WCCTAC
West Contra Costa Transportation Advisory Committee

West Contra Costa High-Capacity Transit Study

FINAL TECHNICAL MEMORANDUM #15

Final Evaluation

March 2017

WSP | PARSONS BRINCKERHOFF

With
Kimley-Horn

Document Review

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Acronyms and Abbreviations

BART	San Francisco Bay Area Rapid Transit District
BRT	bus rapid transit
HCT	high-capacity transit
HOV	high-occupancy vehicles (also known as carpools)
I-80	Interstate 80
O&M	Operating and maintenance
PDA	Priority Development Area(s)
MTC	Metropolitan Transportation Commission
SR-4	State Route 4
UPRR	Union Pacific Railroad
WCCTAC	West Contra Costa Transportation Advisory Committee
WCCTAC TAC	WCCTAC Technical Advisory Committee

EXECUTIVE SUMMARY

In an effort to reduce congestion and plan for future growth, the West Contra Costa High-Capacity Transit (HCT) Study is evaluating options for major transit investments along I-80 corridor. The study is focused on rapid and direct services that can attract new riders among the 250,000 residents and provide a viable and competitive alternative to driving. The ultimate goal of the Study is to identify, evaluate, and refine projects to improve HCT in West County, expand alternatives to driving on congested streets and highways, and improve regional air quality and quality of life.

Central to the study purpose is providing WCCTAC with the analyses necessary to determine and advance the most promising HCT alternative(s). Eight initial alternatives for enhanced public transportation in West County were identified, including express bus, bus rapid transit (BRT), commuter rail, and BART options. These alternatives were structured to serve the key travel markets in West County and underwent an initial evaluation using screening criteria developed from the Study goals and objectives. The WCCTAC Board advanced five of the eight conceptual alternatives for further study based on feedback from the Study Management Group (SMG), WCCTAC Technical Advisory Committee (TAC), and community feedback. These five alternatives, which are briefly described in Table ES-1, were refined to provide better definition and subsequently underwent a second and final round of evaluation, which is discussed in this technical memorandum.

Evaluation criteria for this second tier screening included performance measures related to ridership; transit travel speed and reliability; access and connectivity; cost and efficiency; feasibility; and community. The BRT alternatives emerged as the highest-performing options followed by the Express Bus alternative. The Capitol Corridor and the BART alternatives were rated high in many categories, but fared poorly in other categories. For example, the BART alternatives rated high in the ridership categories but poorly in the costs and cost efficiency categories, while the Capitol Corridor rated high in the cost categories, but low in the ridership and cost efficiency categories. Table ES-1 summarizes the rating for all alternatives.

BRT on San Pablo and Macdonald Avenues performed well against criteria related to its improvements in locations with strong transit demand and locations that currently lack major transit connections; service to regional transit centers and priority development areas (PDAs); annualized cost per rider, and public stakeholder support. The BRT on 23rd Street alternative performed well against criteria related to quality of and enhancement of transit connections, annualized cost per total rider, and proximity to PDAs. The BRT alternatives were comparable in terms of projected ridership.

The Express Bus Alternative had a moderate amount of high and moderate performance ratings. It faired high in the categories of operating and maintenance costs, time to implement,

and public stakeholder support. It scored moderate in most other categories except net new riders and quality of transit connections, where performance was rated low.

The Commuter Rail alternative includes a fare subsidy (which could be used by travelers for trips on Capitol Corridor that start or end in West County) and the build-out of the Regional Intermodal Transit Center at Hercules. It performed well in the criteria involving travel speed and reliability, as commuter rail's dedicated rights-of-way boost transit travel time and are less likely to get stuck in traffic; quality of connections, as Amtrak stations are relatively well-served by other transit providers; time to implementation, as the fare subsidy does not involve further project development; and capital and operating costs, as costs are relatively low as the subsidy does not include capital infrastructure components and do not increase operating costs substantially. It ranked low in ridership and cost efficiency.

The two BART alternatives received high ratings for total and net ridership increases; transit time improvement and reliability as heavy rail's dedicated rights-of-way are conducive to trains travelling faster and not getting stuck in traffic congestion; and quality of transit connections. However, both BART alternatives' poor performance related to cost and efficiency as well as time to implementation decreased their overall ratings.

Table ES-1: Alternatives for Evaluation

Alternative	
	**Alternative 1: Express Bus on I-80** with expanded service between Hercules Transit Center and San Francisco and new service between Hercules Transit Center and Alameda County. For the proposed Alameda County service, trips would originate in the morning at the Hercules Transit Center and provide express service to Berkeley, Emeryville, and Oakland, with intermediate stops at the Richmond Parkway Transit Center and at a potential new Express Bus-BRT transit center at Macdonald Avenue and I-80 in Richmond.
	**Alternative 2: San Pablo Avenue/Macdonald Avenue Bus Rapid Transit (BRT)** between El Cerrito del Norte BART and Hercules Transit Center, serving the Richmond Parkway Transit Center, Hilltop Mall, Contra Costa College and a potential Express Bus-BRT Transit Center on the San Pablo alignment. A second branch would serve the Richmond BART/Capitol Corridor station on Macdonald Avenue and extend west to the Tewksbury Turnaround.
	**Alternative 3: 23rd Street Bus Rapid Transit (BRT),** from the Richmond Field Station and the Richmond Ferry Terminal to the Richmond BART/Capitol Corridor station continuing to Contra Costa College, with possible extension along San Pablo Avenue to Hilltop Mall and the Hercules Transit Center.
	**Alternative 4: Fare subsidies on existing Capitol Corridor service for travel originating in West County or with final destinations in West County and completion of the Regional Intermodal Transit Center at Hercules**, which would include a new Capitol Corridor station.[1]
	**Alternative 6A: BART Extension from Richmond to Hercules via Rumrill Boulevard**, along the UPRR right-of-way transitioning to 13th Avenue and Rumrill Boulevard (around the vicinity of Brookside Drive) before tunneling under Hilltop Mall then following the I-80 right-of-way to the Hercules Transit Center at Willow Avenue/SR-4.
	**Alternative 6B: BART Extension from Richmond to Hercules via Richmond Parkway**, along the UPRR right-of-way up to Richmond Parkway, east towards Giant Road before tunneling under Hilltop Mall then following the I-80 right-of-way to the Hercules Transit Center at Willow Avenue/SR-4.

[1] Fare subsidies were analyzed for trips between the Richmond Station and the Martinez, Berkeley, Emeryville, and Oakland Jack London Square stations.

Table ES-2 Summary of Criteria for Final Evaluation and Screening

EVALUATION CRITERIA	PERFORMANCE MEASURE	1. EXPRESS BUS	2. BRT ON SAN PABLO/ MACDONALD AVE	3. BRT ON 23RD STREET	4. COMMUTER RAIL: FARE SUBSIDY + RITC	6A. BART EXTENSION VIA RUMRILL BOULEVARD	6B. BART EXTENSION VIA RICHMOND PARKWAY
RIDERSHIP	Total riders	◑	◑	◑	○	●	●
	Net new riders	○	◑	◑	○	●	●
SPEED AND RELIABILITY	Transit travel time improvement	◑	◑	◑	●	●	●
	Transit travel time reliability	◑	◑	◑	●	●	●
ACCESS AND CONNECTIVITY	Regional transit centers served	◑	●	◑	◑	◑	◑
	Quality of connections to existing transit systems and facilities	○	◑	●	●	●	●
	Service to West County markets lacking major transit connections	◑	●	●	◑	◑	◑
COST AND EFFICIENCY	Capital cost	◑	◑	◑	●	○	○
	Operating and maintenance cost	●	◑	◑	●	○	○
	Annualized cost per total rider	◑	●	●	○	○	○
FEASIBILITY	Time to implementation	●	◑	◑	●	○	○
COMMUNITY	Consistency with local plans and policies	◑	◑	●	◑	●	◑
	Public and stakeholder support	●	●	◑	◑	●	◑
	Economic and transit-oriented development (West County PDAs served)	○	●	●	◑	◑	○

○ *Low-Performance* ◑ ◀——▶ ● *High-Performance*

1 INTRODUCTION

1.1 Transportation Setting

West Contra Costa County is a sub-region within the Bay Area set between the San Francisco Bay and the East Bay hills. West Contra Costa Transportation Advisory Committee (WCCTAC) is responsible for transportation planning for the sub-region and one of four regional transportation planning committees in Contra Costa County, representing the West Contra Costa sub-area. These four committees were created in 1988 to guide transportation projects and programs included in the Measure C half-cent, transportation sales tax approved by Contra Costa voters. Measure C was succeeded by Measure J in 2004.

Transportation on Interstate 80 (I-80), the primary vehicular route running north-south through this sub-region, has major regional significance to Bay Area travelers. It is frequently one of the most congested freeway corridors in the region and often the most congested.[2] San Pablo Avenue, the former Highway 40, is a major arterial that runs roughly parallel and functions as a possible alternative to I-80 in some sections. It links each jurisdiction in West Contra Costa and is a key commercial thoroughfare for the sub-region. Interstate 580 (I-580), running perpendicular to I-80, connects travelers west to and from Marin County across the Richmond-San Rafael Bridge to I-80, and continues east through Alameda County and beyond.

Traffic is routinely congested during peak commute hours in the peak direction, as well as during off-peak hours and weekends when it is congested in both directions. Preliminary estimates indicate that work trips on the I-80 corridor are expected to increase by approximately 23 percent by 2040. Most trips originate from Richmond, San Pablo, Pinole, and Hercules and the three most frequently traveled destination zones external to the Study Area are Berkeley/Emeryville, Northeast San Francisco, and Oakland/Piedmont.[3]

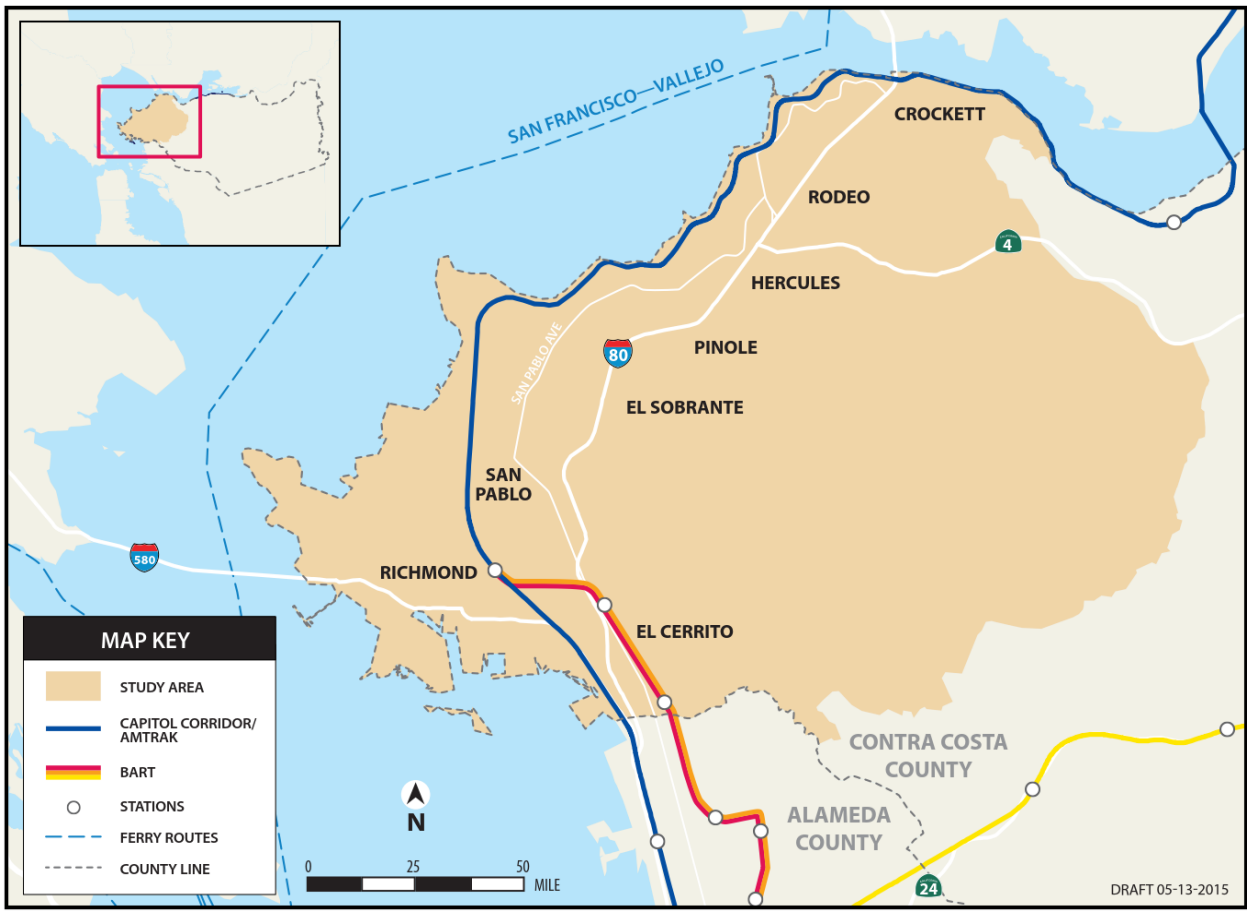
"Bay Area's Worst Commute is Westbound I-80" – *San Francisco Chronicle*, December 17, 2015

[2] MTC, Vital Signs, December 2015, http://mtc.ca.gov/whats-happening/news/fresh-data-bay-areas-vital-signs-include-new-top-10-list-freeway-congestion

[3] *West Contra Costa High-Capacity Transit Study, Technical Memorandum #7, Travel Markets,* January 2016, WSP/Parsons Brinckerhoff, Kimley Horn, and Kittelson & Associates.

Figure 1-1 displays a map of the Study Area, which encompasses West Contra Costa County (West County) from the southern boundary at the Alameda County line north to the Carquinez Bridge and Solano County line. It also includes I-80, I-580, and State Route 4 (SR-4), as well as major surface streets, including San Pablo Avenue and Richmond Parkway.

Figure 1-1: Study Area



Source: WSP/Parsons Brinckerhoff and Kimley-Horn, 2015

1.2 Purpose of the Study

WCCTAC is conducting the West Contra Costa High-Capacity Transit Study to review multimodal high-capacity transit (HCT) options for improving transit to address congestion and to plan for future growth, with consideration of costs and funding opportunities. HCT provides substantially higher levels of passenger capacity with typically fewer stops, higher speeds, and more-frequent service than community-based or local public bus services.

The purpose of this study is to identify and evaluate the feasibility and effectiveness of HCT options in West County for WCCTAC's consideration. Central to the study purpose is providing WCCTAC with the analyses necessary to determine and advance the most promising HCT alternative(s).

Why do we need this study?

Interstate 80 is one of the most congested corridors in the Bay Area, and the Richmond BART line often reaches full capacity during commute hours.

