DUMBARTON RAIL CORRIDOR
ENVIRONMENTAL PHASE 1

VOLUME I
FINAL REPORT

for Environmental Phase 1 of the
DUMBARTON RAIL CORRIDOR PROJECT

March 3, 2006

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# Dumbarton Rail Corridor Project - Environmental Phase 1

## Final Report

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INTRODUCTION
AND
BACKGROUND
1.0 INTRODUCTION AND BACKGROUND

The Dumbarton Rail Corridor (DRC) Project is a proposed passenger rail service that would span the southern portion of the San Francisco Bay, connecting communities in the East Bay (Union City, Fremont, Newark) to communities in the West Bay (Menlo Park, Redwood City, and beyond to San Jose and San Francisco). Six daily westbound trains would depart Union City in the morning and converge with the existing Caltrain line on the West Bay. From the Caltrain line, half of the trains travel north to San Francisco while the other three trains head south to San Jose. During the afternoon peak, all trains would travel eastbound back to Union City. Four stations would be directly served by DRC trains (Union City Intermodal Station, Fremont Centerville, Willow Street in Newark, and Willow Road in Menlo Park). A new bridge crossing the bay would replace the existing bridge which has not been in operation since the mid-1980s. The DRC study area is shown in Figure 1-1.

Figure 1-1: DRC Study Area

This document is the Final Report for Environmental Phase 1 of the DRC Project. It is a compilation of three Technical Memoranda that are presented in Appendix A:

− Technical Memorandum 1.0: Alternatives Development
− Technical Memorandum 2.0: Project Definition
− Technical Memorandum 3.0: Alternatives Analysis

There may be discrepancies between the Final Report and Technical Memoranda that are related to revisions incorporated since development of the Technical Memoranda; the Final Report represents a more refined document.
The most feasible rail and bus alternatives presented in this report will be carried forward into Environmental Phase 2, which will include a more detailed analysis for potential environmental impacts, the preparation of an Environmental Impact Report/Statement, and preliminary engineering.

1.1 Project History

The 20.5-mile DRC has been in active rail service since the turn of the century. Only a relatively short five-mile segment across the San Francisco Bay has been out of service since the mid-1980s. The long-range planning process for the DRC began in 1991, with a study sponsored by the San Mateo County Transportation Authority (SMCTA), *Dumbarton Commuter Service Feasibility Study* that evaluated the feasibility of operating a commuter rail service in the corridor. The rail service option was recommended as a long-term strategy, which included future planned rail expansions. In 1994, the San Mateo County Transit District (SamTrans) purchased the DRC right-of-way between Redwood Junction and Newark Junction as an investment for future freight and/or commuter rail service.

Improvements to the DRC were studied and documented in a report entitled, *Dumbarton Rail Corridor Rehabilitation* (1996). In 1997, SMCTA sponsored the *Dumbarton Corridor Study* to identify short- and long-term transit opportunities in coordination with other regional rail links. Similar to the 1991 study’s conclusions, this study concluded that rail service is a long-term solution and recommended that bus service be expanded as a short-term strategy. In 1998, SMCTA sponsored another study, the *Dumbarton Corridor Transit Concept Plan* that identified the need for rail service and formulated a plan.

In 1999, SMCTA sponsored the *Dumbarton Rail Corridor Study* that defined a logical Rail Service Plan for the DRC. This information allowed Dumbarton Rail Service to be included as a candidate project in the transportation component of the Metropolitan Transportation Commission’s (MTC) *Blueprint for the 21st Century* (2000). The Blueprint listed the priorities for regional transportation projects with recommendations on funding for additional resources beyond those committed in the Regional Transportation Plan (RTP). Funds were programmed with the inclusion of the DRC in MTC’s *Blueprint for the 21st Century*. The Blueprint reaffirmed the priority to address the dramatic increases in Bay Area population and traffic and other changes affecting transbay travel. The DRC Project is almost fully funded in MTC’s Transportation 2030 Plan, the most recent RTP, which was adopted in February 2005.

The SMCTA initiated the DRC Project Study Report (PSR) in 2003 to further understand the scope, schedule, and cost for implementing the project. The PSR is an engineering report; the purpose of which was to document agreement on the project scope, schedule and estimated cost so that the project could be seriously considered for inclusion in a future capital improvement program. The rail alternative analyzed in the PSR is one of the alternatives currently being considered in Environmental Phase 1.

In March 2004, the voters in Alameda, Contra Costa, Marin, San Francisco, Santa Clara, and San Mateo counties passed the Regional Traffic Relief Plan, also known as Regional Measure 2 (RM2). RM2 will fund a variety of transportation improvements, to be funded through a $1 toll increase on the Bay Area’s seven state-owned bridges, and is expected to raise approximately $125 million annually to help relieve traffic congestion and enhance the convenience and reliability of the region’s public transit system in the vicinity of the bridge corridors. RM2 will provide $135 million in construction funds and $5.5 million annually for operating and maintenance costs for the DRC Project.

The following are the completed studies or regional plans that relate to the DRC Project:

- *Dumbarton Commuter Service Feasibility Study*, prepared by Parsons Brinckerhoff for the San Mateo County Transportation Authority, 1991;
- *Dumbarton Corridor Rehabilitation*, prepared by Morrison Knudsen for the San Mateo County Transportation Authority, 1996
In Fall 2005, work commenced on the Regional Rail Plan, which will study the improvements necessary for seamless integration of all existing and planned Bay Area passenger and freight rail systems. The Plan will also look at proposed alignments for statewide high-speed rail to connect with the existing rail network. The study, sponsored by the MTC, Caltrain/JPB, and BART, is expected to be complete by mid-2007. The DRC Project will be coordinated with the development of the Regional Rail Plan to promote consistency between the two efforts.

1.2 Study Process

The DRC Project Environmental Phase 1 consists of an Alternatives Analysis and development of a Project Purpose and Need, as summarized in this Final Report and presented in detail in Appendix A. The study process entailed developing and refining alternatives for bus and rail service for the years 2010 and 2030 and comparing those to a Base Case (2005) and No-build scenario for 2010 and 2030. The following is a summary list of the study alternatives.

<table>
<thead>
<tr>
<th>Alternative</th>
<th>2005 (Base)</th>
<th>Universe</th>
<th>Refined</th>
<th>Final</th>
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<td>Rail</td>
<td>-</td>
<td>9</td>
<td>4</td>
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</tr>
<tr>
<td>Bus</td>
<td>-</td>
<td>6</td>
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The beginning point for the work summarized in this report was the PSR, which identified a feasible rail alternative. The current work built upon the PSR work and investigated eight rail alternatives in addition to the PSR alternative. These alternatives were then evaluated to determine the most feasible ones for further rigorous analysis. The final four alternatives included the PSR alternative and three variations of the PSR alternative.

A primary tool for evaluating the final four alternatives was the Rail Traffic Controller (RTC) simulation tool applied to the Northern California Rail Advisory Planning Group (NOCRAP) regional rail model. This application simulates the actions of human rail dispatchers, allowing for simulations that closely track real railroad operations. Since the DRC is shared by other operators including the Altamont Commuter Express, Capitol Corridor, Caltrain, Amtrak, and the Union Pacific Railroad, the RTC/NOCRAP model is an accepted tool by all of the agencies and was key to determining which of the primary alternatives were workable on these shared tracks.
Six initial bus alternatives were developed and investigated as an alternative to rail in the DRC. Each potential bus alternative represented a transportation alternative to rail along the DRC without the need for constructing a new transit guideway, requiring major capital improvements, or acquiring right-of-way. The routes of the different bus alternatives were not designed to parallel the DRC exactly, but were designed to serve similar markets as the proposed rail service by enhancing the existing Dumbarton Express (DB/DB1) bus service, or by adding an additional bus route between the East Bay and Peninsula along the corridor.

Based on results from the initial screening, the recommended bus alternative included a combination of two of the original six alternatives. This recommendation entailed one bus route from the East Bay to Millbrae, Oyster Point, and Brisbane; and a second route from the East Bay to Redwood Shores and Foster City.

The results of the Phase 1 work will be used in Phase 2 of the Environmental Study. Two rail alternatives and one bus alternative emerged from Phase 1 as the most feasible to be evaluated further in Phase 2. In Phase 2, these alternatives will be scrutinized considering several social, economic and environmental factors to determine how and if the project should be advanced to construction and ultimate operation.

1.2.1 Meetings

During Phase 1 of the Environmental Study, regular meetings with the Technical Advisory Committee (TAC), Policy Committee, and Union Pacific Railroad (UPRR) were conducted to review the alternatives and gather stakeholder input on the project.

The Technical Advisory Committee (TAC) was originally formed in 2004 for the Project Study Report, and includes representatives from the following agencies:

- Alameda County Congestion Management Agency (ACCMA)
- Alameda County Transportation Improvement Authority (ACTIA)
- Altamont Commuter Express (ACE)
- Bay Area Rapid Transit District (BART)
- California Department of Transportation (Caltrans)
- Capitol Corridor (CCJPA)
- City/County Association of Governments of San Mateo County (C/CAG)
- City of Fremont
- City of Menlo Park
- City of Newark
- City of Union City
- Metropolitan Transportation Commission (MTC)
- San Mateo County Transportation Authority (SMCTA)
- Santa Clara Valley Transportation Authority (VTA)
The TAC continues to provide input on technical issues during the Environmental Phase 1 of the DRC Project and meets bi-monthly. ACTIA, SMCTA, and VTA are funding the Environmental Study work through sales tax revenues, and MTC is providing funding through Regional Measure 2.

In addition, a Policy Committee comprised of Board members from each of the project funding agencies meets regularly to provide input on policy decisions associated with the DRC. The agencies represented on the Policy Committee are ACTIA, SMCTA, VTA, CCJPA, and MTC. Regular meetings with UPRR representatives were conducted during the development of the rail alternatives. Coordination with the UPRR continues throughout the Environmental Study.

1.2.2 Technical Reports
A series of technical memoranda and working papers have been developed during the Phase 1 Study. This Final Report is a summary of those technical reports and reflects the comments received from the TAC, Policy Committee and stakeholders throughout the study process. The technical memoranda and other detailed data are contained in the appendix of this report, including a log of all comments received.

1.2.3 Screening
An evaluation process was developed to guide the screening of DRC bus and rail alternatives. The intent of the screening process was to compare the strengths and weaknesses of the alternatives and to identify the final, most feasible bus and rail alternatives that will be carried forward to a more detailed evaluation during Environmental Phase 2.

Screening criteria were applied to the alternatives. They address issues such as the following:

- **Markets Served** - What is the population, transit-dependent population, employment, and activity centers served by the alternative?

- **Reduced Traffic Congestion** - Is the alternative likely to contribute to a reduction in highway and local traffic congestion?

- **Operational Efficiency and Compatibility** - How well does the alternative integrate with existing operations (road, highway, transit, freight, etc.)? Does the alternative have the potential for an efficient operations plan?

- **Engineering Feasibility** - Are there any engineering constraints affecting an alternative’s viability?

- **Constructability** - Is the project implementation likely to involve costly, complex, or time consuming construction or procurement activities?

- **Environmental Impacts** - Will the alternative have positive air quality effects, minimal community disruption, and a positive effect on the natural and manmade environments?

- **Institutional Acceptance** - Does the alternative have features or implementation requirements that might limit its acceptance by community, stakeholders (UPRR, ACE, CCJPA, transit operators), and local governments?

The DRC screening process is illustrated in Figure 1-2 on the following page.
Figure 1-2: DRC Screening Process

Preliminary RR Ops and Ridership Modeling
- Modeling methodology, assumptions and data collection
- Existing, 2010, and 2030 no-build development
- Validation and calibration
- ID maximum demand potential (infra. & riders)
- ID capacity constraints (infra. & riders)

Detailed RR Ops and Ridership Modeling
- 2010 and 2030 new alternatives development
- Model runs
- Model results and documentation

Universe of Alternatives
- Rail
  1. No-Build
  2. PSR '04
  3. New Rail 1
  4. New Rail 2
  5. New Rail 3
- Bus
  1. New Bus 1
  2. New Bus 2
  3. New Bus 3

1st Level Screening
- Existing data
- Qualitative
- Rough order of magnitude estimates

Refined Rail & Bus Alternatives (2010 – 2030)
1. No-Build
2. PSR '04
3. New Rail 1
4. New Rail 2
5. New Rail 3
6. New Bus 1
7. New Bus 2

2nd Level Screening
- Purpose & Need
- Goals & Objectives
- Evaluation criteria
- Phasing

Preferred Rail & Bus Alternatives (2010 – 2030)

Stakeholder Input (workshops and 1-to-1 meetings)
- Policy Committee
- Technical Advisory Committee
- UPRR
- Others TBD
Further description and results of the evaluation process are presented in Sections 3.0 and 4.0 of this report.

1.2.4 Phase 2
Phase 2 of the Environmental Study will consist of analyzing the most feasible project alternatives for potential environmental impacts, preparing an Environmental Impact Report/Statement, and conducting preliminary engineering. Phase 2 will begin in early 2006 and conclude in 2007. The Peninsula Corridor Joint Powers Board (PCJPB) will assume the lead agency role beginning with Phase 2.
2.0

PURPOSE AND NEED
2.0 PURPOSE AND NEED

2.1 Project Purpose

The purpose of the proposed Dumbarton Rail Corridor project is to use existing rail infrastructure to provide an east-west rail connection in the southern portion of the San Francisco Bay, connecting communities of the East Bay and West Bay, and to address the transportation issues and deficiencies related to highway congestion, transit, population and employment, and air quality in the corridor. Proposed transportation solutions must address the following four basic issues.

