
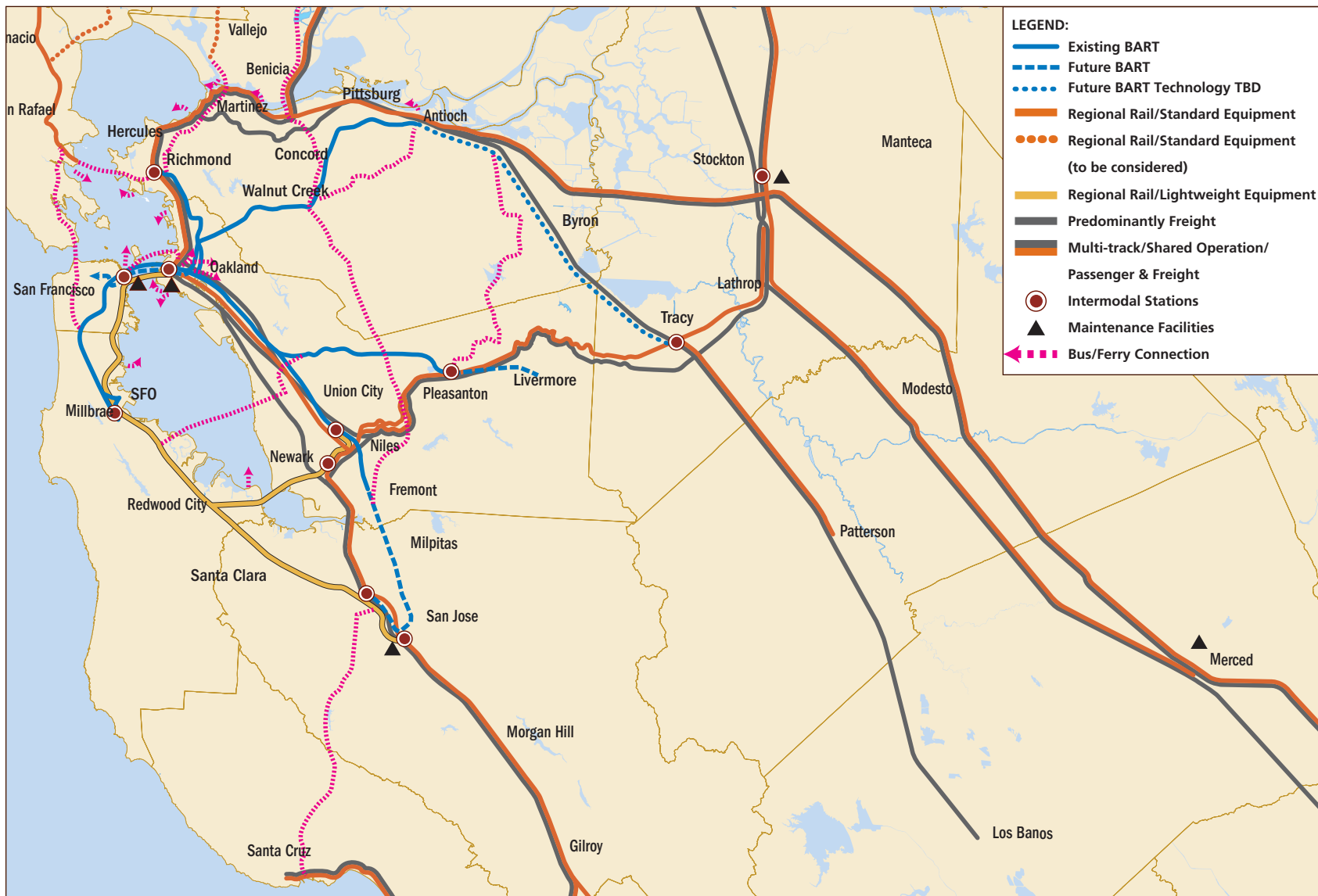


Fig. 15 2050 Regional Rail Without High-Speed Rail (South)





8.2 Phased Implementation of Regional Rail without High-Speed Rail

The Regional Rail Plan is financially unconstrained, and funding availability is an important consideration when determining phasing. For purposes of this plan, considerations for phasing include the size of the potential market for various services in each corridor, the development of the systemwide network over time, and the potential to defer high-cost options until later phases. The phasing plan included herein will help to inform the investment decisions to be made in both the financially constrained and vision elements of MTC's Regional Transportation Plan (RTP).

Resolution 3434 defines various improvements in the Regional Rail corridors, which are potentially fundable by Year 2030. The Regional Rail Plan includes provisions, which would result in greater investment in regional services over a timeframe extending to Year 2050. In addition, the Regional Rail Plan also identifies near term provisions, which would be desirable in conjunction with development of projects defined in Resolution 3434.

In general, services and improvements which are high priority and potentially fundable in the near term given existing Resolution 3434 commitments were indicated in the near term. Projects that are very high in cost and which could potentially be deferred or which appear to have promise but are not needed in the near or intermediate term were included in the ultimate plan under the Year 2030 - 2050 category.

A *possible* phasing plan including brief description of the corridor services is presented in Table 8.2-1. The phasing plan is for Regional Rail without High Speed Rail. This plan is provided to show how the system could be improved in phases; development of projects and services would be tied to future project development activities to confirm travel market demands, project descriptions and costs as well as project and service implementation priorities.



Table 8..2.1 Corridor Synopsis and Phasing Plan

Corridor	Synopsis	Present–Year 2015	Year 2015–2030	Year 2030–2050
<p>BART System</p>	<ul style="list-style-type: none"> ■ Core Capacity investments to accommodate passenger growth and system expansion ■ Resolution 3434 projects: <ul style="list-style-type: none"> – Warm Springs Extension – Silicon Valley Extension – eBART – Oakland Airport Connector ■ Infill stations ■ Operating plan refinements potentially including skip-stop and turn-back service ■ Livermore extension to connect with ACE ■ Completion of Oakland 4th track ■ New transbay tube and SF subway line 	<ul style="list-style-type: none"> ■ Warm Springs extension ■ Oakland airport connector ■ eBART service between Pittsburg and Byron (vehicle technology to be determined) 	<ul style="list-style-type: none"> ■ Silicon Valley extension including San Jose airport connector ■ Peplemover connection to new West Oakland Capitol Corridor station ■ Fourth BART track and Oakland subway lower level platforms Mac Arthur – Oakland Wye ■ Livermore BART extension and ACE intermodal Dublin/Pleasanton – Isabel/Stanley or Greenville/I-580 (preferred station location(s) and phasing to be determined by more detailed ridership and engineering analysis) ■ Infill Stations (developed in accordance with BART policies) 	<ul style="list-style-type: none"> ■ New Transbay Tube and subway line Oakland – Alameda – San Francisco (specific alignment to be studied further)



Table 8.2.1 Corridor Synopsis and Phasing Plan (continued)

Corridor	Synopsis	Present–Year 2015	Year 2015–2030	Year 2030–2050
U.S. 101 North (Marin – Sonoma)	<ul style="list-style-type: none"> ■ Sonoma-Marin Rail Transit Project (SMART) is implemented (Resolution 3434) ■ SMART service operates with compliant equipment allowing some freight traffic during off-peak periods 	<ul style="list-style-type: none"> ■ Track, signal and station Improvements to support Larkspur – Cloverdale service (SMART startup) 	<ul style="list-style-type: none"> ■ Operational improvements to support expanded operations 	<ul style="list-style-type: none"> ■ Operational improvements to support expanded operations ■ Potential extension to San Quentin ferry terminal with I-580 bus link
North Bay (Marin – Solano)	<ul style="list-style-type: none"> ■ Napa-Solano rail services are developed connecting between SMART line and Capitol Corridor ■ Service operates with compliant equipment compatible with connecting lines 	<ul style="list-style-type: none"> ■ Corridor preservation plan 	<ul style="list-style-type: none"> ■ Corridor preservation plan 	<ul style="list-style-type: none"> ■ Consider as appropriate track, signal and station improvements to support initiation of Vallejo – Napa service ■ Consider as appropriate track, signal and station improvements to support initiation of east-west service between San Rafael and Fairfield/Vacaville with Napa Junction timed transfer ■ Consider as appropriate track signal and station improvements to extend north-south service to St. Helena

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Table 8.2.1 Corridor Synopsis and Phasing Plan (continued)

Corridor	Synopsis	Present–Year 2015	Year 2015–2030	Year 2030–2050
I-80 (Auburn – Oakland)	<ul style="list-style-type: none"> ■ Capitol Corridor regional services between Auburn and San Jose extended to Roseville/Auburn with long-haul service to Reno/Sparks; capacity and operational improvements as well as new stations and grade separations are developed to support improved operation of corridor shared with high levels of freight traffic (Resolution 3434) ■ Investments are made in UPRR main line between Port of Oakland and Nevada to support activities of Port of Oakland, California trade, and to allow long-haul freight service to be concentrated on the “Central Corridor” to free up other lines for regional passenger and freight movements ■ Peplemover connection to new Capitol Corridor station at West Oakland ■ Overlay services are provided operating on passenger tracks in the East Bay between Hercules and Oakland/Union City ■ Third main track Oakland – Richmond 	<ul style="list-style-type: none"> ■ Operational improvements to support expansion of service to Roseville/Auburn ■ Hercules station ■ Fairfield/Vacaville station ■ Outer Harbor Intermodal Terminal and new freight leads (Port of Oakland) ■ Donner Pass tunnel improvements to allow operation of double-stack freight movements 	<ul style="list-style-type: none"> ■ Fourth main track Oakland – Richmond ■ Relocate BNSF / UPRR junction from Stege to North Richmond ■ wBART type service on UPRR (actual phasing to be determined by more detailed ridership and engineering analysis) ■ Third main track Benicia – Auburn ■ Dixon station ■ Swanston station ■ Peplemover connection to new Capitol Corridor station at West Oakland ■ Bridge rehabilitation for Martinez and I Street bridges 	<ul style="list-style-type: none"> ■ Revise passenger alignment Richmond – Ozol to add third track and improve operating speeds ■ Bridge replacements at Martinez and I Street bridges