Since its inception in 1988, WCCTAC's policy goals have called for facilitating the use of transit, encouraging transit projects aimed at congestion relief, and participating in studies focused on transit capital investments. West County action plans since that time have included consideration and prioritization of transit improvements such as express bus expansion, ferry implementation, a BART extension, and other types of rail improvements. For example, the most recent 2014 Action Plan called for participation in a study of HCT options in the I-80 corridor.[4]

This study's investment strategy will position WCCTAC to be competitive for transportation funds within the county and to leverage outside funding sources. The transit capital investments will also benefit a wide range of people and trip types in West County.

1.2.1 Study Activities to Date

Eight initial conceptual alternatives for enhanced public transportation in West County were identified, including express bus, bus rapid transit, commuter rail, and BART options. These alternatives were structured to serve the key travel markets in West County, providing alternatives to driving on I-80 and transit options for getting around and within West County.[5] These alternatives were evaluated against screening criteria developed from the study goals and objectives.[6] Preliminary capital and operating cost estimates were also prepared. This information was presented to the Study Management Group (SMG), WCCTAC Technical Advisory Committee (TAC), and at general community open houses in spring of 2016 as well as on the study's website. The WCCTAC Board advanced five of the eight conceptual alternatives for further study.

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4 Item #46 of the *2014 West County Action Plan*.

5 *West Contra Costa High-Capacity Transit Study, Technical Memorandum #7, Travel Markets*, January 2016, WSP/Parsons Brinckerhoff, Kimley Horn, and Kittelson & Associates.

6 *West Contra Costa High-Capacity Transit Study, Technical Memorandum #8, Preliminary Alternatives*, January 2016, WSP/Parsons Brinckerhoff, Kimley Horn, and RL Banks.
West Contra Costa High-Capacity Transit Study, Technical Memorandum #10, Preliminary Evaluation and Screening, May 2016, WSP/Parsons Brinckerhoff, Kimley Horn, and M Lee Corporation.

These five alternatives, which are briefly described in Table 1-1, were refined to provide better definition and to determine how the improvements might be phased in over the short-term (one to five years); medium-term (five to 15 years) and long-term (more than 15 years). *Technical Memorandum #11: Alternatives Refinement* includes a full description of the five alternatives.[7]

More detailed capital and operating cost assumptions were developed for each of the refined alternatives, to refine the capital and operating cost estimates presented in Phase 1. The range of alternatives offer a framework for development of a sound transit network in West County. If the WCCTAC Board decides to carry these options forward for further study, project development and environmental review would occur under the guidance of the Board, staff, and stakeholders.

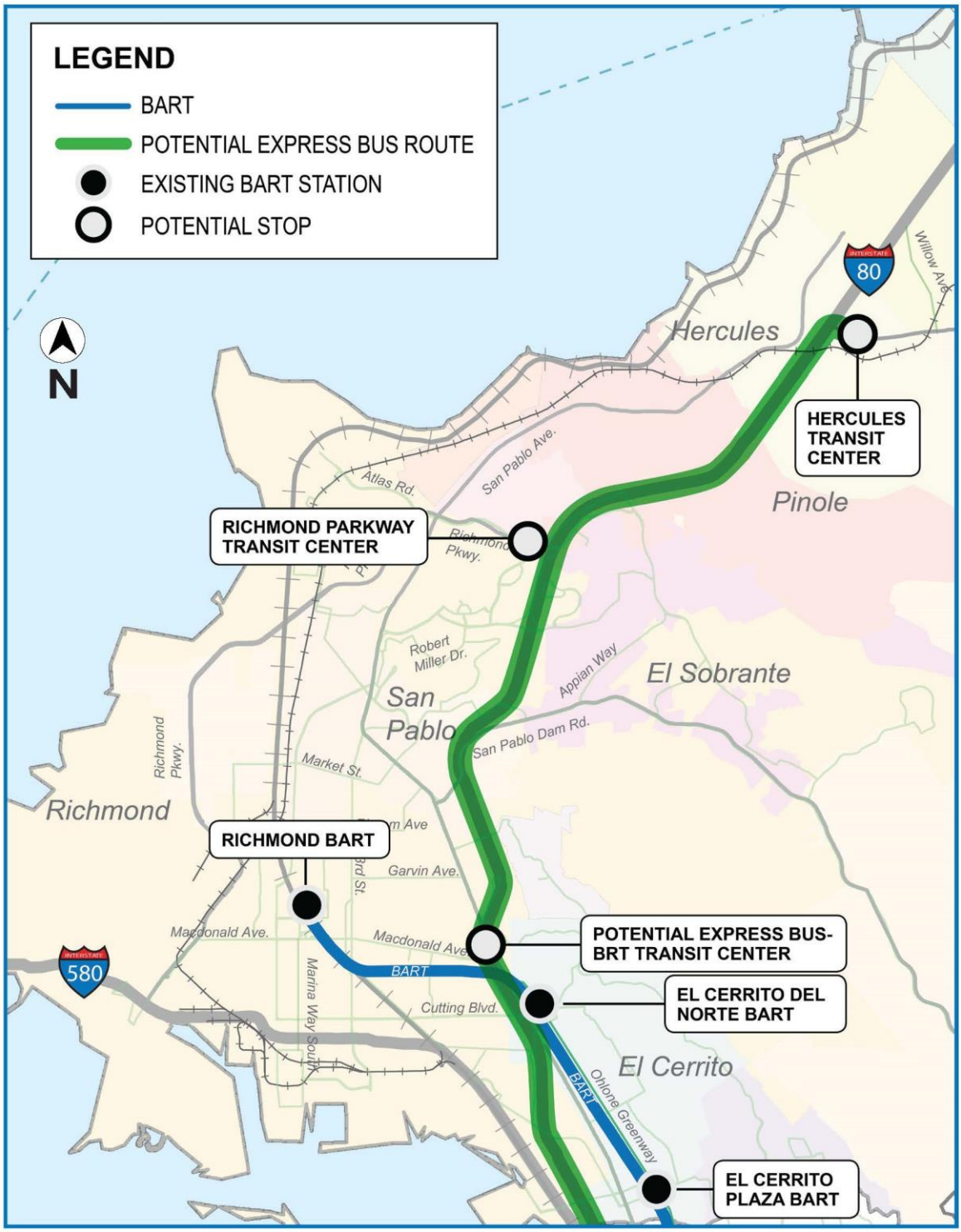
[7] *West Contra Costa High-Capacity Transit Study, Technical Memorandum #11, Alternatives Refinement*, November 2016, WSP/Parsons Brinckerhoff, Kimley Horn, WCCTAC.

Table 1-1: Alternatives for Evaluation

Alternative	
	**Alternative 1: Express Bus on I-80** with expanded service between Hercules Transit Center and San Francisco and new service between Hercules Transit Center and Alameda County. For the proposed Alameda County service, trips would originate in the morning at the Hercules Transit Center and provide express service to Berkeley, Emeryville, and Oakland, with intermediate stops at the Richmond Parkway Transit Center and at a potential new Express Bus-BRT transit center at Macdonald Avenue and I-80 in Richmond. (See Figure 1-2 and Figure 1-3.)
	**Alternative 2: San Pablo Avenue/Macdonald Avenue Bus Rapid Transit (BRT)** between El Cerrito del Norte BART and Hercules Transit Center, serving the Richmond Parkway Transit Center, Hilltop Mall, Contra Costa College and a potential Express Bus-BRT Transit Center on the San Pablo alignment. A second branch would serve the Richmond BART/Capitol Corridor station on Macdonald Avenue and extend west to the Tewksbury Turnaround. (See Figure 1-4.)
	**Alternative 3: 23rd Street Bus Rapid Transit (BRT),** from the Richmond Field Station and the Richmond Ferry Terminal to the Richmond BART/Capitol Corridor station continuing to Contra Costa College, with possible extension along San Pablo Avenue to Hilltop Mall and the Hercules Transit Center. (See Figure 1-5.)
	**Alternative 4: Commuter Rail - Fare subsidies on existing Capitol Corridor service for travel originating in West County or with final destinations in West County and completion of the Regional Intermodal Transit Center at Hercules**, which would include a Capitol Corridor station.[8]
	**Alternative 6A: BART Extension from Richmond to Hercules via Rumrill Boulevard**, along the UPRR right-of-way transitioning to 13th Avenue and Rumrill Boulevard (around the vicinity of Brookside Drive) before tunneling under Hilltop Mall then following the I-80 right-of-way to the Hercules Transit Center at Willow Avenue/SR-4. (See Figure 1-6.)
	**Alternative 6B: BART Extension from Richmond to Hercules via Richmond Parkway**, along the UPRR right-of-way up to Richmond Parkway, east towards Giant Road before tunneling under Hilltop Mall then following the I-80 right-of-way to the Hercules Transit Center at Willow Avenue/SR-4. (See Figure 1-7.)

[8] Fare subsidies were analyzed for trips between the Richmond Station and the Martinez, Berkeley, Emeryville, and Oakland Jack London Square stations.

Figure 1-2: Refined Alternative 1: Express Bus Service – Service in West County

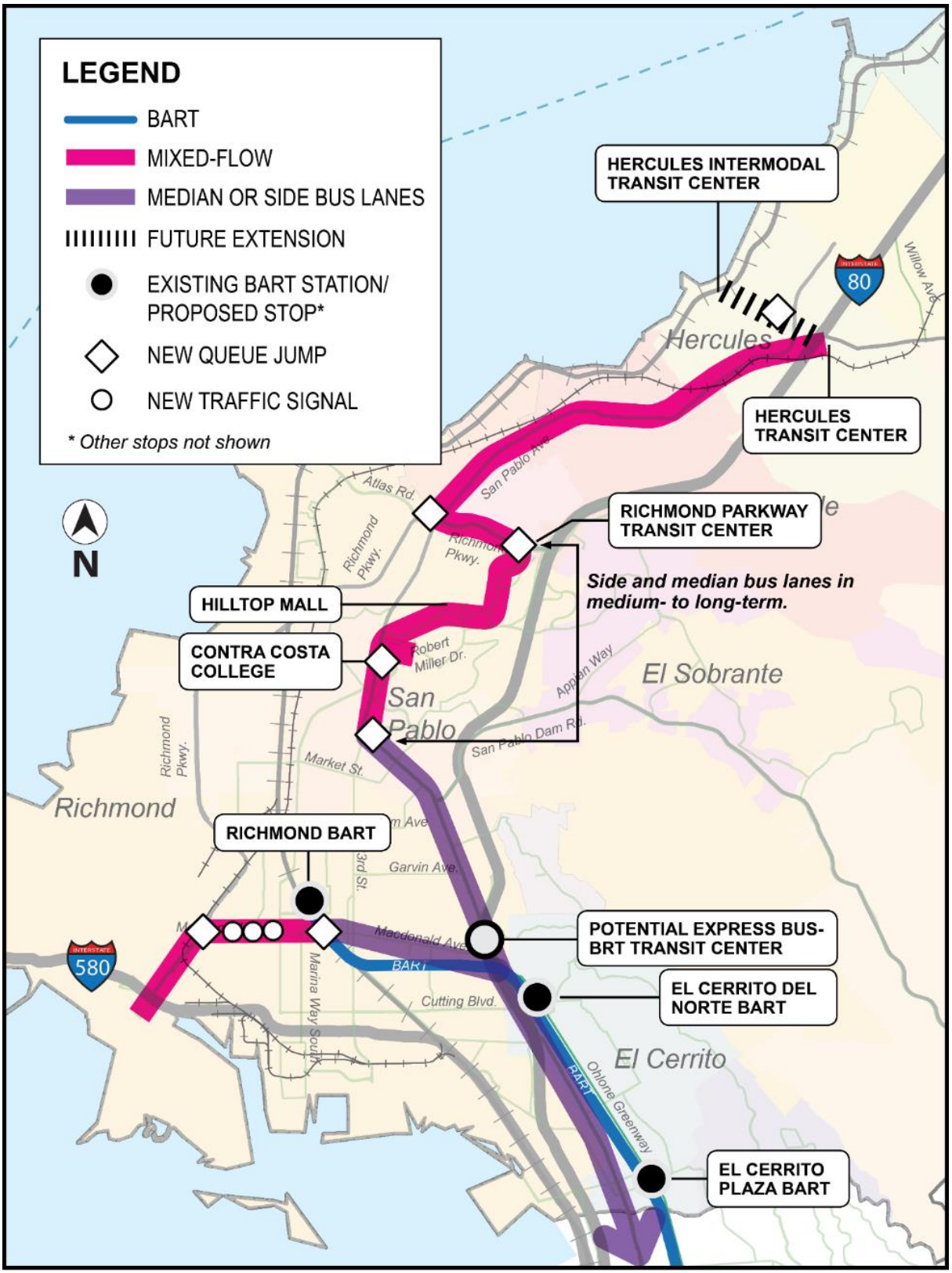


Source: Kimley-Horn and WSP/Parsons Brinckerhoff, 2016

Figure 1-3: Refined Alternative 1: Express Bus Service – Service in Alameda County

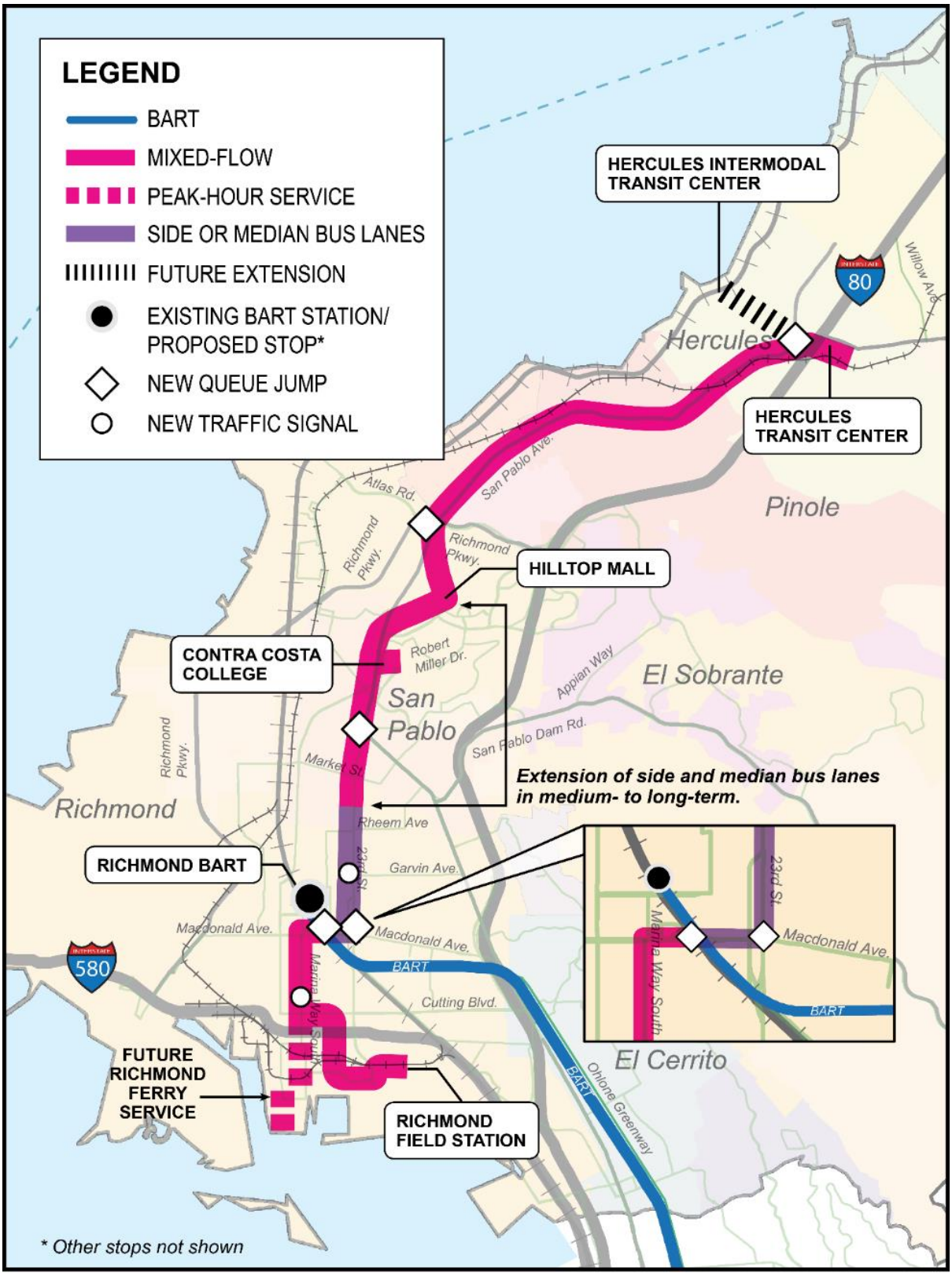
Source: Kimley-Horn and WSP/Parsons Brinckerhoff, 2016

