CONTRA COSTA SOLANO

I-80 RAIL FEASIBILITY STUDY

FINAL REPORT | JUNE 2003

Prepared by

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I. INTRODUCTION

Congestion on the portion of the I-80 corridor through Solano and Contra Costa counties is severe and unrelenting. The California Department of Transportation (Caltrans) forecasts that travel demand in this corridor will increase 30-50% over the next twenty years. Traditional commuting patterns in the corridor based on land use patterns--in the morning, westbound to San Francisco and downtown Oakland, and in the evening, eastbound--are expected to continue. Although significant bus and highway improvements are planned, such as an additional lane on the new Carquinez Bridge span, a completed westbound HOV network and a regional express bus program, these improvements may not keep pace with increasing demands on capacity. Congestion and travel times are likely to worsen.

The transportation network in the I-80 corridor potentially could be improved by providing passenger rail service on existing railroad rights of way in the corridor. The corridor's rail lines are the Union Pacific (UP) Railroad and the Burlington Northern and Sante Fe (BNSF) Railway. Both rail lines currently operate significant freight service into the Port of Oakland, and the UP hosts Amtrak *Capitol Corridor*, *San Joaquin*, and long-distance intercity trains. Although the rail lines are active, passenger rail services on either the UP or BNSF lines could offer residents of Solano and Contra Costa counties a viable travel alternative to a congested I-80.

This study evaluates options for operating passenger rail on existing railroad rights of way to provide a commute alternative to residents of Solano and Contra Costa counties. The study examines a short-term option--commuter rail service along the existing *Capitol Corridor* route--and long-term options--local passenger service from Hercules to Richmond along either the UP or the BNSF right of way. Both the short-term and the long-term options connect with BART at its Richmond station, thereby providing regional connectivity through the BART system.

The Contra Costa-Solano I-80 Rail Feasibility Study began in July 2002, funded by the West Contra Costa Transportation Advisory Committee (WCCTAC), the Contra Costa Transportation Authority (CCTA), the Metropolitan Transportation Commission (MTC) and the Solano Transportation Authority (STA). The Policy Advisory Committee (PAC), composed of elected officials from the two counties, met on a regular basis throughout the year. The PAC reviewed a series of Working Papers (as summarized and referenced herein and collected in Volume 2 of this report) covering such topics as study goals and objectives, corridor conditions, short and long term rail options, and transit-oriented development, and provided policy direction (see Appendix A for a list of Policy Advisory Committee members).

The PAC established the following goals for rail service in the corridor (Working Paper #2):

1. Provide a transportation option that reduces the growth in the level and extent of travel delay projected in this corridor.
2. Provide convenient, fast and seamless transit service.
3. Enhance regional mobility, especially access to jobs.
4. Generate growth in rail transit usage on a cost-effective basis.
5. Reduce auto emissions and improve air quality.

6. Provide opportunities for transit oriented development.
7. Reduce the reliance on single occupant automobiles.
8. Provide opportunities for coordination with local transit, and joint ticketing.
9. Provide a rail option that is consistent within the constraints of anticipated funding, BART expansion criteria, and local goals and objectives.
10. Identify opportunities to integrate this proposed service with the growing rail freight business, largely generated by growth of the Port of Oakland.

In addition, the PAC agreed to add BART's recently adopted System Expansion Criteria to their alternative evaluation process. These criteria help evaluate a project based on the presence of transit supportive land use and access, ridership development plans, project cost-effectiveness, improved regional network connectivity, and system and financial capacity.

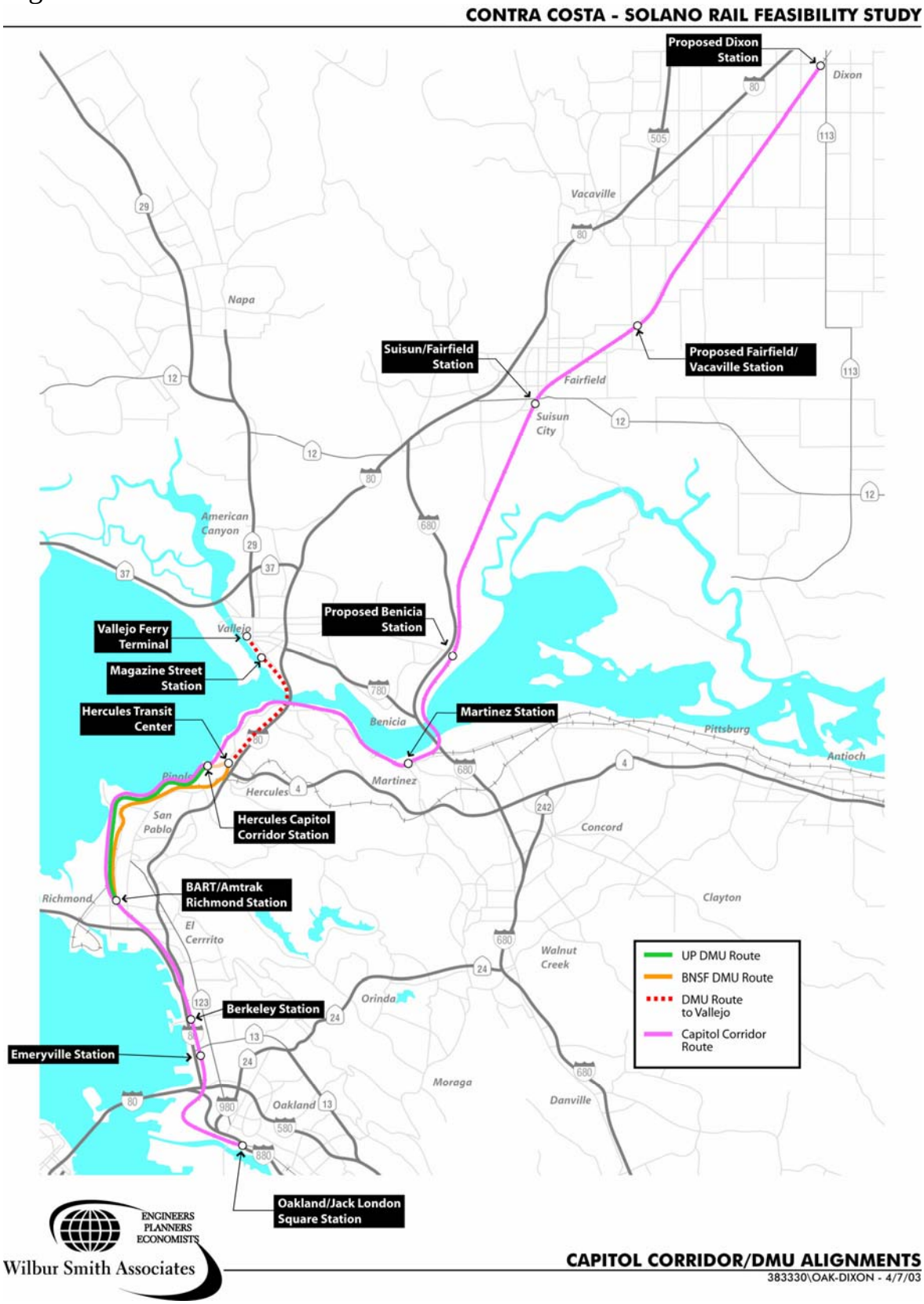
The I-80 Rail Feasibility Study focuses on the following short-term and long-term rail options for the corridor:

Short-term: Provide increased commuter rail service along the existing *Capitol Corridor* line from Solano County to the Richmond BART station.

Long-term: Operate one of three potential rail services from Hercules to the Richmond BART station:

- **Alternative 1:** Railroad Diesel Multiple Unit technology on BNSF alignment between Richmond BART and a proposed new Hercules Transit Center east of I-80.
- **Alternative 2:** Railroad Diesel Multiple Unit technology on UP alignment between Richmond BART and the planned Hercules *Capitol Corridor* Station.
- **Alternative 3:** Same alignment as Alternative 2 but using "light" Diesel Multiple Unit technology.

Figure 1: Rail alternatives



II. EXISTING AND FUTURE CONDITIONS

The study area spans the I-80 corridor from the Solano/Yolo County border at Dixon through western Contra Costa and northern Alameda counties, to downtown San Francisco. The cities included in the corridor are Dixon, Vacaville, Fairfield, Suisun City, Benicia, Martinez, Hercules, Pinole, San Pablo, Richmond, El Cerrito, Albany, Berkeley, Emeryville, downtown Oakland, and downtown San Francisco. Unincorporated county areas are also included. Figure 1 presents the geographical boundaries of the I-80 corridor study area. For illustrative purposes, Sacramento also is shown in Figure 1.

This section on study area conditions provides information that is key to understanding the current situation as well as the factors affecting the corridor's future viability. Topics covered are:

A. Population

B. Employment density

C. Traffic volumes

D. Transportation services

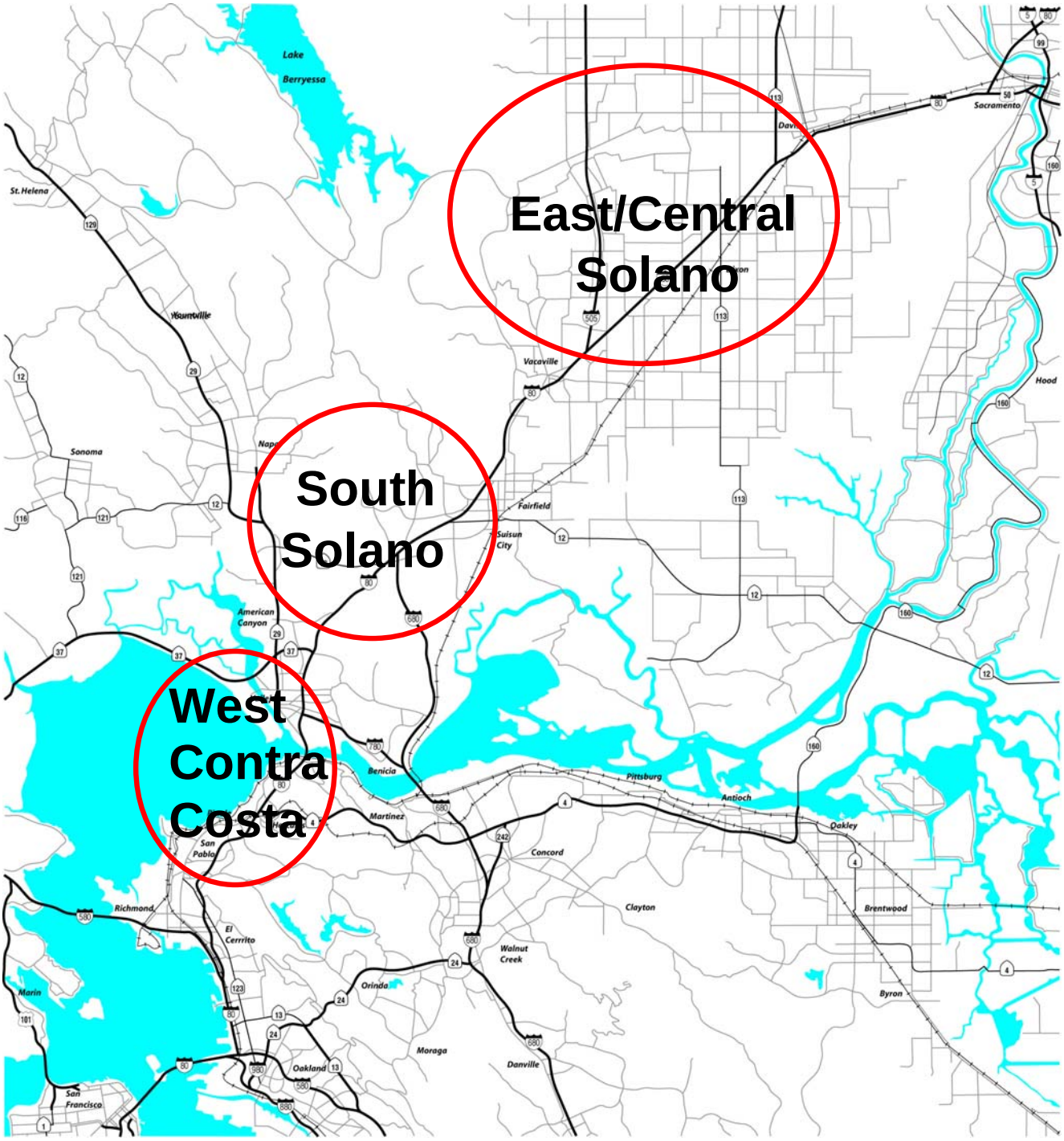
E. Travel patterns

F. Transportation improvement projects

G. Rail assets and constraints

The section concludes with a summary of conditions.

