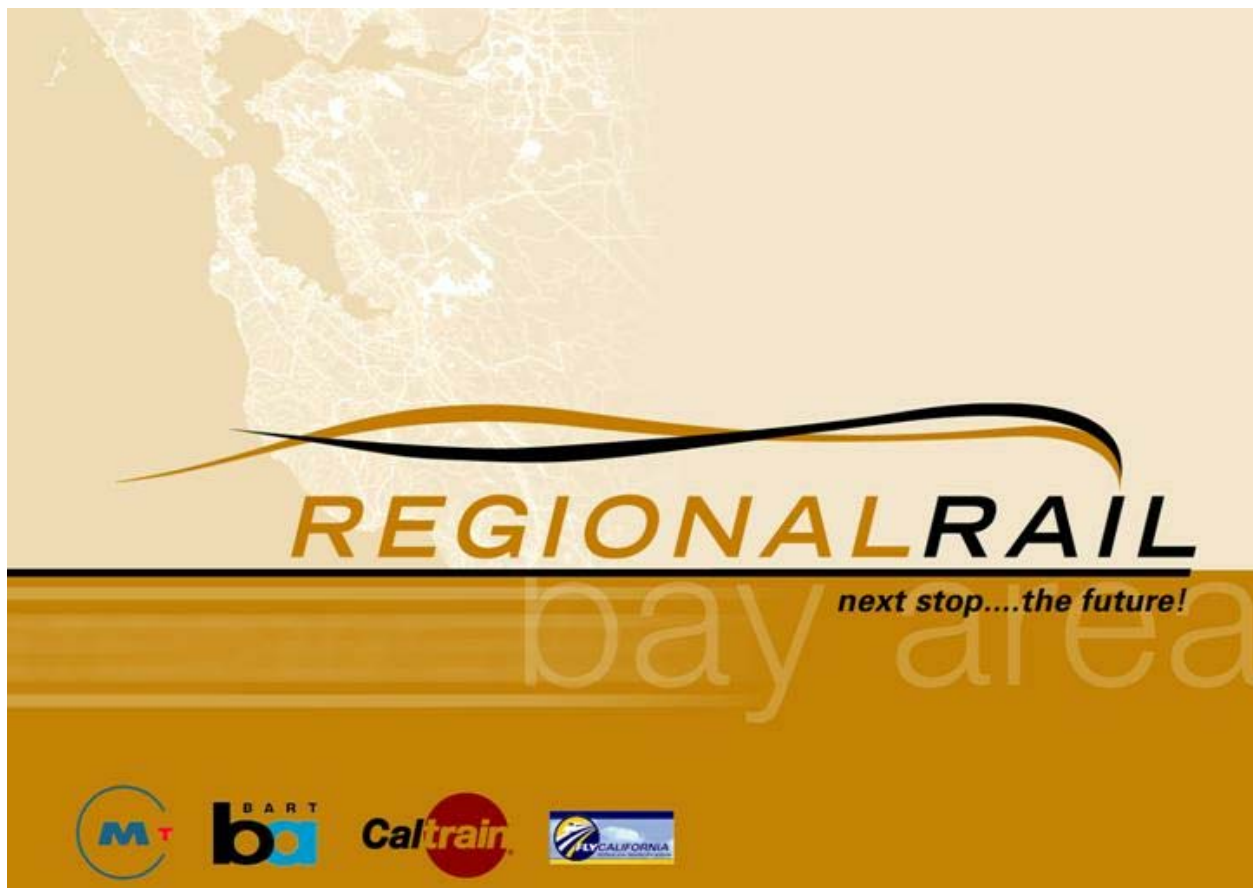


# BAY AREA REGIONAL RAIL PLAN CONCEPTUAL ALTERNATIVES TASK

Technical Memorandum 3.b  
Systemwide Study Alternatives Refinements



December 7, 2006

## OVERVIEW

This technical memorandum summarizes the refinements to Regional Rail Alternatives including BART and railroad-based regional rail services. (High speed rail options and overlay services will be addressed in a separate memorandum.) As such, this memo addresses System Alternatives 1 – 3 (System Alternatives 4 – 12 are those which include High Speed Rail and Regional Overlay Services.)

Since the initial conceptual alternatives were identified, the Regional Rail working group consisting of the Consultant Team acting under the direction of the Project Management Team has been developing information and assembling input from a wide range of sources including:

- Meetings and consultations with the two Class I freight railroads – the Burlington Northern Santa Fe (BNSF) and Union Pacific Railroad (UPRR);
- Meetings and consultations with Port of Oakland;
- Meetings and consultations with the Bay Area Rapid Transit District (BARTD) senior staff;
- Meetings and consultations with the Capitol Corridor Joint Powers Authority (CCJPA) senior staff;
- Meetings and consultations planners representing Caltrain, the Transbay Transit Center and Dumbarton Rail Project; and,
- Meetings and consultations with planners and officials representing various planning zones within the Regional Rail study area including the Tri Valley Area, City of San Francisco, City of San Jose, and other locations.

## SYNOPSIS OF SUGGESTED REFINEMENTS

Based upon review and analysis of the data and input received, the working group has identified the following refinements:

- Elimination of many of the “freight by-pass” alignments from further consideration, resulting in the elimination of Systemwide Study Alternative 3;
- Consolidation and simplification of the three BART alternatives into two distinct study alternatives and design options which carry the most promising planning concepts forward for analysis, and,
- Refining Systemwide Study Alternatives 1 & 2 to include the most promising stations, alignments and services options including identified BART refinements, surviving freight-bypass options, and the most promising regional rail passenger services.

The following sections provide more detail on the proposed refinements as well as a summary description of the two refined alternatives. In addition to Alternatives 1 and 2 which do not include high speed rail, additional alternatives with high speed rail will be identified based upon

separately-developed refinements for the high speed system (refer to the “ON GOING AND FUTURE STEPS” section at the end of this memo.)