Figure 1-4: Refined Alternative 2—San Pablo Avenue/Macdonald Avenue BRT



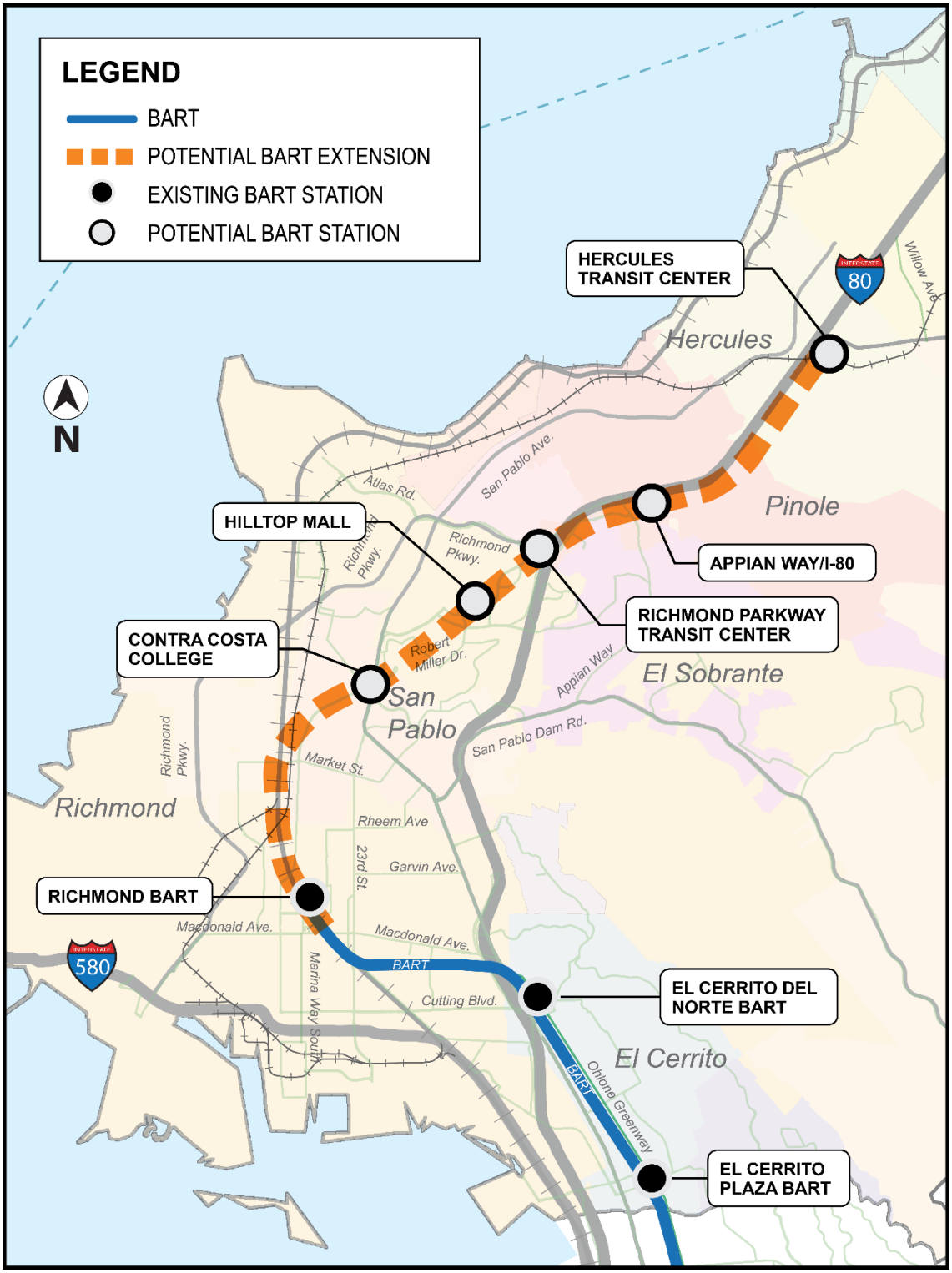
Source: Kimley-Horn, WSP/Parsons Brinckerhoff, 2016

Figure 1-5: Alternative 3—23rd Street BRT



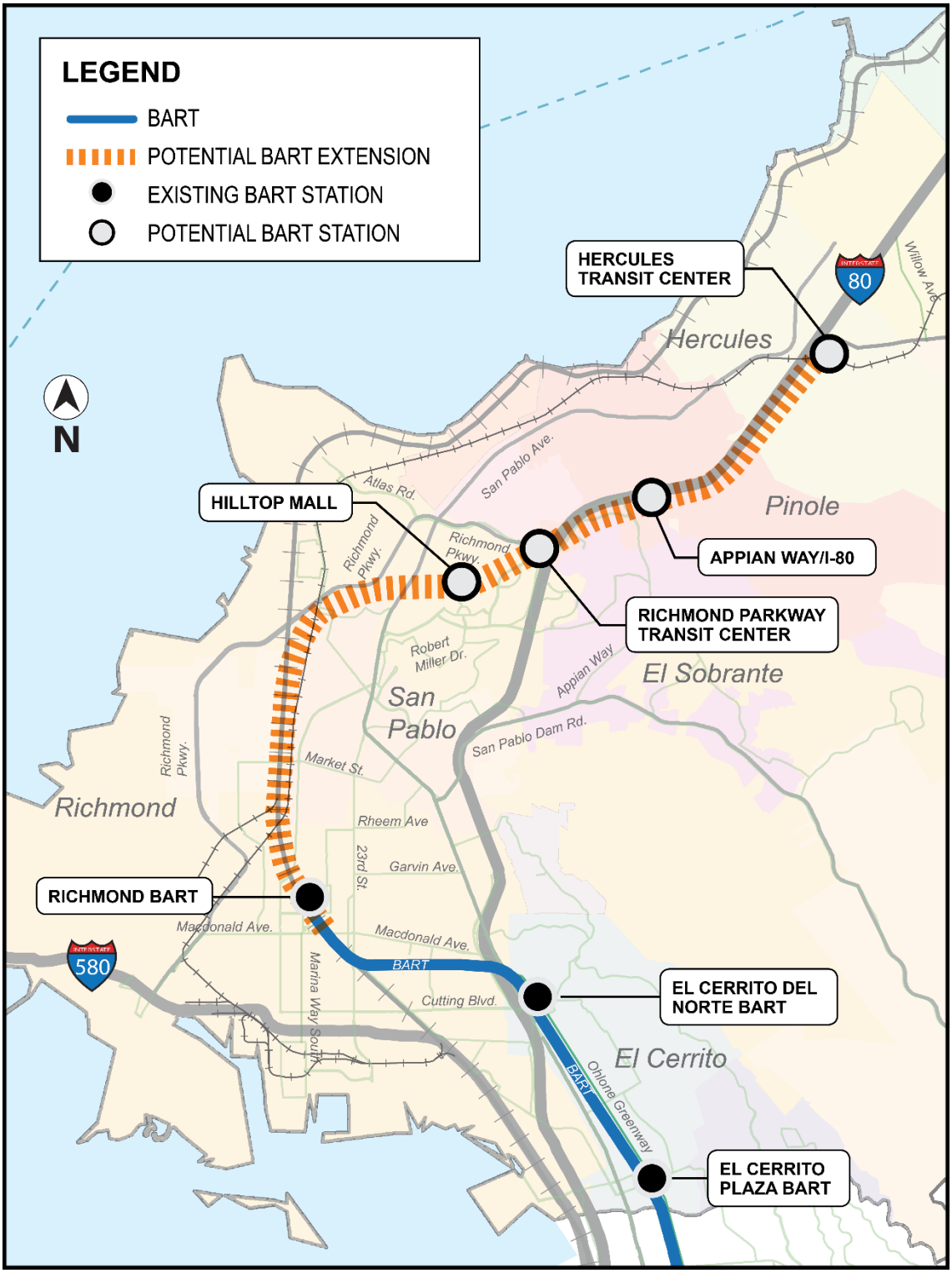
Source: Kimley-Horn, WSP/Parsons Brinckerhoff, 2016

Figure 1-6: Refined Alternative 6A—BART Extension from Richmond Station to Hercules via Rumrill Boulevard



Only one or two BART stations would be constructed.
Source: WSP/Parsons Brinckerhoff, 2016

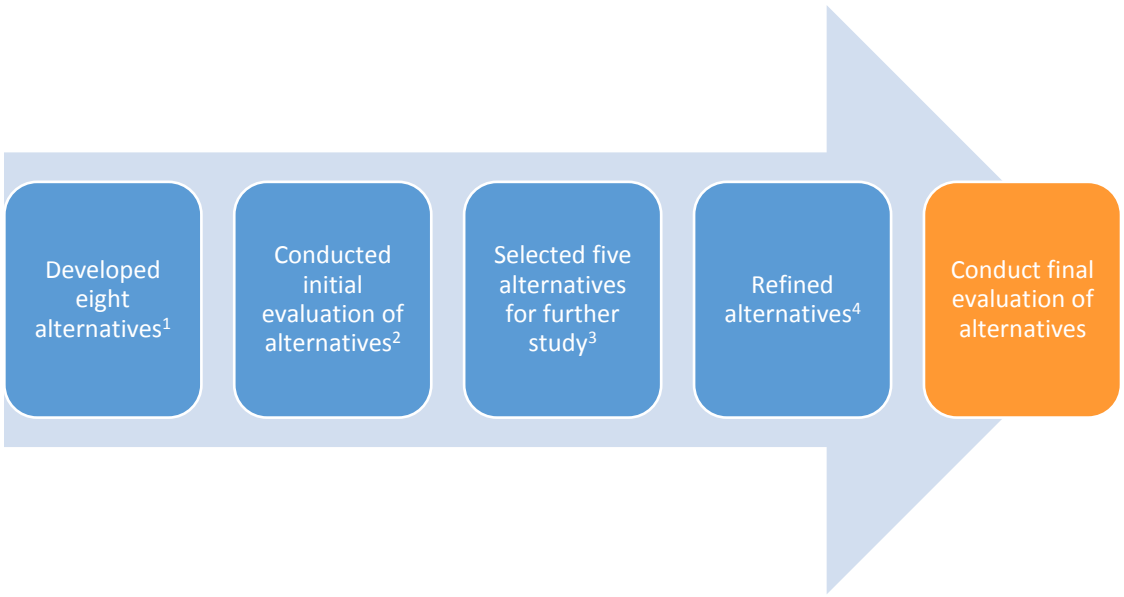
Figure 1-7: Alternative 6B—BART Extension from Richmond Station to Hercules via Richmond Parkway



Only one or two BART stations would be constructed.
Source: WSP/Parsons Brinckerhoff, 2016

1.3 Purpose of this Technical Memorandum

The refined alternatives were evaluated against a set of six key criteria summarized in Table 1-2 along with the methodology that was used to assess each performance measure. The results are presented in this document to provide information on each alternative's various features prior to making decisions about which alternative(s) to advance for further development.



[1] See *West Contra Costa High-Capacity Transit Study: Technical Memorandum #8, Preliminary Alternatives*, January 2016

[2] See *West Contra Costa High-Capacity Transit Study: Technical Memorandum #10, Preliminary Evaluation and Screening*, May 2016

[3] WCCTAC Board action, May 27, 2016

[4] See *West Contra Costa High-Capacity Transit Study: Technical Memorandum #11, Alternatives Refinement*, November 2016

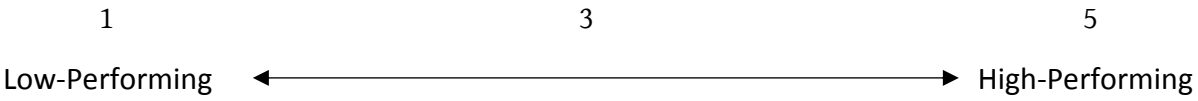
Table 1-2: Criteria, Performance Measure, and Methodology for Final Evaluation and Screening

EVALUATION CRITERIA	PERFORMANCE MEASURE	METHODOLOGY
RIDERSHIP	Total riders	Results from ridership modeling*
	Net new riders	Results from ridership modeling*
SPEED AND RELIABILITY	Transit travel time improvement	Change in travel time with and without project improvements
	Transit travel time reliability	Length of route in exclusive guideway or dedicated transit lanes
ACCESS AND CONNECTIVITY	Regional transit centers served	Existing BART stations, multimodal transit centers, and major business districts with high levels of transit that are directly served by alternative
	Quality of connections to existing transit systems and facilities	Ease of movement and transfers between different modes of transit and/or within the same mode
	Service to West County markets lacking major transit connections	Service to markets currently lacking major transit connections
COST AND EFFICIENCY	Capital cost	Order-of-magnitude capital cost
	Operating and maintenance cost	Annualized O&M cost
	Annualized cost per rider	Annualized capital and annualized O&M cost per rider (total annualized costs/total annual riders)
FEASIBILITY	Time to implementation	Time to benefit, i.e., improvements can be made in shorter time period
COMMUNITY	Consistency with local plans and policies	Consistency with local plans and policies
	Public and stakeholder support	Public and stakeholder support for proposed alternative
	Economic and transit-oriented development (West County PDAs served)	West County PDAs served

** See West Contra Costa High-Capacity Transit Study, Technical Memorandum #12, Ridership Estimates, February 2017, Kittelson & Associates.*

2 EVALUATION RESULTS

This section provides the results of the second and final evaluation of the study's refined alternatives based on the criteria shown in Table 1-2. Each alternative was rated on a three-point scale as shown below, which can be roughly translated to rating of low (1), medium (3), and high (5) performance.