Figure 2: Map of study area



A. Existing and Future Population

Understanding projected population and employment densities is useful in evaluating future commute trends and patterns.

The Metropolitan Transportation Commission (MTC) evaluates population and travel markets by "superdistricts." Superdistricts are groups of census tracts that provide a more aggregated geographic context of densities and commute patterns. As Table 1 shows, the largest projected population growth over the next 25 years is in the Solano County superdistricts encompassing Vallejo/Benicia and Fairfield/Vacaville.

Table 1: Population by Superdistrict in the I-80 Corridor

Superdistrict	2000	2010	2025	Percent Change 2000-2025
Downtown San Francisco	125,742	135,926	139,041	10.6%
Oakland/ Alameda	454,351	482,570	506,115	11.4%
Berkeley/ Albany	154,406	162,923	176,078	14.0%
Richmond/ El Cerrito	242,439	257,983	272,177	12.3%
Concord/ Martinez	221,068	242,440	265,632	20.2%
Vallejo/ Benicia	146,849	163,607	177,609	**20.9%**
Fairfield/ Vacaville	247,693	311,293	393,691	**58.9%**

Source: ABAG *Projections 2002*

B. Existing and Future Employment Density

Table 2 shows current and future employment density by superdistrict. The central Bay Area superdistricts (downtown San Francisco, Oakland/Alameda, and Berkeley/Albany) will continue to be commute destinations for residents of outlying communities. These superdistricts have the highest employment densities and have the highest number of jobs per capita. The suburban superdistricts along the I-80 corridor exhibit lower employment densities and a low ratio of jobs per resident, and will therefore continue to generate commute travel into the central Bay Area. Employment in suburban areas, such as Solano County, could also generate reverse commute travel. Not all work centers in a superdistrict, however, would be equally accessible to a new BART/I-80 rail service.

Table 2: Net Employment Density (Jobs per Acre) by Superdistrict in the I-80 Corridor

Superdistrict	2000	2010	2025	Percent Change 2000-2025
Downtown San Francisco	127.2	135.8	150.6	18.4%
Oakland/ Alameda	15.6	17.5	20.3	30.1%
Berkeley/ Albany	31.5	33.1	36.1	14.6%
Richmond/ El Cerrito	7.4	8.2	9.1	22.9%
Concord/ Martinez	8.5	9.3	10.4	23.5%
Vallejo/ Benicia	5.6	6.5	7.8	39.2%
Fairfield/ Vacaville	5.0	5.5	6.7	33.7%

Source: ABAG *Projections 2002*
Note: Net Employment Density = Total Employment / Commercial - Industrial Acres

C. Existing Traffic Volumes

Roadway congestion can be measured by comparing the roadway's traffic volume to its capacity. This ratio is then expressed as a "Level of Service" (LOS). Levels of Service range from "A" (the best) to "F" (the worst). Levels of Service A, B, and C indicate conditions where traffic can move relatively freely. Levels of Service D and E describe conditions where traffic volumes are reaching capacity, resulting in significant delays. LOS F characterizes conditions where traffic demand exceeds the available capacity, with very slow speeds (stop-and-go), and long delays (over one minute at intersections). Congestion Management Agencies and traffic planners consider a LOS grade of E or F a failing condition.

Table 3 illustrates what most commuters in the I-80 corridor already know: the commuter traveling westbound in the morning experiences signficant congestion and delays (LOS D-F at many intersections). The eastbound commuter also hits congestion at key intersections during the commute home in the evening.

Table 3: Existing Levels of Service during Peak Periods

	AM Level of Service		PM Level of Service	
I –80 Location	Eastbound	Westbound	Eastbound	Westbound
Solano/Yolo County Line	C	C	C	C
Highway 12 Junction, Fairfield	B	C	**D**	C
Carquinez Bridge	B	**D**	**E**	**E**
Highway 4 Junction, Hercules	C	C	**D**	**D**
Appian Way, Pinole	C	**D**	**D**	C
Hilltop Drive, Richmond	C	**D**	C	**D**
Central Avenue, Richmond	B	**D**	**D**	C
University Avenue, Berkeley	C	**E**	**E**	C
Bay Bridge, Alameda County	**D**	**F**	**E**	**D**
Fremont Street, San Francisco	**E**	**F**	**E**	**F**

Wilbur Smith Associates – January 2003

D. Existing Transportation Services

Major transit and transportation facilities in the corridor include:

- **Bay Area Rapid Transit:** BART service in the I-80 corridor extends from the Richmond BART station to Civic Center Station in San Francisco, with 12 intermediate stations. BART's Richmond-Daly City line operates at 15-minute frequencies during weekdays, as does the Richmond-Fremont line.
- **Capitol Corridor:** The *Capitol Corridor* intercity rail service extends from Auburn and Sacramento to Oakland and San Jose. Currently, there are 11 daily *Capitol Corridor* round trips serving the regional travel markets in the corridor. Trains are operated by Amtrak, with financial support from Caltrans and management oversight by the Capitol Corridor Joint Powers Authority. Current stations within the study area are Suisun-Fairfield, Martinez, Richmond, Berkeley, Emeryville, and Oakland. The Richmond station provides a direct transfer to BART. Additional stations are being planned to serve Fairfield-Vacaville, and Hercules.
- **Express Bus:** Vallejo Transit, Fairfield-Suisun Transit, AC Transit and the West Contra Costa Transit Authority (WestCAT) operate express buses in the corridor, bringing commuters from park and ride locations to the El Cerrito del Norte BART station. Some routes travel directly into downtown San Francisco.
- **Vallejo Ferry:** The City of Vallejo provides daily commute service from the Vallejo Ferry Terminal to the San Francisco Ferry Terminal and Fisherman's Wharf.

E. Future Travel Patterns

The Bay Bridge and BART Transbay line in the westbound direction on a weekday morning serve the largest commute market in the Bay Area. In 1990, about 132,000 commuters used the

Bay Bridge and BART in the westbound direction, and 160,000 did so in 2000. If current growth projections are accurate (1.9 percent annually), approximately 179,000 commuters will be using the BART Transbay tube or Bay Bridge in 2010, and 200,000 residents will be making the same commute in 2020.

The commute from Solano, Yolo, Napa and Sacramento counties to the central Bay Area across the Carquinez and Benicia-Martinez bridges is also expected to grow. In 1990, about 57,000 commuters crossed the Carquinez Strait on I-80 or I-680 southbound during the morning commute. The number of commuters entering the central Bay Area across the Strait is estimated to have nearly doubled to 110,000 from 1990 to 2000. In 2010, it is estimated that 130,000 commuters will pass through this gateway, with 147,000 doing so in 2020.

Table 4 shows the projected county-to-county commute patterns over a 30-year period. Commuters from Solano County into the central Bay Area will have the highest rate of growth during this period.

Table 4: County-to-County Commute Projections (1990-2020)

County of Residence	County of Work	1990	2000	2010	2020	% Change 1990-020
San Francisco	San Francisco	299,926	319,546	345,726	358,700	16.4%
San Francisco	Alameda	18,822	19,512	21,866	21,845	13.8%
San Francisco	Contra Costa	5,747	5,453	5,931	6,365	9.7%
San Francisco	Solano	377	244	299	325	-16.0%
Alameda	San Francisco	60,505	62,155	67,197	76,590	21.0%
Alameda	Alameda	433,159	459,845	528,071	596,928	27.4%
Alameda	Contra Costa	34,613	32,529	36,913	44,414	22.1%
Alameda	Solano	1,309	820	1,018	1,232	-6.3%
Contra Costa	San Francisco	47,678	57,704	66,751	72,726	34.4%
Contra Costa	Alameda	83,446	102,173	124,597	134,740	38.1%
Contra Costa	Contra Costa	237,511	268,909	323,764	375,307	36.7%
Contra Costa	Solano	6,060	4,528	6,043	6,929	12.5%
Solano	San Francisco	9,805	14,803	16,607	18,503	47.0%
Solano	Alameda	10,326	15,363	18,133	19,693	47.6%
Solano	Contra Costa	20,899	29,391	33,457	39,225	46.7%
Solano	Solano	93,704	94,756	127,640	158,371	40.8%

The following graphics illustrate the projected 2025 commuter travel patterns in the I-80 corridor. Study area residents are projected to make substantial "out-commuting" trips to the central destinations of San Francisco and Oakland/Berkeley. For West Contra Costa County residents, 59% of their 280,000 daily trips will be to these central destinations. For South Solano (Vallejo) residents, 34% of their 195,000 trips will be bound there, while 21% of the trips made by east or central Solano County residents will be headed to downtown San Francisco or Oakland. The source of this data is MTC; percentages are based on the total number of out-commuters.

Other Solano and Contra Costa commuters will be traveling to destinations besides the central Bay Area, including southern Alameda County and central Contra Costa County that BART or other transit systems may serve.