Table 8.2.1 Corridor Synopsis and Phasing Plan (continued)

Corridor	Synopsis	Present–Year 2015	Year 2015–2030	Year 2030–2050
East Bay (Oakland – San Jose)	<ul style="list-style-type: none"> ■ Capitol Corridor services are expanded and improved with capacity and operational improvements as well as new stations for services operating between Oakland and San Jose (Resolution 3434) ■ Oakland Subdivision is purchased; passenger services are shifted to it south of Industrial Parkway in Hayward providing new intermodal with BART and Dumbarton at Union City ■ Niles Subdivision is improved to handle all traffic between Oakland and South Hayward; the line becomes freight-only south of Industrial Parkway in Hayward ■ Regional freight operates over existing UPRR lines between the Port of Oakland and Niles / Newark; in longer term, freight trains use Niles Subdivision south of Industrial Parkway in Hayward and former Southern Pacific through Niles Canyon 	<ul style="list-style-type: none"> ■ Purchase Oakland Subdivision ■ Restore track connection along Oakland Subdivision between Melrose (High Street, Oakland) and East Oakland yard for short haul freight (interim operations) ■ Union City station, Shinn and Industrial connections and second track on Oakland Subdivision for passenger-only operation Hayward – Niles ■ Second main track on Niles Subdivision Oakland-Hayward ■ Second main track on Coast Subdivision Alviso – Santa Clara ■ Construct separate passenger tracks within Niles Subdivision between South Hayward and 5th Avenue, Oakland 	<ul style="list-style-type: none"> ■ Track, signal and grade separation improvements on Oakland Subdivision for passenger-only operation Union City – South Hayward ■ Route freight traffic over Niles Subdivision between Oakland and Niles Junction, then either to and from the south via Warm Springs Subdivision to Milpitas or to and from the east via the former SPRR line through Niles Canyon 	<ul style="list-style-type: none"> ■ Second main track on Coast Subdivision Newark – Alviso ■ Extend third main track between Market Street and Jack London Square in Oakland; revise roadway configuration and waterfront access and circulation <p style="text-align: right;">continued next page</p>



Table 8.2.1 Corridor Synopsis and Phasing Plan (continued)

Corridor	Synopsis	Present–Year 2015	Year 2015–2030	Year 2030–2050
Transbay (Oakland – San Francisco)	<ul style="list-style-type: none"> ■ BART Core Capacity improvements are accomplished to address Transbay demand in early years ■ Additional BART “Metro” provisions are implemented to increase service in core areas ■ In long term, new Transbay BART tube and San Francisco subway is developed to reduce demand on Market Street subway and to improve coverage in San Francisco ■ A four-track central segment is constructed to provide a conventional rail connection between Oakland and San Francisco; ultimately Caltrain and Capitol Corridor services may interline with signal improvements and revised regulations 	<ul style="list-style-type: none"> ■ BART Core Capacity improvements 	<ul style="list-style-type: none"> ■ BART Metro improvements (to be defined) 	<ul style="list-style-type: none"> ■ New BART Transbay crossing and San Francisco subway (alignment to be defined) ■ New standard rail Transbay crossing (service plan to be defined)



Table 8.2.1 Corridor Synopsis and Phasing Plan (continued)

Corridor	Synopsis	Present–Year 2015	Year 2015–2030	Year 2030–2050
Peninsula (San Francisco – San Jose)	<ul style="list-style-type: none"> Caltrain develops over time into a three and four track, grade separated, railway to support operation of lightweight electrified multiple-unit consists between San Francisco and Tamien Station in San Jose (Resolution 3434) Service to Gilroy is handled with standard equipment shared with freight operating on Coast Subdivision 	<ul style="list-style-type: none"> Grade separations and third/fourth main track) 	<ul style="list-style-type: none"> Grade separations and third/fourth main track Electrification and light-weight EMU consists San Francisco – Tamien Transbay transit center 	
South Counties (Santa Cruz, Monterey, San Benito)	<ul style="list-style-type: none"> Service between San Jose and Gilroy is extended to Salinas and Monterey; in longer term, when Peninsula converts to lightweight electrified equipment, the South Counties may be served by Capitol Corridor trains using standard equipment shared with freight on Coast Subdivision “Wharf to Wharf” service between Santa Cruz and Monterey is implemented using standard equipment connecting to the Salinas trains with timed transfers at Pajaro and Castroville A shuttle connection is provided between Gilroy and Hollister to meet all corridor trains 	<ul style="list-style-type: none"> Second main track San Jose – Gilroy Track, signal and station improvements to support service extensions to Salinas 	<ul style="list-style-type: none"> Modified service plan to serve San Jose – Salinas territory using standard equipment operating on the Colfax – San Jose line Line restoration, track and signal upgrades and stations to support Santa Cruz – Monterey service and Monterey corridor trains 	<ul style="list-style-type: none"> Track, signal and station improvements to support passenger shuttle to Hollister meeting all trains at Gilroy

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Table 8.2.1 Corridor Synopsis and Phasing Plan (continued)

Corridor	Synopsis	Present–Year 2015	Year 2015–2030	Year 2030–2050
Dumbarton (Redwood City – Union City)	<ul style="list-style-type: none"> ■ Dumbarton Rail project is implemented (Resolution 3434) ■ The service operates with standard equipment in the near term; separate passenger trackage is developed in the Centerville line over the longer term allowing operation of lightweight equipment between points along the Peninsula and the greater East Bay 	<ul style="list-style-type: none"> ■ Bridge, track and signal improvements are made to support initiation of service between Redwood City and Union City across the Dumbarton Bridge 	<ul style="list-style-type: none"> ■ Passenger only tracks constructed between Newark and Niles to allow operation of lightweight consists between Peninsula and East Bay 	
I-680 & Tri Valley (Contra Costa & Southern Alameda)	<ul style="list-style-type: none"> ■ Near term investments are made to Oakland Subdivision to improve reliability of ACE services sharing with freights; in the longer term, sections of the former SPRR are put back into service west of Pleasanton allowing freights to be separated from passenger lines ■ Regional bus services are developed in I-680 corridor connecting with regional rail ■ An intermodal connection is made by extending BART to meet ACE in Pleasanton ■ Regional freight operates between the San Joaquin Valley and Bay Area over the Altamont lines 	<ul style="list-style-type: none"> ■ Track and signal improvements to Oakland Subdivision Niles – Tracy ■ Regional bus in I-680 corridor 	<ul style="list-style-type: none"> ■ Restore SPRR to service Niles – Hearst (Pleasanton); use to provide direct freight connection to Niles Subdivision ■ Construct passenger-only tracks between Hearst (Pleasanton) – Vasco Road (Livermore) to improve reliability of operations ■ Livermore BART extension and ACE intermodal Dublin/ Pleasanton – Isabel/Stanley or Greenville/I-580 (preferred station location(s) and phasing to be determined by more detailed ridership and engineering analysis) ■ Extend eBART to Tracy with intermodal connection to ACE 	<ul style="list-style-type: none"> ■ Construct second main track between Vasco Road (Livermore) and Lathrop to improve reliability of operations ■ Track, signal and station improvements to West Side Line to extend service from Tracy to Patterson



Table 8.2.1 Corridor Synopsis and Phasing Plan (continued)

Corridor	Synopsis	Present–Year 2015	Year 2015–2030	Year 2030–2050
Central Valley (Sacramento – Merced)	<ul style="list-style-type: none"> ■ ACE services are expanded in stages along a new passenger-only line constructed in phases along the UPRR Fresno Subdivision between Sacramento and Merced 	<ul style="list-style-type: none"> ■ R/W plan for Central Valley lines ■ Construct passenger-only line along UPRR Fresno Subdivision Stockton – 65th Street, Sacramento ■ Construct new passenger platforms for San Joaquin trains at Stockton diamond and provide rubber-tired shuttle to Channel Depot (Stockton) 	<ul style="list-style-type: none"> ■ Extend passenger-only line along UPRR Fresno Subdivision Lathrop – Modesto ■ Develop rail/rail grade separation between north-south UPRR line and east-west BNSF line in Stockton to improve capacity and operations; relocate UPRR and BNSF passenger platforms to crossing to provide vertical transfer 	<ul style="list-style-type: none"> ■ Extend passenger-only line along UPRR Fresno Subdivision Modesto – Merced
Grade Crossings and Grade Separations (All Lines)	<ul style="list-style-type: none"> ■ Staged, prioritized improvements are implemented in accordance with train and highway conflict levels to improve grade crossing safety ■ Implement “Quiet Zones” in the near term and to provide grade separations where needed in the long term 	<ul style="list-style-type: none"> ■ Grade separation studies to define improvements and required right-of-way (corridor specific) ■ Construct high priority grade separations along principal lines ■ Construct “Sealed Corridor” safety improvements and implement “Quiet Zones” along crossings which remain at grade 	<ul style="list-style-type: none"> ■ Construct second priority grade separations along principal lines 	<ul style="list-style-type: none"> ■ Construct grade separations needed for high speed operation along principal lines



8.3 REGIONAL RAIL WITH HIGH-SPEED RAIL

8.3.1 Planning Context

The Regional Rail Plan effort was tasked with conducting a regionally-focused analysis of potential high-speed rail routes between the Bay Area and Central Valley. The study recommendations on the most promising high-speed rail alignments for Pacheco and Altamont Passes are formulated independently of the California High-Speed Rail Authority (CHSRA). The intent of this plan is to provide input to the CHSRA as it prepares its final environmental document for the Bay Area to Central Valley High-Speed Train Program. The CHSRA will ultimately decide on the preferred route for high-speed rail between the Bay Area and Central Valley. CHSRA has published a draft program-level environmental document which provides detailed information on potential impacts associated with a wide range of options under consideration in the region. The purpose of this section is to evaluate the high-speed rail options in the context of the recommended regional rail network absent high-speed rail including the benefits to the regional system which could occur with the addition of high-speed rail funding and service implementation.