Highway and Congestion

- Highway capacity in the study corridor is not sufficient to accommodate current and forecasted peak hour demands.
- Substantial congestion exists during peak periods and will increase over time, making travel times unpredictable.
- Travel times on freeways are currently substantial and will increase over time.
- Connections between north-south freeways are extremely limited and are congested during peak periods.

Transit

- Existing transit service in the Dumbarton Corridor has no dedicated right-of-way and therefore is subject to delay from incidents and traffic congestion, which is projected to grow significantly over the next 25 years.
- No direct South Bay connection exists between high volume/high capacity transit routes in the East Bay (BART and commuter rail service) and the Peninsula (Caltrain commuter rail service).
- Existing transit service in the Dumbarton Corridor consists of two bus routes on the Dumbarton Bridge (SR 84) that both terminate in Palo Alto and do not serve several major activity centers in the corridor, requiring passengers to transfer to other transit services to reach these destinations.
- Existing transit service between activity centers is infrequent, even during peak hours.

Population and Employment

- Access between areas of current and forecasted population and locations of current and forecasted employment must utilize transportation facilities that are currently at or over capacity during peak periods.
- Only some of the activity centers in the corridor are connected to existing transit services, affecting potential access to employment for persons without automobiles.

The corridor is expected to grow substantially in population and employment through 2030, and such growth would place ever-increasing demands on the transportation infrastructure.

Air Quality

- The San Francisco Bay Area Air Basin is designated as a serious non-attainment area for ozone, and a non-attainment area for particulate matter (both PM 10 and PM 2.5).
- Transportation improvements must demonstrate conformity with the regional air quality plan.
2.2 Goals and Objectives

The DRC project goals, as excerpted from the PSR, are listed below and remain valid ways of defining important components of need for the DRC.

− Utilize existing infrastructure to enhance regional connectivity between BART, AC Transit, ACE, Capitol Corridor and Union City Transit in Alameda County and Caltrain and SamTrans in San Mateo County.

− Improve access to public transit service and facilitate freight movement.

− Enhance operational efficiency by decreasing delays to existing passenger and freight systems such as ACE, Capitol Corridor, and UPRR.

− Alleviate severe traffic congestion on the existing Dumbarton Bridge (Hwy 84) and on intersecting highways.

− Improve regional air quality by reducing auto emissions.

− Accommodate future travel demands and improve mobility options to employment, education, retail and community centers.

Additional goals include:

− Support Smart Growth policies, regional and local land use plans, including transit-oriented development.

− Ensure compatibility with adjacent land uses and planned development.

− Support community goals and institutional objectives.

2.3 Issues

This section provides an overview of the potential environmental impacts and issues for the bus and rail alternatives.

2.3.1 Rail Alternative Issues and Impacts

An Environmental Scan Technical Report was prepared in March 2004 to describe the potential environmental impacts that may result from rehabilitation of the existing rail corridor, new track connections, and passenger station construction or improvements associated with the DRC. The following is a brief summary of the issues identified:

Land Use and Development Planning: Several components of the rail alternatives would be located near residential development. There is the potential for impact on the residences due to increased railroad operations. There is a potential for change in land use to occur in proximity to rail stations, if such changes are allowed by local jurisdictions.

Environmental Justice: A preliminary screening for environmental justice impacts revealed that certain communities along the DRC exhibit higher percentages of minority and low-income populations when compared to the respective county percentages. Further analysis of potential disproportionate adverse impacts to the minority and low-income populations identified in this screening report would be required to determine if environmental justice impacts actually occur. Environmental justice impacts would occur if there are disproportionate adverse impacts from such topics as displacements, air quality, noise, changes in land use, economic development, visual, employment, local and regional traffic and transportation, and safety. To determine whether there are disproportionately high and adverse impacts, the distribution of impacts (determined through and documented in the environmental analysis
process) between geographic sub-areas would be compared between low-income and minority communities and the general population (county).

**Visual Resources/Aesthetics:** The necessary curvature of the proposed Shinn Connection (see Section 3.4.6) would require that an existing wooden fence barrier and a section of landscaping along the development property line of several residences be removed and a concrete sound barrier be constructed to replace the fence. Local residents in the immediately adjacent area may experience direct visual impact on their views.

**Cultural Resources:** The potential for impacts encompasses railroad-built features within the rail right of way, possible effects to the non-railroad built resources (buildings/structures) adjacent to the new station locations, possible effects on significant resources along the alignment, and destruction of the two steel-truss swing-bridges over San Francisco Bay and Newark Slough. The potential impacts on archaeological resources may include inadvertent discovery, adverse effects, destruction or damage to archaeological resources and human remains in the project corridor.

**Special-Status Species and Wetlands:** Probable biological resource impacts resulting from the rail alternative include:

- Temporary or permanent disturbance or removal of seasonal wetland habitat, riparian habitat, freshwater marsh habitat, and open water habitat;
- Indirect impacts associated with operation and maintenance of trains (noise and vibration) and related disturbance of wildlife;
- Creation of a possible barrier to wildlife movement;
- Impacts on habitat for steelhead, Congdon’s spikeweed, raptors, western burrowing owl, California clapper rail, the salt marsh harvest mouse, vernal pool invertebrates, red-legged frogs, and special-status bat species; and
- Noise disturbance of marine mammals and breeding birds during construction and operation of trains (e.g., harbor seal, California clapper rail and black rail).

**Water Quality and Floodplains:** A rail alternative has the potential to violate state and federal water quality standards due to the potential for accidental spills of sediment, fuel, and other toxic materials during construction of the proposed rail crossings. The water quality impacts from spills could be short or long term depending on the type of material, size of the spill, and seasonal timing.

The process of uprooting old track and relaying railroad ties for new track may disturb smelter slag, which is commonly used as bed material for railroad tracks and which contains high amounts of oxidized and environmentally sensitive heavy metals. If this slag is discharged into waters of the state, contaminants may exceed California Department of Health Services maximum contaminant levels for antimony, arsenic, barium, cadmium, copper, lead, mercury, selenium, silver, thallium, and zinc.

The daily operation and maintenance of the project components may increase surface water runoff and non-point-source pollution to the Alameda Creek Flood Control Channel, sensitive wetland areas, and the San Francisco Bay. Non-point-source pollution containing suspended solids, organic and inorganic compounds, oils and grease, and miscellaneous waste may be deposited to the Flood Control Channel from train engine crankcases, and lubricants used on tracks, and track maintenance activities. These pollutants may increase turbidity, stimulate algae growth, increase sedimentation of aquatic habitat, and introduce compounds that are toxic to humans and aquatic organisms. Runoff pollutants from station operations may also threaten water quality.

The DRC intersects waters listed under the federal Clean Water Act (CWA), Section 303(d), as being impaired, making some of these impacts more serious.
**Air Quality:** Project-related activities, such as the operation of diesel-powered locomotives, an increase in the levels of vehicular traffic at intersections near the station sites, and the operation of heavy equipment during construction, could result in changes in localized air quality and affect sensitive receivers located along the alignment. Potential benefits could occur depending on the amount of automobile traffic shifted to rail.

**Noise and Vibration:** Noise and vibration impacts could occur at noise-sensitive uses adjacent to new station sites and along track locations as a result of temporary construction activities and long-term operation of the rail service. Possible impacts resulting from construction activities include increased noise from relocation of railroad tracks closer to noise-sensitive properties, vibration impacts from operation of construction equipment, and vibration impacts on aquatic species. Potential impacts from continued operation of the rail service include an increase in noise levels and vibration along the project alignment.

The main sources of noise impact for rail projects are the sounding of train horns in advance of at-grade crossings and the sounding of the warning devices at the crossings. Under new rules published in 2005 by the Federal Railroad Administration, “quiet zones” can be established that eliminate these noise impacts. Establishment of the quiet zones requires both the installation of safety protection devices, typically median barriers on street approaches to the rail corridor or 4-quadrant gates, and application for designation by a local jurisdiction.

**Hazardous Materials:** Potential impacts from hazardous materials include the possibility for spills of hazardous materials from either construction-related activity or the operation of rail cars; potential release of hazardous materials from construction-related excavation; potential increase in public hazard from the routine transport of hazardous materials; and potential increase in public hazard from exposure to hazardous materials during construction.

**Traffic and Traffic Safety:** Impacts of the rail alternatives on traffic include the potential for increased vehicle delay at at-grade crossings along the entire alignment and the potential for stopped trains at the proposed stations to block traffic. Also, the proposed stations could create more vehicle trips and more pedestrian/cyclist traffic in some portions of the DRC. Potential benefits would depend on the amount of automobile traffic shifted to rail.

### 2.3.2 Bus Alternative Issues and Impacts

**Land Use and Development Planning:** The bus alternatives have low potential to affect land use patterns since the service would occur over existing streets and no new substantial physical facilities would be required.

**Environmental Justice:** The impacts of bus alternatives are generally the same along all routes being served, so there is limited potential for disproportionate adverse impacts to arise.

**Visual Resources/Aesthetics:** Visual impacts for bus alternatives are generally limited to the locations in which new bus shelters are created.

**Cultural Resources:** The potential for cultural resources to be affected by bus alternatives is limited, given that the service would occur within existing streets. The creation of new bus shelters is typically the only source of impacts to cultural resources.

**Special-Status Species and Wetlands:** Bus alternatives typically do not have substantial impacts to biological species. There would not be anticipated direct impacts to wetlands; see the discussion of water quality for potential indirect impacts.
Water Quality and Floodplains: A bus alternative has the potential to violate state and federal water quality standards due to the potential for accidental spills of sediment, fuel, and other toxic materials during construction. The water quality impacts from spills could be short or long term depending on the type of material, size of the spill, and seasonal timing.

The daily operation and maintenance of the buses may increase surface water runoff and non-point-source pollution to the Alameda Creek Flood Control Channel, sensitive wetland areas, and the San Francisco Bay. Non-point-source pollution containing suspended solids, organic and inorganic compounds, oils and grease, and miscellaneous waste may be deposited to the Flood Control Channel. These pollutants may increase turbidity, stimulate algae growth, increase sedimentation of aquatic habitat, and introduce compounds that are toxic to humans and aquatic organisms. Runoff pollutants from station operations may also threaten water quality.

The DRC intersects waters listed under the federal Clean Water Act (CWA), Section 303(d), as being impaired, making some of these impacts more serious.

Air Quality: Project-related activities, such as the operation of buses, an increase in the levels of vehicular traffic at intersections near the station sites, and the operation of heavy equipment during construction, could result in changes in localized air quality and affect sensitive receivers located along the alignment. Potential benefits could occur depending on the amount of automobile traffic shifted to bus.

Noise and Vibration: There is some potential for noise impacts to occur from a bus alternative, depending on the increase in number or frequency of buses passing by noise- or vibration-sensitive locations. If there are areas where buses idle for lengthy periods, noise impacts or annoyance may occur.

Hazardous Materials: Potentials impacts from hazardous materials include the possibility for spills of hazardous materials from either construction-related activity or the operation of buses; potential release of hazardous materials from construction-related excavation; potential increase in public hazard from the routine transport of hazardous materials; and potential increase in public hazard from exposure to hazardous materials during construction.

Traffic and Traffic Safety: Impacts of the bus alternatives on traffic include the potential for increased vehicle delay at intersections along the streets with new or enhanced service. The potential is typically affected most by the proximity of bus stops to intersections and the number of buses operating at peak hour. Potential benefits would depend on the amount of automobile traffic shifted to bus.
3.0 ALTERNATIVES DEVELOPMENT

3.1 Introduction
This chapter describes the development of the rail and bus alternatives. Multiple alternatives were developed for each mode, then evaluated and refined until the most feasible alternatives were selected for further analysis in Environmental Phase 2.

An evaluation process was developed to guide the initial screening of DRC bus and rail alternatives. The intent of this initial screening of the alternatives was to compare the strengths and weaknesses of the preliminary alternatives and to identify refined bus and rail alternatives to be evaluated in more detail in the Alternatives Analysis.

The criteria for the initial screening are largely qualitative in nature, but in some cases are related to quantitative data such as socioeconomic data, travel demand, and projected congestion levels. The evaluation criteria, which are related to the issues and objectives raised in the Purpose and Need Statement (Section 2.0), are as follows:

− **Markets Served** - What is the population, transit-dependent population, employment, and activity centers served by the alternative?
− **Reduced Traffic Congestion** - Is the alternative likely to contribute to a reduction in highway and local traffic congestion?
− **Operational Efficiency and Compatibility** - How well does the alternative integrate with existing operations (road, highway, transit, freight, etc.)? Does the alternative have the potential for an efficient operations plan?
− **Engineering Feasibility** - Are there any engineering constraints affecting an alternative’s viability?
− **Constructability** - Is the project implementation likely to involve costly, complex, or time consuming construction or procurement activities?
− **Environmental Impacts** - Will the alternative have positive air quality effects, minimal community disruption, and a positive effect on the natural and manmade environments?
− **Institutional Acceptance** - Does the alternative have features or implementation requirements that might limit its acceptance by community; stakeholders (UP, ACE, CCJPA, transit operators); and local governments?

The alternatives that were selected after the initial round of screening are further described in Section 4.0.