Figure 3: 2025 West Contra County Travel Patterns
280,000 Daily Out-Commuting Trips (68% of West County trips)

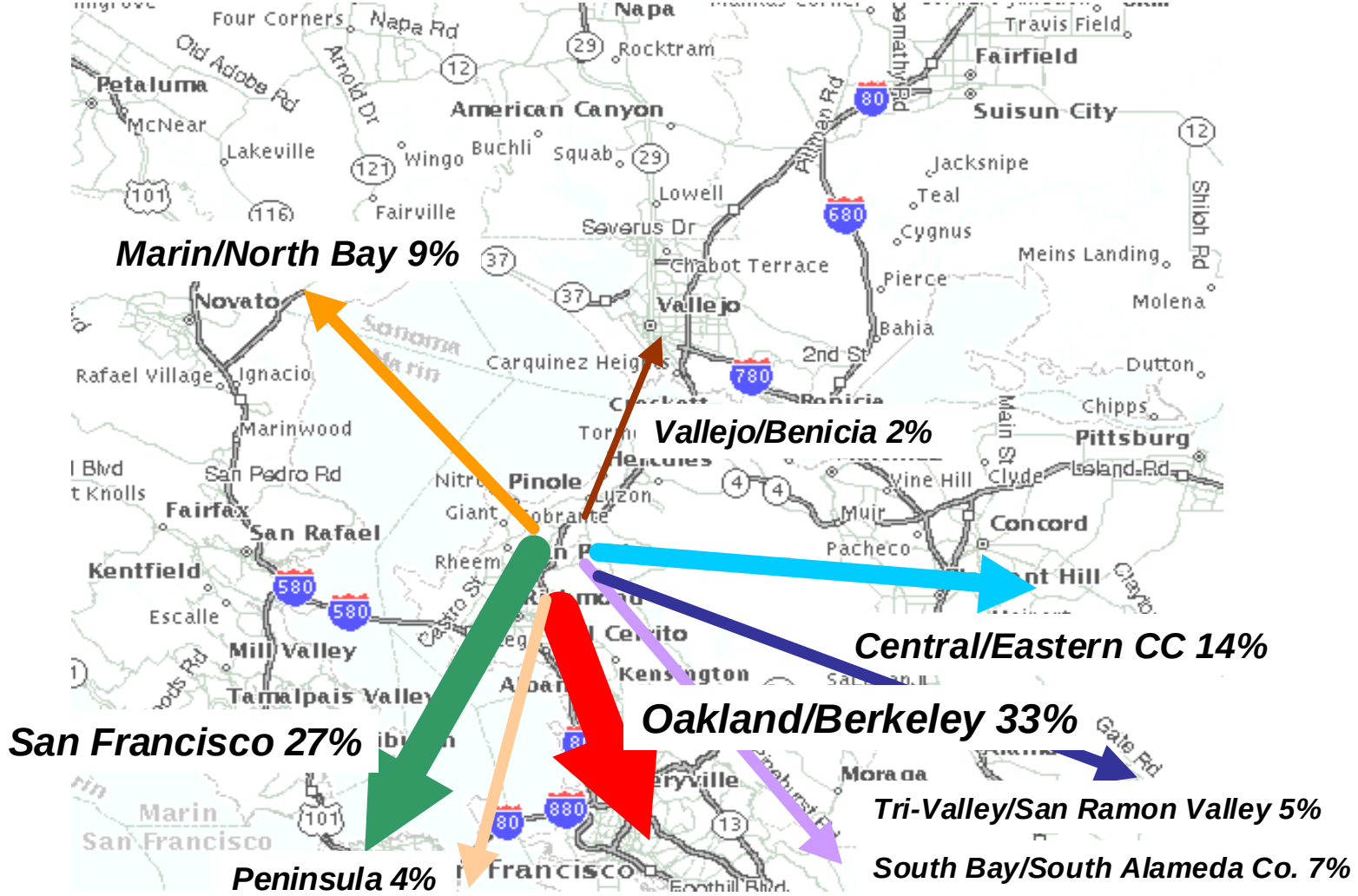


Figure 4: 2025 South Solano County Travel Patterns
195,000 Daily Out-Commuting Trips (70% of South Solano County trips)

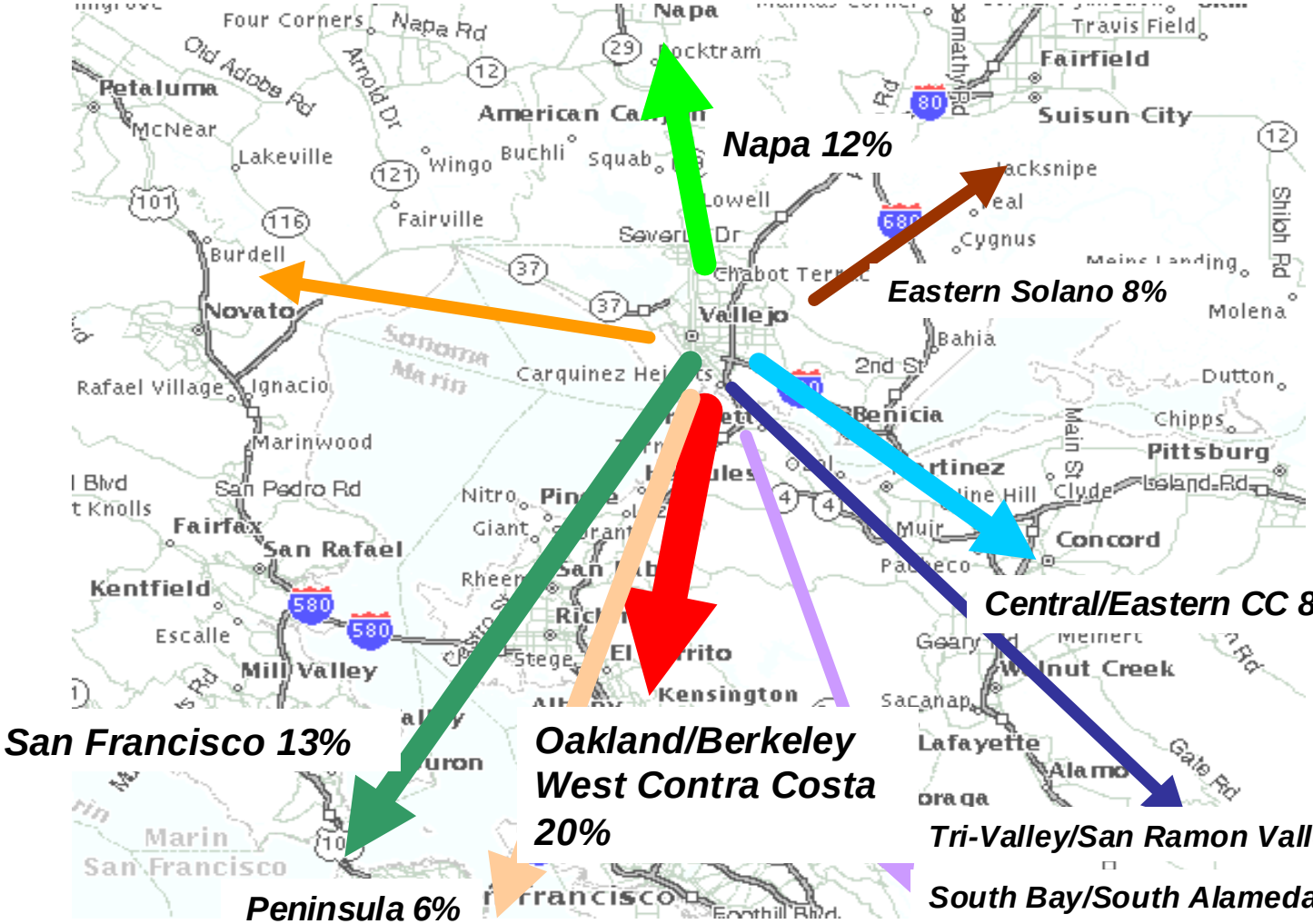
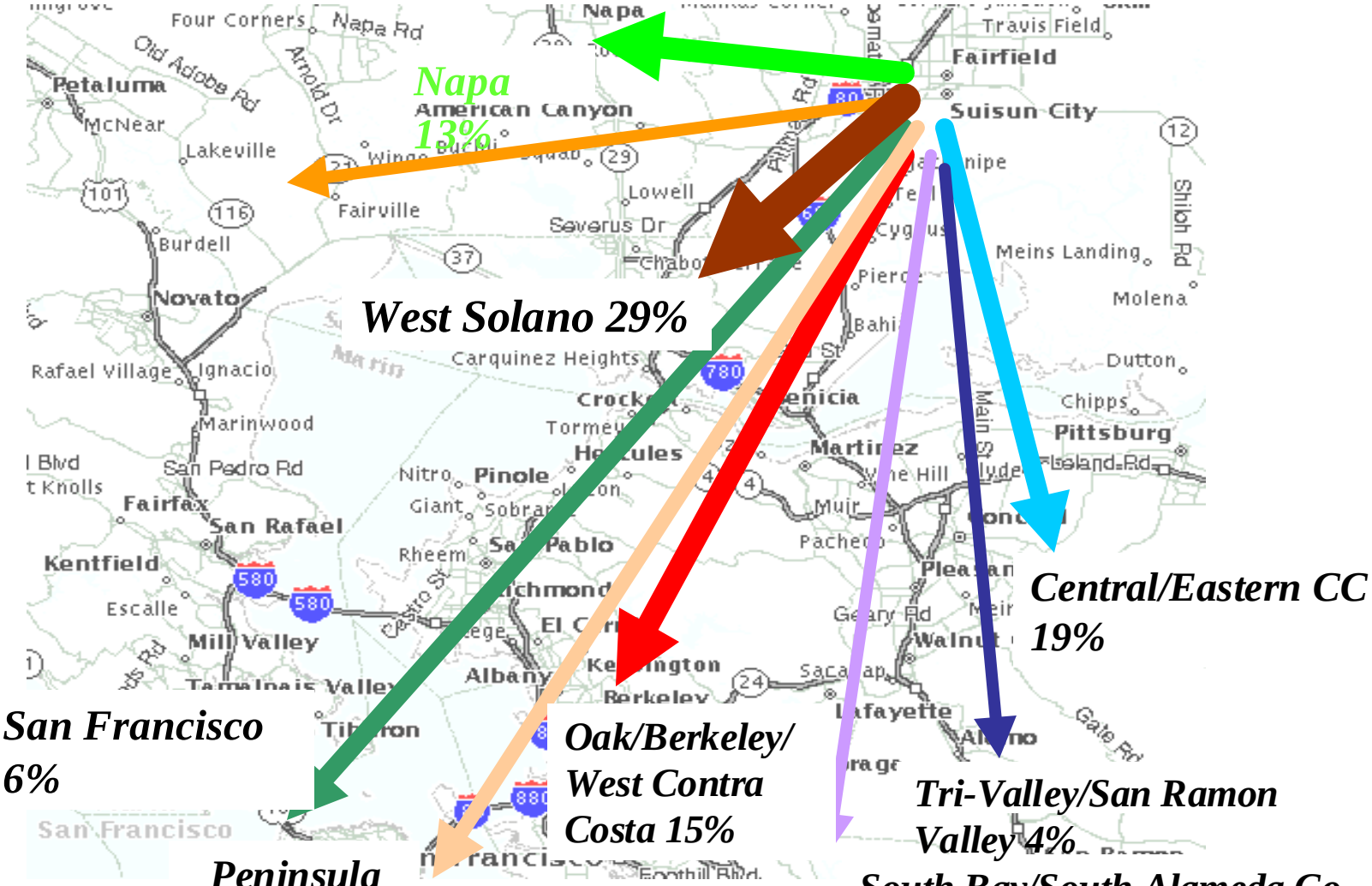


Figure 5: 2025 East/Central Solano County Travel Patterns
280,000 Daily Out-Commuting Trips (47% of East/Central Solano County trips)