CHSRA has indicated a willingness to support operation of regional operations which serve regional destinations over lines provided such services are operated with compatible equipment and additional improvements. These would include provision of four-track sections approaching and departing stations as well as additional and more complex train signaling allowing regional and statewide trains to operate in mixed-flow with statewide high-speed rail express trains.

The high-speed trains under consideration by CHSRA operate with lightweight electric equipment at speeds which are generally over 100 mph and with a top speed of 220 mph over lines which do not have any grade crossings. (Highest speeds would be attained in rural areas or other stretches of track which would be generally tangent and where operation at speeds up to 220 mph would not conflict with adjacent land uses.)

Such lines would be similar to the separate, passenger-only lines which were generally shown in Alternative 2. Whereas Alternative 1 was developed to operate up to 79 mph using standard equipment in which operations would be shared with freight traffic (and include grade crossings), Alternative 2 provides separate passenger-only trackage generally capable of speeds ranging up to and exceeding 110 mph depending upon the track alignment and adjacent land uses, with full grade-separation. Therefore, high-speed trains entering or operating within the Regional Rail network could operate over line segments evaluated in Alternative 2. The portions of Alternative 2 which were recommended for inclusion in the preferred Regional Rail network without high-speed rail include the Peninsula Corridor (San Francisco - San Jose) and the cross-bay connection via the Dumbarton Bridge to Union City.

In addition to stations served by some or all statewide high-speed rail trains, Alternative 2 includes a number of stops where only Regional Rail trains would stop. Additionally, whereas some statewide trains would stop at some of the Regional Rail stops, most regional trains would stop at all of these locations.

CHSRA has prepared an initial statement on potential system phasing. This report, which was presented to the High-Speed



Rail Authority Board in May 2007, identifies a Phase 1 project extending from Anaheim to Los Angeles to Merced and the San Francisco Bay Area. In this context, a Central Valley segment extending to Merced (where the central yards and shops for the statewide network may be located) would be included in any Phase 1 project, along with a connection to the Bay Area to be identified. The phasing policy further defines the Bay Area connection to include “San Francisco, Oakland, or San Jose or any combination of those cities including all three cities” with the understanding that the selected Phase I segment will be further defined at the conclusion of EIR/EIS and after a preferred route or routes has been selected.

At the same time, it is important to recognize that CHSRA is committed to developing an ultimate network which would link all of California’s major metropolitan areas, including San Diego and Sacramento. From the perspective of the Northern California region, this means that a Sacramento connection via the Central Valley is included in the high-speed rail plan. As service to Sacramento is also a consideration for the Regional Rail Plan, the opportunity to support regional overlay services therefore extends beyond the inner bay area cities of San Francisco, Oakland and San Jose and would include, for example the ability to operate a regional service between Sacramento and Merced.

Finally, the CHSRA staging policy statement notes that local decisions to invest in regional corridors where high-speed rail may also provide service would provide opportunities for the CHSRA to leverage statewide funds with local investments to develop corridors for mutual benefit. In this regard, the policy statement specifically points to the Peninsula alignment:

“should the San Francisco to San Jose segment be identified and selected as part of the preferred alternative, including this segment in Phase I will enable the Authority to maximize the use of these resources and will help to reduce the need for state funds.” This is the same segment where the recommended Regional Rail Plan without High-Speed Rail identifies improvements to support operation of higher speed electrified trackage suitable for operation of multiple unit lightweight electric equipment with operational similarities to the statewide high-speed rail.

In summary, the following points emerge:

- Improvements to provide separate passenger-only regional rail trackage suitable for operation of lightweight equipment are most compatible with the high-speed rail system.
- Additional investments would need to be made to the lines to provide four track sections approaching and departing regional stops and where regional stops are themselves closely spaced, this may require development of extensive stretches of four track line.
- Even though the cost of supporting regional and statewide services on the same line would add to the development cost of either service separately, combined local and statewide funding would potentially be available — this additional level of funding would allow identified improvements to Bay Area segments to occur sooner with the addition of high-speed rail funding than might otherwise occur absent high-speed rail..
- The recommended Regional Rail network includes a “high-speed ready” line along the Peninsula from San Francisco



to San Jose as well as consideration for upgrading the Dumbarton project to provide trackage for lightweight regional trains operating between Union City and Peninsula destinations.

- The recommended phasing for High-Speed Rail will provide an initial investment in a segment in the Los Angeles area, a potential Central Valley segment between Bakersfield and Merced which could be used to demonstrate the 220-mph high-speed rail technology in addition to early investment in a selected Bay Area corridor. With further development of connections between the Bay Area and Central Valley segments, along with extension of the Central Valley segment to Sacramento, there would be numerous opportunities to support regional overlay services between Merced, Sacramento and the Bay Area in addition to operation of regional services within the Central Valley.

8.3.2 Ridership Analysis

The Regional Rail Plan ridership analysis considers the implementation of regional overlay services on the high-speed rail network. The ridership numbers were developed using the CHSRA “inter-regional model” which identifies travel into and through the MTC nine-county area from statewide locations. The regional market ridership was extracted from the model by identifying travel within and between five regional sub-markets served by high-speed rail with regional overlay services:

- **Northern San Joaquin Valley** — Composite inter-county ridership between Sacramento, San Joaquin, Stanislaus and Merced Counties which would be served by trains

operating on 60-minute schedules between Sacramento and Merced as well as Altamont trains operating on 30-/60-minute (directional) schedules between Sacramento or Merced and the Bay Area. This travel market comprises 5.3-million riders in Year 2030.

- **Altamont / Tri-Valley** — Composite ridership across Altamont Pass between the Northern San Joaquin Valley and Bay Area including travel between the Tri-Valley area and points west in the inner Bay Area which would be served by regional trains operating over Altamont and through the Tri-Valley. This travel market constitutes 5.7-million riders in Year 2030.
- **South Counties** — Ridership between counties located in the Association of Monterey Bay Area Governments district and south Santa Clara County to points north within the Bay Area which would be served by regional trains operating on 30-minute schedules from Gilroy north. This travel market would include 1.7-million riders in Year 2030.
- **East Bay** — Ridership across the Alameda / Santa Clara county screenline attracted to regional express trains operating on 30-minute schedules between Oakland and San Jose (the local travel market along the corridor would be served by BART.) This travel market would include 5-million riders in Year 2030.
- **Peninsula** — Ridership across the San Mateo / Santa Clara county screenline with 15-minute limited and/or express service (excepting local travel which would be attracted to Caltrain local services). This travel market would include 6.3-million riders in Year 2030.



Ridership figures were modeled with two-way branching of services between the Peninsula and East Bay as applicable; discounts were applied for three-way branching or alternatives serving only a portion of a travel market shed. In order to provide a consistent comparison to the CHSRA ridership estimates, the regional trips (e.g., No CA / No CA trips for the zone which includes all stops from Merced north) were added to the statewide trips (e.g., No CA / So CA trips to and from points from Fresno and south) to develop estimated systemwide ridership and total Northern Region ridership with express and regional services.

8.3.3 Cost Estimates

An independent evaluation of the cost of improving the corridors to support both statewide express service as well as regional services was prepared. Agreed-upon consistent unit costs were utilized in the CHSRA and Regional Rail capital cost estimating process. However, the Regional Rail figures are generally higher than the CHSRA figures due to the provision of additional stations and four-track sections.

For the purpose of developing a “cost per rider” figure, the capital cost estimate was annualized assuming a 50-year service life and 7 percent discount rate. The annualized capital cost was compared to the total Northern CA ridership figure (e.g., No CA / No CA trips plus No CA / So Ca trips.)

8.3.4 Regional Rail with High-speed Rail Entering from East (Altamont)

Tracy, Altamont and Tri Valley Segments

The recommended Regional Rail Plan without high-speed rail would provide substantial upgrades to the Altamont Pass and Tri Valley corridors to support higher frequencies, improved running times and fewer delays to ACE trains operating between the San Joaquin Valley and the inner Bay Area. The recommended Regional Rail Plan would also provide capacity improvements to the “Central Corridor” route north out of Oakland to Richmond and beyond such that transcontinental freight traffic could generally be shifted away from the Tri Valley and Altamont lines thereby reducing freight impacts to the ACE services and freeing up capacity to operate a short haul freight connection using shorter trains operated by a public entity.