3.2 Existing Transit Service and Freight Operations
A combination of rail, bus, and rapid transit operators currently provide passenger service in the DRC study area. Table 3-1 lists the different transit operators and the geographic areas served. Figure 3-1 on page 21 illustrates the service coverage of the passenger and freight rail operators.
Table 3-1: Existing Transit Service in DRC Study Area

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<td></td>
<td>Capitol Corridor Joint Powers Board (CCJPA)</td>
<td>Sacramento to San Jose via Oakland</td>
</tr>
<tr>
<td></td>
<td>Caltrain/Peninsula Corridor Joint Powers Board (PCJPB)</td>
<td>San Francisco to San Jose to Gilroy</td>
</tr>
<tr>
<td>Rapid Rail</td>
<td>Bay Area Rapid Transit (BART)</td>
<td>Pittsburg-Bay Point/Richmond/Dublin-Pleasanton/SFO-Millbrae via San Francisco to Fremont</td>
</tr>
<tr>
<td></td>
<td>Alameda - Contra Costa Transit District (AC Transit)</td>
<td>Alameda and Contra Costa Counties Transbay service between East Bay and San Francisco</td>
</tr>
<tr>
<td></td>
<td>Dumbarton Express</td>
<td>Union City to Palo Alto via Dumbarton Bridge</td>
</tr>
<tr>
<td></td>
<td>SamTrans</td>
<td>San Mateo County</td>
</tr>
<tr>
<td></td>
<td>Santa Clara Valley Transit Authority (VTA)</td>
<td>Santa Clara County</td>
</tr>
<tr>
<td></td>
<td>Union City Transit</td>
<td>Union City</td>
</tr>
</tbody>
</table>

The Dumbarton Express bus service is currently the only transit service which provides transportation between the East Bay and the Peninsula by crossing the Bay. It is assumed that it will continue to operate should the DRC service be implemented.

More detailed descriptions of the rail services that operate in the DRC study area are presented below. This includes passenger and freight operations which will share tracks with DRC trains.

**Capitol Corridor Joint Powers Authority (CCJPA)/Capitol Corridor**

Commuter and intercity rail service between Sacramento and San Jose via Oakland over the UPRR-owned rail lines. The CCJPA presently operates eight (8) weekday passenger trains between Oakland and San Jose and 12 trains on weekends. Improvements are under construction at Newark and CP Coast to allow the CCJPA to operate 14 weekday trains (seven in each direction).

The stations served by CCJPA in the study area include:
- Oakland Coliseum
- Hayward
- Fremont/Centerville
- Great America
- San Jose
Figure 3-1: Passenger and Freight Rail Operations in Study Area

LEGEND:
- Red: Dumbarton (Proposed)
- Yellow: Caltrain
- Blue: ACE
- Green: Capital Corridor
- Black: Union Pacific
Altamont Commuter Express (ACE)
Commuter rail service between Stockton and San Jose over the UPRR-owned rail lines ACE presently operates six (6) weekday trains between Stockton and San Jose, with three morning rush-hour trains from Stockton to San Jose, and three afternoon rush-hour trains in the reverse direction. The trains operate on the Oakland Subdivision between Stockton and Niles Junction and on the Centerville Line of the Niles Subdivision between Nile Junction and Newark, with a stop at the Centerville/Fremont passenger station. The ACE trains operate on Track No. 1 on the Centerville Line. Newark to San Jose, the ACE trains operate on the Coast Subdivision with a station stop at Great America. ACE has the right to operate a fourth train to San Jose in the morning rush-hour and to Stockton in the evening rush-hour. There are no plans at present to add these trains.

The stations served by ACE in the study area include:
- Fremont/Centerville
- Great America
- San Jose

Peninsula Corridor Joint Powers Board (PCJPB)/Caltrain
Commuter rail service between San Francisco and Gilroy via San Jose. Caltrain currently operates 96 weekday trains between San Francisco and San Jose with limited service continuing on to Gilroy. The Baby Bullet express service operates between San Jose Diridon Station and San Francisco 4th & King Station, with four intermediate stops on the Caltrain-owned corridor. Caltrain also provides other service types including limited-stop and local-stop trains. Caltrain operates 32 local trains on Saturdays and 28 local trains on Sundays.

The 34 stations served by Caltrain include (listed from north to south):  
- San Francisco 4th & King
- 22nd Street
- Paul Avenue
- Bayshore
- So. San Francisco
- San Bruno
- Millbrae
- Broadway
- Burlingame
- San Mateo
- Hayward Park
- Bay Meadows
- Hillsdale
- Belmont
- San Carlos
- Redwood City
- Atherton
- Menlo Park
- Palo Alto
- Stanford
- California Avenue
- San Antonio
- Mountain View
- Sunnyvale
- Lawrence
- Santa Clara
- College Park
- San Jose Diridon
- Tamien
- Capitol
- Blossom Hill
- Morgan Hill
- San Martin
- Gilroy

Current Caltrain capital improvement projects include a new maintenance facility at Lenzen Yard (CEMOF), the San Bruno Grade Separation, and a new center island platform and pedestrian underpass at Santa Clara Station.

1. In August 2005 service at the Paul Avenue, Broadway, Bay Meadows, and Atherton stations was suspended due to low ridership and budget cuts, however, weekend service is still provided to Broadway and Atherton. The Stanford station is used for special events only. The Bay Meadows station will eventually be closed when the Hillsdale station is rebuilt.
Amtrak

Intercity rail service (Coast Starlight) between Seattle and Los Angeles via San Jose. Amtrak operates one daily round trip between Seattle, WA and Los Angeles, CA. These trains operate between Oakland and San Jose on the UPRR Coast Subdivision, with no intermediate stops. There are no plans at present to modify the existing operations.

The stations served by Amtrak include:
- Oakland,
- San Jose

Freight Operations

Union Pacific Railroad (UPRR) has a network of interconnected routes in Northern California that connects to the entire UPRR national system. The DRC study area comprises most of the southern Bay Area rail network. There are several different subdivisions in the area, carrying a variety of trains run by several operators and dispatchers. The UPRR subdivisions and lines in the DRC study area include:
- Niles Subdivision - Oakland to Niles Junction
- Oakland Subdivision - Melrose to Stockton
- Coast Subdivision - Elmhurst to Salinas
- Warm Springs Subdivision - Niles Junction to San Jose
- Centerville Line\(^2\) - Niles Junction to Newark Junction
- Dumbarton Line - Newark Junction to Redwood Junction
- Peninsula Line - San Francisco - Santa Clara

UPRR attempts to route the freight trains on the preferred routes but congestion on a particular route and train crew availability may require trains to operate on other routes. Table 3-2 presents a summary of a typical weekly schedule by UPRR on each of the rail segments in the study area.

Table 3-2: 2005 Weekly Union Pacific Railroad Operations

<table>
<thead>
<tr>
<th>Approximate Trains Per Week(^a)</th>
<th>Coast Subdivision Oakland to Newark</th>
<th>Coast Subdivision Newark to San Jose</th>
<th>Centerville Line Newark to Niles Jct.</th>
<th>Niles Subdivision Oakland to Niles Jct.</th>
<th>Warm Springs Sub Division Niles Jct to Warm Springs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>70</td>
<td>82</td>
<td>58</td>
<td>12</td>
<td>52</td>
</tr>
</tbody>
</table>

The UPRR has freight yards at Warm Springs and Newark that dispatch local freight trains to serve freight customers in the area.

\(^a\) These assumptions have been prepared by the Consultant Team and submitted to the UPRR for their review and comment. They are not confirmed, validated, or authorized in anyway by the UPRR at this time.

3.3 No-Build Alternative

For this study, a no-build alternative has been defined for each of the evaluation years: 2010 and 2030. Existing infrastructure is illustrated in Figure 3-2 and the operations in the DRC for existing and no-build scenarios are summarized below.

\(^2\) The Centerville Line is part of the Niles Subdivision, but for the purpose of this report is treated as a completely separate entity due to its important status in the simulation. The Niles Subdivision should be treated as ending at Niles Junction, with the Centerville Line continuing on to Newark Junction.
Figure 3-2: Existing Rail Infrastructure
2005

Existing operations in the study area are as follows:

- CCJPA – eight (8) trains per weekday, four (4) in each direction (between Oakland and San Jose) operating on:
  - Niles Subdivision between Oakland and Niles Junction
  - Centerville Line between Niles Junction and Newark
  - Coast Subdivision between Newark and San Jose
- ACE six (6) trains per day, three (3) trains in each direction, operating on:
  - Oakland Subdivision between Stockton and Niles Junction
  - Centerville Line between Niles Junction and Newark
  - Coast Subdivision between Newark and San Jose
- UPPR operates through train service and local service from freight yards to local customers

2010

The baseline scenario for 2010 includes capacity improvements outside the immediate area of the DRC that are proposed by the CCJPA.

This scenario assumes that the CCJPA will be operating 14 trains per day, 7 trains in each direction on the same routing as the 2005 operations. ACE will be operating eight (8) trains per day, four (4) trains in each direction on the same routing as the 2005 operations. It is assumed that the UP freight service will operate approximately 5% more than the 2005 operations.

2030

The baseline scenario for 2030 includes all capacity improvements outside the immediate area of the DRC as proposed by the CCJPA. There are no additional improvements beyond 2010.

This scenario assumes that the CCJPA will be operating 22 trains per day, 11 trains in each direction on the same routing as the 2005 operations. ACE will be operating eight (8) trains per day, four (4) trains in each direction on the same routing as the 2005 operations. The UPPR freight service may increase depending upon the additional capacity improvements at the Port of Oakland. The freight train patterns will be further developed in the study, but for this scenario the through freight train traffic is projected as a 20% increase from 2005. The local freight train service will remain at the present level.

3.4 Rail Alternative

The rail alternatives were developed first by establishing common assumptions about the DRC service, then determining which capital improvements to include. The primary distinction between the rail alternatives are the capital improvements, which were evaluated for cost and benefit to passenger and freight rail operations along the DRC. While the rail alternatives were modeled to examine their performance with regard to rail operations, the difference between these alternatives is nonexistent from a travel demand perspective. The travel time, stations served, station access/parking supply, and passenger fare would be the same across the different rail alternatives, which therefore would not yield different ridership forecasts for the individual alternatives. Vehicle technology and treatment of at-grade crossings are also constant amongst the alternatives. Although the addition of a 2nd Avenue station and Hayward station would likely result in a change in ridership, these are considered future stations and are not included in the rail alternatives.

3. These projected volumes are based on the latest consensus volumes agreed upon by the Northern California Rail Advisory Planning (NOCRAP) group. These train volumes can be supported by the identified plan for capital infrastructure in the corridor between Oakland and San Jose as agreed upon by the passenger operators and the UP. Additional volumes beyond those cited require additional capital improvements and operating agreements that have yet to be funded or approved.
Table 3-3 presents the different alternatives and a description of key features. All alternatives are a variation of the project description from the Project Study Report. The PSR alternative is the result of previous studies and discussions with the project stakeholders related to the implementation of rail service in the DRC.

Table 3-3: Summary of Dumbarton Rail Alternatives

<table>
<thead>
<tr>
<th>Alternative No.</th>
<th>Alternative Description</th>
<th>Key Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dumbarton Rail Corridor Project Study Report (DRC PSR)</td>
<td>— Accomplishes the full set of improvements proposed in the Project Study Report</td>
</tr>
<tr>
<td>2</td>
<td>DRC PSR without Niles Junction Connection</td>
<td>— Accomplishes most of the improvements proposed to improve passenger service in the project study report, without one element designed to serve freight service exclusively</td>
</tr>
<tr>
<td>3</td>
<td>DRC PSR with Additional Centerville Line Improvements</td>
<td>— Accomplishes the full set of improvements proposed in the Project Study Report.</td>
</tr>
<tr>
<td></td>
<td>— Triple Tracking</td>
<td>— May ease congestion and conflicts between passenger and freight traffic along the Centerville Line.</td>
</tr>
<tr>
<td></td>
<td>— Crossovers</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>DRC PSR with Additional Centerville Line Improvements and Dumbarton Line Double Tracking</td>
<td>— Accomplishes the full set of improvements proposed in the Project Study Report.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>— May ease congestion and conflicts between passenger and freight traffic along the Centerville Line.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>— May reduce delay on the Dumbarton Line.</td>
</tr>
<tr>
<td>5</td>
<td>DRC PSR with Relocation of UP from Coast Line to Warm Springs</td>
<td>— Accomplishes the full set of improvements proposed in the Project Study Report.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>— Potentially reduces freight traffic and conflicts along the Centerville Line and the Coast Subdivision</td>
</tr>
<tr>
<td>6</td>
<td>Passenger on Oakland Subdivision, from Melrose Junction, Freight on Niles Subdivision</td>
<td>— Accomplishes the full set of improvements proposed in the Project Study Report, except for the Industrial Parkway connection.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>— Separates passenger and freight traffic north of Niles Junction</td>
</tr>
</tbody>
</table>
3.4.1 Travel Demand

Before conducting travel forecasts of the bus and rail alternatives, an analysis of the travel demand model assumptions was conducted to develop expectations about ridership patterns. The intention was not to predict ridership before running the model; rather, analyses of socio-economic data, trip tables, and walk versus drive access to DRC stations was undertaken to provide a better overall understanding of the forecasts - as they were completed.

Travel model data was used from the most up-to-date Santa Clara VTA model forecasts for the Years 2010 and 2030. This model system includes the nine-county San Francisco Bay Area, three-County AMBAG region, plus San Joaquin County. Socio-economic data is from ABAG’s Projections 2003, and future year highway and transit networks are consistent with MTC’s 2004 Regional Transportation Plan.

The initial analysis of the VTA model assumptions yielded the following insights into expected DRC ridership patterns:

- Population and employment projections for the East Bay suggest that workers residing near the Willow Street station in Newark would be less likely to travel to jobs outside the area via the DRC service given that there are many more jobs than workers close to home. On the other hand, the areas surrounding the Union City and Fremont Centerville stations have greater potential for attracting workers to use the DRC service for commute trips.

- Population and employment projections for the Peninsula suggest that the area surrounding the Willow Road station in Menlo Park has significantly more jobs than workers residing near the station and would likely attract workers to the area that would use the DRC service. The 2nd
Avenue station area has more workers than jobs and has the potential to attract workers that would use the DRC service to commute to jobs along the Caltrain line.

- DRC service cannot assume feasibility based solely on walk access to or walk egress from the stations. Many DRC patrons will require drive access to DRC stations, and some will transfer to other modes on the egress end of a trip to arrive at their destinations. The drive access market is approximately ten times the walk access market.