F. Future Transportation Improvement Projects

The MTC *Transportation Blueprint for the 21st Century* projects a 28 percent increase in vehicle miles traveled, a 4 percent increase in new lane miles, and an 11 percent increase in new peak hour transit capacity. Accordingly, MTC projects that the Regional Transportation Plan (RTP) will not provide sufficient new capacity to keep up with regional growth. Major transportation projects planned for the I-80 Corridor include:

- **HOV Lanes:** On I-80, High Occupancy Vehicle (HOV) lanes are existing or proposed in the westbound direction from the Carquinez Bridge to the San Francisco/Oakland Bay Bridge on-ramp. HOV lanes are also being planned for I-80 through Fairfield and Vacaville between I-680 and I-505, as well as for the eastbound direction from Hercules to the Carquinez Bridge.
- **Express Bus Service:** The proposed Express Bus System in this corridor would provide service from the Fairfield Transit Center to the El Cerrito del Norte BART station, terminating at the San Francisco Transbay Terminal. A new West Contra Costa County service is envisioned, traveling on San Pablo Avenue and the I-80 HOV lane, connecting to employment and activity centers in West Berkeley and Emeryville, and continuing on to San Francisco.
- **Capitol Corridor Service:** Capitol Corridor service is expected to increase from its current 12 roundtrips per day to 16 roundtrips by 2008. In addition several local jurisdictions are planning to develop new stations – such as the City of Hercules and the City of Fairfield.
- **San Francisco Transbay Terminal:** The Transbay Terminal project consists of the redevelopment of the downtown San Francisco terminal with expanded capacity for bus and rail service. The project includes the extension of Caltrain from its current terminus at Fourth and Townsend Streets and the revitalization of the Terminal area. The multi-modal Transbay Terminal will provide a centralized location for public and private bus and rail services in San Francisco's Financial District/South of Market area and will enhance transit access for passengers arriving in and departing from San Francisco.

G. Existing Rail Assets and Constraints

- **Union Pacific Railroad:** The UP route extends north from Oakland to Richmond, generally parallel to I-80. At Richmond, the UP track follows the BART line to the joint BART/Amtrak station at Macdonald Avenue and 19th Street. The track extends northward from the station, through the unincorporated communities of North Richmond and Parchester Village. Beyond Parchester Village, the UP route follows the shoreline of San Pablo Bay and the Carquinez Straits through Crockett to Martinez. At Martinez, the line crosses Suisun Bay via a drawbridge to Benicia and then runs northeast across the Suisun marshlands to Suisun City and Fairfield, and beyond in a northeasterly direction to Davis and Sacramento. This UP route was originally Southern Pacific trackage until the railroads were merged in 1996. The track configuration is double track and employs a Centralized Traffic Control (CTC) dispatching/signaling system, whereby a dispatcher in a remote location directs trains by wayside signals and radio. The railroad currently operates 42 daily freight trains (local and through trains) between Sacramento and Oakland in addition to the *Capitol Corridor* and *San Joaquin* service mentioned above.

- **Burlington Northern and Santa Fe Railway:** The BNSF route currently begins at Richmond, where BNSF maintains a major freight yard west of downtown. The route passes over the UP tracks one mile north of the Richmond BART station, and then generally parallels the UP line on a more inland alignment as far as Hercules. From Hercules, the BNSF route continues easterly through Franklin Canyon and southern Martinez before continuing east to Stockton across the San Joaquin Delta. This BNSF route was originally part of the Atchison, Topeka, and Santa Fe Railway (AT&SF) prior to a major rail merger with the Burlington Northern in 1995. The track configuration is single track with sidings, and employs an older Automate Block Signal (ABS) system, which is less efficient than CTC. The railroad currently operates between 20 and 30 freight trains a day between Stockton and Richmond.

While these rail lines represent transportation assets in the corridor, there are significant constraints on them for use in passenger service. The UP's double track system is becoming increasingly congested with freight and passenger service. The BNSF, although it has less freight traffic, is also congested, and carries some time-sensitive freight. The BNSF's signaling system is outdated, and the line itself travels through narrow ravines and on structures that are old; any additional service on this line will require infrastructure as well as capacity enhancing improvements. Both lines serve as major freight carriers in the region, and are sensitive to the demands of the industry including any expansion of the local ports. Finally, the impact on local communities of additional train service – whether freight or passenger – must be considered.

H. Summary of Findings on Existing and Future Conditions

The population, employment and commute projections all suggest that the I-80 corridor will continue to be severely congested during peak period commute hours, placing greater pressure on existing and planned transportation improvements. In addition, areas with higher population growth rates but relatively low residential densities, such as Fairfield/Vacaville, are expected to generate increasing commute traffic and generally longer commute trips. Exploring commute alternatives may help ease this situation. The findings on existing and future conditions are summarized below:

- Population and employment in the I-80 corridor will grow.
- Existing commute trends are likely to continue.
- Investment in highway and transit systems may not keep pace with population and employment growth.
- Levels of service (congestion) on I-80 may worsen as a result.
- Rail assets exist that may provide attractive alternatives for commuters, although these lines will require infrastructure and capacity improvements to become usable for passenger service.

III. SHORT-TERM RAIL CONCEPT PLAN

This section outlines a conceptual operating plan for increasing the frequency of service between Sacramento and Oakland during the morning and evening peaks by adding commuter rail service, offering riders a connection to BART at its Richmond station. See Working Paper #4 for more detailed information on this concept.

Integrated Service Concept

The Short-Term Rail Concept Plan proposes to integrate the service of three commuter trains traveling between Sacramento and Oakland with four existing *Capitol Corridor* trains during the peak-period commute hours. By integrating the services, commuters in Solano and Contra Costa counties would enjoy commute-level frequency of service during peak hours. The mix of *Capitol Corridor* and commuter rail schedules provides for half-hour frequencies departing Sacramento in the morning peak (between 4:55 a.m. and 7:55 a.m.). The same half-hour frequency departing Oakland would occur in the evening peak (between 3:40 p.m. and 6:40 p.m.). *Capitol Corridor* trains would continue to provide mid-day service. By using the same vehicles as the *Capitol Corridor*, the integrated service will appear identical to the rider. The commuter trains' sponsoring agency would probably be a Joint Powers Authority (JPA) composed of the jurisdictions served.

Ridership Estimates

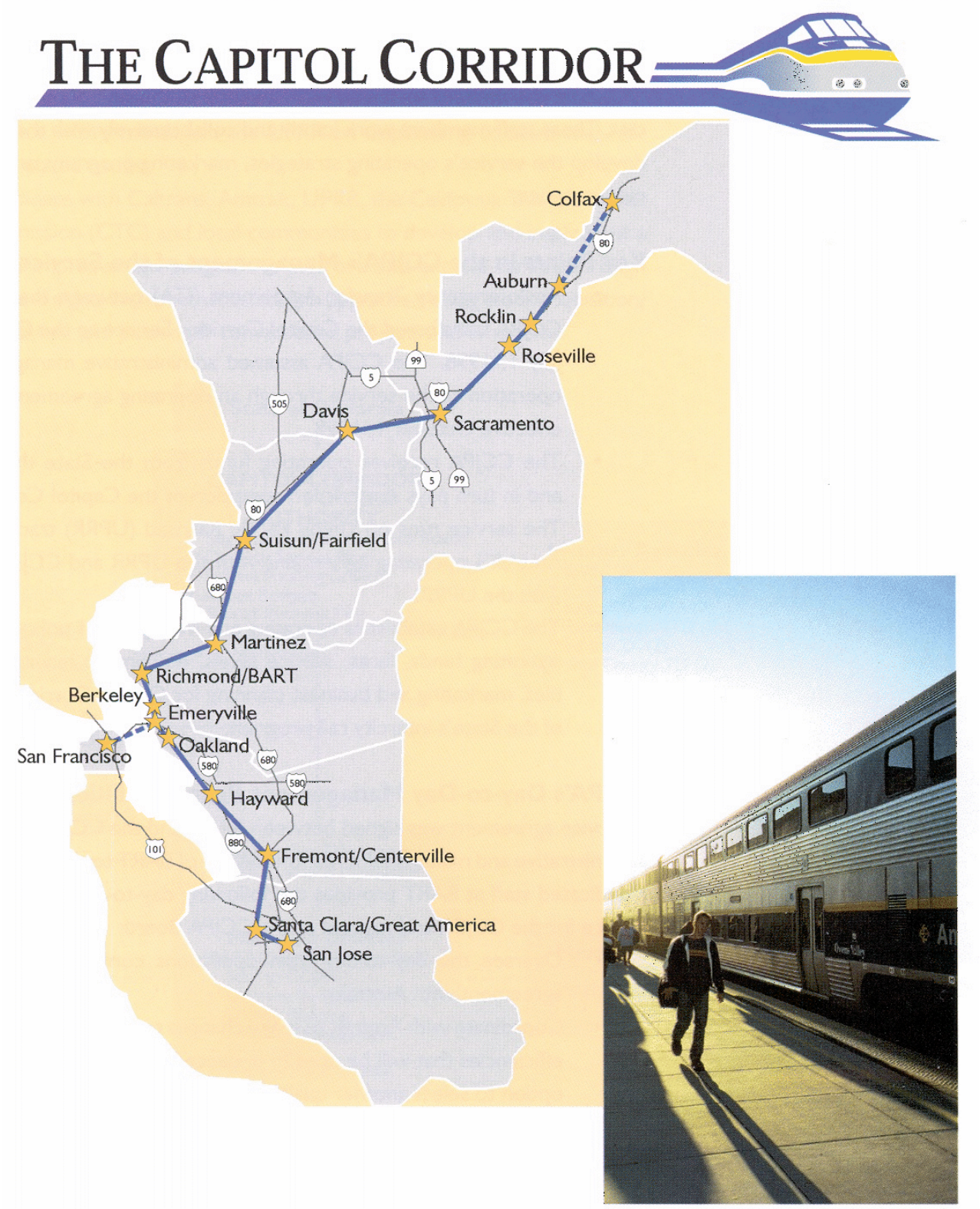
The addition of three commuter roundtrips integrated with four intercity roundtrip schedules represents a significant service improvement, and will gain new Sacramento and Davis riders as well as new commuters from Solano and Contra Costa counties. Currently, boardings at Suisun/Fairfield and Martinez represent approximately 15 percent of all *Capitol Corridor* boardings on the segment between Sacramento and Oakland, with riders from Sacramento and Davis accounting for approximately 85 percent of the boardings. It is reasonable to assume that there will be Sacramento and Davis residents riding the proposed integrated service in large numbers.

The integrated seven-train commute-level service will present a significant increase in service, and so many more residents of "closer in" locales with jobs in the central Bay Area are likely to choose to ride the service than is the case today. Therefore, a reasonable range of the share of riders from Solano and Contra Costa counties would be from 25 to 33 percent with 67 to 75 percent from Davis and Sacramento. A preliminary assessment of ridership for the integrated service would fall within the ranges presented below.

Table 5: Anticipated ridership for 7 commute-level service in 2005

Trip Origination	Peak Period Ridership*
Solano and Contra Costa Counties	2,500
Sacramento and Davis	5,000-7,600
Total	**7,500-10,100**
Average Riders per Train	540-720

* Combined boardings and alightings.