## BART REFINEMENTS

- Baseline Improvements – The BART system will require on-going investments to facilities and rolling stock to continue to provide a high quality of service to customers. These costs will be incurred regardless of any system expansion or growth in patronage. As such, these costs will be estimated separately from those associated with a particular alternative.
- Core Capacity – The BART system will need “Core Capacity” improvements to address issues such as station access and service reliability. Some of these needs are “backlog” needs which are outstanding at this point in time and other needs are future needs which may be necessary to accommodate anticipated increases in patronage regardless of specific system expansion plans. As such, these costs will be estimated separately from those associated with a particular alternative. (Additionally, system expansion options will include an estimate of additional “Core Capacity” needs which would be associated with a particular alternative.)
- Second Transbay Tube – Previous studies of the BART demand patterns and capacity constraints with the existing Transbay Tube and Market Street subway indicate that a second Transbay crossing and new San Francisco subway line will be required in the long term (post 2025). With appropriate track connections in Oakland and San Francisco, a second bay crossing could improve operational reliability and provide redundancy should unforeseen events put the existing tube out of service for an extended period of time. A second tube and new line would provide additional stations and coverage to regional destinations in San Francisco, and as such would provide for a better distribution of demands coming from four East Bay branches; by distributing the load to a second Peninsula branch, Core Capacity demands on the existing Market Street subway could potentially be relieved. Two San Francisco alignments are proposed for analysis – a new line between the Transbay Transit Center and Presidio Transit Center via Folsom, Van Ness and Lombard (included in Alternative 1) and an alternative between the 4<sup>th</sup> / Townsend Caltrain station and 33<sup>rd</sup> / Geary via Townsend, Division/13<sup>th</sup>, Van Ness and Geary (included in Alternative 2). In alternative 2, the new BART line would be constructed as part of a four-track rail crossing which would also carry new electrified regional rail lines across the bay allowing electrified Peninsula services to be extended to Oakland and points north (Alt 1 would be BART-only). The new SF BART subway lines would have a 3-block concourse level connection between the Van Ness Civic Center stop and the existing Market Street Civic Center stop.
- Infill Stations – As only a limited number of infill station opportunities have been identified<sup>1</sup>; it is proposed to include all candidate infill stations in each of the two alternatives to test the productivity of these stations with each of the major alternative transit networks.
- Express Trains - BART stations are closely-spaced in areas where land use densities are generally higher, making it undesirable to skip any of these stops; and, where stations are spaced far apart long extents of express trackage would be necessary to generate

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<sup>1</sup> Albany, San Antonio (East Oakland), West Dublin, Irvington (Fremont), Calaveras (Milpitas), and 30<sup>th</sup> Street (San Francisco).

significant time savings for express trains. Thus it does not appear that development of express trackage would result in benefits which would justify the high cost of making retrofits to the system along with potential disruption during construction. Therefore no express trackage has been proposed. (However, additional trackage has been identified for Oakland and San Francisco for reasons noted in subsequent points.)

- Skip Stop Service Plans – The time savings with “skip-stop” service would be only one or two minutes saved per pair of stations and passenger inconvenience would be experienced for persons boarding at an “A” stop who wished to disembark at a “B” stop. Skip-stop service is a potential strategy for management of under-performing stations and as such could be a strategy pursued by BART in specific circumstances but does not appear to have such applicability as to be “packaged” in a particular system alternative.
- Fourth Track in Oakland / “X” Operations Plan – Provision of a fourth track through Oakland is necessary as a point of connection for a second Bay Crossing but could be constructed without a new crossing to provide improved connectivity as it would enable cross-platform transfers between all East Bay lines. Therefore, the cost of constructing a fourth track from MacArthur to the Oakland wye will be developed independent of Bay Crossing costs. With convenient cross-platform transfers in Oakland, BART could streamline operations by eliminating some or all of the direct service to San Francisco from the Richmond and Fremont lines. This strategy could be pursued by BART in the event future improvements to the train control system do not reduce headways enough to serve future demands. However, the “X” or other revised operating plans would not be presumed in any of the system alternatives as passenger convenience would be maximized by retaining the existing four lines operating to San Francisco.
- eBART Options – The eBART project would provide service between the existing Pittsburg / Bay Point station and Byron. Rail plan alternatives for Year 2050 assume eBART would be extended further to Patterson via Tracy: Alternative 1 would consider use of equipment which could be shared with the existing freight service on the West Side line whereas Alternative 2 assumes use of non-standard passenger equipment (freight needs between Tracy and Patterson would be accommodated using time separation in a similar fashion to Caltrain which allows freight during a limited mid-day window and overnight.)

#### REFINEMENTS TO RAILROAD-BASED SERVICES

- Freight By-Pass Options Eliminated – The following potential freight by-passes identified in Study Alternative 3 are recommended to be eliminated as specified below:
  - *I-80 Bypass (via New Antioch Bridge, Sacramento Northern alignment and new alignment to Roseville)* – Eliminated due to environmental concerns, potential high cost, need to re-assemble right-of-way and lack of interest by UPRR which is concerned with the need to serve interchange and industry points along existing line.
  - *Stockton – Sacramento Bypass (via Central California Traction)* – Eliminated due to existing short-line operation from Lodi to Stockton, adjacencies to residential land uses north of Lodi, and lack of need due to presence of two existing parallel freight lines which have expansion potential.