- It is projected that over the 30-year time horizon, traffic congestion on the Dumbarton Bridge (Hwy 84) and major north-south arteries on the Peninsula and East Bay will be congested throughout the three-hour AM commute period. Travel times provided by the DRC service will make it a more attractive travel mode as highway congestion increases. However, the challenge for patrons to complete the “last mile” of their trip from the station to their destination will still exist and can decrease the attractiveness of DRC service if transfers to other modes are not convenient.

- While DRC service will be attractive to peak-direction (east-to-west in the morning) commuters, it will be less attractive to other markets, such as non-work travelers and reverse-direction commuters.

3.4.2 Service
The proposed DRC service consists of six daily westbound trains that begin service in the morning at the Union City Intermodal Station and converge with the existing Caltrain line on the West Bay. From the Caltrain line, half of the trains travel north to San Francisco, while the other three trains head south to San Jose. During the afternoon peak, all trains travel eastbound back to Union City. There are no planned reverse commute direction trains, or midday or night service trains in either direction. Travel demand analyses of both commute and reverse commute direction travel patterns were conducted and predicted that demand for reverse commute service would be significantly lower than that of the commute direction.

It is assumed that the existing Dumbarton Express bus service would continue to run while the DRC service is in operation. The Dumbarton Express could potentially be modified to provide feeder service, reverse commute, or off peak service when the DRC is not operating.

3.4.3 Stations
There are four proposed, primary DRC stations:
- Union City Intermodal Station
- Fremont Centerville Station
- Willow Street Station in Newark, and
- Willow Road in Menlo Park.

Additionally, future station locations at the Hayward BART Station and 2nd Avenue in San Mateo County near Redwood City are still being considered.

In all, a total of 25 stations were analyzed for travel demand purposes: five (5) stations along the DRC and 20 that are part of the current Caltrain system. These stations are summarized below:

Dumbarton Line: Union City Intermodal Station, Fremont Centerville, Willow Street in Newark, Willow Road in Menlo Park, and 2nd Avenue in San Mateo County
Caltrain North: Redwood City, San Carlos, Belmont, Hillsdale, Hayward Park, San Mateo, Burlingame, Broadway, Millbrae, San Francisco (4th and King)
Caltrain South: Atherton, Menlo Park, Palo Alto, California Ave, San Antonio, Mountain View, Sunnyvale, Lawrence, Santa Clara, San Jose
The 2nd Avenue (near Redwood City) and Hayward stations are not included in the alternatives, but could be added to the DRC in the future if operating and capital costs can be justified by ridership gains and other benefits. The 2nd Avenue station would be located about 1/4 mile east of the Redwood Junction wye, where the Dumbarton line connects with the Caltrain mainline. The travel demand analysis in this study showed that the 2nd Avenue station would most likely be used by persons within walking distance of the station with destinations along the Caltrain line. Preliminary analysis estimates that 1,200 riders would use the 2nd Avenue station daily by the year 2030.

DRC service to a station adjacent to the existing Hayward BART station would require an extension from the Union City terminus north along the Oakland subdivision and BART line. It would allow DRC passengers to board trains in Hayward instead of having to transfer from BART to DRC in Union City or drive to the Union City station. This new station would only be served by DRC service, as Capitol Corridor trains run on the Niles Subdivision. The Hayward DRC station would also have no relation to the Hayward Capitol Corridor station, which would most likely be closed when the Union City station is reconstructed to accommodate DRC and Capitol Corridor. Preliminary travel demand analysis showed that an extension to Hayward has the potential to attract more passengers to the DRC service. A study conducted for the City of Hayward in 2002 estimated a net gain of 460 transit riders in the corridor with such an extension.

3.4.4 Vehicle Technology

For the DRC PSR, it was assumed that DRC train locomotives would be powered using diesel-electric locomotives, the same technology that is currently being used by the Caltrain system in addition to conventional diesel locomotives. In June 2004, a technical memorandum was prepared which summarized the different rail technology options that were reviewed for operation on the DRC. It was assumed that the technologies reviewed would be capable of “push-pull” operations, allowing DRC trains to operate in both directions. This would eliminate the need to de-couple a locomotive from one end of train once it reaches its terminus.

The three rail technologies reviewed for DRC operations were:
- Diesel electric locomotives
- Equipment with electric locomotives
- Equipment with dual mode locomotives

Based on the review of the three technologies, it was determined that the electric power and dual mode options would not be feasible for start-up service in the DRC and were not further considered. However, it should be noted that future conversion to these or other technologies are not precluded.

3.4.5 Grade Crossings

There are 23 existing street/railroad, at-grade crossings along the proposed Dumbarton Rail Corridor. Eight (8) of these grade crossings are on the West Bay alignment, while the other 15 are in the East Bay, as listed in Table 3-4.

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While the impact on all grade crossings will be evaluated in detail in Environmental Phase 2, a preliminary analysis of grade crossings and the impact of initial implementation of DRC service was conducted for 2010. Only grade crossings on the Dumbarton Line from Redwood Junction to Union City were considered in the analysis presented herein. The purpose of this analysis was to identify grade separations that may be desirable to have in place as service is initiated in 2010. Since no project funding has been identified to date for grade separations in the 2010 timeframe, this analysis could be used in part to help secure funding for such improvements.

The tool used for analyzing grade separations was the California Public Utilities Commission (PUC) formula for crossings nominated for separation or elimination (provided by SMCTA). For this exercise, the most critical variables in analysis of grade separations were assumed to be the average 24-hour vehicular volume (V) and the average 24-hour train volume (T). Vehicular traffic volumes were only available for major intersections, and therefore the analysis was conducted for major crossings only. In subsequent analysis in the Environmental Phase 2 and other studies, all variables, including additional factors like cost, inflation, and special conditions, will need to be considered to objectively evaluate and compare DRC grade crossings. At that time, accident history data and factors related to each individual crossing should also be evaluated.

Table 3.5 on the next page illustrates the train and vehicular volumes at grade crossings.
Table 3-5: Train and Vehicular Volumes at Grade Crossings in Study Area

<table>
<thead>
<tr>
<th>Location</th>
<th>2010 Weekly Vehicular Traffic (V)</th>
<th>2010 Weekday Train Volumes (T)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marsh Road</td>
<td>29,930</td>
<td>12</td>
</tr>
<tr>
<td>Willow Road</td>
<td>41,190</td>
<td>12</td>
</tr>
<tr>
<td>University Avenue</td>
<td>25,580</td>
<td>12</td>
</tr>
<tr>
<td>Willow Street</td>
<td>9,400</td>
<td>12</td>
</tr>
<tr>
<td>Cherry Street</td>
<td>12,480</td>
<td>43</td>
</tr>
<tr>
<td>Cedar Boulevard</td>
<td>19,070</td>
<td>43</td>
</tr>
<tr>
<td>Blacow Road</td>
<td>15,940</td>
<td>43</td>
</tr>
<tr>
<td>Fremont Boulevard</td>
<td>28,780</td>
<td>43</td>
</tr>
<tr>
<td>Decoto Road</td>
<td>44,940</td>
<td>26</td>
</tr>
<tr>
<td>Whipple Street</td>
<td>28,270</td>
<td>26</td>
</tr>
</tbody>
</table>

Priority locations that appear to warrant consideration and further investigation in subsequent analyses for grade separations are as follows:

- Menlo Park:
  - Willow Road
- Newark:
  - Cherry Street
  - Cedar Boulevard
- Fremont:
  - Blacow Road
  - Fremont Boulevard
- Union City:
  - Decoto Road
  - Whipple Street

It should be noted that implementation of any grade separations in 2010 will add to the project cost and are not currently funded.

3.4.6 Capital Improvements

The DRC Project will introduce a package of capital improvements to the southern Bay Area rail network to accommodate its new cross-bay service. The build alternatives assume a number of common improvements, some of which are not directly related to the DRC Project.

Non-DRC Capital Improvements

Even without the capital improvements planned for the DRC Project, the East Bay railroad network will see a host of projects between 2005 and 2030. These improvements are needed to support planned expansions of Capitol Corridor and Caltrain service in the coming years. As shown in Table 3-6, the non-DRC capital improvements, including unfunded improvements in 2030, are included in all no-build and build scenarios. This gives an accurate representation of the future rail network apart from the improvements planned to implement DRC service.
Table 3-6: Non-DRC Capital Improvements

<table>
<thead>
<tr>
<th>2005-2010 (programmed and funded)</th>
<th>2030 (not programmed or funded)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCJPA/Capitol Corridor</td>
<td>CCJPA/Capitol Corridor</td>
</tr>
<tr>
<td>Centralized Traffic Control between Oakland - Jack London and Elmhurst (2005)</td>
<td>Second main track linking the South Newark and Albrae sidings</td>
</tr>
<tr>
<td>Crossovers and depot track at Coliseum (2005)</td>
<td>Second main track between CP Coast (Santa Clara) and Great America</td>
</tr>
<tr>
<td>Controlled siding and tail track at Newark (2006)</td>
<td>Access to Great America station from both main tracks</td>
</tr>
<tr>
<td>Second main track between Newark and Albrae (2010)</td>
<td></td>
</tr>
<tr>
<td>Controlled siding at Newhall yard (2006)</td>
<td></td>
</tr>
<tr>
<td>PCJPB/Caltrain</td>
<td>CCJPA/Capitol Corridor</td>
</tr>
<tr>
<td>Second main track between Tamien and Lick (2005)</td>
<td></td>
</tr>
<tr>
<td>Second main track between Coyote and MP 67 (by 2010)</td>
<td></td>
</tr>
<tr>
<td>Extension of the siding at Morgan Hill (by 2010)</td>
<td></td>
</tr>
<tr>
<td>New crossover at Coyote (by 2010)</td>
<td></td>
</tr>
</tbody>
</table>

DRC Improvements Common to All Build Alternatives

All rail alternatives analyzed in this study include a set of common improvements needed to implement DRC service. These improvements, including stations, new connections and track improvements, are listed below and illustrated in Figure 3-3.

**Stations**

- **Union City Station** - This new station, to be located on the Oakland Subdivision adjacent to the current Union City BART station, would allow for transfers between Capitol Corridor, DRC, and BART trains.
- **Newark Station** - A new station on the Dumbarton Line at Willow Street in Newark. It would be served by DRC trains only.
- **Menlo Park Station** - A new station on the Dumbarton Line at Willow Road in Menlo Park. It would be served by DRC trains only.

**Connections**

- **Industrial Parkway Connection** - A new connection near Industrial Parkway in Hayward where the Oakland and Niles subdivisions cross. This new connection would allow trains to switch between the subdivisions, as the current grade separation does not allow such movements. One purpose of this connection would be to allow Capitol Corridor trains to switch from the Niles to the Oakland Subdivision here, bringing Capitol Corridor service to the planned Union City Station. It would also allow Union Pacific freight trains to switch between the Niles and Oakland subdivisions, but the UPPR does not currently plan to use this capability.
- **Shinn Connection** - This connection to the south of the Union City station would allow trains to switch between the Oakland Subdivision and the Centerville Line. It would leave the Oakland Subdivision just before it reaches the former yard at Fremont, pass beneath the BART embankment in a new structure, and connect to the Centerville Line west of Niles Junction. This would allow a connection between the Union City and Centerville stations for planned DRC and Capitol Corridor service.
Figure 3-3: DRC Capital Improvements
− **Niles Junction Connection** - A new connection at Niles Junction would allow freight train movements between the Niles Subdivision and the Oakland Subdivision east through the Niles Canyon. The connection would require the construction of bridges over Alameda Creek and Mission Boulevard.

**Track Improvements**

− **DRC Train Storage Yard** - A new layover yard would be constructed to allow for the storage of DRC trains when not in service. Two locations are currently being considered for the yard. The first is north of the Union City station at Whipple Road. The second is along the new Shinn Connection between the Oakland Subdivision and Centerville Line. An additional track may be required to connect the yard to the Union City station.

− **Rehabilitation of Dumbarton Railroad Bridge and Approach Spans** - These structures will undergo substantial reconstruction, including the complete replacement of the swing bridge across San Francisco Bay.

− **Dumbarton Line Track Replacement** - The rail on the Dumbarton Line will be replaced with new, continuously welded track. The improved Dumbarton Line will be able to support passenger trains speeds up to 79 miles per hour.

− **Centerville Triple Tracking** - The Centerville Line west of the Niles Subdivision is a double track main line. Triple-tracking would involve adding a third track so that freight trains could bypass passenger trains stopped at the Fremont Centerville station. In general, it would increase the capacity of the Centerville Line.

− **Redwood Junction Upgrade** - The tracks at Redwood Junction, where the Dumbarton Line connects to the Caltrain mainline, would be upgraded to better accommodate both DRC and Caltrain trains. Consultations with Caltrain indicate that capital improvements at Redwood Junction could facilitate integration of DRC trains with the core Caltrain San Francisco-to-San Jose service. Potential improvements may include an extension of the West Control Siding of the Peninsula Line. (See Appendix B for analysis and drawings of the Redwood Junction Upgrade; see Appendix E for detailed capital costs.)

− **Newark Junction Upgrade** - Track improvements would be constructed to facilitate DRC trains switching from the Centerville to the Dumbarton Line. They would include new turnouts and track realignment for the north leg of the wye track from the Centerville Line to the Coast Subdivision and the south leg of the wye track from the Coast Subdivision to the Dumbarton Line.

− **Mulford Siding** - This new siding at Mulford yard would allow through trains to bypass local switching yard operations on the Coast Subdivision, instead of having to use the Niles Subdivision and Centerville Line.

− **Other Sidings, Switches, and Crossovers** - Along with the larger improvements listed above, there are several smaller improvements included with the DRC capital improvements. The 2004 DRC PSR provides a more detailed listing of these improvements.