THE CAPITOL CORRIDOR
Colfax
Auburn
Rocklin
Roseville
Davis
Sacramento
Suisun/Fairfield
Martinez
Richmond/BART
Berkeley
Emeryville
Oakland
San Francisco
Hayward
Fremont/Centerville
Santa Clara/Great America
San Jose
80
99
5
505
680
580
880
101

Capitol Corridor Train

Capital Costs

Capital costs consist of three elements: rolling stock (i.e. the locomotives and cars required to run the service), infrastructure improvements, and track and signal improvements to the UP mainline in the study area. As Table 6 shows, these three elements total to almost $92 million:

Table 6: Capital Cost Summary

	Dollars (millions)
Rolling Stock	$68.1
Support Track	$2.3
Mainline Improvements	$21.1
Total	**$91.5**

Rolling Stock

The service concept outlined above will require four train sets, each consisting of five bi-level California Cars (four coaches and a cab car for a total seated capacity of 439) and a locomotive. Three of these sets will be required for daily operations in 2005, while one set serves as a spare. There is an assumption that the commuter train sets will not include a café car (in order to minimize costs); including a café car would increase the capital costs by $2.75 million per train set. The costs for the train sets and spares appear in Working Paper 4, Table #4.

Maintenance and Storage Tracks

Cars and locomotives will be maintained at the new Amtrak maintenance facility in Oakland, so there will be no need of a separate maintenance facility for this equipment. However, more storage tracks will be needed at the Amtrak facility to handle this equipment. Accordingly, that cost, estimated at $2.3 million inclusive of contingencies, is included above.

Mainline Track and Signal Improvements

A preliminary list of main line capacity improvements will be needed between Oakland and Sacramento to accommodate a commute-oriented service. The costs for additional sidings and trackage are detailed in Working Paper #4.

Stations

The stations planned for Hercules and Fairfield/Vacaville are assumed in this analysis. Additional stations in Dixon and Benicia were assumed in the outer years, the costs of which are expected to be borne by the local communities. Therefore, no station costs are assumed in this analysis.

Operating Costs and Farebox Recovery

Total estimated annual operating costs for three additional commuter roundtrips are summarized in Table 7. For the three morning and three evening peak commuter trains, the total is approximately $9 million annually.

Table 7: Estimated Annual Operating Costs for Commuter Rail Service
(for 3 Roundtrips)

Cost Item		Unit	Unit Cost	Estimated Cost (in millions)
Amtrak Costs	136,093	Train Miles	$40	$5.4
UP Access	136,093	Train Miles	$8	$1.1
UP MOW Contribution	1	Lump Sum	$2 million	$2.0
CCJPA Overhead Contribution	1	Lump Sum	$500,000	$0.5
Total				**$9.0**

Source: Wilbur Smith Associates and Amtrak

Using an estimated revenue figure of $5.6 million for these trains, the resulting farebox recovery ratio is 62 percent, with a required operating subsidy of $3.4 million, as shown in Table 8. This figure is on the high end of typical commuter rail farebox ratios due in large part to the number of riders originating in Davis and Sacramento, who pay the highest fares[1].

Table 8: Estimated Financial Performance for Commuter Rail Service
(for 3 roundtrips)

Revenue	$5.6 million
Operating Cost	$9.0 million
Farebox Recovery Ratio	62 percent
Required Operating Subsidy	$3.4 million

Source: Wilbur Smith Associates

[1] If these longer trips do not meet estimates, the resulting farebox recovery ratio will be lower.

Using the estimated costs and revenues above, the cost per new rider is calculated (Table 9):

Table 9: Cost per New Rider for 3 Commuter Trains

2005 Operating Costs for 3 Commuter Trains	$9 million
Annualized Capital Costs for 3 Commuter Trains	$3 million
Total Annualized Costs	$12 million
Existing Riders per Train with 4 Peak Period Trains	158
2005 Riders per Train with 7 Peak Period Trains	540
New Riders per Train	382
New 2005 Riders for 3 Commuter Trains	582,168
Cost per New Rider	$20.75

Source: Wilbur Smith Associates

Comprehensive Transit Integration

An important issue beyond the operations of commuter trains in the short-term is transit integration. There needs to be a well-developed plan involving all transit operators in the corridor to maximize the potential for transit integration. Specifically, these agencies, along with the CCJPA, need to coordinate their schedules, fare structures and instruments, and marketing efforts to ensure the greatest market capture possible. The goal is to offer a seamless service for the rider to move to and from the train stations. The operating costs that are identified above do not include revenue streams to support intersystem transfers. There will be revenue and cost impacts to transit operators as a result of transit integration. Therefore, the service's sponsor should initiate discussions with the CCJPA and transit operators to establish meaningful transit integration for riders in the corridor.

Longer-Term Train Adjustment

A peak-period commuter rail service consisting of seven morning peak inbound trains (a combination of commuter and CCJPA trains) is a high level of service. It seems likely that this service level will satisfy demand for many years to come; however, adding trains in the long term may become necessary at some point in the future.

Coordination with the Auburn-Dixon Regional Rail Study

A parallel study has been undertaken to explore similar commuter rail options along the *Capitol Corridor* route in the Auburn-Dixon corridor. This study, a joint effort of the Placer County Transportation Planning Agency (PCTPA), Sacramento Regional Transit, and Yolo and Solano counties, is exploring the possibility of adding commute-level service along the *Capitol Corridor* route to augment existing service during the heavy commute periods. The proposed time schedule for these additional roundtrips overlaps with the Sacramento-Oakland time schedule.

Both the Contra Costa-Solano and the Auburn-Dixon rail study teams quickly determined that expanding the study corridor to include the entire length (from Auburn to Oakland) and integrating the services would increase ridership, and reduce operating and overhead costs compared to two stand-alone operations. Both the I-80 Rail Policy Advisory Committee and the Auburn-Dixon Regional Rail Steering Committee have agreed to move forward on a joint study, and to request the UP to model a proposed integrated schedule to determine infrastructure and

access improvements needed to operate the service. This joint study will set forth the operating parameters of the service, and recommend institutional and funding arrangements to make this service a reality.

Considerations for Determining Cost-Sharing Formula with Participating Counties

The upcoming Auburn-Oakland Rail Study described above will involve five counties in the I-80 Corridor: Placer, Sacramento, Yolo, Solano and Contra Costa. Alameda County may elect to participate as well. Each county will designate one elected official to serve on the study's Policy Advisory Committee (PAC). A primary task of the PAC will be to determine an appropriate cost-sharing formula among the counties for the capital and operating costs of the three commuter roundtrips. The following are factors that should be considered during the negotiations.

Mainline Capital Improvements: The track and other infrastructure improvements that will be necessary to operate three additional roundtrips will benefit both the commuter as well as the intercity (Capitol Corridor) service, and the costs associated should be borne by both services. In addition, one factor to consider is the proportionate share for each county of these improvements; that is, the counties that require the greatest amount of infrastructure improvement may need to bear a larger portion of the costs.

Boardings: This study demonstrated that a large percentage of trips into the central Bay Area during the peak commute hours originate from Sacramento, Yolo and Solano counties.

Other: Other considerations include track miles and number of stations within each county.

IV. LONG-TERM RAIL CONCEPT PLAN

This section discusses the highlights of Working Paper #6, which provides general alignment descriptions; a definition of operating characteristics; preliminary capital, operating and maintenance costs; and an initial ridership estimate for Diesel Multiple Unit (DMU) options along the Union Pacific (UP) and the Burlington Northern Santa Fe Railway (BNSF) alignments between the Richmond BART station and Hercules. The three alternatives studied are:

- **Alternative 1:** Railroad DMU technology on the BNSF alignment between Richmond BART and a proposed new Hercules Transit Center east of I-80.
- **Alternative 2:** Railroad DMU technology on the UP alignment between Richmond BART and the planned Hercules *Capitol Corridor* Station.
- **Alternative 3:** Same alignment as Alternative 2 but using "light" DMU technology.

In addition, Working Paper #6 discusses the following possibilities:

1. Blending Alternatives 1 and 2, in which the UP alignment would be followed north from Richmond BART to Montara Bay, and then northward via a new connection to the BNSF;
2. Converting the BNSF line to passenger-only use;
3. Integrating new rail service with existing transit services in the study area; and
4. Extending DMU service from Hercules to Magazine Street in Vallejo.

Alternatives

Alternative 1

Technology: This alternative is based on the use of railroad-compatible DMU technology that meets the regulatory requirements of the Federal Railroad Administration (FRA) for passenger equipment operating on tracks that are part of the national railroad system. A DMU is a self-propelled, diesel-powered rail passenger car arranged either for independent operation or for simultaneous operation with other similar cars, when connected to form a train. The only such equipment that meets FRA safety requirements for operation on railroads, and which is presently available, is the Colorado Railcar prototype, which has been widely displayed and demonstrated. Other railcar manufacturers have indicated an interest in producing such a vehicle for the North American market if sufficient demand develops. Older versions of this kind of equipment, the Budd-built "Rail Diesel Car" (RDC), are still in commuter rail service in Dallas-Fort Worth.

Diesel Multiple Unit Commuter Train
Photo by Bill Farquhar

Alignment: The alignment would begin on a new terminal track located on the west side of the Richmond BART station. This new track could be constructed at a slight elevation in order to provide a cross-platform transfer to southbound BART trains. The alignment would run northward between the Union Pacific mainline and BART's Richmond Yard, and under a rebuilt BNSF overpass. North of the overpass, it would swing over to the northeast to connect into the BNSF mainline, which it would follow to Hercules. This alternative would continue through central Hercules, passing below I-80 at site of the present BNSF bridge over Sycamore Avenue, and continue to the potential location site for the Hercules Transit Center east of I-80.

Stations: Potential stations could be located at Richmond BART, Market Avenue, Richmond Parkway, Pinole Shores Drive, downtown Pinole and a new Hercules Transit Center.

Service Levels, Capacity and Fleet Size: The distance from Richmond BART to a new Hercules Transit Center east of I-80 is 9.4 miles. The estimated running time over this distance, with three intermediate stops, is 16 minutes, with a conservative round trip cycle time of 60 minutes.

The proposed base headway is 15 minutes, with timed connections to BART Transbay line trains at Richmond. Two-car trains that consisted of FRA-compliant DMUs, such as the Colorado Railcar, would provide capacity for 196 seated riders, with an overall capacity of 294 riders (with standees). At a 15-minute headway, line capacity would be about 1,200 passengers per peak hour per direction. A total fleet of ten DMUs would be required to operate this level of service, including two spare cars as required.

Alternative 2

Technology: The technology in Alternative 2 would be the same as that in Alternative 1.

Alignment: As with Alternative 1, the alignment would begin on a new terminal track located on the west side of the Richmond BART station. This new track could be constructed at an elevation that would make possible a cross-platform transfer to southbound BART trains. The alignment would run northward between the UP mainline and BART's Richmond Yard, and under the BNSF overpass, which likely will have to be rebuilt. The alignment would follow the UP mainline through North Richmond, through the cut at Giant (Pinole Point) and along the bay shoreline as far as Hercules, 8.8 miles from Richmond BART. This alignment also serves the *Capitol Corridor* trains. A new station is already planned at the Hercules shoreline.