- *Tracy – Fresno Bypass (via UPRR West Side Line)* – Eliminated due to gap in right-of-way through downtown Los Banos<sup>2</sup>; re-instatement of freight rail service would result in impacts to adjacent neighborhoods; additionally the line is paralleled by two existing freight lines which have expansion potential.
- *Livermore – Pleasanton Bypass (south or north of Livermore)* – Eliminated due to environmental fatal flaws.
- Freight By-Pass Options Retained – The remaining freight-only bypass opportunities are recommended to be included in Alternative 1, which expands regional passenger services primarily using lines shared with freight:
  - *Richmond – Port Chicago (BNSF)* – Existing freight-only line would continue to operate without passenger service; this line could potentially be jointly operated in conjunction with UPRR Martinez subdivision, possibly for highly directional travel, to reduce the need to provide additional freight tracks along the Martinez subdivision between North Richmond and Port Chicago.
  - *Oakland – Newark (UPRR Coast Subdivision)* – Existing largely freight-only line<sup>3</sup> would continue to operate without added passenger service and could relieve demands on the Niles Subdivision south of Elmhurst Junction.
- Refinement of Freight Operating Practices – Even with expansion of track capacity, with expansion of both freight and passenger traffic levels it may be necessary to modify freight dispatching practices to balance loads between various segments so this strategy should be included with Alternative 1. Conversely, with development of largely separated passenger-only lines, Alternative 2 would allow for continuation of existing dispatching practices by the freight railroads.
- Short-Haul Freight between Port of Oakland and Central Valley via Altamont (Alternatives 1 & 2) – Short haul freight would be subsidized and operated between Port of Oakland and various Central Valley freight intermodal ramps and ports including Port of Stockton (BNSF), Lathrop (UPRR) and new intermodal ramps developed along UPRR West Side line (Crows Landing near Patterson) or UPRR Fresno Subdivision. The short-haul freight would mitigate increases in truck traffic operating on the I-880, I-580/I-205 and I-5 / SR-99 corridors.
- Addition of Service from Merced to Oakland via Altamont (Alternatives 1 & 2) – Alternative 3 included a concept to provide a Merced to Oakland service operating via the UPRR Fresno subdivision passing through downtown districts between Merced and Manteca. This service concept has been added to Alternative 1 operating on shared trackage with UPRR freight services and to Alternative 2 operating on new separate passenger trackage along the UPRR freight lines or alternative parallel alignments such as the abandoned SPRR alignment through the Altamont Pass and Niles Canyon. (Existing long-haul services such as the “San Joaquin” trains would continue to operate via the BNSF between Bakersfield and Oakland via Stockton and Martinez.)
- Extension of US 101 North (“SMART”) Service to Merced via Stockton (Alternative 2) – As a complement to a new lightweight separate passenger network, standard equipment

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<sup>2</sup> Right-of-way through downtown has been converted to bike path.

<sup>3</sup> The long-haul Coast Starlight train operates on this trackage.

operating in the US 101 North corridor could be extended to Merced via Stockton. The route would be via a reconstructed I-580 bridge and abandoned BNSF right-of-way parallel to Ohio Avenue in Richmond connecting to the UPRR line serving the Richmond BART/Capitol Corridor station. From that point, the line would utilize UPRR trackage from Richmond to Port Chicago and BNSF trackage from Port Chicago to Merced. (Alternative 1 would provide an express bus connection across the Richmond – San Rafael bridge between San Rafael and the Richmond BART/Amtrak station where “San Joaquin” services could be accessed.)

- I-80 Corridor New Rail Alignment (Alternative 2) – Engineering investigation of possible improvements to provide separate passenger rail trackage across the Carquinez Strait has identified significant feasibility constraints at the existing Martinez – Benicia crossing. A separate passenger bridge, if constructed, should provide a high level crossing not subject to the significant operational delays encountered by Capitol Corridor trains operating on the existing low-level bridge. However, it is not feasible to provide a desirable profile grade for a high-level structure which would meet the trackage serving the existing Martinez passenger station. In addition, the existing rail and highway bridge and new highway bridge under construction makes construction of a fourth span at this location problematic. At the same time, a viable alignment has been identified which would traverse from a point north of the new Capitol Corridor Hercules station to I-80 and which would follow I-80 across the Carquinez, potentially utilizing the existing foundations for the highway bridge presently being dismantled. The alignment would continue to follow I-80 resulting in a new station at the SR-37 / I-80 interchange near the north Vallejo Fairgrounds redevelopment area and connecting via tunnel back to the UPRR Martinez subdivision right-of-way in Cordelia. This alignment would also avoid direct involvement with high maintenance efforts required to construct and maintain high-speed track geometry through the environmentally-sensitive wetlands and peat bogs in Suisun Bay between Benicia and Cordelia. (The Martinez station would continue to be served by the long-haul Amtrak trains including the “San Joaquin” services, the “California Zephyr” and “Coast Starlight” trains.)
- Calistoga Feeder Bus (Alternatives 1 & 2) – The right-of-way of the former Napa Valley Railroad has been abandoned and incorporated into vineyard properties north of St. Helena. Re-establishment of rail would require re-purchase of right-of-way and modifications to many roadways and vineyard properties. For the purpose of patronage testing, a bus-only connection to Calistoga will be modeled and the rail service potential will be re-evaluated pending results from the travel demand forecasting.
- Express Bus Connection between eBART and Livermore via Vasco Road (Alternatives 1 & 2) – The Tri Valley cities have identified a travel demand market between the Livermore area and Eastern Contra Costa County. Whereas provision of rail service in the Vasco Road corridor would require extensive grading and tunneling due to the curvature and grades of the existing highway alignment, Alternative 1 and 2 will include consideration for an express bus link between Livermore and Pittsburg. The express bus would connect with conventional BART and eBART at the Pittsburg / Bay Point station and would terminate at the BART East Dublin / Pleasanton BART station, operating via Stanley Blvd. to downtown Livermore, and Vasco Road to Antioch and Pittsburg. The bus service would connect with the end-of-line Tri Valley BART station (at a new Greenville / I-580 / UPRR BART and “ACE” station in Alternative 1 or at a new Isabel Road / UPRR BART and “ACE” station in Alternative 2.)