### 3.4.7 Screening Results

Using the evaluation criteria presented in Section 1.2.3, decisions to eliminate or consolidate the rail alternatives for analysis were based on the following factors:

− **Institutional Compatibility** - Projects that supported or did not conflict with the core business mission or optimal operation of a particular train service with the priorities of an implementation partner were retained.

− **Safety** - Alternatives that posed significant safety hazards were eliminated.

− **Cost Effectiveness** - Alternatives which were anticipated to have significant negative impacts to cost effectiveness were eliminated.

Table 3-7 on the following page presents the original nine alternatives and the screening results.
### Table 3-7: Summary of 1st Level Screening for Dumbarton Rail Alternatives

<table>
<thead>
<tr>
<th>Alternative No.</th>
<th>Alternative Description</th>
<th>Implementation Issues</th>
<th>Screening Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dumbarton Rail Corridor Project Study Report (DRC PSR)</td>
<td>May have additional congestion between passenger and freight traffic on the Oakland Subdivision</td>
<td>Carried forward</td>
</tr>
<tr>
<td>2</td>
<td>DRC PSR without Niles Junction Connection</td>
<td></td>
<td>Carried forward</td>
</tr>
<tr>
<td>3</td>
<td>DRC PSR with Additional Centerville Line Improvements</td>
<td>Requires additional cost and right-of-way acquisition</td>
<td>Carried forward</td>
</tr>
<tr>
<td>4</td>
<td>DRC PSR with Additional Centerville Line Improvements and Dumbarton Line Double Tracking</td>
<td>Significant additional capital infrastructure investment required. Potentially expands impacts to sensitive wetlands.</td>
<td>Carried forward -- Will be incorporated into the analysis for Alternative 3, if simulations warrant double tracking along the Dumbarton Line.</td>
</tr>
<tr>
<td>5</td>
<td>DRC PSR with Relocation of UP from Coast Line to Warm Springs</td>
<td>Safety hazards and high density of crossings and housing along the Warm Springs Subdivision slow down freight operation and create significant community impacts</td>
<td>Eliminated -- Safety Concerns and Institutional Incompatibility</td>
</tr>
<tr>
<td>6</td>
<td>Passenger on Oakland Subdivision, from Melrose Junction, Freight on Niles Subdivision</td>
<td>Safety hazards for Capitol Corridor trains due to limited visibility adjacent to columns supporting the BART viaduct along the Oakland Subdivision Precludes the use of the new Coliseum Station of the Capitol Corridor</td>
<td>Eliminated -- Safety Concerns and Institutional Incompatibility</td>
</tr>
<tr>
<td>7</td>
<td>Passenger on Oakland Subdivision from San Leandro, Freight on Niles Subdivision</td>
<td>Safety hazards for Capitol Corridor trains due to limited visibility adjacent to columns supporting the BART viaduct along the Oakland Subdivision</td>
<td>Eliminated -- Safety Concerns and Institutional Incompatibility</td>
</tr>
<tr>
<td>8</td>
<td>DRC PSR with Dumbarton to San Francisco Only</td>
<td>May reduce ridership due to lack of service to one half of the projected market, reducing cost effectiveness.</td>
<td>Eliminated -- Adverse Impacts to Cost Effectiveness Ridership impacts will be analyzed as part of Alternative 1.</td>
</tr>
<tr>
<td>9</td>
<td>DRC PSR with CCJPA Service to Palo Alto</td>
<td>Does not conform to the medium-term Capital Corridor business mission</td>
<td>Eliminated -- Institutional Incompatibility</td>
</tr>
</tbody>
</table>
The initial screening eliminated many of the nine build alternatives for further analysis. Alternatives 1 and 2 were carried forward, and Alternative 3 was carried forward, but with two variations:

1. Triple tracking of the Centerville Line in addition to the other improvements included in the PSR alternative; and
2. Triple tracking of the Centerville Line and a flyover (or trench) separating tracks at Newark Junction.

Alternative 3 and its variations were included in the list of finalist alternatives due to ongoing meetings with the UPRR. UPRR officials wanted consideration given to infrastructure improvements provided by the variations in Alternative 3.

Accordingly, four alternatives were developed as finalist alternatives for further evaluation in the Alternatives Analysis (second level screening), and are listed in order of escalating capital improvements required:

- **Alternative A, DRC PSR without Niles Junction (formerly Alternative 2),** which accomplishes all of the improvements proposed to improve passenger service in the PSR minus one element designed to serve freight service exclusively; (see Figure 4-1);
- **Alternative B, DRC PSR Alternative (formerly Alternative 1),** which accomplishes the full set of improvements proposed in the PSR (see Figure 4-2);
- **Alternative C, DRC PSR with Centerville Improvements (formerly Alternative 3),** which accomplishes the full set of improvements proposed in the PSR and could potentially ease congestion and conflicts between passenger and freight traffic along the Centerville Line (see Figure 4-3); and
- **Alternative D, DRC PSR with Centerville Improvements and additional Newark Junction Improvements (flyover),** as suggested by the UPRR (see Figure 4-4).

### 3.5 Bus Alternative

Six bus alternatives were developed and evaluated prior to establishing a final bus alternative to be compared with the no-build and rail alternatives in Environmental Phase 2. Each potential bus alternative represents a transportation alternative to rail along the DRC without the need for constructing a new transit guideway or requiring major capital improvements or right-of-way acquisitions. The bus options were identified to be compatible with the basic intent of the Baseline Alternative (i.e., the best that can be done without major investment in the corridor), and will be evaluated as required by the National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA) for the preparation of an Environmental Impact Statement (EIS) and Report (EIR), respectively. The bus alternatives are not aimed at exactly paralleling the rail alignment, but rather they strive to serve similar markets as rail by either enhancing the existing Dumbarton Bus (DB) service or adding an additional bus route between the East Bay and the Peninsula along the DRC. Table 3-8 shows the different bus alternatives and their key features.

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5. It is assumed that the DRC will not be applying for Federal Transit Administration’s (FTA) New Start’s funding; therefore, the preferred bus alternative was not developed to satisfy the FTA New Starts funding criteria. However, the alternative was developed to meet the requirements of the Baseline Alternative for a NEPA and CEQA EIS/EIR, respectively.
3.5.1 Screening Results

Based on the initial screening of the bus alternatives, Alternatives 3 and 5 were combined with the existing DB/DB1 service and studied further as part of the Alternatives Analysis. Alternatives 3 and 5 were chosen because they both connect unique, unserved markets that have a compelling number of potentially intercepted trips. Alternative 3 was developed to serve major employment centers at the San Francisco Airport, in Millbrae, Brisbane, and Oyster Point. Alternative 5 was developed to serve employment areas of Menlo Park and Redwood City by providing a bus route the Redwood Shores area by way of Menlo Park. The two alternatives are complementary rather than competitive, and they would both complement the existing DB/DB1 service in terms of proposed and markets served both along the Peninsula and in the East Bay. The combined bus alternative was carried forward in the Alternatives Analysis (second level screening) and is discussed in Section 4.0.

Table 3-8: Summary of Dumbarton Bus Alternatives

<table>
<thead>
<tr>
<th>Alternative No.</th>
<th>Route Description</th>
<th>Route Length (Miles)</th>
<th>One-Way Travel Time (Min.)</th>
<th>Key Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Enhanced DB service along existing alignment (Union City BART to Palo Alto via Decoto Road)</td>
<td>20</td>
<td>40-56</td>
<td>Increase existing frequency &amp; add prioritization</td>
</tr>
<tr>
<td>2</td>
<td>Union City BART to Redwood City Caltrain parallel to rail corridor</td>
<td>20</td>
<td>31-52</td>
<td>HOV usage at Dumbarton Toll; add prioritization in East Bay</td>
</tr>
<tr>
<td>3</td>
<td>Union City BART to Burlingame via Union City and Oyster Point</td>
<td>42</td>
<td>70-107</td>
<td>HOV usage at Dumbarton Toll and along U.S. 101 (in Mobility 2030); prioritization in East Bay; BART &amp; Caltrain transfer at Millbrae</td>
</tr>
<tr>
<td>4</td>
<td>Union City BART to Mountain View Caltrain/LRT via south Fremont</td>
<td>35</td>
<td>59-80</td>
<td>HOV usage at Dumbarton toll &amp; along U.S. 101; connection to Tasman LRT &amp; Caltrain for travel to Golden Triangle &amp; San Jose</td>
</tr>
<tr>
<td>5</td>
<td>Union City BART to Redwood Shores via Central Fremont</td>
<td>35</td>
<td>75-108</td>
<td>Highest O-D volumes of all alternatives; HOV usage at Dumbarton toll; prioritization in East Bay</td>
</tr>
<tr>
<td>6</td>
<td>Union City BART to Palo Alto via Central Fremont</td>
<td>31</td>
<td>73-104</td>
<td>Similar to DB/DB1 service with optimized East Bay routing; add prioritization &amp; increase existing frequency</td>
</tr>
</tbody>
</table>
4.0

EVALUATION OF ALTERNATIVES
4.0 EVALUATION OF ALTERNATIVES

4.1 Introduction
As described in Section 3.0, the first level screening analysis identified four rail alternatives and two bus alternatives for further evaluation and consideration. This section defines the alternatives in more detail and identifies the most feasible alternative to carry forward for the Environmental Phase 2 Study.

4.2 Rail Alternatives
There are four build alternatives that were carried forward from the initial screening that include a common set of capital improvements and represent increasing levels of investments between Niles Junction (to the east) and Newark Junction (to the west) along the Centerville Line. Capital costs vary amongst the alternatives (see Section 4.5), while operating and maintenance costs and travel demand remain the same.

The four build alternatives are ordered based on level of capital improvement and investment (least to most) and are described and illustrated in Figures 4-1 through 4-4:

| Alternative A | PSR without Niles Junction |
| Alternative B | PSR                      |
| Alternative C | PSR with Centerville Triple Track |
| Alternative D | PSR with Centerville Triple Track and Newark Grade Separation |
4.2.1 Alternative A: PSR without Niles Connection

Alternative A involves the lowest level of capital investment of the four build alternatives. This alternative includes most of the improvements specified in the 2004 DRC PSR, plus additional improvements at Redwood Junction. This alternative, however, does not include the connection at Niles Junction, so the impact of the Niles Connection could be analyzed by comparing it to Alternative B, which does include the connection. The improvements planned for Alternative A correspond to the common improvements for the corridor discussed in Section 3.4.6, as shown in Figure 4-1 below.

**Figure 4-1: Alternative A**

![Diagram of Alternative A](image-url)
4.2.2 Alternative B: PSR

Alternative B represents all of the improvements recommended in the PSR, plus additional improvements at Redwood Junction. This alternative includes all of the improvements found in Alternative A, as well as a new connection at Niles Junction. Figure 4-2 shows the track improvements planned for Alternative B, including the Niles Connection in green (red represents the common East Bay improvements).

Figure 4-2: Alternative B
4.2.3 Alternative C: PSR with Centerville Triple Track

Alternative C builds on the improvements of Alternative B by including a third track on the Centerville Line. This alternative includes all of the proposed improvements from the PSR plus Redwood Junction improvements, along with a proposed third track for the entire Centerville Line, as presented in green in Figure 4-3 (red represents common DRC, Alt A and Alt B improvements). This third track would be for the exclusive use of UP freight trains. Alternative C would attempt to alleviate congestion on this stretch that would carry all four of the major services (Capital Corridor, ACE, DRC, and UP) that would operate through the area.

Figure 4-3: Alternative C
4.2.4 Alternative D: PSR with Centerville Triple Track and Newark Grade Separation

Alternative D represents the highest proposed level of investment for the Centerville area. This alternative includes all of the improvements listed in the PSR plus Redwood Junction improvements, the Centerville triple-track segment described in Alternative C, and a new, grade-separated track at Newark Junction, as presented in green in Figure 4-4 (red represents common DRC, Alt A, Alt B and Alt C improvements). The Newark Grade Separation would completely separate DRC trains from the Coast Subdivision. The grade separation, in addition to the third track along the Centerville Line and the Shinn Connection, would segregate DRC trains from UP freight trains.

**Figure 4-4: Alternative D**
4.3 Bus Alternative

4.3.1 2010 Bus Alternative

The year 2010 bus alternative was developed as a stand-alone project that could also serve as a partial implementation of an ultimate 2030 bus alternative. Both the 2010 and 2030 bus alternative alignments are shown in Figure 4-5.

Figure 4-5: Bus Alternative Alignments

![Bus Alternative Alignments Map]

The year 2010 development process focused on travel markets that were found to be viable and feasibly served in the 2030 bus alternative - this includes services to the Millbrae/Oyster Point/Brisbane area and the Redwood Shores/Foster City area. These two service destinations were further analyzed to assess their feasibility for the 2010 scenario, with the following observations obtained:

- The travel market from the East Bay study area to Redwood Shores/Foster City is currently more established and mature than the Millbrae/Oyster Point/Brisbane market, and will continue to be the case in 2010.
- The Redwood Shores area is a bigger travel market from the East Bay study area than Foster City, and provides an opportunity for the largest potential ridership with a startup service.
- Southern portions of the East Bay study area have larger existing employment bases than the northern portion.
- HOV lanes exist on US101 as far north as Redwood City, so the 2010 bus route would accrue travel time savings based on an existing facility.

Overall, service through the southern portion of the East Bay study area to Redwood Shores, coupled with the existing DB/DBI service, provides the best all-around opportunities for the 2010 bus alternative. This route is essentially a truncated version of Alternative 5 from the 2030 bus alternative. The 2010
bus alternative could serve as an initial start-up phase with the ability to eventually expand to the ultimate 2030 scenario.