Stations: Potential stations could be located at Richmond BART, Market Avenue, Richmond Parkway, Pinole (Tennent Avenue) and the new Hercules *Capitol Corridor* station.

Service Levels, Capacity and Fleet Size: The distance from Richmond BART to the Hercules *Capitol Corridor* station is 8.8 miles. The estimated running time, with three intermediate stops is 16 minutes, with a conservative round trip cycle time of 60 minutes.

As with Alternative 1, the proposed base headway is 15 minutes, with timed connections to BART Transbay line trains at Richmond. Two-car trains consisting of FRA-compliant DMUs, such as the Colorado Railcar, would provide capacity for 196 seated riders, with an overall capacity of 294 riders (with standees). At a 15-minute headway, line capacity would be about 1,200 passengers per peak hour per direction. A total fleet of ten DMUs would be required to operate this level of service, including two spare cars as required.

Alternative 3

Technology*:* In contrast to the railroad-based DMU technology in Alternatives 1 and 2, Alternative 3 is based on a non-FRA compliant or "light" DMU concept. Like the railroad DMU, the Light DMU has as its fundamental characteristic a self-propulsion capability based on a diesel engine, as well as the ability to be arranged either for independent operation or for simultaneous operation with other similar cars, when connected to form a train. However, unlike technologies such as the Colorado Railcar prototype DMU, which are intended for operation co-mingled with freight and passenger trains on railroad tracks, Light DMUs do not meet the FRA safety criteria and must therefore be used on tracks that do not have such traffic on them at the same time that the DMU service is running. This requirement may be met by either spatial or temporal separation, that is, either an entirely separate track with no meaningful connection with the railroad system must be provided, or the freight service (as well as conventional passenger service) using the same tracks must be restricted to hours in which the DMU service is not running. Typically, this latter criterion is found on light-rail transit systems that run during the daytime on tracks over which some freight service is provided in the midnight-5 a.m. time frame.

Light Diesel Multiple Unit

Alignment: The alignment of Alternative 3 is the same as Alternative 2. From the Richmond BART station, the line would parallel the Union Pacific mainline on its east side to the Hercules *Capitol Corridor* station.

Stations: Potential stations would be the same as for Alternative 2: Richmond BART, Market Avenue, Richmond Parkway, Pinole (Tennent Avenue) and the new Hercules *Capitol Corridor* station.

Service Levels, Capacity and Fleet Size: The running time and cycle time of this service would be the same as for Alternative 2.

The proposed base headway is 15 minutes, with timed connections to BART Transbay line trains at Richmond. Two single-unit DMU trains and two two-unit trains would provide an overall capacity of 200 riders (with standees) per car; line capacity would be 1,200 passengers per peak hour per direction. A total fleet of eight DMUs would be required to operate this level of service, including two spare cars as required.

Ridership

Riders attracted from automobiles (Auto Access), transit (Transit Access), and transit-oriented development (TOD) are identified in Table 10 for 2010, 2015 and 2025. Alternative 1, the BNSF alignment, serves as the basis for the ridership forecasts. No separate calculations were done for Alternatives 2 and 3, the UP alignments, as the BNSF and UP alignments and stations are close to each other. Thus, ridership for one should stand for the others–at least for the Auto Access and the Transit Access rider estimates.

Table 10: Estimated Average Weekday Ridership

Richmond-Hercules DMU Service	2010	2015	2025
Auto Access	6,550	7,520	9,290
Transit Access	1,400	1,450	1,530
TOD-Generated	3,275-6,550	3,760-7,520	4,645-9,290
Total	**11,225-14,500**	**12,730-16,490**	**15,465-20,110**

The totals include new riders, riders diverted from existing transit services, and riders generated from transit-oriented development (TOD) at various station sites. This TOD ridership was calculated in a range, as the specifics of the future TOD potential were not quantified. The increase related to TOD potential was estimated at 50-100 percent of Auto Access (base) patronage at sites with high (good) TOD potential. TOD-generated ridership along the UP route would differ slightly from the numbers appearing below, because the TOD potential of stations on the UP varies from the potential of stations on the BNSF.

Capital Costs

Capital cost estimates are based on vehicle and infrastructure improvements needed to operate the service, including new track, structures, signaling maintenance facilities, and stations. The estimated capital costs for each alternative are detailed below in Table 11:

Table 11: Capital Costs for Richmond-Hercules Long Term Rail Alternative

	Vehicles	Infrastructure	Total
Alternative 1	$41 million	$353 million	$394 million
Alternative 2	$41 million	$220 million	$261 million
Alternative 3	$35 million	$241 million	$276 million

Source: LTK Engineering Services and Wilbur Smith Associates

Operating and Maintenance Costs

Revenue is a function of ridership and fares, and fares are based on distance traveled. With revenue and operating and maintenance (O&M) costs calculated, Table 12 presents the annual farebox recovery ratio (proportion of operating costs covered by fare revenue) and operating subsidy calculations for the three alternatives. To be conservative, TOD-generated ridership is excluded from the revenue calculation; only revenue relating to Auto Access and Transit Access appears in the table. The operating costs do not reflect changes due to ridership increases beyond what is projected. Depending on ridership increases, additional equipment might be needed, resulting in additional capital and operating and maintenance costs.

Table 12: Annual Revenue, O&M, Farebox Recovery and Operating Subsidy

		2010	2015	2025
Alternative 1	Revenue	$4.6m	$5.1m	$5.8m
	O&M	$8.9m	$8.9m	$8.9m
	Farebox	51.7%	57.3%	65.2%
	Subsidy	$4.3m	$3.8m	$3.1m
Alternative 2	Revenue	$4.6m	$5.1m	$5.8m
	O&M	$8.8m	$8.8m	$8.8m
	Farebox	52.3%	58.0%	65.9%
	Subsidy	$4.2m	$3.7m	$3.0m
Alternative 3	Revenue	$4.6m	$5.1m	$5.8m
	O&M	$8.6m	$8.6m	$8.6m
	Farebox	53.5%	59.3%	67.4%
	Subsidy	$4.0m	$3.5m	$2.8m

Source: Wilbur Smith Associates

Summary of Alternatives

Table 13 presents a summary of the alternative service plans described above.

Table 13: Long Term Rail Alternatives for Richmond-Hercules Service in 2010

	Alternative 1	Alternative 2	Alternative 3
Technology	FRA compliant DMUs	FRA compliant DMUs	Non-compliant DMUs
Alignment	BNSF	UP	UP
Potential Stations	Richmond BART Market Avenue Richmond Parkway Pinole Shores Drive Hercules Transit Center	Richmond BART Market Avenue Richmond Parkway Montara Bay Hercules Capitol Corridor	Richmond BART Market Avenue Richmond Parkway Montara Bay Hercules Capitol Corridor
Run Time	16 minutes	15 minutes	15 minutes
Service Level	15-mnute base headway	15 minute base headway	15 minute base headway
Fleet Size	10 DMU cars	10 DMU cars	8 DMU cars
Capital Costs	$393.9 million	$260.8 million	$276.3 million
Operating Costs	$8.9 million	$8.8 million	$8.6 million

Source: LTK Engineering Services and Wilbur Smith Associates

TOD Assessment of Potential Station Sites

The purpose of the assessment (described fully in Working Paper #5) was to identify the potential for transit-oriented development at possible station sites along the two proposed Richmond-to-Hercules alignments. The California Department of Transportation defines TOD as "moderate to higher density development, located within an easy walk of a major transit stop, generally with a mix of residential, employment, and shopping opportunities designed for pedestrians without excluding the auto. TOD can be new construction or redevelopment of one or more buildings whose design and orientation facilitate transit use" (Caltrans 2001). Another criterion for good TOD is "livability," which is generally characterized by a community with walkable, compact neighborhoods, a sense of place, some open and/or community space and attractive and varied housing.

In terms of the residential density necessary for TOD, most studies suggests above 15 dwelling units to the acre to achieve potential market increases to the point where it is economically feasible to run transit at frequencies at which it can compete as a viable mode choice. Based on experience at existing suburban BART stations, housing at a moderate density between 15 and 30 units per acre will generate 24 to 48 trips per acre. In contrast, office space generates only about 11 trips per acre.

TOD Evaluation

The analysis provided a TOD assessment at potential station sites:

Along the BNSF: Market Avenue, Richmond Parkway, Atlas Road, Pinole Shores Drive, Pinole (downtown), and Hercules Civic Center

Along the UP: Market Avenue, Richmond Parkway, Atlas Road, Montara Bay, Tennent Avenue, Hercules Capitol Corridor Station, Hercules Transit Center

Additional analysis is provided for potential sites from a future Hercules-to-Vallejo route including Cummings Skyway and Magazine Street in Vallejo.

Each potential station site was evaluated against key criteria that fell under one of four categories: *Access*, *Property*, *Land Use*, and *Other*. *Access* considers the existing access roads to the site and their proximity to regional highways or arterials, as well as potential for access road improvement. *Property* considers whether or not there is vacant, attainable or underutilized land that could be developed for residential and mixed-use development. *Land Use* considers existing land uses, as well as zoning designations, and whether or not they are commensurate with TOD-type uses. *Other* includes other factors that can influence the potential of a TOD, such as considerations of "livability," as defined above, or large existing residential areas. Or, for example, if the TOD provides for a social good, such as providing for potential economic growth that may benefit an existing population, e.g., Parchester Village.

The potential station sites that appear to have the best potential for transit-oriented development are Market Avenue (on both UP and BNSF alignments), Richmond Parkway (both alignments), Montara Bay, Pinole Shores, Tennent Avenue, the Hercules Capitol Corridor station, and Magazine Street. A full discussion of this analysis can be found in Working Paper #5.

Other Possibilities

The "Blended" Alternative

All three alternatives studied begin at the Richmond BART station and follow the UP for some distance; use of the BNSF in Alternative 1 requires a transition from the UP north of the Richmond BART station. One option is to make the transition from the UP to the BNSF at a point approximately six miles north of the Richmond BART station in the vicinity of Montalvin Park and the Montara Bay Community Center. At this site, the UP and BNSF lines are quite close, and are almost at the same elevation. A short connecting track could be built to take trains from the UP to the BNSF.

There are some clear advantages to this arrangement. First, it would avoid a conflict with the freight service to and from the UPS facility in North Richmond. Second, it would minimize the reconstruction required on the BNSF, in favor of a potentially easier upgrade of the Union Pacific. Third, this might be a better access route for the BNSF, which exercises trackage rights over the UP in order to serve the Port of Oakland. This concept, however, would require triple-track from Richmond to Montalvin Park, including the curve at Giant (Point Pinole), which is located in a cut.

Conversion of BNSF to Passenger-Only Use

Another concept worth exploring is the possibility that freight service could be largely or wholly removed from the BNSF in favor of trackage rights over the Union Pacific. Currently, the BNSF uses the UP tracks south of Richmond in order to access the Port of Oakland.