CHSRA studied a number of sub-options extending from the Central Valley over Altamont Pass including four alternatives through Tracy and four through the Tri Valley area. For the purpose of the Regional Rail Plan, the key consideration in Tracy is providing an intermodal which allows a future opportunity for connections to an ultimate eBART extension as well as service to Patterson via the West Side line. Further to the west in the Tri Valley area, the Regional Rail Plan identifies a one-station extension of the BART Dublin/Pleasanton line to an intermodal at Isabel/Stanley as the lowest-cost solution to provide connectivity between BART and ACE. The Regional Rail Plan is not financially-constrained and accommodates this connection in the ultimate plan. In this context, the most consistent alignment through the Tri Valley area would enter via one of the Altamont



alignments connecting with the UPRR corridor through central Livermore to meet a future BART extension at the Isabel/Stanley or Greenville/I-580. This routing would avoid the need to modify I-580 to accommodate high-speed rail and would make a connection to BART by a more direct route between Altamont Pass and Pleasanton than options following I-580. CHSRA would need to obtain an agreement to use the UPRR right-of-way; however this corridor includes wide segments due to a prior consolidation of former Southern Pacific and Western Pacific rail lines in the Tri Valley. In closing, it should be noted that the CHSRA environmental document identifies the UPRR / downtown Tracy alignment as the “Base Case” for Altamont analysis.

As the Regional Rail Plan envisions creation of the Livermore intermodal along with improving ACE services through investment in capacity and operational improvements along the route between Niles and Tracy, development of the corridor for high-speed rail service would provide an opportunity to develop a higher-speed passenger service where the market presently served by ACE is addressed with a regional overlay train operating along the high-speed rail alignment. Combined funding from regional and high-speed rail sources could accelerate these improvements. Regardless of high-speed rail some freight service would remain as this link is a key segment for regional freight mobility even though not located along the principal transcontinental lines extending north and east from Oakland. The combined requirement to accommodate high-speed rail while maintaining a freight connection could result in additional grade separations which would benefit highway and rail uses along with reducing community noise impacts.

Bay Area Segments

From Niles, where the high-speed rail alignment would reach the inner Bay Area, there are a number of combinations of improvements to reach Bay Area urban centers. Whereas the CHSRA EIS evaluates some 11 Altamont alternatives, this analysis focuses on three of the most promising options:

- San Jose, Oakland and San Francisco - via Transbay Tube
- San Francisco, Oakland and San Jose Termini
- San Francisco and San Jose via SF Peninsula (modified to include Oakland via Transbay Tube)

San Jose, Oakland and San Francisco via Transbay Tube (“A11”)





This alternative branches at Fremont and provides direct service to San Jose and Oakland via the East Bay; San Francisco is reached via transbay tube from Oakland. This option would support regional services between the Central Valley and San Jose or Oakland/San Francisco as well as a regional express between Oakland and San Jose. The total cost of all Northern California segments including provisions for regional rail stations is estimated to be \$16-billion.

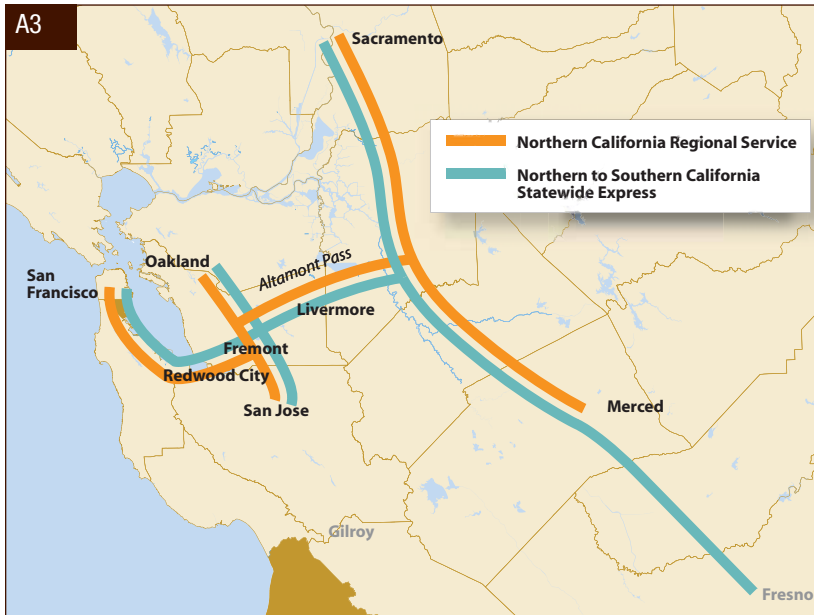
Considerations with this option include:

- **Modified East Bay Alignment** — This option would provide an East Bay connection between Fremont and San Jose. A direct connection via I-880 would be the least costly and would result in the fastest travel times, but a modified alignment with stops at I-880/Tasman and Trimble/North First (both with connections to VTA LRT) as well as at Santa Clara (with connection to San Jose Airport) costing about \$2.6-billion vs. \$1.9-billion for a direct line following I-880 would serve regional overlay services better. Regional stops on the Oakland leg would include Union City, Coliseum (Oakland Airport) and West Oakland, all with BART connections.
- **Duplicate Investment** — Commitments have already been made to improve Capitol Corridor service and to extend BART to San Jose but these improvements could not support high-speed rail service, which is on a different alignment. When fully developed, BART and Capitol Corridor will provide complementary rail options with BART serving more local stops and Capitol Corridor primarily serving regional stops. The capital cost of the East Bay line segment is approximately \$4.9-billion.
- **Risk of UPRR Right-of-Way Agreement** — Risk of reaching agreement from UPRR to obtain the right to construct high-speed rail along the Niles Subdivision where the high-speed alignment is proposed between Mission Boulevard and Oakland.
- **Potential Environmental Justice Concerns** — The environmental screening indicated potential concerns with construction of a new elevated alignment through existing urbanized areas especially in the East Bay between Fremont and Oakland.
- **Ability to Improve ACE Service with High Speed Regional Train** — This alternative would allow a train to be operated from Sacramento to San Jose via Altamont Pass, thereby resulting in a major service upgrade in the market area currently served by the Altamont Commuter Express.
- **Construction within I-880** — The East Bay alignment segment south of Fremont would need to be constructed along I-880 freeway south of Mission Boulevard towards San Jose with the potential for a long process with Caltrans to define and construct the high speed rail trackway within the freeway right-of-way.
- **Transbay Tunnel Schedule and Cost Risk** — The travel analysis indicates the BART transbay lines will be heavily loaded even with planned improvements; therefore lack of direct service to San Francisco with implementation of statewide service was not considered viable. A long timeframe would be needed to deliver a new bay crossing considering the development of mitigation measures and approvals resulting in schedule risk that this segment could not be available for service in conjunction with other segments.



There is also cost risk associated with tunneling. The Regional Rail Plan cost estimate of \$2.2-billion includes one half the cost of a four track sunken tube connection (the other 50% of the cost is assumed to be borne by a new BART connection.) The cost is based upon use of a sunken tube to provide a shallow entry into San Francisco to connect with the Transbay Transit Center. (A two-track deep bore tunnel connecting to 4th/King would cost about \$1.75-billion and would result in reduced impacts to San Francisco Bay compared to a sunken tube.)

San Francisco, Oakland and San Jose Termini (A3)



This alternative includes a three-way branch at Fremont and would provide direct service to San Jose and Oakland via the East Bay as well as San Francisco via the Dumbarton Bridge, thereby avoiding the need for a transbay tube as provided in the “A11” option. This alternative would support regional services between the Central Valley and any of the three major Bay Area population centers as well as support operation of a regional express between Oakland and San Jose. The cost of all Northern California segments in this alternative is estimated to be \$17.7-billion; even though this alternative avoids a new Oakland - San Francisco tube, the total number of track miles required results in a higher total cost compared to the “A11” alternative.