Alignment Description
The specific alignments for the bus route in the 2010 bus alternative were refined from the original suggestions to improve running time and better serve the top activity centers on each side of the bay. Based on these refinements, the recommended alignment is as follows:

- Alvarado-Niles Road from the Union City BART Station;
- Mission Boulevard(SR-238) to Walnut Avenue;
- Fremont Boulevard to Thornton Avenue, Jarvis Avenue, and the park-and-ride facility in Newark;
- SR-84, crossing over the Dumbarton Bridge;
- Bayfront Expressway, to Marsh Road and U.S. 101 North (mixed-flow lanes);
- Loop on Seaport Boulevard, and return to U.S. 101 (mixed-flow lanes); and
- A long loop on Redwood Shores Parkway.

Upgrades to the bus along this alignment would be in the form of transit priority at select locations where congestion is high during the peak commute time, including the following:

- Along SR-238, from south of Decoto Road/SR-84 to north of Niles Canyon Road;
- Along Fremont Boulevard from north of Mowry Avenue to south of Thornton Avenue;
- Along Jarvis Avenue, near SR-84;
- Along Bayfront Expressway from the Dumbarton Bridge to Willow Road; and
- U.S. 101 access near Redwood Shores.

These modified alignments for the East Bay and Peninsula are shown in Figure 4-6 and Figure 4-7.
Figure 4-6: Recommended 2010 Bus Alternative - East Bay Alignments and Stops

![Map of East Bay Alignments and Stops]

Sources: Cambridge Systematics, Inc., HNTB, Inc.; USGS; and ESRI, Inc.

Figure 4-7: Recommended 2010 Bus Alternative - Peninsula Alignments and Stops

![Map of Peninsula Alignments and Stops]

Sources: Cambridge Systematics, Inc., HNTB, Inc.; USGS; and ESRI, Inc.

**Bus Stop Locations**
The next step in detailing the 2010 bus alternative was to identify the most likely stop locations along the bus route. The main criteria for identifying these stops include:

- **Intermodal stations** - Stops along the bus route that were part of intermodal transit connections such as the Fremont Centerville Station, and the Union City BART Station were included.

- **Existing stops** - AC Transit, Union City Transit, and Santa Clara VTA have existing bus lines going through Fremont, Newark, and Union City. Bus stops along existing bus routes that shared a part of their alignment with the final preferred alternative were included.
Activity centers - Major activity centers along the final preferred alternative (i.e., Ardenwood park-and-ride station in Newark) along the final preferred alternative were included.

High Density Locations – Other high density clusters that could attract transit ridership such as residential neighborhoods, apartment complexes, and employment centers (i.e., Sun Microsystems in Newark and Menlo Park, and Oracle Corporation in Redwood Shores) along the alignment were also included.

4.3.2 2030 Bus Alternative

Based on results from the initial screening, the recommended bus alternative included a combination of slightly modified versions of previous alternatives. This recommendation entailed one bus route from the East Bay to Millbrae, Oyster Point, and Brisbane; and a second route from the East Bay to Redwood Shores and Foster City. The first route looped through the northern portion of the East Bay study area, while the second route looped through the southern portion of the East Bay study area. The two routes would join at the Ardenwood park-and-ride facility where a transfer point would be available between the two routes as well as with the existing DB/DB1 service. It is assumed that bus schedules would be coordinated so that all three East Bay markets (northern loop, southern loop, and direct route) would have options for connecting to all three Peninsula markets (Millbrae/Oyster Point/Brisbane, Redwood Shores/Foster City, and Palo Alto).

Alignment Description

The specific alignments for the two routes in the recommended 2030 bus alternative were refined from the original suggestions for Alternatives 3 and 5 in order to improve running time and better serve the top activity centers on each side of the bay. The specific refinements for the two routes are as follows:

Millbrae/Oyster Point/Brisbane Route

– Switch from Central Avenue and Whipple Road to Alvarado-Niles Road, Almaden Boulevard, and Valent Way. This refinement allows the bus to bypass the industrial development around Whipple Road and instead, provide a direct service to the residential areas along Alvarado-Niles Road and Almaden Boulevard.
– Switch from Whipple Road to Dyer Road in Union City to allow access to Union Landing Mall;
– Exit U.S. 101 North at the San Francisco International Airport exit instead of Oyster Point Boulevard to serve passengers going to the airport;
– Follow North McDonnell Road to South Airport Boulevard to serve the north side of San Francisco International Airport;
– Use a longer loop through Oyster Point; and
– Use a shorter loop through Brisbane.

Redwood Shores/Foster City Route

– Use Thornton Avenue and Jarvis Avenue instead of Newark Avenue to access the Ardenwood park-and-ride facility;
– Use a shorter loop on Seaport Blvd off of U.S. 101
– Use a longer loop through Redwood Shores
– Use a longer loop through Foster City.

These modified alignments are included in the updated alignment maps depicted in Figure 4-8 through Figure 4-10.
Figure 4-8: Recommended 2030 Bus Alternative – East Bay Alignments and Stops

Sources: Cambridge Systematics, Inc., HNTB, Inc.; USGS; and ESRI, Inc.

Figure 4-9:Recommended 2030 Bus Alternative - Peninsula (North) Alignments and Stops

Sources: Cambridge Systematics, Inc., HNTB, Inc.; USGS; and ESRI, Inc.
Bus Stop Locations
Similar to the methodology for the 2010 bus alternative, the next step in detailing the 2030 bus alternative was to identify the most likely stop locations along the two bus routes. The approximate locations of these potential bus stops are also displayed in Figures 4-8 through 4-10.

Conceptual Bus Operations Plan
The conceptual bus operations plan is driven by the periods of bus operations for the bus alternatives. The 2010 and 2030 bus alternatives were assumed to have the same time periods for bus operations. Service frequencies for the recommended bus alternative were set at 20 minutes for the AM and PM peaks, 30 minutes for the base, and 60 minutes in the evening. Average running speeds on each roadway segment were estimated as a function of roadway type, posted speed limit, bus service type (i.e., express or local), and existence of potential transit priority at key congested roadway locations. Typical dwell times and layover times were estimated and added to create total travel times. The estimated travel times were then combined with typical planning parameters to estimate order of magnitude fleet size, revenue vehicle miles, revenue vehicle hours, and operating cost for each route.

4.4 Travel Demand
Travel demand was estimated for the bus and rail alternatives for the years 2010 and 2030. The Santa Clara County Valley Transportation Authority (VTA) regional model, an enhanced version of the Metropolitan Transportation Commission (MTC) model was used to conduct travel forecasting. Inputs to the model included bus and train speeds, station locations, and schedules/operating plan information for the bus and rail alternatives. It is assumed that all proposed DRC stations will have park-and-ride lots. Future transit and highway improvements are assumed from the MTC financially constrained 2004 Regional Transportation Plan.

Although different rail operations alternatives were modeled, they had only a negligible impact on travel demand and transit ridership. Travel times, stations served, station access/parking supply, and passenger fares would be the same across the different rail operations alternatives, and therefore would yield identical ridership forecasts.
4.4.1 Rail

Years 2010 and 2030 Rail Alternative generates DRC ridership of 5,630 and 12,800 daily riders, respectively, as shown in Table 4-1 on the following page. Also presented is ridership by station for the Dumbarton line, and station groupings for existing Caltrain alignment. Daily station-level entries and exits for each of the DRC stations, as well as for the entire system, are also shown in the table.

Table 4-1: Years 2010 and 2030 Weekday Dumbarton Rail Service Station Entries and Exits

<table>
<thead>
<tr>
<th>DRC Station</th>
<th>2010</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Station/Group</td>
<td>System Total</td>
</tr>
<tr>
<td></td>
<td>Entries and Exits</td>
<td>Ridership</td>
</tr>
<tr>
<td>Union City BART</td>
<td>2,760</td>
<td>7,140</td>
</tr>
<tr>
<td>Centerville – Fremont Amtrak</td>
<td>1,150</td>
<td>1,490</td>
</tr>
<tr>
<td>Willow Street/ Newark</td>
<td>470</td>
<td>1,580</td>
</tr>
<tr>
<td>Willow Road/ Menlo Pk – Sun Microsystems</td>
<td>1,270</td>
<td>2,440</td>
</tr>
<tr>
<td>2nd Avenue/San Mateo County</td>
<td></td>
<td>1,200</td>
</tr>
<tr>
<td>Redwood City/ Hillsdale</td>
<td>1,250</td>
<td>3,900</td>
</tr>
<tr>
<td>San Mateo/ Millbrae/ South San Francisco</td>
<td>790</td>
<td>1,020</td>
</tr>
<tr>
<td>San Francisco</td>
<td>110</td>
<td>460</td>
</tr>
<tr>
<td>Menlo Park/ Palo Alto/California Avenue</td>
<td>2,150</td>
<td>5,350</td>
</tr>
<tr>
<td>Mountain View/ Santa Clara/ San Jose</td>
<td>1,310</td>
<td>1,040</td>
</tr>
<tr>
<td>Total Entries + Exits</td>
<td>11,260</td>
<td>25,600</td>
</tr>
<tr>
<td>Daily Boardings</td>
<td>5,630</td>
<td>12,800</td>
</tr>
</tbody>
</table>

In 2010, most riders live in the East Bay and travel to jobs on the Peninsula and South Bay. DRC ridership is strongest at the Union City BART Station, although each of the proposed new DRC stations has substantial riders. Approximately 400 of the East Bay DRC trips are forecasted travel to the Willow Road Station in Menlo Park. The remaining DRC riders have destinations up and down the Caltrain corridor, although DRC ridership is concentrated at the stations closest to the Dumbarton tracks – Redwood City and Menlo Park Stations have the highest numbers of DRC riders on the Caltrain lines, as does Mountain View. On the other hand, the San Francisco and Diridon stations have very low DRC ridership, indicating that the DRC may not be competitive with other, existing and planned transit services for those destinations.

In 2030, ridership is strongest at the Union City BART Station, although each of the proposed new DRC stations has substantial numbers of riders. Two-thirds of the morning DRC riders at the Willow Road-Sun Microsystems station in Menlo Park alight (i.e., use this station as their destination location), while only one-third board (i.e., travel to other station destinations along the Caltrain lines north and south). This is the only DRC station predicted to have more travelers alighting than boarding. No riders are predicted to travel only within the East Bay. Thus, of the 10,000+ daily station entries and exits for the three East Bay Stations combined, all are traveling transbay.

Average DRC trip lengths are projected to decline slightly from 19.4 miles in 2010 to 17.1 miles in 2030. Union City to Redwood City and Fremont to Mountain View are example trips that fall within the average trip lengths. It is likely that average trip lengths decline due to increased Year 2030 traffic congestion; DRC service becomes increasingly competitive for shorter distance commute trips over time.
The travel demand model assumed unconstrained parking for both 2010 and 2030. There will likely be a need for additional parking at the East Bay stations, which will warrant discussions and policy decisions in the future by local jurisdictions.

Table 4-2 shows rail and bus boardings for all transit services in the DRC corridor for 2010 and 2030. Although 2010 ridership does decline for the bus service, overall transit ridership nearly triples for the two systems combined. Also shown in Table 4-2 is the change in net new transit riders. Net new transit trips are riders who would have otherwise not used transit for their trips (e.g., an auto driver or passenger). In 2010 the rail alternative yields an increase in 2,000 net new transit trips - out of a total increase in 4,600 total boardings. In 2030, the rail alternative yields an increase in 5,600 net new transit trips - out of a total increase in 14,000 total boardings.

It is likely that much of the difference between the net new transit riders and transit boardings figures is mostly accounted by riders who switched from bus in the No-Project to DRC service in the Rail Alternative. See footnote 1, below, to distinguish net new transit trips, linked transit trips, and transit boardings.

### Table 4-2: Years 2010 and 2030 Total Weekday Transit Boardings – Services Across Dumbarton Bridge – and Linked Transit Trips

<table>
<thead>
<tr>
<th></th>
<th>2010</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Operator</strong></td>
<td>No-Build</td>
<td>Rail Alternative</td>
</tr>
<tr>
<td>Net New Transit Trips</td>
<td>--</td>
<td>2,000</td>
</tr>
<tr>
<td>Transit Boardings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dumbarton Rail</td>
<td>--</td>
<td>5,600</td>
</tr>
<tr>
<td>DB Express - (existing bus routes)</td>
<td>2,600</td>
<td>1,600</td>
</tr>
<tr>
<td>Total Boardings</td>
<td>2,600</td>
<td>7,200</td>
</tr>
<tr>
<td>Change in Transit Boardings (Unlinked Transit Trips)</td>
<td>4,600</td>
<td>12,200</td>
</tr>
</tbody>
</table>

In summary, DRC projected daily ridership is 5,600 in 2010 and 12,800 in 2030. For 2010, of the 5,600 DRC riders, approximately, 1,000 come from the DB Express (ridership declines from 2,600 to 1,600), 2,000 comes from persons formerly using autos (both drivers and passengers), and the remainder come from other transit services (BART, Caltrain, etc.). For 2030, of the 12,800 DRC, approximately 600 come from the DB Express, 5,600 comes from persons formerly using autos, and the remainder come from other transit services.

#### 4.4.2 Bus

The bus alternative consists of new services across the Dumbarton Bridge. The bus alternative definitions are discussed in detail in Section 4.3. The bus alternatives are not designed as rubber-wheel

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6. Linked transit trips are distinguished from unlinked transit trips, or boardings. A linked transit trip counts the entire trip from origin to destination as a single trip, while an unlinked transit trip counts each boarding needed to complete a trip from origin to destination. The practical difference between these two measures is unlinked transit trips include all transfers, while linked transit trips discount transfers.

Net new transit riders was a measure devised by the Federal Transit Administration for the New Starts program. Net new transit riders are calculated as the difference in linked transit trips in a build alternative compared to a no-build alternative. Net new transit trips, by definition, count the trips that use transit in the build alternative, but used auto in the no-build. In other words, net new transit riders are those that are forecast to switch to transit.