One way to accomplish this conversion would be for BNSF through freights to use the Amtrak *San Joaquin* route from Stockton to Port Chicago, where there is a connection to permit passenger trains to transition over to the Union Pacific. This may require the triple-tracking of the UP so that it could handle the growing *Capitol Corridor* service, additional *San Joaquins*, UP freight growth as well as the BNSF freight.

While BNSF access to the UPS facility, and other shippers, would need to be accommodated, a passenger-only line would allow either FRA compliant or a Light DMU service on the BNSF with time segregation of the minimal remaining freight traffic. This would obviate much of the major investment in new track needed to implement Alternative 1.

Comprehensive Transit Integration

The successful implementation of rail service requires good feeder bus service. To better understand the cost implications of providing feeder bus service for a long term rail network, this study considered what it would take to implement a bus/rail network that provided bus connections for every train as well as train connections for every bus, using the Western Contra Costa Transit Authority (WestCAT) service as an example. This bus/rail network would provide a very high level of local service as well as direct connections with the rail system. Capital costs (including 12 additional buses, the expansion of the maintenance, storage and servicing facilities) would be approximately $14 million. Annual operating costs are estimated at $2-3 million. The

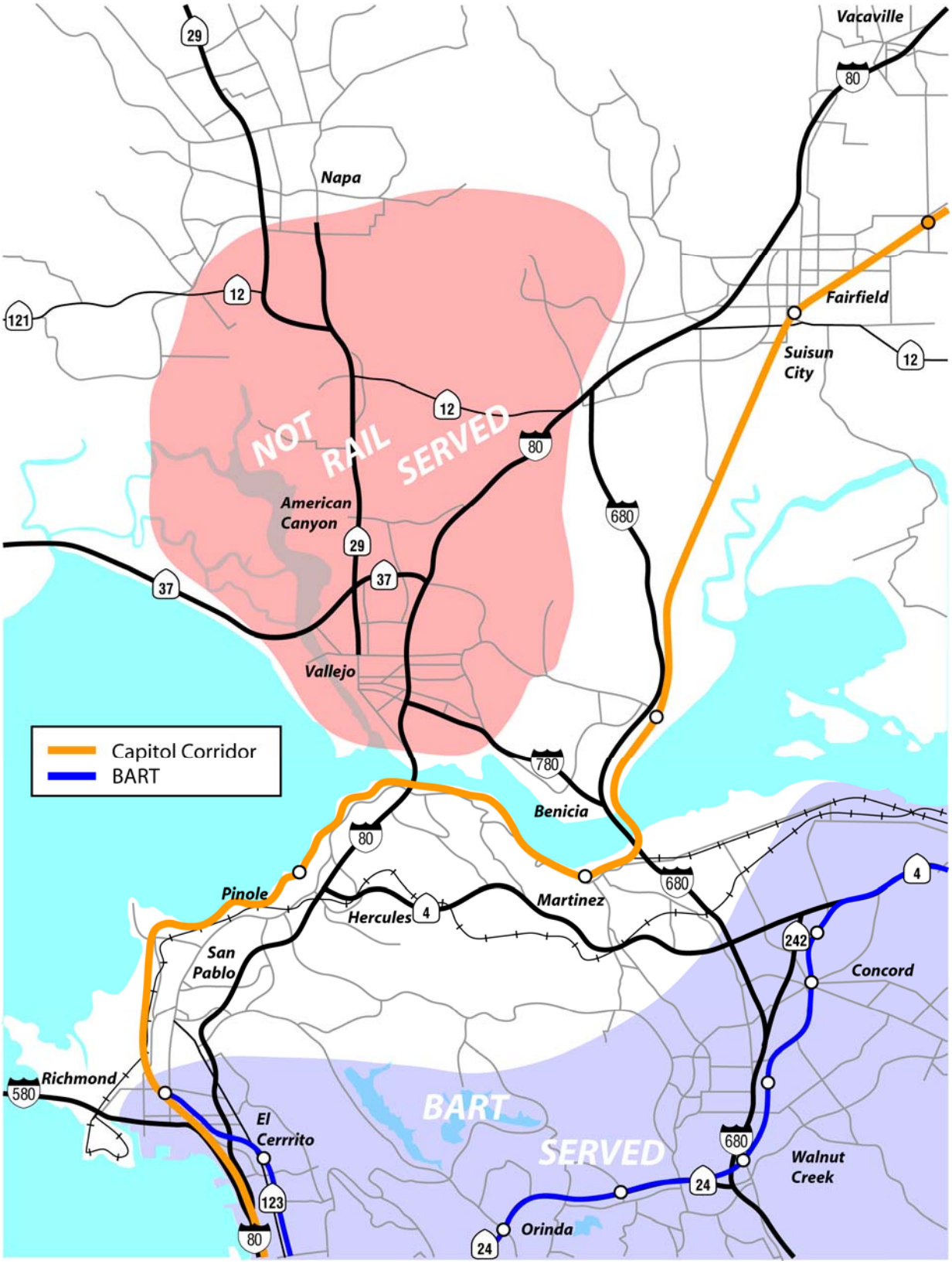
service assumes an integrated fare structure and fare collection system providing seamless service to the passenger.

These issues should be fully addressed as part of an integrated transit system, combining rail with the existing transit operations and delivering superior rail and local and feeder bus service to West Contra Costa County residents.

Extension of Service from Hercules to Vallejo

In conducting this study, it became apparent that while many areas of Solano and Contra Costa counties would be well served by increased intercity and commuter rail service and adding new local-serving DMU service from Richmond to Hercules, the City of Vallejo and southern Solano County has no direct access to rail service. Figure 7 below illustrates the gap in rail service. Earlier working papers discussed the projected growth in the I-80 corridor, in terms of employment, housing and daily commuters, and concluded that the proposed increases in highway capacity and express bus services will not substantially alleviate projected congestion in this corridor. In addition, given the projected growth in Vallejo and Solano County, this area represents a significant underserved market for rail transit.

Figure 7: Study Areas Not Served by Rail



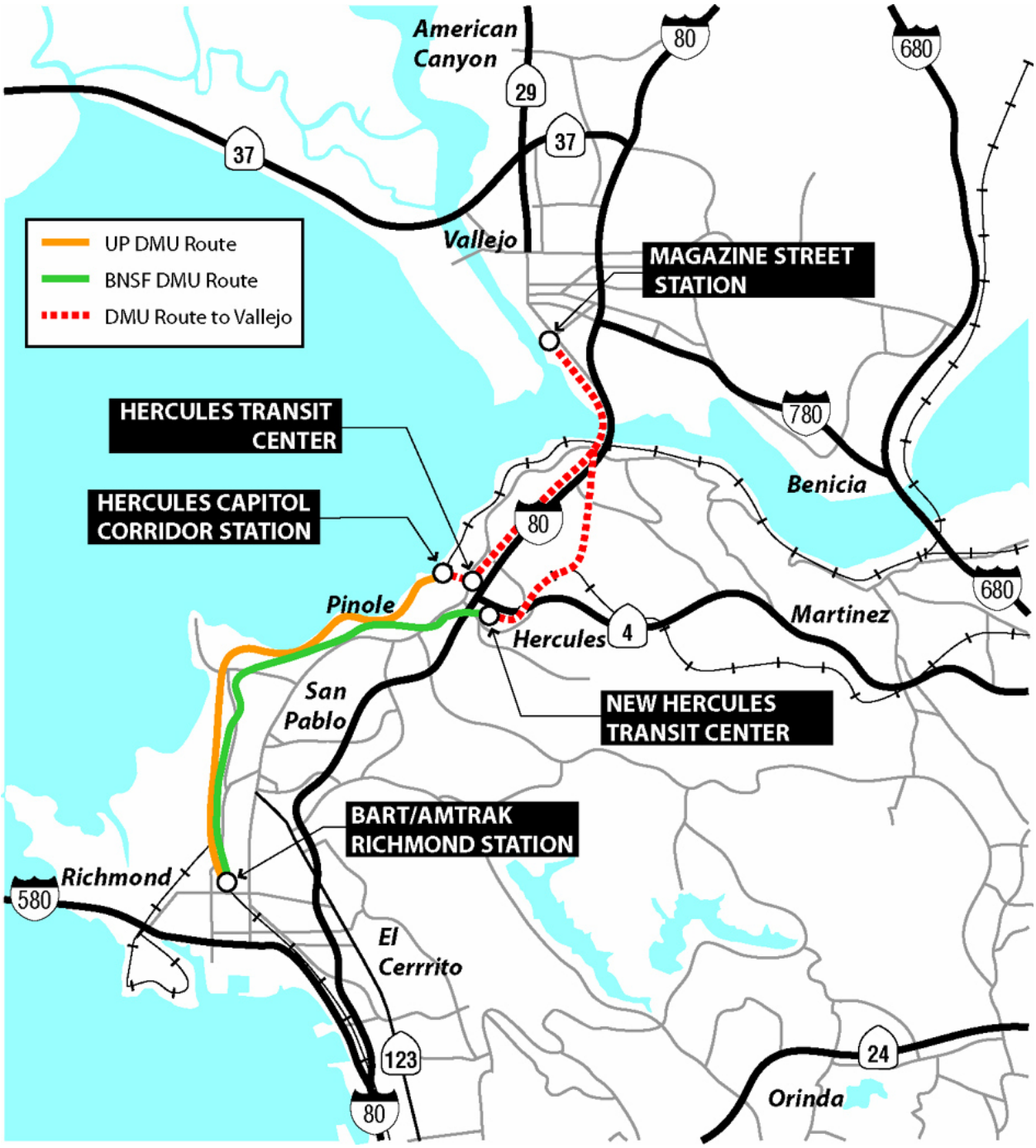
Although not included in the study work scope, the possibility of extending the local DMU service from Hercules to Vallejo was briefly analyzed. That analysis is described here.

Alignments

The analysis first identified potential alignments and operating characteristics from Hercules to Vallejo, extending from the three alternative Richmond-Hercules routes.

- **Alternative 1 (Richmond-New Hercules Transit Center via BNSF):** From a new Hercules Transit Center east of I-80, the route would continue on the BNSF for approximately one mile. Leaving the BNSF, the alignment would head north on new track, travel through a set of tunnels under the ridges between Hercules and Crockett, and transition into the median of I-80 as it approaches the new span of the Carquinez Bridge. The line would cross the Carquinez Strait on the easternmost 15 feet of the new bridge deck. On reaching the north shore of the Strait, the rail alignment would tunnel under the southbound lanes of I-80, and enter the median of Sonoma Boulevard, which it would follow to a terminal and park and ride lot at Magazine Street. The distance from Hercules to Magazine Street in Vallejo is approximately 5.5 miles. Run time between Richmond BART and Magazine Street on this alignment would be 25 minutes.
- **Alternatives 2 and 3 (Richmond-Hercules Capitol Corridor Station via UP):** Leaving the proposed Hercules *Capitol Corridor* station along the waterfront, the alignment would leave the UP right of way and follow a new alignment east toward I-80, paralleling the proposed John Muir Parkway. At I-80, the alignment would turn north and parallel the freeway on the west side. At the approaches to the bridge, the alignment would tunnel under the westbound lanes of I-80 in order to cross the new span on the easternmost side. This alignment would then follow the same route as in Alternative 1 to terminate at a Magazine Street station. The distance on this alignment from the Hercules Capitol Corridor station to Magazine Street in Vallejo is approximately six miles. Run times between Richmond BART and Magazine Street would be approximately 28 minutes for FRA compatible DMUs and 25 minutes for Light DMUs.