- I-680 Express Bus Connection (Alternative 2) – Tri Valley cities and Contra Costa County has identified express bus as an alternative to rail for the I-680 corridor. For the purpose of providing connectivity with the balance of the separate higher speed regional rail system, a “680 Connector” express bus will be included operating between the Fairfield Transit Center near the I-80 / West Texas / Beck intersection and the VTA Tasman I-880 / Milpitas LRT station. The express bus would connect to the higher speed rail stop at Cordelia, and to the proposed BART Warm Springs station as well as other intermediate points.

## FINAL DESCRIPTION OF SYSTEMWIDE STUDY ALTERNATIVE 1

(System plan and services map attached.)

### Key Characteristics

- No High Speed Rail
- Standard Passenger Rail Shared with Freight (Capacity Improvements as Needed)
- Freight Dispatching Optimized for Best Use of Capacity on Shared Lines
- Short Haul Freight between Port of Oakland and Central Valley via Altamont
- BART Regional System Expansion
- New BART Transbay Tube and San Francisco Subway (Transbay Transit Center to Presidio via Fremont – Van Ness – Lombard)

### Corridor by Corridor Descriptions

#### *US 101 North Corridor (San Francisco - Cloverdale)*

- Improve 101 corridor service operating between Larkspur or San Quentin to Cloverdale to support long term growth using standard passenger equipment mixed with freight service north of Ignacio Wye (Novato)
- Provide high frequency express bus connection across Richmond-San Rafael Bridge to connect between US 101 North corridor service at San Rafael and Richmond BART / I-80 Corridor services and long-haul “San Joaquin” trains

#### *I-80 Corridor (Oakland – Auburn)*

- Upgrade UPRR line to 3 or 4 tracks with grade separations and operational improvements for enhanced regional service operations with standard passenger equipment; add grade separations to 4-track segments
- Extend BART Richmond line to intercept station on I-80 north of Hercules

*North Bay Corridor (US 101 to I-80 across San Pablo Bay between Petaluma and Cordelia)*

- Operate St. Helena to Vallejo (feeder bus to Calistoga) and San Rafael to Fairfield / Vacaville service via NWP and California Northern lines

*Peninsula Corridor (San Francisco – San Jose)*

- Improve capacity to 2-4 tracks grade separated to support express and local services with electrified standard equipment; freight operates at night

*South Counties Corridor (San Jose – Santa Cruz / Monterey / Salinas)*

- Extend commuter service operating with standard equipment to Salinas with provision for San Francisco to Monterey regional train

*East Bay Corridor (Oakland – San Jose)*

- Shared regional service with programmed capacity & operational improvements and additional capacity & operational improvements to support higher service levels; add grade separations at selected locations
- BART extension to Warm Springs & Santa Clara

*Transbay (Oakland – San Francisco) & Dumbarton Corridors*

- Construct 4th BART track through Oakland; break out of wye to new alignment serving Alameda and provide new BART transbay crossing connecting to new San Francisco subway line between Transbay Transit Center and Presidio via Fremont, Van Ness and Lombard
- Dumbarton bridge service operates with standard consist between Peninsula and Union City with increased frequencies and reverse-peak service

*Central Valley (Sacramento – Fresno)*

- Improvements as necessary along BNSF and UPRR lines to accommodate growth in regional services and freight movements; extend existing Altamont Pass service north to Sacramento to provide Sacramento to San Jose trains; provide new Merced to Oakland service over Altamont Pass providing more direct access to Oakland from San Joaquin Valley; line between Oakland and Stockton via BNSF will continue to carry long-haul “San Joaquin” trains
- Extend eBART to Tracy and Patterson using standard passenger equipment

*Tri-Valley Corridor (I-580, I-680 & I-205 from East Bay to Tracy/Manteca)*

- Upgrade UPRR route with capacity and operational improvements to provide higher speed service for regional trains to Central Valley; put SPRR alignment through Niles Canyon back in service to provide continuous second main between Niles Junction and Sunol; add trackage in Pleasanton and Livermore to provide two continuous main tracks; put SPRR alignment over Altamont Pass back in service and shift Altamont trains to former SPRR line; relocate Tracy station to downtown on former SPRR trackage and relocate Vasco Road station to provide intermodal with BART at Greenville Road / I 580 (refer to Central Valley for description of services)
- Extend BART system along I-580 to intermodal with regional rail standard trains at Greenville Road interchange with added BART stop at Isabel / I-580

*I-680 Corridor (Fairfield – San Jose)*

- Provide new BART line along I-680 from Warm Springs BART station to intermodal with Capitol Corridor at Martinez; transfer stations at West Dublin and Walnut Creek to existing BART Dublin/Pleasanton and Bay Point lines
- Provide express bus connection between East Dublin / Pleasanton BART and Pittsburg / Bay Point BART via Stanley Boulevard, downtown Livermore, Greenville Road BART, Vasco Road and SR-4

## FINAL DESCRIPTION OF SYSTEMWIDE STUDY ALTERNATIVE 2

(System plan and services map attached.)