Similar considerations to development of lines north of San Jose with respect to the Peninsula versus East Bay alignments would pertain to a high-speed service entering from the south via San Jose. These include (refer to details provided for Altamont alternative “A11”):

- Modified East Bay Alignment Fremont - San Jose
- Duplicate Investment with Respect to Capitol Corridor and BART
- Risk of UPRR Right-of-Way Agreement Fremont - Oakland
- Potential Environmental Justice Concerns in East Bay between Fremont and Oakland
- Ability to Improve ACE Service with High Speed Regional Train
- Construction within I-880



Additional considerations with this option include:

- **Dumbarton Crossing Schedule and Cost Risk** - Whereas the recommended Regional Rail Plan would provide separate passenger-only trackage between Redwood City and Union City using upgrades to the existing bridge, a high-speed rail main line suitable for carrying both statewide and regional services would require a new two-track high level bridge or tunnel connection across the Bay. Although a bridge crossing would be less costly than a tunnel, an extensive environmental process would be required to deliver a new Dumbarton crossing which would pass through environmentally sensitive areas including the Don Edwards National Wildlife Refuge. (The region successfully obtained environmental clearances for construction and/or reconstruction of major water crossings over the past two decades including new bridges across the Carquinez Strait at Benicia and Vallejo, as well as Bay Crossings including the Dumbarton Bridge replacement, the San Mateo Bridge widening, and Bay Bridge East Span replacement.) The cost of this crossing is estimated at about \$1.9-billion. It should be noted that if a suitable operating plan could be developed with 15- to 20- minute headways, the line could be operated with a single track bridge in the early years which would allow time for processing and construction of an improved span.
- **Reduced Opportunity for Cost Sharing on Peninsula** - This option would have an opportunity for cost sharing with Caltrain improvements on the Peninsula between Redwood City and San Francisco which is a segment estimated to cost \$3.9-billion. Because this option only shares with Regional Rail north of Redwood City on the Peninsula, there would be no opportunity to leverage local investment in the Caltrain line between Redwood City and San Jose.
- **Problematic Operating Plan due to Three-Way Branch** - This alternative includes a three-way branch in service at Fremont for statewide and regional trains entering via Altamont Pass. The ridership forecasts indicate that splitting service three ways would significantly reduce ridership with a similar number of trains in operation due to reduced headways on each of the branches. This issue is considered a “near fatal flaw”. Service impacts could be addressed by omitting the leg to Oakland; however riders wishing to travel to Oakland would need to transfer to BART at Warm Springs or San Francisco. Omitting the Oakland leg would reduce the cost of this alternative from \$17.7-billion to \$15.5-billion.

San Francisco and San Jose via SF Peninsula with Oakland via Transbay Tube (“A8 Modified”)



This alternative is similar to the “A8” alternative identified in the CHSRA EIS except Oakland is served via transbay tube connection extending from San Francisco. This option would allow the San Francisco depot to operate as a “through” station thereby improving its capacity and by serving both San Francisco and Oakland on the same segment a three-way branch at Fremont would be avoided. The alternative would require branching at Redwood City and would provide direct service to San Jose and San Francisco; however trains to San Jose would operate via Redwood City. This option would support regional services between the Central Valley and the Peninsula

as well as providing an opportunity to support additional enhancements to “Baby Bullet” service by with additional trains and improved speeds between San Francisco and San Jose.

Considerations with this option include:

- **Significantly Higher Peninsula Investment** — To support high-speed rail with existing and proposed services, the Peninsula corridor would need substantial additional investments including the provision of a minimum of three tracks between stations with four tracks through all station areas, requiring extensive use of subway or aerial trackage. The estimated cost of the Peninsula alignment in Regional Rail System Alternative 2, which reflects improvement to high speed rail standards, is approximately \$5.6-billion.
- **Compatibility with Caltrain on Peninsula and Opportunity for Cost Sharing** — The recommended regional rail plan includes improvements to the Peninsula line with fully separate passenger only trackage and operation of lightweight electrified equipment compatible with high-speed rail equipment. As a result, there would be an opportunity for the region to partner with CHSRA to accelerate and/or defray the cost of investments in the Peninsula line by leveraging local and statewide funding.
- **Opportunity for Incremental Improvement** — In anticipation of high-speed rail, four track sections and grade separations which are currently being developed could allow for the Peninsula to become “high-speed rail ready” from the present time forward. In the event the Federal Railroad Administration approves Caltrain’s application for a waiver to inter-operate compliant and non-compliant equipment, con-



version of the Peninsula to become high speed rail ready would be facilitated as standard and lightweight equipment could be operated together until such time as the equipment would be fully changed over. Additionally, the transbay tube connection to Oakland could potentially be omitted from a first statewide phase

- **Dumbarton Crossing Schedule and Cost Risk** — Whereas the recommended Regional Rail plan would provide separate passenger-only trackage between Redwood City and Union City using upgrades to the existing bridge, a high-speed rail main line suitable for carrying both statewide and regional services would require a new two-track high level bridge or tunnel connection across the Bay. Although a bridge crossing would be less costly than a tunnel, an extensive environmental process would be required to deliver a new Dumbarton crossing which would pass through environmentally sensitive areas including the Don Edwards National Wildlife Refuge. (The region successfully obtained environmental clearances for construction and/or reconstruction of major water crossings over the past two decades including new bridges across the Carquinez Strait at Benicia and Vallejo, as well as Bay Crossings including the Dumbarton Bridge replacement, the San Mateo Bridge widening, and Bay Bridge East Span replacement.) The cost of this crossing is estimated at about \$1.9-billion. It should be noted that if a suitable operating plan could be developed with 15- to 20- minute headways, the line could be operated with a single track bridge in the early years which would allow time for processing and construction of an improved span.

- **Fremont Line Segment Impacts** — Improvements would need to be made along the “Centerville” line across Fremont between Niles and Newark. One or two standard rail tracks would need to remain in place to serve ACE, Capitol Corridor and freight service making it difficult to fit two high-speed rail tracks with four-track stations and approaches. A combination of right-of-way takes and grade separations would be required to fit all of the services into the corridor. Accordingly, the cost of this segment was estimated at \$300-million.
- **Transbay Tunnel Schedule and Cost Risk** — A long timeframe would be needed to deliver a new bay crossing considering the development of mitigation measures and approvals resulting in schedule risk that this segment could not be available for service in conjunction with other segments. However, this segment could be opened to service subsequent to an initial operating segment ending in San Francisco.

There is also cost risk associated with tunneling. The Regional Rail plan cost estimate of \$2.2-billion includes one half the cost of a four track sunken tube connection (the other 50% of the cost is assumed to be borne by a new BART connection.) The cost is based upon use of a sunken tube to provide a shallow entry into San Francisco to connect with the Transbay Transit Center. (A two-track deep bore tunnel connecting to 4th/King would cost about \$1.75-billion and would result in reduced impacts to San Francisco Bay compared to a sunken tube.)



Comparison of Altamont Pass Alternatives

Table 8.3.4-1 presents a summary comparison of the three most promising Altamont alternatives described in this section. As shown in the table, Alternative A8 (modified to include a transbay tube connection to provide direct service to Oakland) is identified as the preferred alternative with Alternative A3 listed as an option. “A8 modified” has generally lower cost and would serve generally more riders compared to the other two alternatives. It should be noted that “A3” could be modified to omit the Fremont - Oakland leg, resulting in a cost savings of \$2.2-billion and eliminating the three-way branch in service at Fremont; however, there would be no direct service to Oakland so this option does not provide equivalent service to “A8 modified”.

Between these three principal options, improving the Peninsula alignment to support high-speed rail end to end between San Francisco and San Jose as provided in alternative “A8 modified” would maximize the partnership opportunities with CHSRA, could be incrementally developed, provides consistency with existing plans and minimizes duplication with committed plans and investments.

The “A8 modified” alternative would require significant investment and would require following a potentially long environmental clearance process to clear and construct a crossing at Dumbarton; further project development and environmental effort would be required to obtain required rights-of-way and approvals for the entire segment back to a connection with the Central Valley line north of Merced, including at various “hard spots” where the right-of-way is restricted or where there may be impacts to adjacent land uses.

This option would support regional services operating with higher speed equipment between San Jose and San Francisco on the Peninsula as well as allow service to be provided between the Central Valley and Peninsula cities including San Francisco and San Jose.

Whereas the added capital cost of improving the estimated capital cost of the full Peninsula alignment upgrade between San Jose and San Francisco is about \$5.6-billion versus about \$4.9-billion for an East Bay alignment between San Jose and Oakland, extending the East Bay segment to San Francisco via a transbay tube connection would add as much as \$2.1-billion (assuming a one-half share of a four-track sunken tube shared with BART.)

By contrast, development of an East Bay option with direct service to San Jose and Oakland would include significant right-of-way risk gaining an agreement from UPRR to provide access to Oakland and would also require construction of a Transbay rail tunnel in order to serve San Francisco in the initial phase.

In the event this alternative would be selected, it would be appropriate to increase frequencies along the Capitol Corridor by increasing service to Great America — one way in which this could be accomplished would be by extending the Capitol Corridor overlay service between Hercules and Union City (refer to the recommended Regional Rail plan) to San Jose to allow for frequent transfers at Fremont.