Figure 8: DMU Extensions from Hercules to Vallejo



Estimated Capital and Operating Costs

Extending service to Vallejo will require significant investment in infrastructure (track, signals, stations, etc.), as well as additional vehicles. The estimated capital costs are described below:

Table 14: Capital Costs for Extensions from Hercules to Vallejo *(in millions of dollars)*

	Vehicles	Infrastructure	Total
Alternative 1 DMU	$8.2	$353.2	**$361.4**
Alternative 2 DMU	$8.2	$260.3	**$268.5**
Alternative 3 Light DMU	$4.4	$260.3	**$264.7**

Source: LTK Engineering Services and Wilbur Smith Associates

The estimated annual operating costs for Alternatives 1 and 2 between Richmond and Vallejo (both using FRA compliant vehicles) are approximately $11.5 million annually, representing a 30 percent increase over the anticipated cost of operating the same type of service between Richmond and Hercules. Estimated operating costs for Alternative 3 between Richmond and Vallejo, the Light DMU alternative, is $9.5 million, a 36 percent increase. These operating costs would be offset, somewhat, by fare revenues generated by the service.

Ridership

It is generally recognized that Vallejo represents a significant travel market. For this analysis, Magazine Street at Sonoma Boulevard was assumed as the terminus. At a later date, the terminus could move north to the Vallejo Ferry Terminal. A detailed analysis of ridership would reveal the impacts of service to the ferry terminal and connections to a proposed North Bay/ Napa-Solano rail service.

Challenges and Opportunities

Previous corridor studies that evaluated the feasibility of extending rail service over the Carquinez Strait using conventional BART technology have found the cost to be prohibitive. By using other available rail technologies, such a service may be feasible in the long term. There are, however, a few issues that must be evaluated before such a project can move forward.

Although Caltrans designed the new span of the Carquinez Bridge to accommodate light rail vehicles, it is unclear whether the span could support the weight of and deflection produced by either FRA compliant or light DMU vehicles. A thorough analysis and simulation testing of these vehicles on the bridge span would be required to confirm the viability of operating rail service across the new Carquinez span.

Another issue to consider is the terminus of the extension. For purposes of this study, Magazine Street is considered the terminus because of its easy freeway access. A better alternative might be to extend the service to the Vallejo Ferry terminal, which serves as a transit hub in the City. Solano and Napa counties are currently studying the feasibility of extending rail from the Ferry Terminal north to Napa. Bringing the Richmond-Hercules-Vallejo rail line to the Vallejo Ferry Terminal may close a regional gap, increase ridership and boost the City's development plans in the area.

One drawback to extending the line to the Vallejo Ferry Terminal is that the operation of FRA compliant vehicles (proposed in Alternatives 1 and 2) may not be acceptable along Sonoma Boulevard, either to regulatory agencies or the community.

Evaluation of Long-Term Rail Alternatives

The purpose of this effort is to evaluate the long term rail alternatives to determine their compatibility with the adopted criteria. As shown in Table 15, all three of the alternatives appear to meet the established criteria. However, because the level of analysis is more conceptual than specific, the alternatives are quite similar in how they fare under the criteria when compared to each other. No one alternative stands out as the "winner" when compared to the other alternatives.

Table 15: Evaluation of Long Term Rail Alternatives in 2010

Project Goals for Service Options		Evaluation Criteria	BNSF Route with Compliant DMU	UP Route with Compliant DMU	UP Route with Light DMU
1	Reduced travel delay	- Travel time savings	- 2 minutes to El Cerrito Del Norte[1]	- 2 minutes to El Cerrito Del Norte	- 2 minutes to El Cerrito Del Norte
2	Convenient, fast and seamless service	- Travel time savings - - Passenger miles - Intermodal connections at stations	- 2 minutes to El Cerrito del Norte - 12,726,500 (annual) - Transit connections at all stations	- 3 minutes to El Cerrito del Norte - 12,304,700 (annual) - Transit connections at all stations	- 3 minutes to El Cerrito del Norte - 12,304,700 (annual) - Transit connections at all stations
3	Enhanced regional mobility	- Travel time savings - - Intermodal connections at stations	- 2 minutes to El Cerrito del Norte - Transit connections at all stations	- 2 minutes to El Cerrito del Norte - Transit connections at all stations	- 2 minutes 3 minutes - Transit connections at all stations
4	Growth in rail transit usage on a cost effective basis	- Passenger miles - Fare box recovery - Net cost per passenger - Net cost per passenger mile - Start-up ridership threshold	- 12,726,500 (annual) - 51.7 percent - $2.16 - - $0.34 - 7,950 daily riders exceeds threshold of 4,600 daily riders	- 12,304,750 (annual) - 52.3 percent - $2.11 - - $0.34 - 7,950 daily riders exceeds threshold of 4,600 daily riders	- 12,304,750 (annual) - 53.5 percent - $2.01 - - $0.32 - 7,950 daily riders exceeds threshold of 3,700 daily riders
5	Reduction in auto emissions and improved air quality	- Vehicle miles traveled - - Mode shift - Non-motorized access to stations	- 9,436,500 (annual) - - 2.6 percent of I-80 traffic - Non-motorized assess exists by city streets for all stations	- 9,224,750 (annual) - - 2.6 percent of I-80 traffic - Non-motorized assess exists by city streets for all stations; Richmond Parkway station access is remote	- 9,224,750 (annual) - - 2.6 percent of I-80 traffic - Non-motorized assess exists by city streets for all stations; Richmond Parkway station access is remote

[1] Minutes of travel time saved by traveling by rail versus single occupant vehicle from Hercules to the El Cerrito del Norte BART station.

Table 15: Evaluation of Long Term Rail Alternatives in 2010

6	Opportunities for transit oriented development (TOD)	- Land use designations around stations consistent with TOD - Intermodal connections at stations	- Land use designations around station sites are consistent with TOD - - - Transit connections at all stations	- Land use designations around station sites are consistent with TOD - - - Transit connections at all stations	- Land use designations around station sites are consistent with TOD - - - Transit connections at all stations
7	Reduced reliance on single occupancy vehicles	- Vehicle miles traveled - Mode shift - Non-motorized access at stations	- 9,436,500 (annual) - - 2.5 percent of I-80 traffic - Non-motorized access assumed for all stations	- 9,224,750 (annual) - - 2.5 percent of I-80 traffic - Non-motorized access assumed for all stations	- 9,224,750 (annual) - - 2.5 percent of I-80 traffic - Non-motorized access assumed for all stations
8	Opportunities for coordination with transit	- Intermodal connections at stations	- Transit connections at all stations	- Transit connections at all stations	- Transit connections at all stations
9	Consistency with the constraints of anticipated funding, BART expansion criteria, and local goals and objectives	- Consistency with funding constraints - Consistency with BART expansion criteria - Consistency with local goals and objectives, i.e. land use designations	- Project eligible for transportation funding - Project appears to be consistent with BART expansion criteria - Proposed stations and TOD are consistent with local land use goals	- Project eligible for transportation funding - Project appears to be consistent with BART expansion criteria - Proposed stations and TOD are consistent with local land use goals	- Project eligible for transportation funding - Project appears to be consistent with BART expansion criteria - Proposed stations and TOD are consistent with local land use goals
10	Integration with growing freight rail traffic	- Required capacity improvements and costs	- $302 million	- $188 million	- $206 million

Long-Term Rail Study Findings

The following conclusions have been drawn from the analysis of the long-term rail concept:

- Travel demand in the corridor will dramatically increase over the next 20 years; the Richmond-Vallejo corridor represents a significant travel market.
- Ridership projections from Richmond to Hercules demonstrate a viable service.
- The study corridor shows strong TOD potential and local jurisdictions willing to develop along TOD principles.
- Capital costs for extending rail service from Richmond to Vallejo using DMU technology are significantly lower than those of conventional BART (see 1996 MTC study).
- DMU options provide lower cost rail alternatives with a substantial level of service for West Contra Costa County residents.
- An engineering simulation will be required to determine the feasibility of using DMU technology on the new Carquinez Bridge.
- A Richmond-Vallejo rail line closes a gap in a future regional rail system.

V. CONCLUSIONS AND NEXT STEPS

Short-Term Rail Option

This study has shown that by integrating commuter service from Sacramento to Oakland with existing *Capitol Corridor* intercity service, the communities along the I-80 corridor from Solano County through West Contra Costa County will enjoy a high level of commuter service into the central Bay Area. Conservative ridership estimates illustrate solid demand for the service. Operating and capital costs appear reasonable especially if shared among the counties.

Next Steps:

- Participate in the follow-up regional rail study with partners from Placer, Sacramento, Yolo, Solano and Alameda counties to develop an operating plan for the integrated commuter service from Auburn to Oakland. The study will explore cost-sharing arrangements as well as institutional issues, such as governance. Cost-sharing formulas should consider issues such as boardings, and benefits accruing to each county, as described on page 20 of this report. One option for institutional arrangements may be to consolidate the commuter services under the *Capitol Corridor Joint Powers Authority* (CCJPA) management. Both the I-80 Rail Policy Advisory Committee and the Auburn-Dixon Regional Rail Steering Committee have approved a preliminary operating schedule and have agreed to pursue a joint study.

- Recommend that adequate funding be earmarked in future county sales tax measures and/or other funding opportunities in order to fund the future implementation of the increased commuter rail service.

- Encourage Solano County elected officials and transportation agencies to consider adopting growth control measures that will restrict the future growth in traffic demand on the I-80 corridor into Contra Costa County.

Long-Term Rail Option

This study has analyzed three alternatives for operating local passenger rail service from Richmond to Hercules using existing railroad rights of way in West Contra Costa County. Conservative ridership and revenue projections demonstrate that the service is feasible, and is comparable to other rail extensions under consideration in the San Francisco Bay Area. This service may be considered as a stand-alone service or as the first phase of a service extending to Vallejo, providing another travel option for that commute market.

Next Steps:

It is recommended that all three alternatives progress to the next stage of analysis to identify a preferred alternative, including a detailed assessment of the preferred alternative's potential extension to Vallejo. Specific recommendations are:

- Conduct analysis of the long-term commute patterns and travel market segments in the corridor.
- Conduct an alternatives analysis that compares future rail, bus, HOV and ferry services in the corridor.

- Conduct an engineering simulation of DMU technology operating on the new Carquinez Bridge span.
- Study freight consolidation in the corridor to determine if BNSF, UP and Amtrak can share track; determine the potential of BNSF as a passenger-only route.
- Develop a comprehensive transit integration plan that recognizes the revenue and cost impacts new rail service will have on feeder bus services.
- Conduct initial conceptual engineering, environmental clearance, and Ridership Development Plans for UP and BNSF alignments using DMU technology.

In order to conduct these studies and move the project forward, it is recommended that funding be earmarked in future county sales tax measures or addressed in other funding opportunities. It is further recommended that any additional studies include the participation of Solano County and the City of Vallejo, as well as Napa and Sonoma counties.