While a low, medium, or high rating was given to show how the projects performed relative to each other; a low rating can still show improvement over a no-build condition. Each of the alternatives were crafted to improve a feature of existing transit service or expand service to meet current or future demand.

Given the study's early phase of feasibility, weighting was not applied to the evaluation criteria. This was also the case in the initial (Step 1) evaluation of the eight preliminary alternatives. During project development, each alternative will undergo further technical analysis and design, which could provide more detailed information that may be more appropriate for weighting.

2.1 Ridership

The travel demand forecasting conducted for this study forecasted ridership for different "packages" of improvements that would be implemented in the short-term (2020) and long-term (2040). As shown in Table 2-1, each package assumed a range of improvements that would be in place in 2020 or 2040 and were grouped so the results would show how each project would contribute to increased transit ridership, but also show how the development of an enhanced transit network would better serve West County transit riders. (See *Technical Memorandum #12: Ridership Estimates* for more information about the assumptions used in the travel demand forecasting as well as the detailed modeling results for each package.)

Table 2-1: Packages for Travel Demand Forecasting

Package	Time Horizon	Description
A	2020	Express Bus + San Pablo BRT
B	2020	Express Bus + 23rd Street BRT
C	2040	RITC + Express Bus + San Pablo BRT + 23rd Street BRT + BART Rumrill Boulevard alignment
D	2040	RITC + Express Bus + San Pablo BRT + 23rd Street BRT + BART Richmond Parkway alignment
E	2040	RITC + Express Bus + San Pablo BRT + 23rd Street BRT

Source: Kittelson and Associates, February 2017

The evaluation in this section considers the total and net new ridership numbers for the proposed packages of transit investment in the near-term (2020) and long-term (2040), rather than results from individual projects. This approach was taken because the study team recognized that the individual alternatives would work together to form a transit network and potentially serve different transit markets.

A No Build scenario was also presented for both 2020 and 2040 to show how transit demand is expected to change over time, even without the introduction of new services. The No Build scenario includes all of the funded and reasonably foreseeable transportation improvements that are included in the Regional Transportation Plan (RTP) and the projected growth in population and jobs in the future years. The No Build serves as the base case for comparison of new transit riders.

The total and net new transit ridership estimates (i.e., total projected riders minus ridership forecast for the No Build scenarios) are presented in **Error! Reference source not found.** and **Error! Reference source not found.**. The total ridership includes the naturally occurring growth which is significant and cannot be accommodated with existing transit service. The proposed projects would benefit all transit riders in the future as they would improve transit capacity and respond to the naturally occurring anticipated growth. The net new growth only includes growth as a result of the proposed new projects. A discussion of the ratings for low, medium, and high performance follows.

The ridership projections are not constrained by parking supply. The projections assume that everyone that wants to arrive by auto are able to do so and will be able to find a parking space. Unconstrained demand represents a good starting point for estimate of transit ridership. As projects advance, consideration will need to be given to the amount of parking that can actually be provided and consistency with local and transit agencies policies on parking.

The ridership benefits associated with improvements to commuter rail were also assessed. The RITC, which is currently in the early stages of construction, was assumed to be part of the base transit network in 2040. A total of approximately 440 new Capitol Corridor riders were projected for this service.[9] Additional intercity Amtrak passengers might also avail themselves of the service if it was introduced. The proposed commuter rail fare subsidy could also draw new transit riders.[10] A fare subsidy of 75 percent was projected to generate an additional 186 new riders.

[9] The ridership forecasts from the HCT model runs were consistent with the ridership forecasts prepared for the City of Hercules for the Hercules Intermodal Transit Center Transportation Update, February 2017. The update forecast a total of 430 new Capitol Corridor riders in 2040.

[10] The fare subsidy would be cover trips between the Richmond Station and Martinez, Berkeley, Emeryville, and Oakland Jack London Square stations.

Table __: 2020 West Contra Costa County Weekday Transit Ridership (Boardings)

Service	2014/2015 Observed	2020 No Build	Net Change 2020 No Build to 2014/15	2020 Package A	Net Change 2020 Package A to No Build	2020 Package B	Net Change Package B to No Build
BART	17,640	21,100	3,460	21,980	880	20,880	-220
AC Transbay	2,160	2,440	280	3,160	720	3,590	1,150
AC BRT	-	-	--	8,660	8,660	4,110	4,110
AC Local	14,080	15,940	1,860	9,190	(6,750)	13,820	(2,120)
WestCAT	5,000	5,680	680	6,420	740	6,420	740
Express Buses	-	-	--	1,120	1,120	1,230	1,230
Total	38,880	45,160	6,280	50,530	5,370	50,050	4,890

Source: Kittelson and Associates, February 2017. Detailed forecasts included in Technical Memorandum #14

Table _: 2040 West Contra Costa County Weekday Transit Ridership (Boardings)

Service	2014/2015 Observed	2040 No Build	Net Change 2040 No Build to 2014/15	2040 Package C	Net Change 2040 Package C to No Build	2040 Package D	Net Change 2040 Package D to No Build	2040 Package E	Net Change 2040 Package E to No Build
BART	17,640	26,160	8,520	32,530	6,370	32,170	6,010	27,220	1,060
AC Transbay	2,160	3,010	850	3,380	370	3,770	760	3,780	770
AC BRT	-	-	--	18,150	18,150	16,800	16,800	16,500	16,500
AC Local	14,080	21,080	7,000	10,990	(10,090)	11,030	(10,050)	10,500	(10,580)
WestCAT	5,000	7,410	2,410	6,650	(490)	8,480	1,070	7,330	(80)
Express Buses	-	-	--	1,580	1,580	1,560	1,560	2,060	2,060
Commuter Rail - RITC	--	--	--	430	430	430	430	440	440
Total	38,880	57,660	18,780	73,710	16,050	74,240	16,580	67,830	10,170

Source: Kittelson and Associates, February 2017.

In 2020 No Build, transit ridership is projected to be 45,160 riders or a 16 percent increase compared to existing conditions. This growth as attributable to population and employment growth. While some of this growth could be absorbed by existing transit services, new capacity is likely to be needed. With the introduction of capacity improvements, such as new express bus improvements and transit priority treatments, the total West County transit ridership in 2020 would be 50,530 with the San Pablo/Macdonald Avenue BRT improvements (Package A) and 50,050 with the 23rd Street BRT improvements (Package B). This represents about a 30 percent growth from existing conditions.

Implementation of the new express bus service with the San Pablo/Macdonald Avenue BRT would generate 8,660 new BRT riders and 1,120 new Express Bus riders, and with the 23rd Street BRT would generate 4,110 new BRT riders and 1,230 Express Bus riders. With the introduction of new Express Bus and BRT services, transit ridership would realign and some shifting would occur between the various transit operators and lines. Under these two scenarios when compared to the 2020 No Build, there would be 5,370 net new transit riders with the San Pablo Avenue/Macdonald Avenue BRT and 4,380 net new riders with the 23rd Street BRT.

In 2040 No Build, transit ridership will be 57,660 or a 49 percent increase as a result of the natural growth in West County when compared to the existing conditions. This is a substantial amount of growth that will require new transit improvements that are not accounted for in the base transit network. Additional demand as well as capacity would be added with the introduction of full Express Bus and BRT services. With the extension of BART service to the Hercules Transit Center, the total West County transit ridership in 2040 would be in the range of 73,710 to 74,240. This represents nearly a doubling of transit demand when compared to the existing conditions for West County. If the full extent of Express Bus and BRT improvements were put in place but the BART extension was not implemented, the ridership in 2040 is expected to be 67,830. While this is lower than the ridership with the BART extension, it still represents a 74 percent increase from existing conditions.

When compared to the 2040 No Build, implementation of the full complement of Express Bus service and BRT improvements would result in a potential increase of 10,170 new riders. The addition of BART improvements would add up to 6,370 new BART riders when compared to 2040 No Build. As in 2020, the addition of new service would realign transit users among the available transit services. With these changes, there would be up to 16,580 net new transit riders associated with the full complement of bus and BART improvements when comparing the 2040 Build to the 2040 No Build.

2.1.1 Total Riders

This criterion focuses on the anticipated total transit ridership generated under each package of improvements. In other words, which packages of improvements would generate the greatest overall transit ridership and what is the relative contribution of each of the alternatives to achieving the ridership. By packaging the alternatives, we were able to account for the benefits gained by having an integrated transit network that provides a full range of services.

Implementation of the two BART alternatives in conjunction with the two BRT alternatives would generate the most substantial total increase in total West County transit ridership. The BART Rumrill Boulevard alternative, with stations at Contra Costa College, Richmond Parkway, and Hercules Transit Center, is projected to have a total BART ridership of 32,530 in 2040. The BART Richmond Parkway alternative, with stations at Hilltop Mall, Appian Way, and Hercules Transit Center, would generate a slightly lower total West County BART ridership at 32,170 riders in 2040.

Additional analysis on the stations is warranted if the BART projects move forward, however. Based on current analysis, the intermediate stations at Contra Costa College and Appian Way would generate the highest ridership.

Both the San Pablo Avenue/Macdonald Avenue and 23rd Street BRT alternatives generate a high level of transit ridership for West County, in the short-term and the long-term. With the San Pablo Avenue/Macdonald Avenue corridor, the total local bus and BRT ridership for AC Transit would be about 17,900 in 2020 and in the range of 27,000 to 29,140 riders in 2040. This reflects the high transit demand for travel within West County and connecting to northern Alameda County.

The total ridership for the San Pablo Avenue/Macdonald Avenue BRT within West County is 8,660 riders in 2020 and in the range of 11,250 to 12,810 riders for 2040, depending on the package. The San Pablo Avenue leg of the alternative through West County carries most of these riders (about 75 percent). The 23rd Street BRT would generate about 4,700 riders in 2020 and in the range of 5,980 to 6,260 riders in 2040.

The Express Bus Alternative would account for up to 9,320 total riders in 2020 and in the range of 9,120 to 11,160 riders in 2040, depending on the improvements made. The new Capitol Corridor stop associated with the RITC would generate approximately 440 riders by 2040.

Table 2-2 summarizes the relative ratings of the alternatives as to their contribution to total transit ridership.

Table 2-2: Total Riders

Alternative	Performance Rating	Summary of Findings
1. Express Bus Service	3	The combined express bus and transbay transit services of AC Transit and WestCAT are projected to deliver in the range of 9,120 to 11,160 transit passengers in 2040. This is a crucial service to West County that complements the BART system. A BART extension would compete with this service for transit riders.
2. San Pablo Avenue/Macdonald Avenue BRT	3	The San Pablo/Macdonald BRT corridor is expected to deliver in the range of 11,250 to 12,810 transit passengers in 2040, depending on the package of improvements implemented. Implementation of the BART extension does not appreciably affect this ridership.
3. 23rd Street BRT	3	The 23rd Street BRT is expected to generate from 5,980 to 6,260 transit passengers in 2040, depending on the package of improvements implemented. Implementation of the BART extension does not appreciably affect this ridership.
4. Commuter Rail: Fare Subsidies on Capitol Corridor and Station at Regional Intermodal Transit Center at Hercules	1	The introduction of a new Capitol Corridor service would not be highly sensitive to the other new transit services proposed. The RITC is expected to generate a total of 440 new riders and the fare subsidy an expected 190 new riders.
6A. BART Extension from Richmond Station to Hercules via Rumrill Boulevard	5	BART, with the proposed Rumrill Boulevard Alternative, is projected to generate 14,510 transit riders at the three new stations and approximately 32,530 BART transit riders in West County in 2040. The 2015 observed ridership for weekday boardings is 17,640 total riders (includes El Cerrito Plaza, El Cerrito del Norte, and Richmond stations only). The BART system would be the largest single contributor to transit ridership in West County.
6B. BART Extension from Richmond Station to Hercules via Richmond Parkway	5	BART, with the proposed Richmond Parkway Alternative, is projected to generate 12,580 transit riders at the three new stations and approximately 32,170 BART transit riders in West County in 2040. The 2015 observed ridership for weekday boardings is 17,640 total riders (includes El Cerrito Plaza, El Cerrito del Norte, and Richmond stations only). The BART system would be the largest single contributor to transit ridership in West County.

2.1.2 New Riders

This criterion focuses on the anticipated net new riders that would be using the transit service provided by the study's alternatives. This is the number of total riders who would use the new transit service minus the ridership growth represented in the No Build scenario. The range in ridership is dependent on the package of improvements assumed in each package of improvements.

For example, for the Express Bus alternative, the No Build would not include express bus service to Alameda County, as that service does not exist today. However, it does include AC Transit and WestCAT transbay service from the study area to San Francisco and local express bus service, which is shown to increase by 2,480 to 3,020 riders (or up to 48 percent) in 2020 and increase by 990 to 3,030 riders (or up to 37 percent) in 2040, depending on the package of improvements put in place. The introduction of new express bus service between the study area and Berkeley, Emeryville, and Oakland, is projected to add 1,120 to 1,230 new riders in 2020 and 1,560 to 2,060 new riders in 2040.

Compared to the No Build scenario, ridership on the San Pablo/Macdonald Avenue BRT corridor would result in 1,910 net new AC Transit local and BRT riders in 2020 (about 73 percent in the San Pablo Avenue Corridor). The 23rd Street BRT would result in 1,990 net new AC Transit local and BRT riders in 2020 compared to the No Build scenario.

In 2040, when compared to the No Build, the combined San Pablo/Macdonald Avenue and 23rd Street BRT projects would result in in a range of 5,920 to 8,060 net new local and BRT AC Transit riders in 2040. About 48 percent of the riders would be on the San Pablo Avenue BRT, about 35 percent on 23rd Street BRT, and about 17 percent on Macdonald Avenue BRT. The implementation of the BART extension would provide a boost to transit ridership on the San Pablo Avenue corridor. In the future, both BRT projects are expected to be in place and would work in concert with each other to increase transit ridership.

For the BART alternatives, an increase of 6,010 to 6,370 net new riders is anticipated by 2040 (up to 32 percent). The Hercules Transit Center, which would become the new end of the line station, would have the highest ridership out of six stations in West County. With the new BART stations, riders would be pulled away from the El Cerrito del Norte station and to a lesser degree from the Richmond Station. Ridership would decline by about 7,850 to 7,910 net riders at El Cerrito del Norte and up to 1,160 net riders at the Richmond Station when compared to the 2040 No Build. The El Cerrito Plaza Station ridership would continue to grow under all 2040 scenarios in the range of 920 to 1,040 net riders when compared to the 2040 No Build.

The projected declines in ridership at the El Cerrito del Norte and Richmond stations are anticipated, as the BART extension northward is expected to reduce congestion and parking shortages at the El Cerrito del Norte station. El Cerrito del Norte station functions as a terminus

rail station, and terminus stations tend to have larger ridership. The BART extension would remove that status for the Richmond station, thereby curbing its ridership increase (at least by percentage).

Table 2-3 summarizes the relative ratings for the five alternatives in terms of their potential to generate new transit riders in West Contra Costa County.