Table 8.3.4-1 Comparison of Promising Altamont Pass Alternatives

	Capital Cost \$- Billion (2006)	Yearly Ridership (2030)				Cost Effectiveness (\$-Capital/ Regional Riders)	Express Travel Times SAC or LA to		
		No. CA/ No. CA	No. CA/ So. CA	No. CA Regional Subtotal	Statewide Including So. CA		SF	OAK	SJ
A3 — San Francisco, Oakland and San Jose Termini (Option – see comments)									
CHSRA	\$17.3	15.8	29.7	45.5	81.1	\$27.55	1:06/2:36	0:53/2:23	0:49/2:19
Regional Rail	\$17.7	16.1	29.7	45.8	81.4	\$28.02	—	—	—
A8 Modified — San Francisco, San Jose via Peninsula plus Oakland via Transbay Tube (Recommended)									
CHSRA	\$17.5	18.0	33.9	52.0	92.6	\$24.46	1:06/2:36	1:14/2:44	1:03/2:37
Regional Rail	\$16.7	19.9	33.9	53.8	94.5	\$22.46	—	—	—
A11 — San Jose Oakland and San Francisco via Transbay Tube (Not Recommended)									
CHSRA	\$18.2	17.4	32.8	50.3	89.6	\$26.21	0:57/2:31	0:53/2:23	0:49/2:19
Regional Rail	\$16.0	19.0	32.8	51.8	91.2	\$22.38	—	—	—

Comments:

- The "A8 Modified" alternative (Peninsula line with long term Transbay Tube to Oakland) is recommended
- The "A8 Modified" alternative has generally lower capital cost and generally higher cost effectiveness than other options
- The "A3" alternative as defined would require a three-way branch at Niles Junction and would result in poor operating plans with reduced headways; it also conflicts with UPRR in East Bay

- An option to "A8 Modified" would be to construct the "A3" alternative without the Niles-Oakland leg to eliminate the three-way split at Niles Junction; the "A3 Option" as described would have lower cost and improved access to San Jose while avoiding conflicts with UPRR between Niles Junction and Oakland
- The "A11" alternative requires early construction of a Transbay Tube to reach San Francisco; with "A8 Modified" the tube could be deferred to save on early capital cost and reduce schedule risk



The composite East Bay / Peninsula option which could be developed by omitting the Fremont - Oakland leg from alternative “A3” with a Dumbarton and Peninsula connection to San Francisco and a direct line from Fremont to San Jose in the East Bay would save 18 minutes in travel time to San Jose, but would incorporate many of the risk and project delivery issues associated with both the Peninsula as well as East Bay alignments and would also not provide a logical routing for either a San Francisco - San Jose or Oakland - San Jose express train.

The recommended alternative “A8 (modified)” would not serve Oakland directly in the first phase. However, if BART were to be extended to an intermodal with the high-speed rail line in Livermore, Oakland passengers could transfer to BART and reach downtown Oakland in about 45 minutes time or access regional trains operating on the high-speed line in Fremont.

In the long term, a connection to Oakland could be provided by construction of a rail tunnel between San Francisco and Oakland thereby providing direct service to Oakland after a San Francisco stop. While construction of a new Bay Crossing at this location would require a long time for processing of environmental approvals and permitting, these issues are not considered to be fatal flaws.

Construction of a rail tunnel was estimated to cost about \$2-billion for a deep bore or \$3-billion for a sunken tube (total cost of a 2-track tunnel). A sunken tube would have more environmental impact than a bored tunnel and would cost less but would provide a more shallow profile capable of meeting the Transbay Transit Center directly. As the Regional Rail plan has identified the need for an additional BART crossing between

Oakland and San Francisco in the long term, it would be logical to provide a four track segment where BART and standard rail could be accommodated in a single structure (separate approaches for BART and standard rail would be required in San Francisco as well as the East Bay due to differing connectivity requirements. By combining high-speed rail and BART for part of the distance across the bay, a lower cost project would result compared to development of separate alignments.

Extending high-speed rail trains across the Bay from San Francisco to Oakland as through trains in the long term would provide additional operational benefits:

- Overnight storage, light maintenance and provisioning could be provided in Oakland. This would reduce required station dwell times in San Francisco thereby increasing the capacity of the station to accommodate higher levels of terminating Peninsula trains.
- A rail connection between San Francisco and Oakland could also be used to bring trains from the East Bay across to San Francisco. (In order to fully exploit this opportunity, additional consideration would need to be given to resolving the operational incompatibilities between standard Capitol Corridor type equipment versus the lightweight equipment associated with Caltrain and High-Speed Rail. Potential approaches to this issue would include obtaining waivers or ultimate rule revisions from the Federal Railroad Administration allowing for mixed flow of lightweight equipment along the East Bay passenger-only tracks operating with standard Capitol Corridor equipment.)



8.3.5 Regional Rail with High-Speed Rail Entering from South (Pacheco)

Central Valley Segments

The environmental document prepared by CHSRA addresses design options for entering the South Bay from a point on the high-speed initial segment in the vicinity of Merced however from a regional rail perspective any Pacheco design option would enter the inner Bay Area following Monterey Highway and the existing UPRR Coast Subdivision north to Diridon Station in San Jose.

Bay Area Segments

The CHSRA EIS identifies some six alternatives for extending from San Jose into the Bay Area. The Regional Rail analysis compares two of the most promising options including the “P3” alternative which was previously adopted by MTC:

- San Francisco, Oakland & San Jose Termini
- San Jose, San Francisco & Oakland via Transbay Tube

Pacheco Alternative “P3” would branch at San Jose and include a separate East Bay leg to Oakland and Peninsula leg to San Francisco. In doing so, no bay crossing would be required. However, construction of high speed rail trackage on both sides of the bay for the full distance between San Jose and San Francisco/Oakland would be very costly - the total cost of this alternative is estimated at \$18.1-billion.

San Francisco, Oakland & San Jose Termini (“P3”)



This alternative would support regional services operating San Francisco/San Jose on the Peninsula as well as Oakland/San Jose in the East Bay; in addition, regional trains could extend to the Northern San Joaquin Valley cities including Sacramento via Pacheco Pass.



Construction of a new high speed line in the East Bay would raise similar issues as were discussed for Altamont alternatives with East Bay segments. These include (refer to details provided for Altamont alternative “A11”):

- Modified East Bay Alignment Fremont - San Jose
- Duplicate Investment with Respect to Capitol Corridor and BART
- Risk of UPRR Right-of-Way Agreement Fremont - Oakland
- Potential Environmental Justice Concerns in East Bay between Fremont and Oakland
- Ability to Improve ACE Service with High Speed Regional Train
- Construction within I-880

Most importantly, by branching the line at San Jose, one of the most promising potential advantages of the Pacheco Pass alignment would be negated — namely the opportunity to operate all express trains on a single alignment as provided for in the “P5” alternative presented below. The branching of service at San Jose in alternative “P3” would lead to lower ridership levels given similar numbers of express trains operating to Southern California.

The “P5” alternative serves Oakland via transbay tube instead of providing a separate East Bay alignment. The tube could be developed as a joint project in conjunction with a new BART connection and four track central section. Even with a transbay tube connection, Alternative “P5” would have lower total cost, estimated at \$16.1-billion, compared to the “P3” alternative.

San Jose, San Francisco & Oakland via Transbay Tube (“P5”)



This alternative would support regional services operating San Francisco/San Jose on the Peninsula with regional trains extended to the Northern San Joaquin Valley cities including Sacramento via Pacheco Pass.

Alternative “P5” would avoid the issues identified for Alternatives “P3” and “A11” with respect to the East Bay.

It would include issues associated with construction of a new transbay tube San Francisco - Oakland as discussed previously for Altamont Alternative “A8 Modified”. Similar to the “A8 Modified” alternative, construction of the tube could be deferred to a future phase to mitigate cost and schedule risk.



Table 7.3.5-1 presents a comparison of cost and ridership data for the two Pacheco alternatives. As shown The “P5” alternative is recommended as it has lower capital cost and higher cost effectiveness compared to alternative “P3”. Additionally, “P5” has a superior operating plan - with all three major cities on a single line, service levels are maximized.

8.3.6 Comparison of Altamont vs. Pacheco

Table 8.3.6-1 presents a comparison of the recommended Altamont and Pacheco alternatives, “A8 Modified” and “P5”.

As shown, the only ridership statistics which are significantly differentiated are the trips within or served along the two corridors, in which Altamont is 135 percent higher than Pacheco; Northern California regional trips (representing all trips with origins and destinations from Merced north), in which Altamont again exceeds Pacheco by 26 to 36 percent; and Northern California to Southern California trips (e.g., trips from Merced and north to Fresno and south), in which Pacheco exceeds Altamont by 18%. This analysis clearly distinguishes that Altamont provides better regional service and Pacheco provides better express service overall.

Whereas there are small differences in cost and cost-effectiveness, the marginal advantages shown for Pacheco are not significant.

With respect to travel times (refer back to Tables 8.3.4-1 and 8.3.5-1), trips between San Francisco and San Jose and northern San Joaquin Valley points would be substantially longer with Pacheco compared to Altamont. (E.g., travel time between San Francisco and Sacramento would be 1:47 via Pacheco versus 1:06 minutes via Altamont for a savings of 41 minutes.)

On the other hand, with a Pacheco alignment, travel times between San Jose and Southern California and the Central San Joaquin Valley would be nearly one-half hour less than the Altamont alignment (e.g., Los Angeles to San Jose travel times of 2:09 vs. 2:37) and all trains would operate on a single route with no branches in service resulting in the highest number of statewide trains stopping at all destinations in the Bay Area.