Key Characteristics

- No High Speed Rail
- Lightweight Passenger Rail System Separated from Freight
- Freight Operating Practices Independent from Passenger Operations
- BART System Expansion Limited to Short Extensions to Improve Connectivity
- New BART and Passenger Rail 4-Track Bay Crossing with New San Francisco BART Subway Line (4<sup>th</sup> / Townsend to 33<sup>rd</sup> / Geary via Townsend – Van Ness – Geary)

Corridor-by-Corridor Description*US 101 North Corridor (San Francisco - Cloverdale)*

- Improve 101 corridor service operating between Larkspur or San Quentin to Cloverdale to support long term growth using standard passenger equipment mixed with freight service north of Ignacio Wye (Novato)
- Provide rail connection across reconstructed Richmond – San Rafael Bridge and along abandoned BNSF right-of-way connecting to UPRR Martinez Subdivision in Richmond so that compliant self-propelled multiple-unit trains operating to San Rafael as part of the proposed “SMART” service could operate through to Stockton via the UPRR and BNSF (refer to Central Valley service description)
- Provide express bus connection between San Rafael and Daly City BART meeting all trains at San Rafael; connects to future MUNI Presidio LRT station, new BART subway at Geary/Park Presidio and existing MUNI light rail services (N, L and M lines) along Route 1

#### *I-80 Corridor (Oakland – Auburn)*

- Construct new passenger line for lightweight equipment from Oakland to Auburn via UPRR right-of-way; follows I-80 between Hercules and Cordelia; including new bridge across Carquinez Strait at Vallejo (services operate from Auburn to Salinas via Oakland and San Francisco)

#### *North Bay Corridor (US 101 to I-80 across San Pablo Bay between Petaluma and Cordelia)*

- Operate St. Helena to Vallejo (feeder bus to Calistoga) and San Rafael to Fairfield / Vacaville service via NWP and California Northern lines

#### *Peninsula Corridor (San Francisco – San Jose)*

- Improve to 2-4 track grade separated electric system supporting express and local service between San Jose and Transbay Transit Center using lightweight electrified equipment; accommodation for night freight service using standard equipment (local service on Peninsula from San Jose continues via new Bay Crossing in I-80 Corridor to Vallejo)

#### *South Counties Corridor (San Jose – Santa Cruz / Monterey / Salinas)*

- Extend East Bay standard passenger rail from San Jose to Salinas; regional service using standard equipment is provided linking Santa Cruz, Monterey & Salinas with transfers at Pajaro & Castroville (Salinas service operates through to Auburn via San Jose and Oakland)

#### *East Bay Corridor (Oakland – San Jose)*

- Construct separate passenger-only tracks from Oakland to San Jose via UPRR Niles Subdivision right-of-way from Oakland to Niles, along UPRR Warm Springs subdivision from Niles to Mission Boulevard, via I-880 from Mission Boulevard to Montague Expressway, and via Montague Expressway and Trimble Road from I-880 to UPRR Coast subdivision right-of-way in San Jose. (Regional trains operate Oakland to San Jose; service from Sacramento is re-routed to San Francisco via new transbay rail tunnel.)

- BART extension to Warm Springs & Santa Clara

*Transbay Corridors (Oakland – San Francisco & Dumbarton)*

- New transbay rail tunnel from 4<sup>th</sup>/Townsend to Oakland; extend Peninsula express and local service w/ lightweight electric equipment to I-80 corridor with locals terminating at Vallejo and express continuing on to Auburn)
- Construct 4th BART track through Oakland; break out of wye to new alignment serving Alameda and extend BART to San Francisco in four track tunnel shared with regional rail (2 + 2) to new San Francisco subway line between 4<sup>th</sup>/Townsend and 33<sup>rd</sup>/Geary via Townsend, Division/13<sup>th</sup>, Van Ness and Geary
- Dumbarton service operates with lightweight electric on separate trackage through Centerville between Peninsula and East Bay; in conjunction with electrification, the proposed Millbrae to Union City service is extended and re-routed resulting in a San Francisco to Merced service and the proposed San Jose to Union City service is extended to Oakland (dual power locomotives would be utilized beyond electrified territory.)

*Central Valley (Sacramento – Fresno)*

- Develop separate trackage for operation of lightweight passenger equipment along UPRR for regional service from Merced to Sacramento make capacity improvements to BNSF and re-route freight traffic to optimize system capacity; develop separate trackage for operation of lightweight passenger equipment for service between Sacramento and San Jose via Stockton, Tracy and Tri Valley as well as service between Merced and Oakland via Manteca, Tracy and Tri Valley (refer to Tri Valley for details); existing service using standard equipment shared with freight operating between Stockton and Martinez would be provided by interlining with trains from San Rafael operating over a reconstructed Richmond – San Rafael Bridge and existing UPRR from Richmond to Port Chicago.
- Extend eBART to Tracy and Patterson using lightweight passenger equipment

*Tri-Valley Corridor (I-580, I-680 & I-205 from East Bay to Tracy/Manteca)*

- Construct separate higher-speed regional passenger line from Stockton to Niles following former SPRR from Stockton to downtown Tracy with new crossing at Patterson Pass, separate trackage along UPRR alignment through Livermore and Pleasanton, and new tunnel from Sunol to Niles; services operate from Sacramento to San Jose and from Merced to Oakland (refer to Central Valley corridor description)
- Extend BART one stop via El Charro Road to new intermodal terminal with regional lines and buses at Isabel / UPRR