Table 2-3: Net New Riders

Alternative	Performance Rating	Summary of Findings
1. Express Bus Service	1	The Express Bus service, which could be provided by either AC Transit or WestCAT, would add in the range of 1,560 to 2,060 net new transit riders from West Contra Costa County to Alameda County. The combined AC Transit transbay service, LYNX, and WestCAT express services would increase from 990 to 3,030 net new riders. The WestCAT and LYNX service would experience a ridership decline when comparing the 2040 Build to the No Build.
2. San Pablo Avenue/Macdonald Avenue BRT	3	The introduction of BRT services in West County would result in an increase in the range of 5,920 to 8,600 net new local and BRT trips. Ridership on the San Pablo Avenue would represent about 48 percent transit of the new riders and Macdonald Avenue would represent about 35 percent of the ridership.
3. 23rd Street BRT	3	The introduction of BRT services in West County would result in a net increase of about 8,600 net new local and BRT trips. Ridership on 23rd Street would represent about 17 percent of the net new ridership.
4. Commuter Rail: Fare Subsidies on Capitol Corridor and Station at Regional Intermodal Transit Center at Hercules[1]	1	The proposed Regional Intermodal Transit Center at Hercules is projected to attract approximately 440 net new transit riders in this corridor. With the addition of a 75 percent fare subsidy for trips to and from the Richmond Station and Martinez and northern Alameda County, approximately 190 net new riders were projected for West County.
6A. BART Extension from Richmond Station to Hercules via Rumrill Boulevard	5	The BART extension via Rumrill Boulevard would add approximately 6,370 net new riders to BART in 2040, with the highest ridership at the Hercules Transit Center, which would become the new end of the line station. The ridership at the El Cerrito del Norte Station is projected to decline, by 7,900 net passengers.
6B. BART Extension from Richmond Station to Hercules via Richmond Parkway	5	The BART extension via Richmond Parkway would add approximately 6,010 net new BART riders, with the highest ridership at the Richmond Transit Center. The ridership at the El Cerrito del Norte Station would decline by about 7,850 net passengers.

1 *West Contra Costa High-Capacity Transit Study, Technical Memorandum #11*, December 2016, WSP / Parsons Brinckerhoff, and Kimley-Horn. Technical Memorandum #11 evaluates the potential to achieve additional ridership on the Capitol Corridor

2.2 Speed and Reliability

The speed and reliability criterion evaluates the performance of the alternatives in terms of the following performance measures:

- Transit travel time improvement
- Transit travel time reliability

2.2.1 Transit Travel Time Improvement

Improving transit travel time to make it a more attractive alternative than auto travel is critical. More *new* transit trips are expected to be generated if HCT alternatives provide significant decreases in travel times compared to existing service. For some alternatives, new infrastructure, such as direct access ramps for the Express Bus alternative, bus priority signals for the Express Bus and BRT alternatives, and dedicated bus lanes for the BRT Alternatives, would improve existing service by helping buses move more quickly through surface streets. In addition, HOV lanes will enable Express buses to travel more quickly through congested freeway traffic during peak periods.

Greater reductions to travel time are also possible by providing new rail transit opportunities. A new station at the Regional Intermodal Transit Center at Hercules would reduce the travel time of trips between Hercules and Richmond and Martinez and also provide a more expedient way of getting to other regional destinations. Subsidized Capitol Corridor fares for trips within West County and connecting to Martinez, Berkeley, Emeryville, and Oakland would create an opportunity to take advantage of the quicker travel time on the Capitol Corridor for shorter trips. Extending BART from Richmond to Hercules would reduce the transit travel time for trips within West County and those continuing on the BART system to other regional destinations.

Table 2-4 summarizes the rates of each alternative relative to transit travel time improvements.

Table 2-4: Transit Travel Time Improvement

Alternative	Performance Rating	Summary of Findings
1. Express Bus Service	3	More frequent and new service as well as exclusive HOV ramps provide travel time improvements. Approximately 88% of the corridor would benefit from the use of HOV lanes.
2. San Pablo Avenue/Macdonald Avenue BRT	3	More frequent service and new transit priority infrastructure would provide travel time improvement for existing service. Approximately 60% of the corridor would benefit from bus-only lanes.
3. 23rd Street BRT	3	More frequent service and new transit priority infrastructure would provide travel time improvement for existing service. Approximately 50% of the corridor would benefit from bus-only lanes.
4. Commuter Rail: Fare Subsidies on Capitol Corridor and Station at Regional Intermodal Transit Center at Hercules	5	Commuter rail provides travel time improvement over existing bus transit service by making Capitol Corridor available to more potential users with the introduction of a new stations. Users would experience a more direct as well as faster service with exclusive right-of-way. The fare subsidies would make the service available to more users.
6A. BART Extension from Richmond Station to Hercules via Rumrill Boulevard	5	New rail service provides travel time improvement over existing bus transit service with the benefit of 100% exclusive right-of-way.
6B. BART Extension from Richmond Station to Hercules via Richmond Parkway	5	New rail service provides travel time improvement over existing bus transit service with the benefit of 100% exclusive right-of-way.

2.2.2 Transit Travel Time Reliability

Travel time reliability is another major factor that makes transit more attractive and encourages people to take transit rather than drive. Reliability is directly related to travel time: the more dependable the transit alternative, the less time a user must allow in making a trip, including the time waiting for transit at a station or stop and the time spent in the transit vehicle traveling to a destination. Transit modes operating in exclusive guideways are the most reliable as they do not get stalled by traffic congestion or accidents. Exclusive guideways may be shared with similar modes (e.g., passenger and freight rail) but not mixed traffic (e.g., private automobiles). Dedicated transit lanes, which are lanes that adjoin travel lanes of other modes and whose use may at times be shared by other modes (e.g. emergency vehicles), offers the second most reliable option compared to exclusive guideways. High occupancy vehicle (HOV) lanes (also known as carpool lanes) are restricted for use by vehicles carrying the minimum number of people posted at the entrance signs (this is typically 2+ passengers, but sometimes 3+ passengers). HOV lanes comprise a traffic management strategy to promote and encourage ridersharing in order to alleviate congestion and maximize the carrying capacity of highways.

The alternatives are rated according to the extent of its alignment operating on exclusive guideway or dedicated lanes. The highest rating is given to rail alternatives that operate in exclusive guideway.

Bus service is rated lower than rail service. The following exclusive bus lanes are proposed for the BRT alternatives:

- San Pablo/Macdonald BRT – Dedicated bus lanes are proposed on San Pablo Avenue from the El Cerrito del Norte BART station to the Richmond Parkway Transit Center. On Macdonald Avenue dedicated lanes are proposed from San Pablo Avenue to 21st Street. Dedicated lanes are proposed on about 60 percent of the corridor; 65 percent on San Pablo Avenue and 50 percent on Macdonald Avenue.
- 23rd Street BRT – Dedicated bus lanes are proposed for consideration on 23rd Street from Macdonald Avenue to Rheem Avenue. Bus lanes are also recommended for consideration on 23rd Street from Rheem Avenue to its intersection with San Pablo Avenue and then on San Pablo Avenue to Hilltop Mall. A portion of 23rd Street has been reduced to three travel lanes with a median and would require particular consideration for dedicated bus lanes. Dedicated lanes are proposed on about 40 percent of the corridor.

The 23rd Street BRT alternative that would operate in dedicated lanes on about 40 percent of the corridor would likely experience the most frequent operational conflicts with other modes – although BRT features on under this alternative would be an improvement over existing conditions. The Express Bus and BRT alternatives that have the potential to operate in exclusive lanes on more than half of the corridor are rated with moderate performance.

The results of the travel time reliability ratings are summarized in

Table 2-5.

Table 2-5: Transit Travel Time Reliability

Alternative	Performance Rating	Summary of Findings
1. Express Bus Service	3	Alignment 88% in dedicated (HOV) lanes; somewhat unreliable travel times due to HOV lane congestion and need for buses to cross mixed-flow lanes.
2. San Pablo Avenue/Macdonald Avenue BRT	3	Alignment proposed to be 60% dedicated lanes although all proposed locations may not be possible due to conflicts with autos at intersections. Frequent stops although fewer than for local bus service.
3. 23rd Street BRT	3	Alignment proposed to be 40% dedicated lanes although all proposed locations may not be possible due to conflicts with autos at intersections. Frequent stops although fewer than for local bus service.
4. Commuter Rail: Fare Subsidies on Capitol Corridor and Station at Regional Intermodal Transit Center at Hercules	5	Commuter rail provides travel time improvement over existing bus transit service by making Capitol Corridor available to more potential users with the introduction of a new stations. Users would experience a more direct as well as faster service with exclusive right-of-way. The fare subsidies would make the service available to more users.
6A. BART Extension from Richmond Station to Hercules via Rumrill Boulevard	5	Alignment 100% exclusive guideway with no at-grade crossings, no shared use of corridor.
6B. BART Extension from Richmond Station to Hercules via Richmond Parkway	5	Alignment 100% exclusive guideway with no at-grade crossings, no shared use of corridor

2.3 Access and Connectivity

The access and connectivity criterion evaluates the performance of the alternatives in terms of the following performance measures:

- Regional transit centers served
- Quality of connections to existing transit systems and facilities
- Service to West County markets lacking major transit connections

2.3.1 Regional Transit Centers Served

Transit needs to serve desirable destinations to be convenient for users. These can be regional transit centers that connect passengers to other services or can be destinations in themselves. Accessibility and connectivity were measured by the number of regional transit or activity centers that each alternative served. Regional transit centers include existing and planned/proposed BART stations, multimodal transit centers, rail stations, and major business districts with high levels of transit. While this method of measurement for evaluating connectivity to regional transit centers treats all transit centers equally, some centers (e.g., downtown San Francisco) provide access to far more destinations (e.g., jobs and housing) than others.

The San Pablo Avenue/Macdonald Avenue BRT alternative would have the best accessibility and connectivity of the alternatives (since it spans the longest route and passes through the most transit centers) with the remaining alternatives comparable with moderate accessibility and connectivity.

The performance rating and number of transit centers within West County served by each alternative is shown in Table 2-6.

Table 2-6: Regional Transit Centers Served

Alternative	Performance Rating	Summary of Findings
1. Express Bus Service	3	Connects three existing regional transit centers (Hercules Transit Center, Richmond Parkway Transit Center, and El Cerrito del Norte BART) and one potential regional transit center at Macdonald Avenue and I-80. This service level would not be achieved if only operational improvements were implemented (such as adding schedules to existing service).
2. San Pablo Avenue/Macdonald Avenue BRT	5	Connects eight existing regional transit centers (six along San Pablo Avenue (Hercules Transit Center, Richmond Parkway Transit Center, Hilltop Mall, Contra Costa College, El Cerrito del Norte BART, El Cerrito Plaza BART) and two along Macdonald Avenue (Richmond BART and Tewksbury Turnaround)) and one potential regional transit center at Macdonald Avenue and I-80
3. 23rd Street BRT	3	Connects five regional transit centers (Hercules Transit Center, Hilltop Mall, Contra Costa College, Richmond BART, and Ford Point Ferry Terminal)
4. Commuter Rail: Fare Subsidies on Capitol Corridor and Station at Regional Intermodal Transit Center at Hercules	3	Connects three regional transit centers (Regional Intermodal Transit Center at Hercules, Martinez Amtrak, and Richmond BART) as well as transit centers in Alameda and Santa Clara Counties served by Capitol Corridor (Oakland Jack London Square, Diridon Station)
6A. BART Extension from Richmond Station to Hercules via Rumrill Boulevard	3	Connects six regional transit centers (Hercules Transit Center; Appian/I-80, Richmond Parkway Transit Center, Hilltop Mall, or Contra Costa College (only one or two of these options would be selected); Richmond BART; El Cerrito del Norte BART; and El Cerrito Plaza BART) as well as other BART stations in the system, which serve as intermodal transit centers
6B. BART Extension from Richmond Station to Hercules via Richmond Parkway	3	Connects six regional transit centers (Hercules Transit Center; Appian/I-80, Richmond Parkway Transit Center, or Hilltop Mall (only one or two of these options would be selected); Richmond BART; El Cerrito del Norte BART; and El Cerrito Plaza BART) as well as other BART stations in the system, which serve as intermodal transit centers

2.3.2 Quality of Connections to Existing Transit Systems and Facilities

Quality of connections indicates the ease of movement and transfers between different modes of transit (e.g., from a bus to a train or from a ferry to a bus) and/or within the same mode. This was assessed relative to existing transit service and facilities. Existing bus and rail facilities and major bus transfer hubs that would connect to the alignment of each option were identified.

Each station along an alternative was rated individually, receiving a high rating for convenient connections, such as a platform integrated with a transit center, down to a low rating for challenging connections that may require significant walking, roadway crossings, and other obstacles to make a transfer.

The 23rd Street BRT and the BART alternatives earned the highest rating. For 23rd Street BRT, stops would be well-integrated with minimal walking distance. BART would also perform at a high level since there is extensive connectivity to bus services and multimodal access at BART stations. Despite delivering riders along high-employment corridors, the Express Bus alternative earned the lowest ranking because of longer walk distances and access obstacles for non-auto modes along the freeway (although the latter would be addressed by building pedestrian improvements, e.g., grade-separated pathways, such as a pedestrian bridge). In the short-term, walking distance would be shorter since buses are picking riders up at the existing Park and Rides.

Table 2-7 summarizes the rating for the quality of transit connections for each alternative.

Table 2-7: Quality of Connections to Existing Transit Systems and Facilities

Alternative	Performance Rating	Summary of Findings
1. Express Bus Service	1	Okay connections with walking distance required at most stops along freeway corridors to nearby bus transfers and park-and-rides; close proximity to freeway ramps creates obstacles; in the short-term, this walk would be a shorter distance since buses are picking up riders at the existing Park and Rides
2. San Pablo Avenue/Macdonald Avenue BRT	3	High-quality connections except for El Cerrito del Norte and El Cerrito Plaza BART stations, where buses will stop on San Pablo Avenue and not enter the station itself, creating significant walking distance to connections. If buses were routed into the BART station access would be improved.
3. 23rd Street BRT	5	High-quality connections assuming all stops will be well-integrated with limited walking distance to other bus, rail, and ferry connections
4. Commuter Rail: Fare Subsidies on Capitol Corridor and Station at Regional Intermodal Transit Center at Hercules	6	High-quality connections for proposed intermodal transit center, linking Capitol Corridor, WestCAT, and potential ferry service, with access to other connections, including AC Transit, via the Richmond Amtrak/BART station. The introduction of a lower fare would increase the number of people accessing this service.
6A. BART Extension from Richmond Station to Hercules via Rumrill Boulevard	5	High-quality intermodal connections assumed for all BART stations with bus-rail connections possible right outside BART fare gates
6B. BART Extension from Richmond Station to Hercules via Richmond Parkway	5	High-quality intermodal connections assumed for all BART stations with bus-rail connections possible right outside BART fare gates

2.3.3 Service to Underserved Areas

Much of West Contra Costa County has been identified as having a strong transit market.[11] However, not all of the areas with high transit potential currently have good transit connections nor are they currently sufficiently dense to support a high level of transit. For this performance measure, each alternative's service to markets currently lacking major transit connections and the potential for an expanding transit market were examined.