Table 8.3.5-1 Comparison of Promising Pacheco Pass Alternatives

	Capital Cost \$- Billion (2006)	Yearly Ridership (2030)				Cost Effectiveness (\$-Capital/ Regional Riders)	Express Travel Times SAC or LA to		
		No. CA/ No. CA	No. CA/ So. CA	No. CA Regional Subtotal	Statewide Including So. CA		SF	OAK	SJ
P3 — San Francisco, Oakland and San Jose Termini (Not Recommended)									
CHSRA	\$17.4	11.8	35.7	47.5	85.5	\$26.48	1:47/2:38	1:38/2:30	1:18/2:09
Regional Rail	\$18.1	14.4	35.7	50.1	92.7	\$26.22	—	—	—
P5 — San Jose, San Francisco & Oakland via Transbay Tube (Recommended)									
CHSRA	\$17.3	13.2	40.0	53.2	95.8	\$23.61	1:47/2:38	1:53/2:46	1:18/2:09
Regional Rail	\$16.1	15.8	40.	55.8	98.4	\$20.87	—	—	—

- Comments:
- The “P5” alternative is recommended
 - The “P5” alternative has lower capital cost and higher cost effectiveness compared to alternative”P3”
 - This alternative has a superior operating plan - with all three major cities on a single line, service levels are maximized

- This alternative maximizes the ability to match high speed rail funding with regional commitments to the Caltrain line
- This alternative avoids duplication of investment between the Peninsula and East Bay
- This alternative avoids the UPRR East Bay right-of-way



Table 8.3.6-1 Comparison of Recommended Altamont Pass Alternative to Recommended Pacheco Pass Alternative

	Altamont Pass (A8 Modified)	Pacheco Pass (P5)	Margin	Best Option
Ridership comparison (Millions – Yearly 2030)				
Northern California Regional Trips				
CHSRA	18.0	13.2	36%	Altamont Higher
Regional Rail	19.9	15.8	26%	Altamont Higher
Northern California to Southern California Trips				
CHSRA	33.9	40.0	18%	Pacheco Higher
Northern California Regional Trips + Northern California to Southern California Trips				
CHSRA	52.0	53.2	2%	Pacheco Marginally Higher
Regional Rail	53.0	53.2	2%	Pacheco Marginally Higher
Southern California Trips				
CHSRA	40.7	42.6	5%	Pacheco Marginally Higher
Systemwide Trips				
CHSRA	92.6	95.8	3%	Pacheco Marginally Higher
Regional Rail	94.5	98.4	4%	Pacheco Marginally Higher
Year 2006 Capital Cost (\$-Billion)				
CHSRA	\$17.5	\$23.61	(1%)	Pacheco Marginally Lower
Regional Rail	\$16.7	\$16.1	(4%)	Pacheco Marginally Lower
Coast Effectiveness (Capital \$/All No. CA Trips)				
CHSRA	\$24.46	\$23.61	(3%)	Pacheco Marginally Lower
Regional Rail	\$22.46	\$20.87	(7%)	Pacheco Marginally Lower

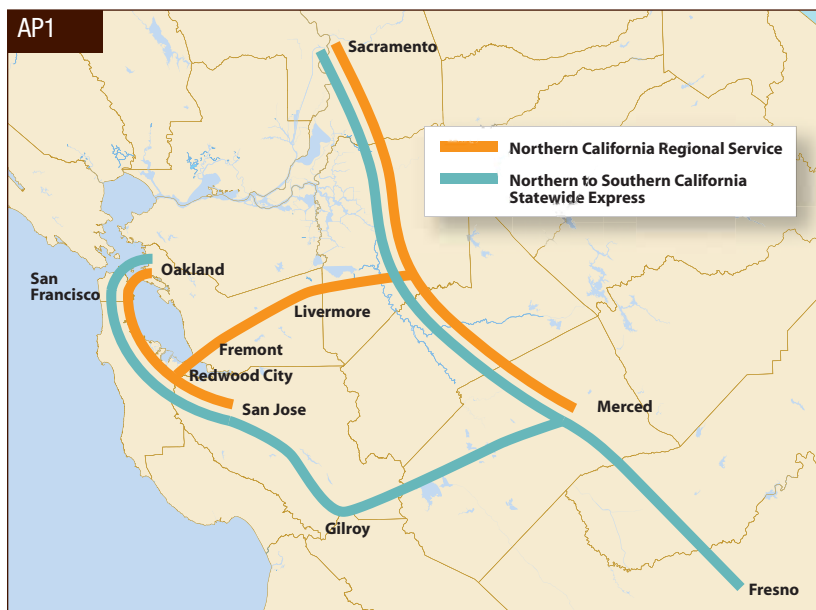


8.3.7 Altamont Alignment with Pacheco Alignment

Given that the Altamont and Pacheco alignments have different advantages, there is some consideration for combining the two alternatives and providing trackage in both corridors. If this were to be done, each of the two corridors (e.g., Altamont between northern San Joaquin Valley and the Dumbarton crossing to Redwood City and Pacheco between northern San Joaquin Valley and San Jose) could be developed with only two tracks.

Although the cost savings would be marginal — about \$650 million — the benefit of a reduced right-of-way requirement could materially reduce impacts where the high speed line

San Francisco & San Jose via Peninsula plus Oakland Via Transbay Tube (“AP1”)



would need to be fitted into existing urbanized areas by tailoring the alignments. The Pacheco Pass alignment would be designed for highest possible speeds as two-track alignment utilized by trains operating to and from Southern California and the Altamont Pass alignment would be designed for speeds approaching the Pacheco and Central Valley segments were feasible but with two tracks and regularly-spaced regional stops.

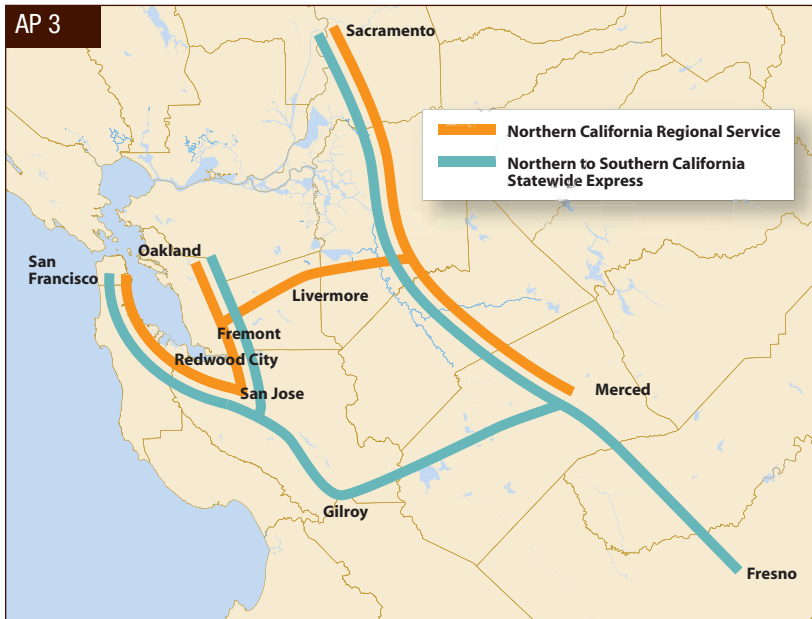
Three such combination alternatives have been identified and compared:

- San Francisco & SJ via Peninsula plus Oakland via Transbay Tube (“AP1 Modified”)
- SF, Oakland & SJ Termini without Dumbarton Bridge (“AP3”)
- San Francisco, Oakland & San Jose Termini with Dumbarton Bridge (“AP5”)

This alternative would include a two-track Altamont alignment and would only include two tracks between San Jose and Gilroy. With only regional trains operating over the Dumbarton Bridge, it would not be necessary to provide a high bridge at this location. This alternative is modified from the CHSRA “AP1” alternative to include a transbay tube connection to Oakland which would allow southern California express trains to serve all three major Bay Area population centers without splitting the service. The transbay tube could be deferred to a future phase to reduce near term cost and speed project delivery. The total cost of this alternative would be \$21.2 billion, representing a savings of more than \$1 billion from “A8 Modified” plus “P5” combined.



San Francisco & San Jose without Dumbarton Bridge (“AP3”)



This alternative would have the same characteristics as the “AP1” option with respect to trackage entering the Bay Area from both Altamont and Pacheco. Without a bay crossing, Altamont trains would need to travel down to San Jose to reach Peninsula destinations. In addition, Southern California express trains would need to branch at San Jose resulting in increased headways for express trains bound to San Francisco and Oakland. Other drawbacks identified with development of a new Oakland-San Jose high-speed line would pertain to this alternative (such as conflicts with the UPRR, the need to develop the line along I-880, and potential environmental justice concerns.) The cost of this alternative is estimated at \$22.1-billion.

San Francisco, Oakland & San Jose Termini with Dumbarton Bridge (“AP5”)



This alternative would be similar to “AP3” except it would include a single-track low bridge at Dumbarton to provide better service to the San Francisco peninsula from Altamont. This option would also incorporate two-track sections south of Gilroy and east of Redwood City similar to the other Altamont + Pacheco alternatives. The negatives with this alignment would include the issues developing a new rail line in the East Bay as well as a three-way split of regional trains at Fremont resulting in reduced headways and ridership for trains using Altamont Pass. The cost of this alternative is estimated at \$23.3-billion.



Comparison of Altamont + Pacheco Options

Table 8.3.7-1 presents comparative ridership and cost data for the Altamont + Pacheco alternatives. As noted, “AP1 Modified” is the preferred option. This alternative, which is consistent with both the “A8 Modified” Altamont alignment as well as the “P5” Pacheco alignment has generally lower cost and generally higher ridership than the other two options. The “AP1 Modified” alternative is stageable from either the recommended “P5” or “A8 Modified” alternatives by adding either the regional track (Altamont) or express track (Pacheco) later.

Alternative “AP3” would require express trains to split between Oakland and San Francisco and would also give poor regional access to San Francisco due to lack of water crossing.

Alternative “AP5” would also require regional trains entering through Altamont to be split three ways at Niles between Oakland, San Francisco and San Jose

Both “AP3” and “AP5” (similar to AP3 with a Dumbarton Bridge) would result in duplicate investment in an East Bay line which would conflict with UPRR.