In the table above, net new transit trips is a significantly lower number than total transit boardings because the net new transit riders figure does not include the riders who switched from bus (in the No-Build) to rail (in the Rail Alternative).
versions of the proposed DRC service; the bus alternative is intended to be a separate stand-alone alternative.

Table 4-3 shows the forecasted new bus riders for Years 2010 and 2030. In 2010, the bus alternative results in an increase of 1,600 riders on services crossing the Dumbarton Bridge. Of these 1,600 new bus riders, 500 were formerly using automobiles. Ridership on the existing Dumbarton Express routes are forecast to decline only slightly by 100 daily boardings under the Bus Alternative.

Table 4-3: Years 2010 and 2030 Total Weekday Transit Boardings – Services Across Dumbarton Bridge – and Change in Linked Transit Trips

<table>
<thead>
<tr>
<th>Operator</th>
<th>2010</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No-Build</td>
<td>Bus Alternative</td>
</tr>
<tr>
<td>Dumbarton Rail</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>DB Express - (existing bus routes)</td>
<td>2,600</td>
<td>4,200</td>
</tr>
<tr>
<td>Total</td>
<td>2,600</td>
<td>4,200</td>
</tr>
<tr>
<td>Change in Total Boardings (Dumbarton Rail - DB Express)</td>
<td>1,600</td>
<td>3,200</td>
</tr>
<tr>
<td>Net New Transit Trips (Linked Trips)</td>
<td>500</td>
<td>3,100</td>
</tr>
</tbody>
</table>

In 2030, the bus alternative results in an increase of 3,200 riders on services crossing the Dumbarton Bridge, and 500 and 5,100 net new riders in 2010 and 2030, respectively.

No-Project Dumbarton bus ridership is substantially lower in 2030 than in 2010. While this result may seem counter-intuitive, the lower ridership figure is likely a result of a combination of factors. First, highway speeds are lower in 2030 due to increased congestion and this results in reduced bus speeds.

In addition, a number of transit service improvements come on-line after 2030, such as the BART extension to San Jose and Santa Clara. Transit service enhancements combined with lower operating speeds make the Dumbarton bus services relatively less competitive.

4.4.3 Travel Demand Summary

Table 4-4 summarizes the travel demand forecasts for the bus and rail alternatives. It is estimated that the DRC bus alternative will attract 4,200 and 5,000 daily boardings in 2010 and 2030, respectively, and the rail alternative will attract 5,600 and 12,800 daily boardings in 2010 and 2030, respectively. A key measurement of the attractiveness of an alternative is the number of net new boardings which represent riders that were not transit riders previously and may have otherwise traveled by private auto. It is estimated that the bus alternative will attract between 500 and 3,100 net new riders in 2010 and 2030, respectively, and the rail alternative will attract between 2,000 and 5,600 net new riders in 2010 and 2030, respectively.
Table 4-4: Travel Demand Forecasts for DRC Bus and Rail Alternatives (Daily)

<table>
<thead>
<tr>
<th></th>
<th>2010</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No Build</td>
<td>Bus</td>
</tr>
<tr>
<td>Boardings</td>
<td>2,600</td>
<td>4,200</td>
</tr>
<tr>
<td>Net New Boardings</td>
<td>0</td>
<td>500</td>
</tr>
</tbody>
</table>

1 = DB Express Bus (existing) service in the DRC.
2 = Decrease from 2010 is due to additional transit services not including DRC (e.g. BART to San Jose) expected to be operating in the region.
3 = Represent riders that were not transit riders previously and may have otherwise traveled by private auto.

4.5 Costs

4.5.1 Capital

Rail and bus capital costs are summarized in Table 4-5 and 4-6, respectively. These costs are in 2004 dollars. For consistency with previous study work performed in 2004, the costs were developed using the same unit costs, soft cost percentages and contingencies used in the PSR. (However, for rail Alternatives D-1 and D-2, which are the PSR Alternative - Newark Flyover and Trench Options, a slightly higher soft cost percentage was used for the grade separation portion of the estimate only to account for uncertainties in construction of rail-to-rail grade separations.)

It should be noted that all of the rail alternatives include track improvements at Redwood Junction that were not included in the 2004 PSR. These improvements were deemed necessary by Caltrain to effectively integrate Dumbarton rail service with Caltrain rail service. These improvements added $7.6 million to the capital costs and are reflected in the totals in Table 4-5.

For the bus alternative, order-of-magnitude capital costs were estimated for each alignment option using unit costs for the major elements that would be included in the construction and implementation of the proposed bus alternatives. Unit costs covered such items as vehicles, station and stop improvements, traffic and transit signals, and transit priority features (such as bus bulbs and queue jump lanes). These items were quantified from an assessment of existing bus stop and station facilities, 2010 and 2030 bus alignment definitions, and previously selected transit priority locations. Unit costs for transit improvements were aggregated and expressed on a cost per linear foot basis. Table 4-6 presents a summary of the bus capital costs.
<table>
<thead>
<tr>
<th>Item No.</th>
<th>Description</th>
<th>Total Estimated Cost ($ millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Alt A</td>
</tr>
<tr>
<td></td>
<td><a href="#">Description</a></td>
<td>PSR, w/o Niles</td>
</tr>
<tr>
<td>1</td>
<td>Reconstruct Existing Facilities</td>
<td>1.9</td>
</tr>
<tr>
<td>2</td>
<td>Civil Site Work</td>
<td>9.9</td>
</tr>
<tr>
<td>3</td>
<td>Structures</td>
<td>48.1</td>
</tr>
<tr>
<td>4</td>
<td>Stations</td>
<td>10.3</td>
</tr>
<tr>
<td>5</td>
<td>Trackwork</td>
<td>30.0</td>
</tr>
<tr>
<td>6</td>
<td>Signals and Communications</td>
<td>16.5</td>
</tr>
<tr>
<td>7</td>
<td>Construction Contingency</td>
<td>22.6</td>
</tr>
<tr>
<td>8</td>
<td>Engineering/Administration</td>
<td>44.6</td>
</tr>
<tr>
<td>9</td>
<td>Right-of-Way</td>
<td>43.3</td>
</tr>
<tr>
<td>10</td>
<td>Project Reserve</td>
<td>11.4</td>
</tr>
<tr>
<td></td>
<td><strong>Total Construction Costs</strong></td>
<td><strong>139.2</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Other Projects</strong></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Engineering/Administration</td>
<td>44.6</td>
</tr>
<tr>
<td>9</td>
<td>Right-of-Way</td>
<td>43.3</td>
</tr>
<tr>
<td>10</td>
<td>Project Reserve</td>
<td>11.4</td>
</tr>
<tr>
<td></td>
<td><strong>Total Other Project Costs</strong></td>
<td><strong>99.3</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Rolling Stock Purchase</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total Project Costs</strong></td>
<td><strong>293.7</strong></td>
</tr>
</tbody>
</table>

Note 1: PSR total now includes $7.6 million for Redwood Junction improvements, as compared to the original PSR that did not include these costs.

Note 2: Capital costs do not include additional cars (12) for 2030 scenario.
<table>
<thead>
<tr>
<th>No.</th>
<th>Classification</th>
<th>Itemized Capital Costs</th>
<th>Unit</th>
<th>Quant.</th>
<th>Itemized Costs</th>
<th>Unit Cost</th>
<th>Total Cost</th>
<th>Unit Cost</th>
<th>Total Cost</th>
<th>Unit Cost</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2010 Bus Alt</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2030 Bus Alt-1&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Stations</td>
<td>2030 Bus Alt-2&lt;sup&gt;g&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Transit Signal Priority</td>
<td>Cost of installing bus stations/stops</td>
<td>EA 21</td>
<td>$5,099</td>
<td>$108,000</td>
<td>25</td>
<td>$128,000</td>
<td>21</td>
<td>$108,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Vehicles</td>
<td>No. of standard buses required per vehicle</td>
<td>13</td>
<td>$330,000</td>
<td>0</td>
<td>$4,290,000</td>
<td>2</td>
<td>$330,000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Maintenance Base&lt;sup&gt;c&lt;/sup&gt;</td>
<td>No. of spare buses needed (15%) per vehicle</td>
<td>15</td>
<td>$439,059</td>
<td>0</td>
<td>$659,000</td>
<td>15</td>
<td>$439,059</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Contingency</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Soft Costs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total Cost</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>($12,223,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$13,701,000)</td>
</tr>
</tbody>
</table>

<sup>a</sup> Millbrae/Oyster Point/Brisbane Route
<sup>b</sup> Redwood Shores/Foster City Route
<sup>c</sup> It is assumed that no additional ROW will be acquired and that AC Transit's existing bus maintenance facilities will be used. The capital cost estimate accounts only for additional equipment or facilities needed to accommodate these buses.
4.5.2 Operating and Maintenance

Operating and maintenance (O&M) costs for the rail alternatives were based on the inputs derived from the 2004 PSR, Fiscal Year 2004 Actual Caltrain Operating Budget, and the FTA National Transit Database (NTD) data. O&M costs and revenue were developed for both 2010 and 2030 based on ridership forecasts and the operation of six weekday round trips. An average fare per passenger was assumed to be $2.30, which is an average of $2.43 for 2010 and $2.17 for 2030, based on the ridership forecasts. It is assumed that the DRC service will be an incremental addition to Caltrain service. For consistency purposes O&M costs were developed in 2004 dollars.

As shown in Table 4-7, it is estimated that the total O&M cost for the rail alternative will be $7.7 million and $9.1 in 2010 and 2030, respectively. The revenue recovery (primarily fares) is estimated to be $3.4 million (44%) and $7.6 million (83%) in 2010 and 2030, respectively. The relatively high revenue recovery ratio of 83% in 2030 is due to an increase of over 100% in riders and the associated additional fare revenues compared to 2010, with no change to the 2010 service plan or train miles.

Table 4-7: Conceptual Operating and Maintenance Costs for the Rail Alternatives

<table>
<thead>
<tr>
<th>Service Level</th>
<th>Unit Description</th>
<th>2010</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Units</td>
<td>Quantities</td>
<td>Total</td>
</tr>
<tr>
<td>Local Trips to San Francisco</td>
<td>Round Trips</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Local Trips to San Jose</td>
<td>Round Trips</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Total Weekday Round Trips</td>
<td>Round Trips</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Daily Train Miles</td>
<td>Union City/Hayward to SF</td>
<td>Train Miles per Round Trip</td>
<td>87.24</td>
</tr>
<tr>
<td>Daily Train Miles</td>
<td>Union City/Hayward to SJ</td>
<td>Train Miles per Round Trip</td>
<td>76.06</td>
</tr>
<tr>
<td>Total Daily Miles</td>
<td>Total Train Miles</td>
<td>490</td>
<td>490</td>
</tr>
<tr>
<td>Total Annual Miles</td>
<td>Train Miles per Day x Days per Year</td>
<td>490</td>
<td>250</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ridership</th>
<th>Unit Description</th>
<th>2010</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated Daily Ridership</td>
<td>Number of Boardings per Day</td>
<td>1</td>
<td>5,630</td>
</tr>
<tr>
<td>Total Annual Ridership</td>
<td>Passengers per Day x No. of Days</td>
<td>5,630</td>
<td>250</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Revenue Component</th>
<th>Unit Description</th>
<th>2010</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Fare</td>
<td>Average Fare per Passenger</td>
<td>$2.30</td>
<td>$2.30</td>
</tr>
<tr>
<td>Total Fare Revenue per Year</td>
<td>Average Fare X Total Annual Ridership</td>
<td>$2.30</td>
<td>$2.30</td>
</tr>
<tr>
<td>CCJPA Trackage Fees</td>
<td>Fee per Train Mile</td>
<td>$2.15</td>
<td>$2.15</td>
</tr>
<tr>
<td>Total Revenue</td>
<td></td>
<td>$2.15</td>
<td>$2.15</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cost Component</th>
<th>Unit Description</th>
<th>2010</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rail Operator Service</td>
<td>Average Cost per Train Mile</td>
<td>$4.891,183</td>
<td>$4.891,183</td>
</tr>
<tr>
<td>Fuel</td>
<td>Average Cost per Train Mile</td>
<td>$39.94</td>
<td>$39.94</td>
</tr>
<tr>
<td>Timetable &amp; Tickets</td>
<td>Average Cost per Train Mile</td>
<td>$0.24</td>
<td>$0.24</td>
</tr>
<tr>
<td>Insurance</td>
<td>Average Cost per Train Mile</td>
<td>$3.08</td>
<td>$3.08</td>
</tr>
<tr>
<td>JPB Facil &amp; Equip Maintenance</td>
<td>Average Cost per Train Mile</td>
<td>$0.66</td>
<td>$0.66</td>
</tr>
<tr>
<td>Utilities</td>
<td>Average Cost per Train Mile</td>
<td>$3.08</td>
<td>$3.08</td>
</tr>
<tr>
<td>Dumbarton &amp; Newark Sl Bridges</td>
<td>Lumpsum</td>
<td>$1,000,000</td>
<td>$1,000,000</td>
</tr>
<tr>
<td>UP Trackage Fees</td>
<td>Fee per Train Mile</td>
<td>$1.00</td>
<td>$1.00</td>
</tr>
<tr>
<td>Total Operating Cost</td>
<td></td>
<td>$6,309,251</td>
<td>$6,309,251</td>
</tr>
<tr>
<td>Administrative Wages &amp; Benefits</td>
<td>Average Cost per Train Mile</td>
<td>$0.60</td>
<td>$0.60</td>
</tr>
<tr>
<td>Other Administrative Costs</td>
<td>Average Cost per Train Mile</td>
<td>$3.18</td>
<td>$3.18</td>
</tr>
<tr>
<td>Train set lease</td>
<td>Trainset</td>
<td>$1,000,000</td>
<td>$1,000,000</td>
</tr>
<tr>
<td>Capital Maintenance Fund</td>
<td>Lumpsum</td>
<td>$1,400,000</td>
<td>$1,400,000</td>
</tr>
<tr>
<td>Total All Cost</td>
<td></td>
<td>$7,694,776</td>
<td>$7,694,776</td>
</tr>
<tr>
<td>O&amp;M cost shortfall</td>
<td></td>
<td>$4,323,553</td>
<td>$4,323,553</td>
</tr>
<tr>
<td>Revenue Recovery</td>
<td></td>
<td>$3,371,223</td>
<td>$3,371,223</td>
</tr>
</tbody>
</table>

For the bus alternative, O&M costs were determined based on conceptual operations. Service frequencies were set at 20 minutes for the AM and PM peaks, 30 minutes for the base, and 60 minutes in the evening. Average running speeds on each roadway segment were estimated as a function of roadway type, posted speed limit, bus service type (i.e., express or local), and existence of potential transit priority at key congested roadway locations. Typical dwell times and layover times were then estimated and added to create total travel times. The estimated travel times were then combined with...
typical planning parameters to estimate order-of-magnitude fleet size, revenue vehicle miles, revenue vehicle hours, and finally operating cost for each route. Similar to the rail alternative all O&M costs were developed in 2004 dollars. The O&M costs for the bus alternative are estimated to be $4.6 million in 2010 and $5.5 million (Millbrae/Oyster Point/Brisbane) and $5.8 million (Redwood Shores/Foster City) in 2030.