The alternatives were overlaid with all existing transit systems in the study area. Areas with low transit service and high transit potential were identified and tabulated to determine the greatest opportunities for expanding service areas. The highest marks were assigned to the San Pablo Avenue/ Macdonald Avenue and 23rd Street BRT alternatives with the highest potential to connect with currently under-served transit markets.

The results of this evaluation measure are presented in Table 2-8.

Table 2-8: Service to West County Markets Lacking Major Transit Connections

Option	Performance Rating	Summary of Findings
1. Express Bus Service	3	Alternative expands service to markets in Hercules, Pinole, Tara Hills, El Sobrante, and south and east Richmond
2. San Pablo Avenue/Macdonald Avenue BRT	5	Alternative expands service to markets in Hercules, Pinole, Tara Hills, and west and central Richmond
3. 23rd Street BRT	5	Alternative expands service to markets in Hercules, Pinole, Tara Hills, and west, central, and south Richmond
4. Commuter Rail: Fare Subsidies on Capitol Corridor and Station at Regional Intermodal Transit Center at Hercules	3	Alternative expands service to Hercules and Pinole
6A. BART Extension from Richmond Station to Hercules via Rumrill Boulevard	3	Alternative expands service to markets in Hercules, Pinole, Tara Hills, San Pablo, and northern Richmond
6B. BART Extension from Richmond Station to Hercules via Richmond Parkway	3	Alternative expands service to markets in Hercules, Pinole, Tara Hills, and northern Richmond

[11] *West Contra Costa High-Capacity Transit Study, Technical Memorandum #7, Travel Markets*, January 2016, WSP/Parsons Brinckerhoff, Kimley Horn, Kittelson & Associates.

2.4 Cost and Efficiency

The cost and efficiency criterion evaluates the performance of the alternatives in terms of the following performance measures:

- Capital cost
- Operating and maintenance cost
- Annualized cost per rider

The high capacity alternative(s) selected for implementation will require funding from public sources, likely a combination of local, regional, state, and federal to construct. Once completed, the alternative(s) would also require an ongoing public subsidy to operate. The operating subsidy, which is the portion of annual operating and maintenance (O&M) costs not covered by farebox and related revenues (such as marketing revenues, fees, etc.), typically comes from local sources. The total capital and O&M costs of each alterative will influence public decisions regarding funding. The required investment must be seen as a sensible and efficient use of tax revenues.

While the total cost of the alternative is important and has a significant impact on the investment decision and general assessment of project feasibility (see 2.5 Feasibility), project costs need to be compared to project benefits. The major direct benefit of an alternative is increased transit ridership. Indirect benefits include: reduced auto congestion; lower emissions of air pollutants, including greenhouse gases; lower energy use per person-trip; economic development opportunities, and reinforcement of desired development patterns. Cost per rider provides a reasonable measure of an alternative's cost to the direct benefits it generates.[12]

To assess the Cost and Efficiency, four evaluation criteria and performance measures are used for comparison of alternatives.

2.4.1 Capital Cost

The total one-time cost to implement a project, inclusive of planning, environmental, design and construction costs, varies considerably by alternative. The bus alternatives are scalable and can be implemented over time, with each investment accruing benefits in terms of increased transit ridership. In contrast, the benefits associated with rail improvements would not be experienced until the full rail investment is made. Rail projects are scalable only to the extent that stations and extensions can be incrementally added to an existing rail system.

[12] No estimate of cost relative to total benefits (direct and indirect) has been made at this time.

The costs of each of the alternatives considered in this memorandum are summarized in **Error! Reference source not found.**. A more detailed description of the costs estimates by alternative is included in Technical Memorandum #13.2.[13] Costs are reported in 2017 nominal dollars.

Table 2-9: Capital Costs of Alternatives (2017 $ in Millions)

	Alternative	Short-Term (1-5 Years)	Medium-Term (5-15 Years)	Long-Term (15+ Years)	Total Cost
1.	Express Bus	$11	$90	$141	**$242**
2.	San Pablo Ave/Macdonald Ave BRT	$3	$180	$60	**$243**
3.	23rd St BRT	$17	$99	$63	**$179**
4.	Commuter Rail: RITC Option[1]	NA	$69	$51	**$69**
6A.	BART Extension from Richmond via Rumrill Blvd.	$56	$74	$3,452	**$3,582**
6B.	BART Extension from Richmond via Richmond Pkwy.	$69	$92	$3,995	**$4,156**

Source: West Contra Costa High-Capacity Transit Study, Task Number 13.2, Refined Preliminary Screening Cost Estimate, WCCTAC, prepared by M. Lee Corporation and WSP/Parsons Brinckerhoff, 3/24/2017

[1] The City of Hercules has identified the total cost to complete the Regional Intermodal Station at Hercules as $68.6 million. The City unsuccessfully pursued a TIGER grant for $17.4 million, and may seek other funds to cover a portion of these costs. There would be no capital costs associated with a Capitol Corridor fare subsidy program. The cost estimate for the RITC has been provided by the City of Hercules and may not fully cover the Capitol Corridor costs for this additional station.

The lowest cost alternative is Commuter Rail, which assumes a Capitol Corridor rail station in Hercules and/or fare incentives for travel between the West Contra Costa County stations and the Martinez station to the north and the Berkeley, Emeryville, and Oakland Jack London Square stations to the south. The fare subsidy would apply to all trips starting or ending in West County (regardless of whether the Regional Intermodal Center at Hercules is built). The fare subsidy would essentially be a service improvement, while the Regional Intermodal Center at Hercules is a capital investment project.

The capital costs for the implementation of the Regional Intermodal Center at Hercules, which will include a new Capitol Corridor station, are estimated at $81 million by the City of Hercules. Funding is available for the first two phases of the project, however, there is an unfunded amount of $68.6 million needed to complete this project, which is identified here. A station in Hercules would require investment in a platform, fare collection equipment, and other passenger amenities. Additional investments may also be required as the City of Hercules works with CCJPA to determine the necessary railroad facility improvements in order for the Capitol Corridor to serve Hercules. No major track or rolling stock improvements outside of the

[13] *West Contra Costa High-Capacity Transit Study, Task Number 13.2, Refined Preliminary Screening Cost Estimate,* WCCTAC, prepared by M. Lee Corporation and WSP/Parsons Brinckerhoff, 3/24/2017

Intermodal Center are proposed. The station would also require an agreement with the Capitol Corridor Joint Powers Authority (CCJPA) supporting the addition of this proposed new station.

Implementation of the Express Bus and BRT alternatives on San Pablo/Macdonald Avenue and 23rd Street are scalable and can be implemented incrementally over time. While the costs are arrayed as short-term, medium-term, and long-term costs in this study, they would vary depending upon the intensity of incremental improvements made. For example, for the Express Bus Alternative, the introduction of new vehicles could initiate service operation without significant infrastructure costs in the short-term. As ridership builds, more intensive improvements can be added over time or eliminated from further consideration. The mid-term cost estimate includes expanded parking in structures at existing transit centers, while the long-term cost estimates include adding direct access ramps to and from I-80 at the Hercules and Richmond Parkway Transit Centers as well as the potential for an Express Bus/BRT Transit Center at I-80 and Macdonald Road. Additional study may be required in the future before undertaking the long-term and more capital intensive improvements to ensure that they would be cost-effective.

For BRT, capital costs are largely proportional to the extent of dedicated bus lanes to be constructed, which require substantial roadway improvements. The major lane and median reconfigurations would in most instances require reconstruction of the roadways to ensure proper drainage and ADA accessibility. The short-term costs are for bus priority treatments and very limited segments of bus only lanes, such as for queue jumps. In the medium-term, dedicated bus lanes would be implemented in the southernmost segments of San Pablo and Macdonald Avenues and along 23rd Street, along with expanded parking at existing transit centers. In the long-term, bus only lanes would extend to either the Richmond Parkway Transit Center (San Pablo Avenue BRT) or the Hilltop Mall Transit Center (23rd Street BRT). The costs are for BRT improvements only in West County.

Overall, because improvements would be made in existing public rights-of-way, the capital costs for the three bus alternatives are lower than if the improvements would be constructed in new right-of-way and as entirely new facilities, which is required for the BART alternatives. All the bus alternatives and scalable in terms of investments and can be phased in over time. However, the longer-term improvements (15+ years) for the Express Bus alternative are costly because of freeway ramp improvements for buses at transit centers, enabling buses to get on/off freeways faster. The BART alternatives, either along Rumrill

> ***Scalable versus Phased Improvements***
>
> Scalable improvements indicate the level of improvement can be changed to respond to funding availability, project viability, and public support. Phased improvements indicate that investments can be implemented over time.

Boulevard to Hilltop Mall and then the Hercules Transit Center or along the UPRR alignment, crossing over to Richmond Parkway and then to the Hercules Transit Center, are the highest cost alternatives because of the right-of-way and new facilities costs. Both alignments would incur substantial costs for new right-of-way or right-of-way purchase and easements, new track/guideway, stations, rail vehicles, and yard facilities. Table 2-10 summarizes the rating of the five alternatives with respect to capital costs.

Table 2-10: Capital Costs Evaluation

Alternative	Performance Rating	Summary of Findings
1. Express Bus Service	3	Moderate capital costs. Express Bus lends itself to scalable improvements that can be phased or deferred over time. The addition of new freeway ramps for improved transit access at Hercules Transit Center, Richmond Parkway Transit Center, and the potential Express Bus/BRT Transit Center at I-80 add significant costs to this alternative.
2. San Pablo Avenue/Macdonald Avenue BRT	3	Moderate capital costs. In full build-out comparable in costs to Alternative 1. BRT lends itself to scalable improvements, which can be phased or deferred over time, but travel time reliability would be adversely impacted.
3. 23rd Street BRT	3	This is the lowest cost of the major bus investments. BRT lends itself to scalable improvements, which can be phased or deferred over time, but travel time reliability would be adversely impacted.
4. Commuter Rail - RITC	5	Lowest cost to implement. The initial costs of the Regional Intermodal Station at Hercules have been funded by others and not included in this study, however, there is an outstanding cost that does not currently have a funding commitment which has been included in this study.
6A. BART Extension from Richmond Station via Rumrill Boulevard	1	High capital costs due to right-of-way acquisition, new facilities with substantial tunneling and elevated structure, new rolling stock, and a new train storage yard. Intermediate stations could be deferred to partially offset initial construction costs or consideration be given to a shorter extension limited to one or two stations.
6B. BART Extension from Richmond Station via Richmond Parkway	1	Highest capital costs due to right-of-way acquisition, new facilities with substantial tunneling and elevated structure, new rolling stock, and a new train storage yard. Intermediate stations could be deferred to partially offset initial construction costs or consideration be given to a shorter extension limited to one or two stations.

2.4.2 Operating and Maintenance Cost

In addition to capital costs, the costs associated with operations and maintenance of the proposed alternatives are an important consideration in determining which projects to move ahead for further development. O&M costs are lowest for enhanced intercity/commuter rail

service under Alternative 4 Commuter Rail and highest for the two BART extension alternatives. In the middle are costs for bus service improvements.

The O&M costs in Table 2-11 represent total O&M costs for each alternative except for the BRT alternatives. Whereas the Express Bus, Commuter Rail and BART Extension alternatives are entirely new services, the BRT alternatives would replace existing Rapid and/or local bus services. For instance, the San Pablo Avenue/Macdonald Avenue BRT alternative would replace AC Transit routes 72R and 72 along San Pablo Avenue and also certain WestCAT services north of Hilltop Mall. The alternative would also replace route 72M along Macdonald Avenue. Under Alternative 3, 23rd Street BRT would replace existing Route 74 service in south and central Richmond and certain WestCAT services north of Hilltop Mall in the San Pablo Avenue corridor. In these two cases, the estimated O&M costs of bus services to be replaced are subtracted from the total cost of the new BRT alternatives to give net O&M costs—the estimated increase in O&M costs after the new BRT services are implemented and the existing bus services are eliminated.

The O&M costs do not reflect the effects of offsetting revenues from the high capacity transit alternatives. The revenues would include fares and other revenues such as advertising revenues. Fare revenues can be a substantial offsetting factor. (BART recovers 64 percent of its O&M costs through fares, however, AC Transit and WestCAT have much lower fare recovery rates, 19.4 percent and 23.5 percent respectively).[14] In project development, the cost analysis could be expanded to estimate these offsetting revenues and thus the bottom line budget impact to the project sponsor. Using total O&M costs are reasonable at this phase of conceptual project development. This is the cost that is used in Cost per Rider and Cost per New Rider metrics of transit funding agencies like the Federal Transit Administration.

Table 2-11: O&M Costs of Alternatives (2017 $)

Alternative	Annual Cost, 2040 Service Levels
1. Express Bus[1]	$3.2 million
2. San Pablo Ave/Macdonald Ave BRT[2]	$5.4 million
3. 23rd St BRT	$5.6 million
4. Commuter Rail – Fare Subsidy and RITC[3]	$2.4 million
6a. BART Extension from Richmond via Rumrill[4]	$59.7 million
6b. BART Extension from Richmond via Richmond Pkwy[4]	$62.6 million

Source: Kimley-Horn & Associates, Inc. based on local transit agency reported information in 2015 National Transit Database, with the exception of Commuter Rail. The cost of fare subsidies was provided by WCCTAC and an estimate of increased O&M costs for the RITC were provided by Kimley-Horn. Costs are escalated through 2016.

[1] Includes costs for increasing WestCAT Lynx service frequencies during peak periods to 10 minutes from current 15 minutes.
[2] Costs estimated only for portion of service in West County.
[3] Costs for fare incentives and maintenance of rail station.
[4] Costs estimated only for West County BART extension service.

[14] 2015 National Transit Database.

Commuter rail O&M costs are associated with two components: (1) proposed fare subsidies for West County passengers getting off or on at Hercules or Richmond and traveling between Martinez and Jack London Square in Oakland, and (2) maintenance of the new Regional Intermodal Transit Station at Hercules. The annualized O&M costs associated with the subsidized fares are estimated at $1.9 million and an additional $500,000 allowance was made for O&M at the proposed RITC.

Express Bus on I-80 would be the lowest cost of the bus alternatives. It represents an expansion of existing express and transbay services in the corridor currently operated by WestCAT and AC Transit. The Express Bus on I-80 Alternative would add 10-minute service from the Hercules Transit Center to and from the East Bay during peak commute periods and limited 30-minute service during the midday. There would be no late weekday evening or weekend Express Bus service. BRT service would operate at high frequencies, seven days a week and late into the evenings, replacing existing, high frequency arterial bus and Rapid Bus service. Because there would be about twice the vehicle hours and miles of service generated from operations of San Pablo/Macdonald Avenue BRT service compared to 23rd Street BRT service, the San Pablo/Macdonald BRT Alternative is approximately twice the cost of the 23rd Street BRT service.