Table 8.3.7-2 presents a three-way comparison of Altamont + Pacheco options to the recommended Altamont “A8 Modified” and Pacheco “P5” alternatives.

On aggregate ridership evaluations, the recommended Altamont + Pacheco alternative “AP1 Modified” performs the highest; Altamont by itself focuses more service on Northern California regional trips and slightly out-performs the Altamont + Pacheco option. Likewise, Pacheco by itself is slightly higher in serving trips to Southern California as more service is concentrated on

Pacheco Pass with a Pacheco-only option. However, as shown, for total regional trips and for systemwide travel, Altamont + Pacheco yields the highest ridership numbers.

With respect to cost and cost-effectiveness, Pacheco by itself would cost less than an aggregate Altamont + Pacheco alternative and would be lower in terms of cost per rider. However, as noted previously, the combination alternative includes savings of about \$1-billion compared to an option which includes 4-tracks and a high bridge in the Altamont corridor.



Table 8.3.7-1 Comparison of Altamont + Pacheco Alternatives

	Capital Cost \$- Billion (2006)	Yearly Ridership (2030)				Cost Effectiveness (\$-Capital/ Regional Riders)	Express Travel Times SAC or LA to		
		No. CA/ No. CA	No. CA/ So. CA	No. CA Regional Subtotal	Statewide Including So. CA		SF	OAK	SJ
AP1 — San Francisco and San Jose via Peninsula plus Oakland via Transbay Tube (Recommended)									
CHSRA	\$22.5	17.8	36.8	54.6	98.0	\$29.84	1:15/2:45	1:23/2:53	0:56/2:26
Regional Rail	\$21.2	19.9	36.8	56.7	100.1	\$27.09	—	—	—
AP3 — San Francisco, Oakland and San Jose Termini without Dumbarton Bridge (Not Recommended)									
CHSRA	\$22.0	15.9	33.0	48.9	87.8	\$32.61	1:48/2:45	1:00/2:30	0:56/2:26
Regional Rail	\$22.1	18.2	33.0	51.2	98.0	\$31.35	—	—	—
A11 — San Francisco, Oakland and San Jose Termini with Dumbarton Bridge (Not Recommended)									
CHSRA	\$23.1	16.9	34.9	51.8	92.9	\$32.37	1:15/2:54	1:00/2:30	0:56/2:26
Regional Rail	\$23.1	20.1	34.9	55.0	96.1	\$30.65	—	—	—

Comments:

- The “AP1 Modified” alternative (AP1 with long term Transbay Tube to Oakland) is recommended; this alternative has generally lower capital cost and generally higher cost effectiveness than other options
- The “AP1 Modified” alternative is stageable from either the recommended “P5” or “A8 Modified” alternatives by adding either the regional track (Altamont) or express track (Pacheco) later

- Alternative “AP3” would require express trains to split between Oakland and San Francisco and would also give poor regional access to San Francisco due to lack of water crossing
- Both “AP3” and “AP5” (similar to AP3 with a Dumbarton Bridge) would result in duplicate investment in an East Bay line which would conflict with UPRR
- Alternative “AP5” would also require regional trains entering through Altamont to be split three ways at Niles between Oakland, San Francisco and San Jose



Table 8.3.7-2 Comparison of Altamont + Pacheco to Altamont or Pacheco

	Altamont Pass (A8 Modified)	Pacheco Pass (P5)	Altamont + Pacheco (AP1 Modified)	Best Option
Ridership Comparison (Millions – Yearly 2030)				
Northern California Regional Trips				
CHSRA	18.0	13.2	17.8	Altamont Higher
Regional Rail	19.9	15.8	19.9	Altamont + Pacheco or Altamont Higher
Northern California to Southern California Trips				
CHSRA	33.9	40.0	36.8	Pacheco Highest
Northern California Regional Trips + Northern California to Southern California Trips				
CHSRA	52.0	53.2	54.6	Altamont + Pacheco Highest
Regional Rail	53.0	53.2	56.7	Altamont + Pacheco Highest
Northern California Regional Trips + Northern California to Southern California Trips				
CHSRA	40.7	42.6	43.4	Altamont + Pacheco Highest
Systemwide Trips				
CHSRA	92.6	95.8	98.0	Altamont + Pacheco Highest
Regional Rail	94.5	98.4	100.1	Altamont + Pacheco Highest
Year 2006 Capital Cost (\$-Billion)				
CHSRA	\$17.5	\$23.61	\$22.48	Pacheco Lowest
Regional Rail	\$16.7	\$16.1	\$21.20	Pacheco Lowest
Cost Effectiveness (Capital \$/All No. California Trips)				
CHSRA	\$24.46	\$23.61	\$29.84	Pacheco Lowest
Regional Rail	\$22.46	\$20.87	\$27.09	Pacheco Lowest



8.3.8 Implementation of High-Speed Rail

There are a number of ways in which various high-speed rail segments could be implemented within Northern California. A project of the magnitude of high-speed rail would take a number of years to deliver from the point of view of environmental clearance, permitting and construction, regardless of funding availability. Given these unknowns, as well as choices regarding specific route alternatives, it is difficult to specify a sequencing of segments at this point in time. Any sequencing which would be developed should, if possible, take into account the ability to utilize portions of the completed network as soon as possible, regardless of the availability of the entire network.

Initial Bay Area Segment

Clearly the San Francisco Peninsula is a location which could be improved with or without high speed rail. In accordance with both the phasing policy of CHSRA as well as the recommended Regional Rail options is improvement of the Peninsula corridor to make it “high-speed ready” for operation as a grade-separated, higher speed alignment suitable for use of electric multiple unit equipment. High-Speed rail limited stop trains could serve Peninsula destinations as a regional overlay to the long distance trains along with continued operation of local services.

Possible Altamont Pass Improvements (“A8 Modified”)

- **Early Elements** — As the Regional Rail Plan recommends upgrade of the Dumbarton service to provide a separate track connection for lightweight equipment between Redwood City and Union City, this segment would be electrified to support high speed rail equipment. An initial two-track high-speed line

would be developed through the Tri Valley area physically separated from the standard rail line, potentially using the abandoned Southern Pacific alignment to defer construction of a tunnel under Niles Canyon. A new 2-track high-speed alignment would be developed over Altamont Pass connecting to the preferred alignment segment in the Central Valley.

- **Later Elements** — In order to support higher frequencies of train operation and to provide higher speed operation of express trains, the Altamont alignment would be expanded to a full 4-track section at all stations, a tunnel would be constructed beneath Niles Canyon, and a new high bridge would be constructed at the Dumbarton Bay Crossing. (Optionally, marina uses south of Dumbarton would be closed and the waterway de-certified for navigation allowing a fixed 2-track low bridge to be constructed.) In addition, BART would be extended to Isabel/Stanley providing a connection to Oakland.

Possible Pacheco Pass Improvements (“P5”)

- **Early Elements** — A two-track Pacheco Pass alignment would be constructed between San Jose and the statewide line south of Merced allowing high speed trains to operate between Southern California and San Jose / San Francisco via the Peninsula line. In order to enhance regional service in the East Bay and Northern San Joaquin Valley, improvements to the ACE line would be accelerated.

- **Later Elements** — In order to accommodate statewide express and regional trains between San Francisco and regional points south of San Jose, four-track station sections would be constructed between San Jose and Gilroy and an



improved intermodal station would be provided at Gilroy to allow South County travelers convenient access to high speed express and regional trains. In the East Bay, BART would be extended to Isabel/Stanley to provide better regional connections between the Northern San Joaquin Valley and East Bay.

Possible Altamont + Pacheco Pass Improvements (“AP1 Modified”)

In the event both the Altamont and Pacheco alignments were included in the high-speed rail network, an even broader set of segments would be available and there would be more choices for advancing individual projects on either or both alignments depending upon funding and priorities.

- **Potential Early Altamont Elements** — The single track Dumbarton Bridge line would be electrified to Fremont to initiate service with an improved bridge connection deferred to Phase 3. An initial two-track high-speed line would be developed through the Tri Valley area physically separated from the standard rail line, potentially using the abandoned Southern Pacific alignment to defer construction of a tunnel under Niles Canyon until Phase 3. A new 2-track high-speed alignment would be developed over Altamont Pass connecting to the preferred alignment segment in the Central Valley.
- **Potential Early Pacheco Elements** — A two-track Pacheco Pass alignment would be constructed between San Jose and the statewide line south of Merced allowing high speed trains to operate between Southern California and San Jose / San Francisco via the Peninsula line.

Potential Later Improvements

Deferred Altamont improvements with an Altamont + Pacheco alternative such as new Dumbarton Bridge or tunnel under Niles Canyon would be constructed.

Build-out of high-speed rail in Northern California would be completed with construction of a transbay tunnel connection extending the Peninsula line from San Francisco to Oakland. This line segment could be developed as part of a four-track tube also serving BART. Construction of the tunnel connection would improve operations at the San Francisco terminal and would provide direct service to Oakland with an intermodal connection to Capitol Corridor and BART at West Oakland. The connection could also provide access to potential storage tracks located along I-880.

Summary

A recommendation regarding selection of an Altamont alignment versus a Pacheco alignment is a policy issue for the responsible elected and appointed officials to consider. The Regional Rail Plan analysis does provide information on the cost, ridership, and other issues relative to either of the two alignments to inform that policy discussion.