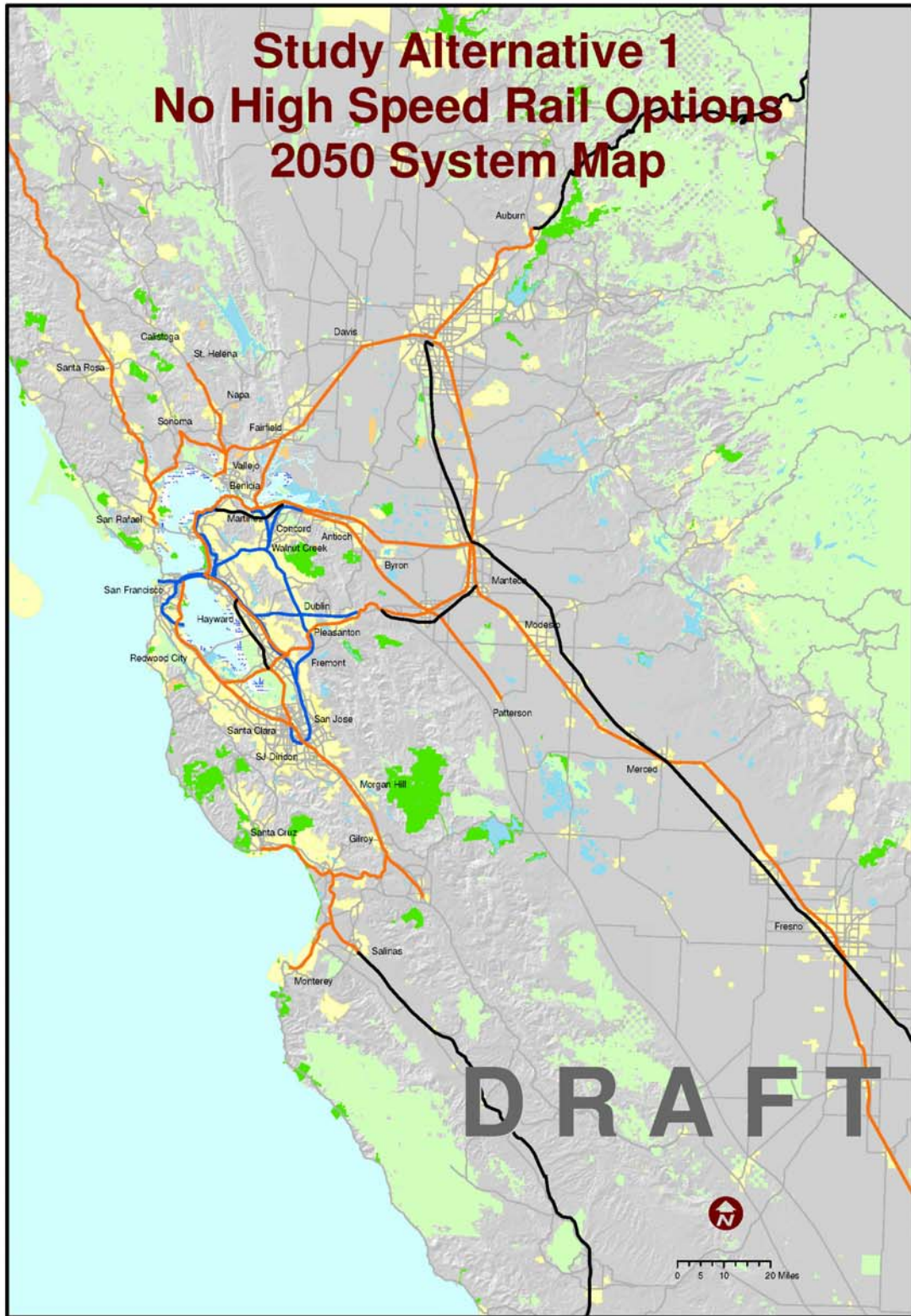
*I-680 Corridor (Fairfield – San Jose)*

- Provide express bus service along I-680 corridor between VTA I-880 / Milpitas LRT station (Tasman Line) and Suisun regional station via I-880 to SR-237 to I-680 with connections to BART Calaveras station (SR-237), BART Irvington station, Pleasanton regional station, BART West Dublin station, BART Walnut Creek station, Martinez Amtrak station, Cordelia regional station, Fairfield Transit Center and Suisun regional station
- Provide express bus connection between East Dublin / Pleasanton BART and Pittsburg / Bay Point BART via Stanley Boulevard, downtown Livermore, Greenville Road BART, Vasco Road and SR-4

- ONGOING AND FUTURE STEPS

- Passenger Travel Demand Forecasting – For the purpose of testing the various travel markets and potential patronage of lines identified in Alternatives 1 & 2, “initial” operating plans have been developed. The initial operating plans identify a high level of service (e.g., train frequencies) and are intended to capture the highest possible levels of patronage in the markets served.
- Freight Train Operating Levels and Required Capacity – Planning level evaluations of potential future freight train operational requirements have been prepared and the Consultant Team is developing anticipated trackage requirements to accommodate the aggregate train operating demands and resulting trackage improvements at a planning level of detail.
- Segment-by-Segment Capital Cost Estimating – Cost estimates are being assembled and/or prepared for rail infrastructure needed to accommodate the anticipated freight and passenger operations.
- Connectivity Investments – Schematic plans and cost estimates are being assembled and/or prepared for a set of identified regional connectivity hubs.
- BART Core Capacity and System Reliability Investments – Planning-level descriptions and order-of-magnitude cost estimates are being prepared for investments which need to be made to the BART system to (1) address existing identified core capacity needs to serve future demand levels under a baseline condition under which all of the Resolution 3434 projects are implemented, and (2) additional investments which would be desirable to improve service and reliability even if no additional extensions of the system were to be made.