BART service would be the most costly to operate because it would operate for approximately 20 to 21 hours every day, and at a high frequency level, particularly on weekdays (6 minute frequencies during peak periods and 7.5 minute frequencies during the midday). The service is assumed to operate at maximum train lengths (10 cars per train) during most periods. This intense level of service generates substantial revenue vehicle miles and hours, the factors used to estimate O&M costs.

Table 2-12 summarizes the ratings of the alternatives relative to their total annual O&M costs.

Table 2-12: O&M Costs Evaluation

Alternative	Performance Rating	Summary of Findings
1. Express Bus Service	5	Second lowest cost alternative. Weekday only service, focused on peak periods (10-minute frequencies) with limited midday and early evening service.
2. San Pablo Avenue/Macdonald Avenue BRT	3	Most costly to operate of the bus alternatives due to high service frequencies and coverage 7 days a week, 20+ hours a day.
3. 23rd Street BRT	3	Substantially increased service frequencies and operation 7 days a week for 20+ hours increase costs compared to existing conditions. 23rd Street service would not be as frequent as for San Pablo BRT, because of lower demand. Alignment is also shorter, generating fewer revenue vehicle (bus) hours and miles.
4. Commuter Rail – Fare Subsidy and RITC	5	Lowest cost to operate. No new service is proposed. Capitol Corridor trains would stop in Hercules to pick-up and drop-off passengers. O&M costs are associated with station maintenance and fare subsidies.
6A. BART Extension from Richmond Station via Rumrill Boulevard	1	High O&M costs for frequent new service between Richmond and Hercules 7 days a week. Assumes operation of 10-car trains for up to 21 hours a day.
6B. BART Extension from Richmond Station via Richmond Parkway	1	High O&M costs for frequent new service between Richmond and Hercules 7 days a week. Assumes operation of 10-car trains for up to 21 hours a day.

2.4.3 Annualized Cost per Total Rider and Per New Rider

This performance metric compares investment costs to returns—or benefits—of each alternative. Returns are measured in terms of the ridership generated for each of the transit alternatives. Historically, the focus for FTA has been on new riders, or new linked trips. [1] When funding decisions were being made, investments that generated more new transit riders for their cost were ranked highest. The benefit generated by the transit investment therefore indicated the project's capacity to increase overall transit ridership. Recently FTA modified this metric for the evaluation of funding decisions to be total riders carried relative to cost, a measure of the overall performance of the proposed project. Both measures are evaluated in this section.

The Cost per Total Rider or, simply, Cost per Rider, is the ratio of the total annualized costs for an alternative, both capital and O&M, to the total annual trips for the alternative, as noted below. Costs represent the change in costs relative to the No Build condition and are the incremental increase in capital and O&M costs that would result from implementing and operating the project.

$$\frac{\text{Annualized Capital Cost + Annualized O\&M Cost (2017 \$)}}{\text{Annual Riders (2040 forecast of linked trips on the project)}}$$

The Cost per New Rider is calculated similarly, except the denominator is the Annual New Transit Trips forecast for the project.

For this study, total riders are derived from the forecasts of weekday trips using the alternative in 2040, annualized using a factor of 300 (weekday riders times 300) for services that would operate seven days a week and 253 for services that would operate weekdays only, such as the Express Bus and Commuter Rail alternatives. The factor of 300 for converting weekday to annual is the same as used on recent funding applications to FTA for BART and BRT projects sponsored by, respectively, the Santa Clara Valley Transportation Authority and AC Transit. The factor of 253 represents the number of weekdays in the year, accounting for holidays and other non-service days.

New riders are also derived from 2040 forecasts made by this study, annualized using a factor of 300 or 253, as appropriate. See Table 2-3, above, for forecasts of weekday riders.

Annualized Cost per Rider or per New Rider is a measure of cost-effectiveness and is expressed in dollars as shown in Table 2-13. The tables presents both metrics. Cost-effectiveness controls for the potentially greater ridership generated from higher cost transit investments and for the potential of a lower cost per passenger for higher capital cost projects that have high ridership.

Table 2-13: Annualized Cost per Rider (2017 $)

Alternative	Annual O&M Cost per 2040 Total Riders	Annual O&M Cost per 2040 New Riders
1, Express Bus[1]	$20	$21
2. San Pablo Ave/Macdonald Ave BRT[2]	$5	$18
3. 23rd St BRT	$8	$17
4. Commuter Rail[3]	$39	$1,050
6a. BART Extension from Richmond via Rumrill[4]	$35	$80
6b. BART Extension from Richmond via Richmond Pkwy[4]	$45	$93

Source: Kimley-Horn & Associates, Inc. based on local transit agency reported information in 2015 National Transit Database. Costs are escalated through 2016.

[1] Includes costs for increasing WestCAT Lynx service frequencies during peak periods to 10 minutes from current 15 minutes.

[2] Costs estimated only for portion of service in West County.

[3] Costs for fare incentives and maintenance of rail station.

[4] Costs estimated only for West County BART extension service.

Table 2-14 presents the ratings of the alternatives relative to the Cost per Total Rider. Alternatives are rated similarly if the Cost per Total Rider is of the same order of magnitude. The ratings would be similar for the Cost per New Rider, however, the cost per new rider for the Commuter Rail option is substantially higher than any of the other alternatives.

Table 2-14: Cost per Total Rider Evaluation

Alternative	Performance Rating	Summary of Findings
1. Express Bus Service	3	Moderate cost per total rider. The cost of major freeway ramp improvements inflate the cost per total rider. The improvements can be scaled to achieve a lower cost per total rider.
2. San Pablo Avenue/Macdonald Avenue BRT	5	Lowest cost per total rider of all alternatives. This alternative would improve service for many existing riders as well as new riders.
3. 23rd Street BRT	5	Low cost per total rider, but does not perform as well as Alternative 2.
4. Commuter Rail	1	Ridership is quite low and the cost of annual fare subsidies and station maintenance are high relative to the few riders. Thus the Cost per Rider is similar to that for the BART extensions.
6A. BART Extension from Richmond Station via Rumrill Boulevard	1	BART alternatives generate the highest transit ridership through West County, but capital and O&M costs are quite high. Thus BART alternatives have a high Cost per Total Rider.
6B. BART Extension from Richmond Station via Richmond Parkway	1	Same as for Alternative 6A although 6B is higher cost per rider due to higher annualized O&M and capital costs associated with a longer corridor length.

Source: WSP/Parsons Brinckerhoff and Kimley-Horn

The BART and the Commuter Rail alternatives are the most costly per rider, while the BRT investments are the most cost effective. The Express Bus alternative falls within the moderate range of cost effectiveness.

2.4.4 Average Trip Length

While Cost per Rider is the metric for assessing cost-effectiveness of high-capacity alternatives considered in this study, other performance metrics measure additional benefits that result when shifting travel from low-vehicle-occupancy to high-vehicle-occupancy modes. One of these metrics is cost per passenger-mile. Passenger-miles account for the variability in distance traveled on a transit trip. A longer trip shifted from auto to transit and generating higher passenger miles compared to a shorter trip potentially has expanded benefits resulting from the greater reduction in auto vehicle miles of travel, auto emissions, and auto energy use. For example, an auto user who shifts to transit for a trip of 10 miles would effectively reduce auto vehicle miles of travel and associated emissions and energy use by twice that of an auto user who shifts to transit for a trip of 5 miles.

Certain of the high-capacity alternatives studied tend to carry passengers for longer average trip distances than trips on other modes. This is represented by the Average Trip Length. Trips on regional and intercity rail and on transbay buses tend to be substantially longer than trips made on local buses and shorter haul express buses, such as BART feeder buses operated by WestCAT. Thus each new trip on BART, the Capitol Corridor, and on WestCAT and AC Transit

transbay buses would generate greater passenger-miles—and potentially more benefits from reduced congestion, emissions and energy use—than each trip on a local or limited express bus. The benefits per trip would be proportional to the differences in average trip length as shown in Table 2-15.

Table 2-15: Average Trip Length by Transit Operator/Mode

Transit Operator and Mode	Miles per Trip[1]
AC Transit Local Bus	3.5
AC Transit Transbay Bus to San Francisco	13.0
BART	13.0
Capitol Corridor Intercity Rail	68.0
WestCAT Transbay to San Francisco	24.0
WestCAT Local and West Bay/East Bay Express	6.5

Source: Kimley-Horn from the National Transit Database (2014 reporting year) and Capitol Corridor.

[1] In-vehicle travel distance per unlinked trip.

..Expressing the benefits in the form of cost per passenger-mile, the performance of high ridership and high average trip length alternatives would be higher than the performance of low ridership and low average trip length alternatives. For this study, it was not feasible to calculate and compare alternatives based on cost per passenger-mile with a high level of accuracy due to resource limitations. However, the differing performance of alternatives when based on passenger-miles of travel and not just riders would be valuable to assess in future studies.

2.5 Feasibility

The feasibility criterion evaluates the performance of the alternatives in terms of the following performance measure:

- Time to implementation

2.5.1 Time to Implementation

This measure accounts for the time needed to plan, design, and construct a project and also the time to obtain funding and consolidate political support. Often times, the lack of funding and political support can present the greatest challenges and can delay the design and construction of a project. The planning process, which includes formal environmental review of project impacts, can also be lengthy and slow the implementation of an alternative with strong public and political support.

The alternatives requiring the longest time to plan, design and construct are usually the most complex and costly, such as BART alternatives. However, BRT projects have proven to involve a lengthy planning and design process in the Bay Area. Despite the lengthy process, the implementation of BRT projects can be scaled by implementing transit signal priority and select queue jumps in the short-term and by implementing more intensive improvements, including more bus-only lanes and additional queue jump lanes, in the longer term. The BART extensions to Hercules, full scale ramp improvements for the Express Bus alternative, and full-scale BRT improvements along San Pablo and Macdonald Avenues and along 23rd Street are expected to have the longest lead times.

A precursor to initiating further planning and design of any of these alternatives is establishing a reasonable project funding and financing plan. For the foreseeable future, existing funding sources may not be adequate to fund the full implementation of these projects; new tax revenues or other public funding must be secured. General funding and financing plans have been developed to guide staff and decision-makers in the process of securing funding for the projects they wish to pursue.

The Express Bus and BRT alternatives do not present comparable funding challenges as the BART projects due to the magnitude of the BART costs and the competitive nature of funds for new rail starts, but they are nevertheless significant if the object is to implement the full range of improvements—direct access freeway ramps and major parking structures under the Express Bus Alternative and extensive dedicated transit lanes under the San Pablo Avenue/Macdonald Avenue and 23rd Street BRT Alternatives. The planning timeframe can become extended based on BRT project experience elsewhere in the Bay Area (East Bay BRT, Van Ness and Geary Street BRT, Santa Clara/Alum Rock BRT). The environmental review process and obtaining local stakeholder support can take up to five to 10 years if the project is controversial, followed by the design and construction phase, that can add five to eight years more. If the alternatives are incrementally phased, with more limited improvements made initially, the time to implement can be shortened by several years.

The Commuter Rail Alternative should be the easiest, and thus fastest, to implement. However, a fare subsidy on existing Capitol Corridor service (for travel originating in West County or with final destinations in West County) may encounter some challenges since ticketing for the Capitol Corridor is integrated into the national Amtrak system. For the Regional Intermodal Transit Center at Hercules, the longest lead time items are obtaining interagency agreements for the introduction of a new commuter station and securing funding to complete the project.

The Express Bus Alternative is rated as favorable for time to implement. This assumes phasing with near-term service enhancements, vehicle purchases and limited infrastructure improvements at existing park and rides, with major improvements delayed to accommodate the planning, design, and construction phases. In the long-term, reconstruction of the I-80

freeway for direct access ramps and extensive garage construction at existing park-and-ride sites (Hercules Transit Center and Richmond Parkway TC) and possibly a new transit center at I-80 and Macdonald Avenue would be possible. These later improvements can be treated as standalone projects and do not preclude adoption and construction of a more limited alternative.[15] Table 2-16 summarizes the rating of the alternatives relative to timeliness of implementation.

Table 2-16: Time to Implementation

Alternative	Performance Rating	Summary of Findings
1. Express Bus Service	5	Initial service with new buses and limited stop improvements could be implemented quickly to increase service and ridership. Major capital improvements will take time to plan, environmentally clear, design and construct.
2. San Pablo Avenue/Macdonald Avenue BRT	3	Improvements can be phased to improve service. Full BRT service, with dedicated lanes, will need a longer planning and environmental approval phase. Construction time itself would not be extensive.
3. 23rd Street BRT	3	Improvements can be phased to improve service. Full BRT service, with dedicated lanes, will need a longer planning and environmental approval phase. Construction time itself would not be extensive. First phase to CCC would be faster to implement than the first phase to CCC for Alt. 2.
4. Commuter Rail	5	While the quickest to implement from the perspectives of design and construction of proposed improvements, the major unknown is the time to reach agreement with Capitol Corridor on the proposed service pattern, including stopping at the Regional Intermodal Transit Center at Hercules.
6A. BART Extension from Richmond Station via Rumrill Boulevard	1	The planning, environmental review and design period will be prolonged. Construction will take several years. But the biggest potential delay is lack of funding in the near term, which would affect the ability to advance planning for this extension.
6B. BART Extension from Richmond Station via Richmond Parkway	1	The planning, environmental review and design period will be prolonged. Construction will take several years. But the biggest potential delay is lack of funding in the near term, which would affect the ability to advance planning for this extension.

2.6 Community

The community criterion evaluates the performance of the alternatives in terms of the following performance measures:

[15] In theory the BART and BRT alternatives could also be phased and the complexity of—and timeline for—implementation somewhat reduced. However, these alternatives are substantially less viable as effective HCT alternatives if built in piecemeal fashion and their planning, design and constructions would be inefficient.

- Consistency with local plans and policies
- Public and stakeholder support
- Economic and transit-oriented development (West County Priority Development Areas served)

2.6.1 Consistency with Local Plans and Policies

Compatibility with local plans and policies was determined by examining an alternative's general consistency with local and regional jurisdictions' blueprints for development and transportation strategies. The results of this evaluation measure are presented in Table 2-17.

Table 2-17: Compatibility with Local Plans and Policies

Alternative	Performance Rating	Summary of Findings
1. Express Bus Service	3	Alternative does not conflict with local plans and policies, however compared to other alternatives, it provides more limited opportunities for transit-oriented development.
2. San Pablo Avenue/Macdonald Avenue BRT	3	The station at Hilltop Mall offers the greatest potential for transit-oriented development, consistent with the city's plans for redevelopment, but dependent on the pending sale of the land and developer's plans. There are potential conflicts with Complete Street plans for implementing bike lanes along portions of these corridors and with the potential removal of on-street parking.
3. 23rd Street BRT	5	Station at Contra Costa College consistent with City of San Pablo's plans for transit-oriented development and for serving this high trip generator. Service would be designed to serve both the planned Richmond ferry terminal and redevelopment planned for the Richmond field station. There are potential conflicts with Complete Street plans for implementing bike lanes along portions of these corridors and with the potential removal of on-street parking.
4. Commuter Rail: Fare Subsidies and RITC	3	The Regional Intermodal Transit Center at Hercules would align with City of Hercules' development plans for this site. However, the Regional Intermodal Transit Center at Hercules is not included in any formal planning documents adopted by the Capitol Corridor Joint Powers Authority (CCJPA).
6A. BART Extension from Richmond Station to Hercules via Rumrill Boulevard	5	Station at Contra College would align with City of San Pablo's development plans for this area and is a high priority for the city. The terminal station at Hercules would require reconciliation between the City of Hercules development plans and the transportation requirements. Right-of-way requirements are not known for maintenance facilities and storage tracks.
6B. BART Extension from Richmond Station to Hercules via Richmond Parkway	3	The station at Hilltop Mall offers the greatest potential for transit-oriented development, consistent with the city's plans for redevelopment, but dependent on the pending sale of the land and developer's plans. Right-of-way requirements are not known for maintenance facilities and storage tracks.