In summary, the O&M costs for the rail alternative are

<table>
<thead>
<tr>
<th>Alternative</th>
<th>2010</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rail</td>
<td>7.7</td>
<td>9.1</td>
</tr>
<tr>
<td>Bus</td>
<td>4.6</td>
<td>5.5</td>
</tr>
</tbody>
</table>

(Millbrae/Oyster Point/Brisbane) (Redwood Shores/Foster City)

### 4.6 Evaluation of Rail Alternatives

The primary difference amongst the rail alternatives is related to capital cost and train operating performance measures (e.g., train delay and running times) brought about by the reduction in congestion due to proposed DRC rail improvements. To measure the train operating performance, it was necessary to simulate train operations with a specialized train operations simulation model, Rail Traffic Controller (RTC). The model is not sensitive enough to calculate train performance indicators at a local level (e.g., just in the DRC). Rather, it estimates train performance over a larger regional network. For the purposes of this study, train performance was estimated for the East Bay network, including passenger and freight operations between Oakland and Salinas (on the Coast, Niles, and Oakland subdivisions) and on the Altamont Line. These networks incorporate operations where the proposed DRC service will operate in the East Bay.

Based on the rail simulation model analysis, it is estimated that there will be an almost 150% increase in total train delay hours/day (passenger and freight operations) on the Oakland –Salinas network between 2005 and 2030 without the DRC Project (no-build alternative). To accommodate the additional DRC trains on the network, the rail build alternatives were developed to maintain or improve the total train performance compared to the no-build alternative. Average train delay in 2030 for the various alternatives is shown in Figure 4-11. Table 4-9 summarizes the cost-benefit ratio for each alternative based on the incremental cost of a capital improvement compared to the incremental benefit (the reduction in average delay/train) associated with that capital improvement. Alternative A is compared to the No-build Alternative, Alternative B is compared to Alternative A, Alternative C is compared to Alternative B, and Alternative D is compared to Alternative C.
Alternative A represents the minimum investment ($293.7 million) required to have a DRC Project and the greatest incremental decrease in average reduction in delay/train (2.97 minutes). However compared to Alternatives B, C, and D, it does not provide any additional operating benefits of redistributing freight traffic from the Coast Subdivision to the Niles Subdivision and will result in a net increase in train volumes on the Centerville Line between Fremont and Newark. As shown in Table 4-9, Alternative B will result in the lowest cost-benefit ratio ($25.8/minute of delay savings), requiring the least investment for the greatest reduction in average delay/train over and above the investment required for Alternative A.

Another significant performance measure is the impact to train running times, which represent the actual travel times based on simulated operating speeds based on a specific segment of the network. Running times represent a different performance measure than delay because changes in delay may
occur outside of the DRC while it is possible to measure changes in running times within a specific segment within the DRC. For this study, the average running time for freight trains outbound from the Port of Oakland to Lathrop over the Altamont Pass were calculated.

As shown in Figure 4-12, Alternatives B, C, and D result in similar reductions in travel times and a greater reduction in travel times than Alternative A when compared to the no-build alternative. Because the average travel times among Alternatives B, C and D are similar, Alternatives C and D are demonstrated to provide minimal time savings benefit. Table 4-10 summarizes the cost-benefit ratio (similar to Table 4-9) for each alternative based on the incremental cost of a capital improvement per incremental benefit (reduced running time). As shown, Alternative B will result in the lowest cost-benefit ratio ($370,000/minute of running time savings) requiring the least investment for the greatest reduction in running time over and above the investment required for Alternative A.

Figure 4-12: Average Running Time for UP Intermodal Freight Trains Outbound from Port of Oakland to Lathrop Over Altamont Pass

Table 4-10: DRC Rail Cost-Benefit Ratio (Incremental Cost per Incremental Reduction in Running Time)

<table>
<thead>
<tr>
<th>ALTERNATIVE</th>
<th>INCREMENTAL COST</th>
<th>INCREMENTAL BENEFIT</th>
<th>COST-BENEFIT RATIO</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Capital Cost¹</td>
<td>Incremental Running</td>
<td>(Cost per Minute of</td>
</tr>
<tr>
<td></td>
<td>($millions)</td>
<td>Time Saved ²</td>
<td>Reduction</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(minutes)</td>
<td>$thousands)</td>
</tr>
<tr>
<td>A</td>
<td>$293.7</td>
<td>15</td>
<td>n.a.³</td>
</tr>
<tr>
<td>B</td>
<td>$13.7</td>
<td>37</td>
<td>$370</td>
</tr>
<tr>
<td>C</td>
<td>$30.5</td>
<td>3</td>
<td>$10,167</td>
</tr>
<tr>
<td>D</td>
<td>$34.9⁴</td>
<td>-1</td>
<td>n.a.⁵</td>
</tr>
</tbody>
</table>

¹ = Incremental 2030 capital cost of Alt. A compared to the no-build; Alt. B compared to Alt A; Alt C compared to Alt B, and so on.
² = Incremental 2030 reduction of average freight running time between Port of Oakland and Lathrop (hours) of Alt A compared to the no-build; Alt B compared to Alt A; Alt C compared to Alt B, and so on.
³ = Not applicable because minimum required for DRC service
⁴ = Assumes lower cost flyover option (D1)
⁵ = Not applicable because does not result in improved running time.
In summary, based on the above analysis, Alternative B appears to offer the greatest benefit for the cost incurred:

- It provides the greatest savings in average train delay for incremental cost of capital improvements; and
- It provides the greatest reduction in freight train running times for incremental cost of capital improvements.

In addition to having the lowest cost/benefit ratios, Alternative B represents the minimum investment required to build the infrastructure that would allow for substantial separation of freight trains and passenger trains in the corridor. Since Alternative B includes the Niles Connection (with a bridge over Alameda Creek), it makes the Niles subdivision available for freight trains traveling from Oakland to Stockton. Thus, with the Industrial Parkway Connection and Shinn Connection, passenger trains will use the Oakland Subdivision while freight trains can use the Niles Subdivision to the east. The separation of freight and passenger trains is not only more efficient and better for schedule adherence, there are inherent safety benefits with the separation.

Alternative A, while having a slightly lower capital cost than Alternative B, does not provide these substantial benefits. Alternatives C and D result in similar benefits to those for Alternative B, but they also do so at considerably higher cost. Alternative B is the recommended alternative to be carried forward to the environmental document phase of the project.
5.0

CONCLUSION AND NEXT STEPS
5.0 CONCLUSION AND NEXT STEPS

5.1 Summary of Conclusions
The investigation and analysis during the study resulted in both a rail alternative and bus alternative to be carried forward into the more rigorous environmental study. Based on an evaluation of capital cost and train operating performance, Alternative B (PSR Alternative) appeared to have the most merit. However, Alternative B would result in the introduction of more freight trains on the Niles Subdivision due to the Niles Connection. Concern was voiced during the study that this could have an environmental impact beyond what would be experienced if Alternative A (without the Niles Connection) were advanced. In order to effectively evaluate environmental impacts in Environmental Phase 2, it is recommended that both Alternative A and Alternative B be advanced to Phase 2.

Comments were received during the study from various agencies, the public, and members of both the Technical Advisory Committee and the Policy Committee. While several of the comments resulted in additional investigation and some entailed revisiting planning concepts, none resulted in any fatal flaws for the project. A summary of the comments and actions taken or recommended are presented in Appendix E.

It should be noted that some of the comments set the stage for part of the work in Environmental Phase 2 of the study. Some of the more substantial ones are as follows:

− The routing of additional freight trains on the Niles Subdivision in Alternative B drew comment regarding the potential environmental impact as described above. This resulted in both rail Alternative A and Alternative B being carried forward to the next phase.

− The Bus Alternative resulted in many comments regarding its viability as a good alternative to be compared directly with the rail alternative. Hence, it is recommended that the Bus Alternative be refined during the next phase, with close coordination with AC Transit.

− The Dumbarton Express bus service was assumed to continue to operate with the implementation of a rail alternative. Concern was voiced that this duplicative service was unwarranted. For Phase 2, it is recommended that the feasibility of eliminating the Dumbarton Express (during the times of rail service) and using the operating savings to enhance feeder bus service to various Dumbarton Rail stations be investigated.

5.2 Recommended Bus and Rail Alternatives
From this alternatives analysis for the DRC Project Environmental Phase 1, Table 5.1 presents the final bus and rail alternatives being recommended and carried forward into Phase 2. Additional information about the alternatives is presented in the following sections.
Table 5-1: DRC Final Alternatives for Phase 2 Analysis

<table>
<thead>
<tr>
<th>ALTERNATIVE</th>
<th>DESCRIPTION</th>
<th>DB EXPRESS (at Peak Periods)</th>
<th>ENHANCED FEEDER BUS SERVICE (at Peak Periods)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rail Alternative A (2010 and 2030)</td>
<td>PSR Alternative without the connection at Niles Junction. This alternative also includes additional improvements at Redwood Junction. It is the lowest cost alternative.</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Rail Alternative B (2010 and 2030)</td>
<td>PSR Alternative including additional improvements at Redwood Junction.</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>Bus Alternative (2010)</td>
<td>The 2010 Bus Alternative provides service to/from the East Bay and Redwood Shores. It would be coupled with existing DB/DB1 service.</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Bus Alternative (2030)</td>
<td>The 2030 Bus Alternative includes service from the East Bay to Redwood Shores/Foster City plus service to Millbrae/Oyster Point/Brisbane. It would be coupled with existing DB/DB1 service.</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

5.2.1 Bus Alternative

- One bus alternative was developed and refined for the year 2010, with a variation that serves additional travel markets for the year 2030.
- The 2010 recommended alignment includes:
  - Alvarado-Niles Road from the Union City BART Station
  - Mission Boulevard (SR-238) to Walnut Avenue;
  - Fremont Boulevard to Thornton Avenue, Jarvis Avenue, and the park-and-ride facility in Newark;
  - SR-84, crossing over the Dumbarton Bridge;
  - Bayfront Expressway, to Marsh Road and U.S. 101 North (mixed-flow lanes);
  - Loop on Seaport Boulevard, and return to U.S. 101 (mixed-flow lanes); and
  - A long loop on Redwood Shores Parkway.
- Expanded travel markets served in 2030 include the Millbrae/Oyster Point/Brisbane area and the Redwood Shores/Foster City area.
- Estimated total ridership for the bus alternative is 1,600 in 2010 and 3,200 in 2030. Net new riders are projected to be 500 in 2010 and 3,100 in 2030.
- O&M costs for the bus alternative are estimated to be $4.6 million in 2010 and $5.5 million and $5.8 million for 2030.
- Capital costs for the bus alternative are $12.2 million in 2010 and $13.7 million and $15.3 million in 2030.

5.2.2 Rail Alternative
- Two rail alternatives are being carried forward into Environmental Phase 2: Alternative A (PSR without Niles Junction) and Alternative B (PSR).
- Estimated total ridership for the rail alternatives is 4,600 in 2010 and 12,200 in 2030. Net new riders are projected to be 2,000 in 2010 and 5,600 in 2030.
- O&M costs for the rail alternatives are estimated to be $7.7 million in 2010 and $9.1 million for 2030.
- Capital costs are estimated to be $293.7 million for Alternative A and $307.4 million for Alternative B.

5.3 Phase 2
Phase 2 will include more detailed analysis for potential environmental impacts, the preparation of a combined NEPA (federal)/CEQA (state) environmental document, and preliminary engineering. The following provides an overview of issues and recommendations for preparation of the environmental documentation for the Dumbarton Rail Corridor.

5.3.1 CEQA Lead Agency
The Peninsula Corridor Joint Powers Board (Caltrain) is recommended as the CEQA Lead Agency since it is the agency that will have the principal responsibility for carrying out the project.

5.3.2 NEPA Lead Agency
The DRC Project must comply with the National Environmental Policy Act (NEPA) and other related federal environmental requirements since it will require federal permits and approvals. It is recommended that the Federal Transit Administration (FTA) be solicited to be the NEPA Lead Agency.

5.3.3 Document Type
It is recommended that an Environmental Impact Statement/Environmental Impact Report (EIS/EIR) be prepared for the project.