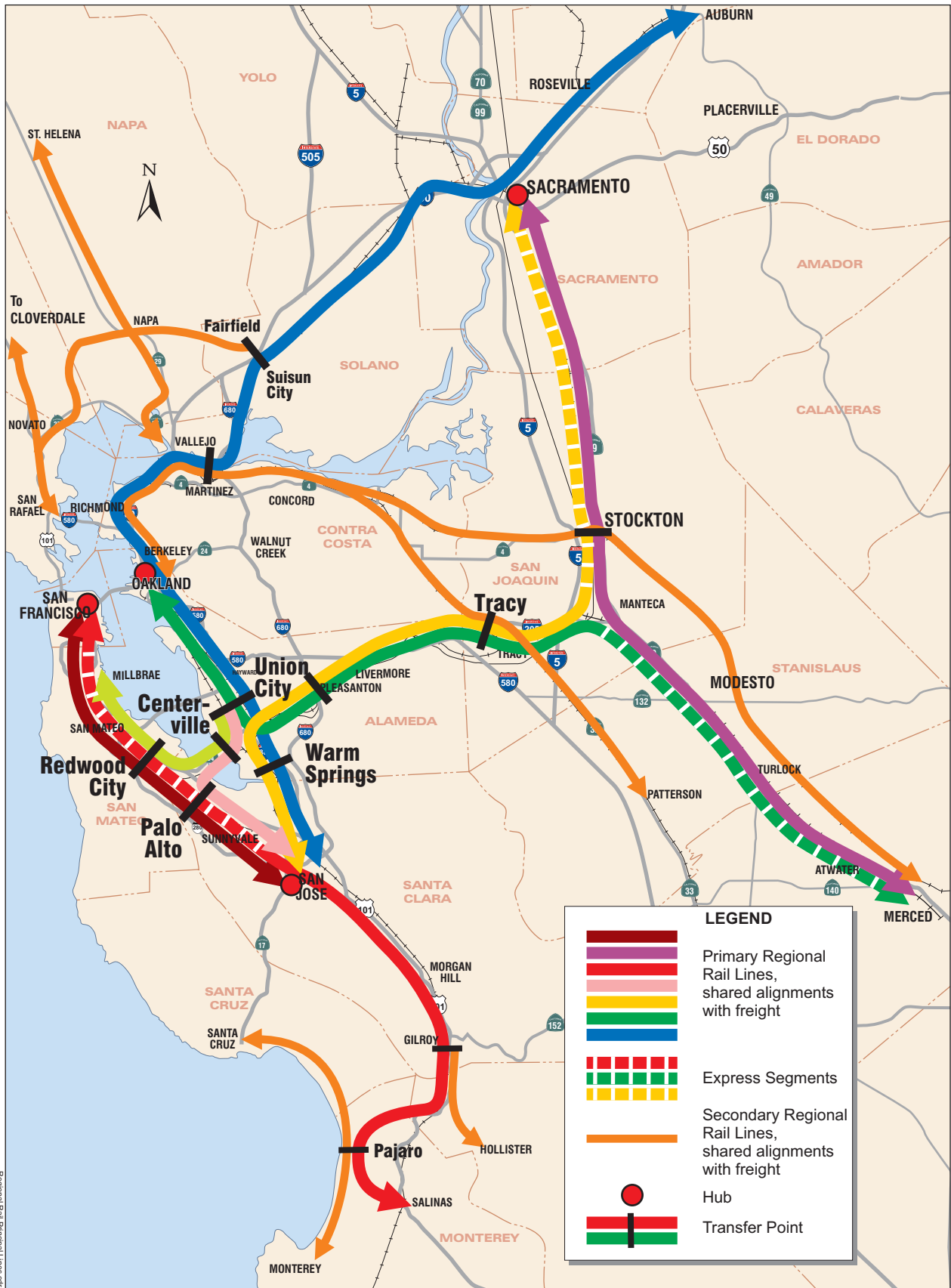
# Study Alternative 1 No High Speed Rail Options 2050 System Map



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## Legend

- HSR only, light weight equipment, double track, fully grade separated
- Regional Passenger Rail, light weight, fully grade separated
- HSR with Regional Passenger Rail
- Freight/Regional Rail
- Predominantly freight, standard equipment
- BART
- Federal Lands
- Park Areas
- Conservation Areas