In general, most of the alternatives are compatible with local plans and policies. All alternatives would support the growth strategies of the corridor cities and provide a good range of transportation choices and mobility. Implementation of the BRT alternatives would need to be coordinated with local cities' Complete Streets plans, which include plans to build bicycle lanes in some segments of the corridors.

The Regional Intermodal Transit Center option of the commuter rail alternative is not currently included in any formal planning documents adopted by the CCJPA Board. In addition, Capitol Corridor service to a Hercules station would need to satisfy the criteria identified in the Train Station Policy adopted by the CCJPA Board, something that has not yet been achieved. The BART alternative would generally not displace existing housing because the construction would predominately be within the existing right-of-way. However, at this early stage of project development, for BART Alternative 6A, there is a potential for a limited taking of homes along about a three-quarter mile stretch of Rumrill Boulevard in San Pablo in an area that serves lower-income families. For BART Alternative 6B, there is a potential for a limited taking of a limited number of residential parcels where the alignment moves east toward Hilltop Mall. The right-of-way requirements have not been determined for a potential new BART maintenance facility in Hercules or expansion of the Richmond maintenance facility and for the required turnback/storage tracks in Hercules.

2.6.2 Public and Stakeholder Support

The study's outreach to date has included stakeholder meetings with the cities within the study area and the county during the summer of 2015, a telephone town hall conducted jointly with Contra Costa Transportation Authority (CCTA) in November 2015, open houses/information sessions organized in April 2016, and presentations to all five cities and the El Sobrante Municipal Advisory Committee in February and March of 2017. The study team has also made regular presentations to the Study Management Group, WCCTAC TAC, and WCCTAC Board and collected feedback during these meetings. Table 2-18 summarizes the ratings for the alternatives relative to the public support expressed by the public and stakeholders.

Table 2-18: Public and Stakeholder Support

Alternative	Performance Rating	Summary of Findings
1. Express Bus Service	5	Alternative provides relatively quick capacity enhancements for commute trips and builds upon existing popular transit service. It can be implemented incrementally, thereby having the potential for early ridership results.
2. San Pablo Avenue/Macdonald Avenue BRT	5	Alternative provides ability to serve the broadest number of people and the greatest returns on ridership. The importance of the short-term bus improvements that provide near-term benefits is recognized, particularly to Contra Costa College, though cities have identified potential conflicts with the removal of parking lanes and mixed-flow travel lanes.
3. 23rd Street BRT	3	Alternative provides ability to serve a large number of people providing enhanced opportunity for local ridership. This alternative is favored by the City of San Pablo due to its improved service to Contra Costa College. It has not received the same level of support as Alternative 2.
4. Commuter Rail: Fare Subsidies and RITC	3	Three-year pilot for this alternative has received stakeholder support at the local and county level. Regional support for the RITC is growing, but the Capitol Corridor JPA has yet to approve the station.
6A. BART Extension from Richmond Station to Hercules via Rumrill Boulevard	5	Alternative enjoys strong public support, especially from the City of San Pablo as it would introduce a BART station serving Contra Costa College and the potential for transit-oriented development in the surrounding area. The high cost for implementation is a contravening factor.
6B. BART Extension from Richmond Station to Hercules via Richmond Parkway	3	Alternative enjoys strong public support and would support the potential for transit-oriented development at Hilltop Mall, which is consistent with the City of Richmond plans, but is not a certainty at this time. The highest cost for implementation is contravening factor.

2.6.3 Economic and Transit-oriented Development

Supporting economic and transit-oriented development was examined by looking at how the alternatives serve Priority Development Areas (PDAs) in West County. These are locations that jurisdictions in the Bay Area have designated for growth, including infill sites that are vacant or under-used land that could be developed for housing or other uses. The Metropolitan Transportation Commission (MTC) defines PDAs as accessible by one or more transit services and generally located near established job centers, shopping districts, and other services. This method for evaluating potential transit-oriented development, does not distinguish between heavy rail transit investments, which are typically much stronger catalysts for development than bus investments.

Most of the PDAs in West County are located in north, central, and south Richmond and along the San Pablo Avenue corridor, as shown in Figure 2-1. The San Pablo Avenue corridor is a designated PDA from El Cerrito north to Rodeo and the 23rd Street corridor is a designated PDA in Richmond. The Hercules Transit Center, the planned Regional Intermodal Transit Center, and the potential BART Appian Way station, are all located in designated PDAs. Contra Costa College, Hilltop Mall, and the Richmond Parkway Transit Center are located outside of PDA areas.[16]

Figure 2-1: Priority Development Areas in West Contra Costa County

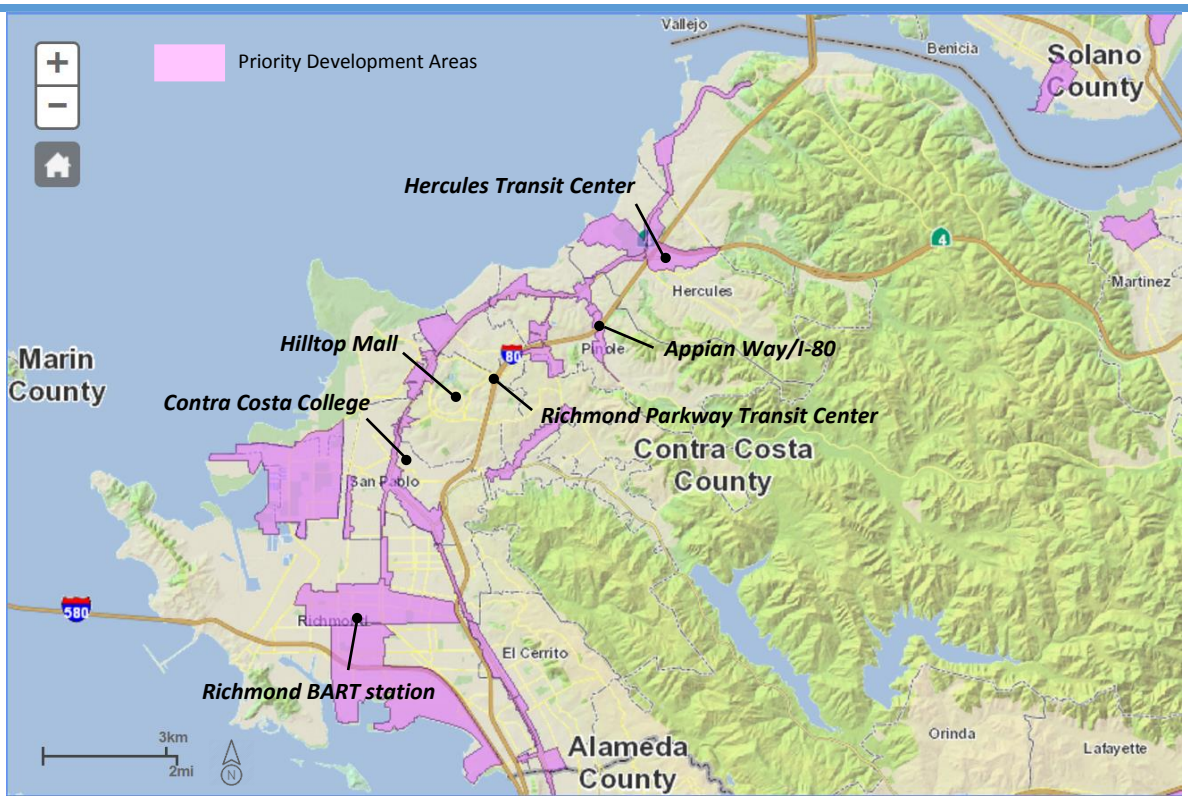


Image: Plan Bay Area, Priority Development Area Showcase, http://gis.abag.ca.gov/website/PDAShowcase/

The rating for serving West County PDAs was determined by the area in square miles of PDAs served within a one-half mile of the alternatives' proposed stops or stations: serves less than one square mile of PDAs (1); between one to two square miles (3); and more than two square miles of West County PDAs(5). Table 2-19 summarizes the ratings.

Given the overlap of the San Pablo Avenue and the 23rd Street corridors with the designated PDAs, the two BRT alternatives scored highest because they have many stops in this corridor.

[16] http://abag.ca.gov/abag/events/agendas/r080515a-Item7_bAttachment%201_List%20of%20Priority%20Development%20Areas.pdf

With 35 proposed stops and the longest BRT alternative, the San Pablo Avenue/Macdonald Avenue BRT rates the highest serving 3.85 square miles of PDAs. In contrast, the Express Bus alternative and the BART alternative on Richmond Parkway were the lowest rated alternatives. The Express Bus alternatives' three stops only serve two PDAs, and the BART alternative on Richmond Parkway's three stations only serve two PDAs.

Table 2-19: West County PDAs served

Alternative	Performance Rating	Area in square miles in PDAs within one-half mile of stations	Summary of Findings
1. Express Bus Service	1	0.60	With three stop options along the I-80 corridor, this alternative has a low accessibility to PDAs, serving only an area of 0.6 square miles of PDAs.
2. San Pablo Avenue/ Macdonald Avenue BRT	5	3.85	With 35 station options, alternative can serve an area of 3.85 square miles of PDAs. The San Pablo Avenue corridor is a designated PDA.
3. 23rd Street BRT	5	3.68	With 27 station options, alternative can serve an area of 3.68 square miles of PDAs. 23rd Street in Richmond and the San Pablo corridor alignment are designated PDAs.
4. Commuter Rail: Fare Subsidies and RITC	3	0.90	With one new station option and one existing station, alternative can serve an area of 0.90 square miles of PDAs. The planned location for the Regional Intermodal Transit Center at Hercules is located in a PDA.
6A. BART Extension from Richmond Station to Hercules via Rumrill Boulevard	3	1.21	With three station options, alternative can serve an area of 1.21 square mile of PDAs. (Only one or two of these station options would be built.)
6B. BART Extension from Richmond Station to Hercules via Richmond Parkway	1	0.59	With three station options, alternative can serve an area of just under 0.6 square miles of PDAs. (Only one or two of these station options would be built.)

3 SUMMARY

The evaluation presented in this document involves an examination of the refined high-capacity alternatives' performance in the areas of ridership, speed and reliability, access and connectivity, cost and efficiency, feasibility, and community considerations.

With all these factors in mind, the BRT alternatives emerged as the highest-performing options followed by the Express Bus alternative. The Capitol Corridor and the BART alternatives were rated high in many categories, but fared poorly in other categories. For example the BART alternatives rated high in the ridership categories but poorly in the costs and cost efficiency categories, while the Capitol Corridor rated high in the cost categories, but low in the ridership and cost efficiency categories. Table 3-1 summarizes the rating for all alternatives.

BRT on San Pablo and Macdonald Avenues performed well against criteria related to its improvements in locations with strong transit demand and locations that currently lack major transit connections; service to regional transit centers and priority development areas (PDAs); annualized cost per rider, and public stakeholder support. The BRT on 23rd Street alternative performed well against criteria related to quality of and enhancement of transit connections, annualized cost per total rider, and proximity to PDAs. The BRT alternatives were comparable in terms of projected ridership.

The Express Bus Alternative had a moderate amount of high and moderate performance ratings. It faired high in the categories of operating and maintenance costs, time to implement, and public stakeholder support. It scored moderate in most other categories except net new riders and quality of transit connections, where performance was rated low.

The Commuter Rail alternative includes a fare subsidy (which could be used by travelers for trips on Capitol Corridor that start or end in West County) and the build-out of the Regional Intermodal Transit Center at Hercules. It performed well in the criteria involving travel speed and reliability, as commuter rail's dedicated rights-of-way boost transit travel time and are less likely to get stuck in traffic; quality of connections, as Amtrak stations are relatively well-served by other transit providers; time to implementation, as the fare subsidy does not involve further project development; and capital and operating costs, as costs are relatively low as the subsidy does not include capital infrastructure components and do not increase operating costs substantially. It ranks low in ridership and cost efficiency.

The two BART alternatives received high ratings for total and net ridership increases; transit time improvement and reliability as heavy rail's dedicated rights-of-way are conducive to trains travelling faster and not getting stuck in traffic congestion; and quality of transit connections. But both BART alternatives' poor performance related to cost and efficiency as well as time to implementation pulled down their overall ratings.

Table 3-1: Summary of Criteria for Final Evaluation and Screening

EVALUATION CRITERIA	PERFORMANCE MEASURE	1. EXPRESS BUS	2. BRT ON SAN PABLO/ MACDONALD AVE	3. BRT ON 23RD STREET	4. COMMUTER RAIL: FARE SUBSIDY + RITC	6A. BART EXTENSION VIA RUMRILL BOULEVARD	6B. BART EXTENSION VIA RICHMOND PARKWAY
RIDERSHIP	Total riders	◑	◑	◑	○	●	●
	Net new riders	○	◑	◑	○	●	●
SPEED AND RELIABILITY	Transit travel time improvement	◑	◑	◑	●	●	●
	Transit travel time reliability	◑	◑	◑	●	●	●
ACCESS AND CONNECTIVITY	Regional transit centers served	◑	●	◑	◑	◑	◑
	Quality of connections to existing transit systems and facilities	○	◑	●	●	●	●
	Service to West County markets lacking major transit connections	◑	●	●	◑	◑	◑
COST AND EFFICIENCY	Capital cost	◑	◑	◑	●	○	○
	Operating and maintenance cost	●	◑	◑	●	○	○
	Annualized cost per total rider	◑	●	●	○	○	○
FEASIBILITY	Time to implementation	●	◑	◑	●	○	○
COMMUNITY	Consistency with local plans and policies	◑	◑	●	◑	●	◑
	Public and stakeholder support	●	●	◑	◑	●	◑
	Economic and transit-oriented development (West County PDAs served)	○	●	●	◑	◑	○

○ *Low-Performance* ◑ ◀——▶ ● *High-Performance*

4 NEXT STEPS

This technical memorandum summarizes the evaluation of the refined alternatives for high-capacity transit in West County. The evaluation is the culmination of the study's analysis that examined the study area's existing and future transportation network and land use; transit markets in this sub-region as well as the larger Bay Area; preliminary environmental assessment; ridership modeling to forecast travel demand should the alternatives be built; and preliminary and refined capital cost estimates. The evaluation can serve as a tool for the WCCTAC Board and decision-makers to advance one or a combination of the alternatives, if any, to proceed into project development which would involve additional engineering analysis and environmental review.