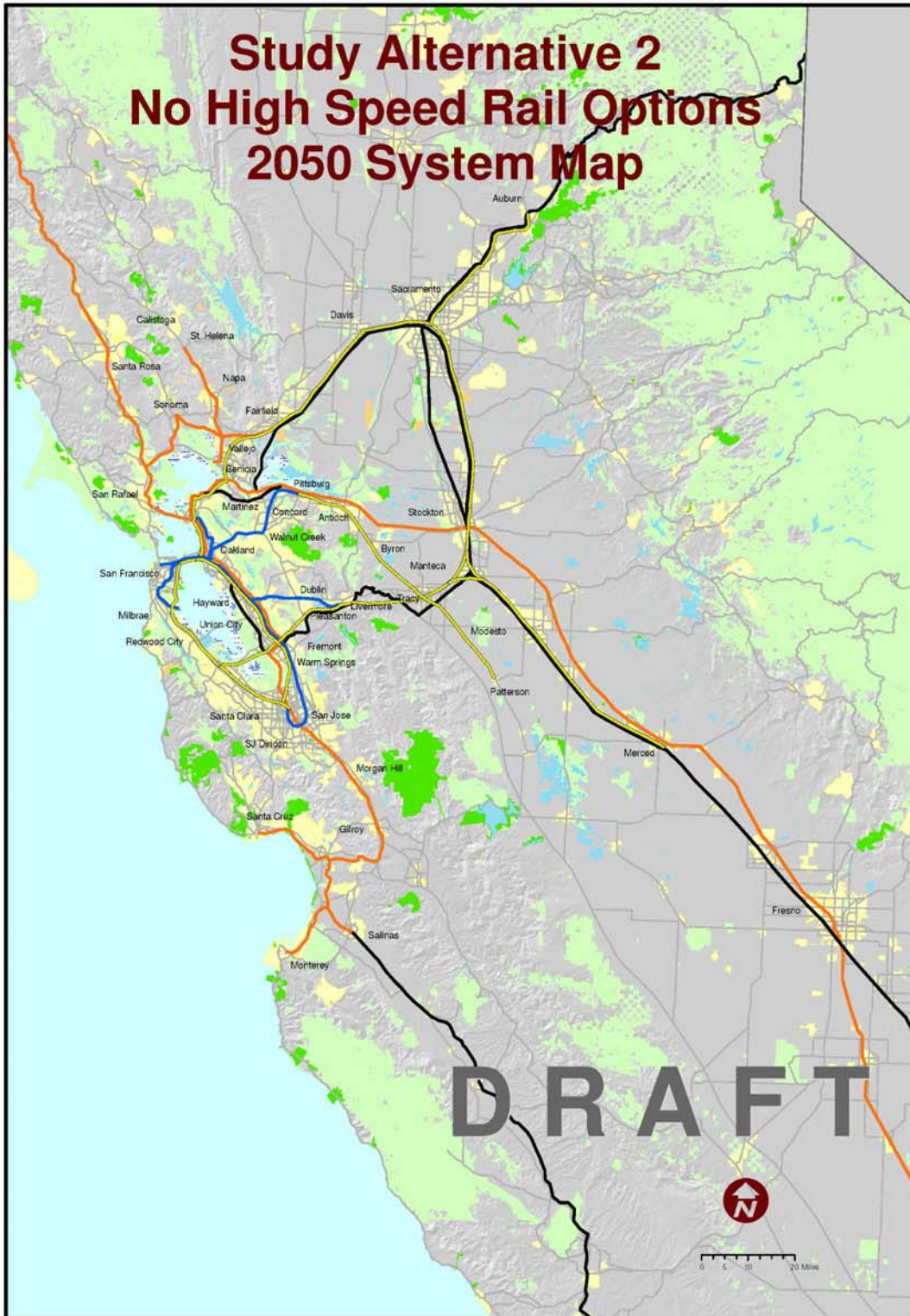


Regional Rail Principal Lines.pdf

BAY AREA REGIONAL RAIL PLAN

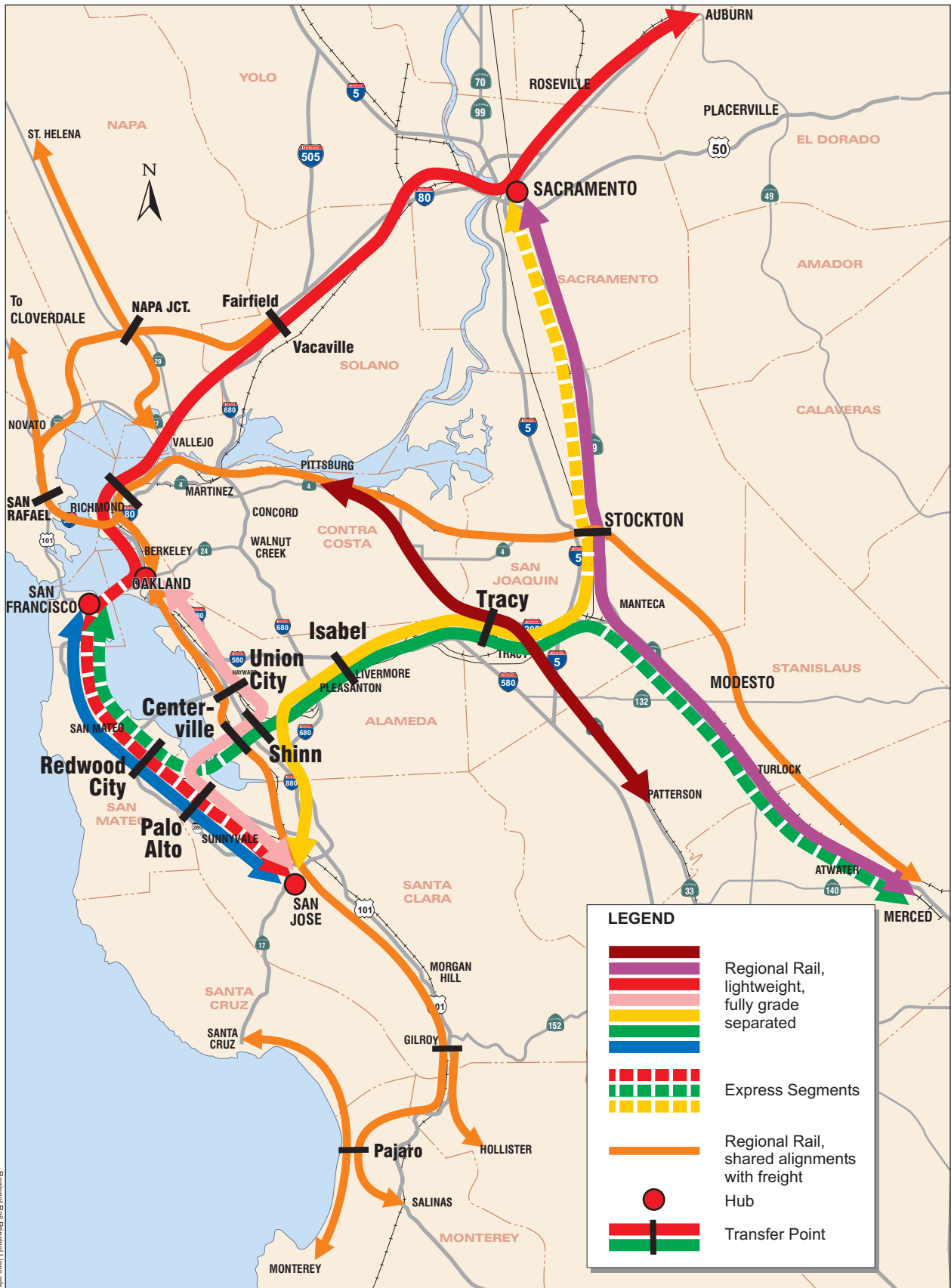
# ALTERNATIVE 1 REGIONAL RAIL PRINCIPAL LINES

# Study Alternative 2 No High Speed Rail Options 2050 System Map



## Legend

- HSR only, light weight equipment, double track, fully grade separated
- Regional Passenger Rail, light weight, fully grade separated
- HSR with Regional Passenger Rail
- Freight/Regional Rail
- Predominantly freight, standard equipment
- BART
- Federal Lands
- Park Areas
- Conservation Areas



Regional Rail Principal Lines.cdr

BAY AREA REGIONAL RAIL PLAN

## ALTERNATIVE 2 REGIONAL RAIL PRINCIPAL LINES