WCCTAC
West Contra Costa Transportation Advisory Committee

West Contra Costa High-Capacity Transit Study

FINAL TECHNICAL MEMORANDUM #9
Evaluation Criteria

January 2016

WSP | PARSONS BRINCKERHOFF

With

Kimley-Horn

THIS PAGE INTENTIONALLY BLANK

Document Review

Revision Date	Updated By	Organization	Description of Revision
12/21/15	Tam Tran	WSP | Parsons Brinckerhoff	Revisions to address feedback from TAC and Study Management Group
12/31/2015	Rebecca Kohlstrand	WSP | Parsons Brinckerhoff	Review of Revisions

Document Sign-off

Name	Date	Signature
Rebecca Kohlstrand	12/31/15	

THIS PAGE INTENTIONALLY BLANK

Table of Contents

Table of Figures

Table of Tables

Attachments

THIS PAGE INTENTIONALLY BLANK

Acronyms and Abbreviations

BART	San Francisco Bay Area Rapid Transit District
BNSF	Burlington Northern Santa Fe
BRT	bus rapid transit
DMU	diesel multiple unit
FTA	Federal Transit Administration
GHG	greenhouse gas emissions
GIS	Geographic Information System
HCT	high-capacity transit
I-80	Interstate 80
LRT	light rail transit
MAP-21	Moving Ahead for Progress in the 21st Century (Federal transportation funding and authorization bill)
MTC	Metropolitan Transportation Commission
O&M	Operations and maintenance
PDA	Priority Development Area
SR-4	State Route 4
TAC	Technical Advisory Committee
TAZ	Traffic Analysis Zone
TSI	Transit Suitability Index
UPRR	Union Pacific Rail Road
VMT	Vehicle Miles of Travel
WCCTAC	West Contra Costa Transportation Advisory Committee

THIS PAGE INTENTIONALLY BLANK

1 INTRODUCTION

1.1 West Contra Costa County Transportation Setting

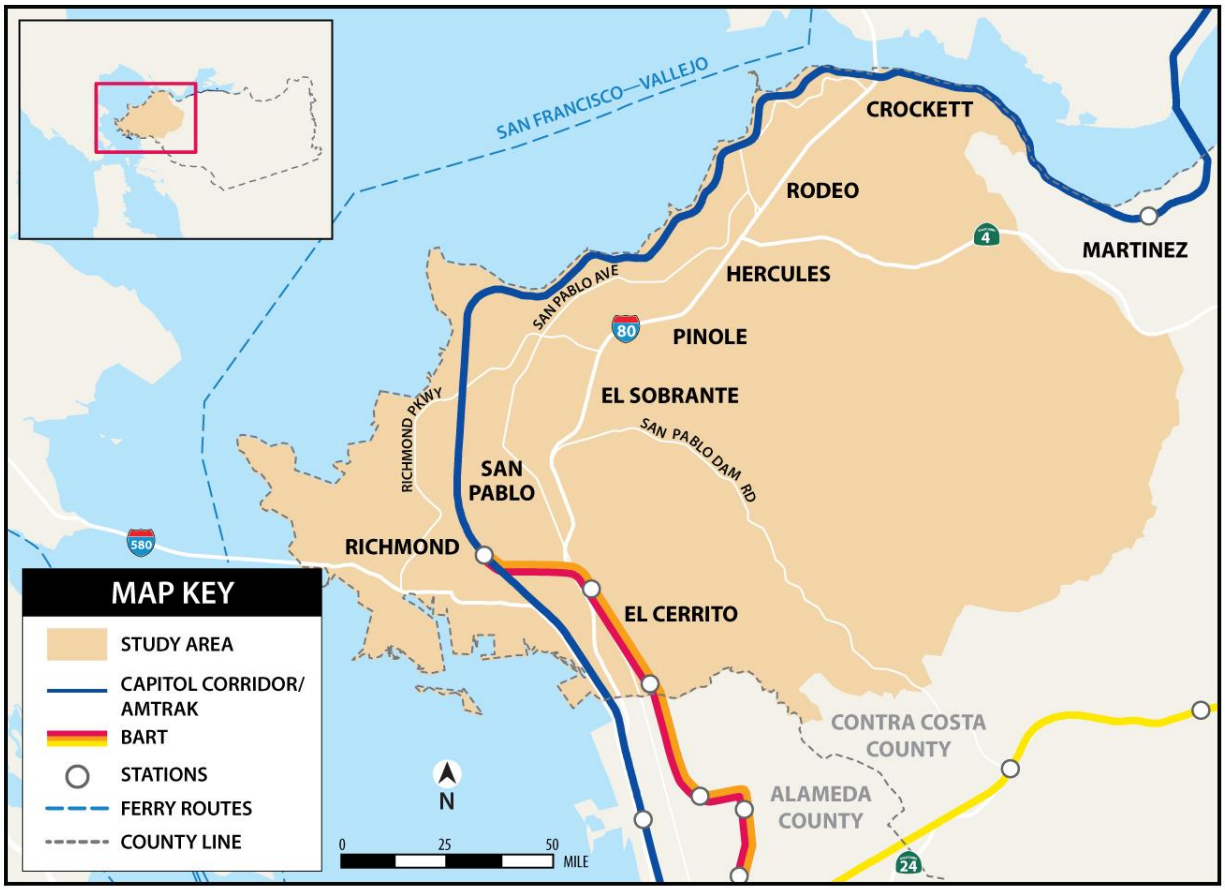
West Contra Costa County is a distinctive sub-region within the Bay Area set between the San Francisco Bay and the East Bay hills. Interstate 80 (I-80), the primary vehicular route running north-south through this sub-region, has major regional significance to Bay Area commuters, and is considered one of the most congested freeway corridors in the region. San Pablo Avenue is a major arterial that runs parallel and functions as a possible alternative to I-80. 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.

The study area encompasses West Contra Costa County from the southern boundary at the Alameda County line north to the Carquinez Bridge and Solano County line. It essentially encompasses the Metropolitan Transportation Commission's (MTC) Superdistrict 20, which includes the Cities of El Cerrito, Hercules, Pinole, Richmond, and San Pablo and the unincorporated communities of Crockett, El Sobrante, and Rodeo. **Figure 1-1** displays a map of the core study area, which includes I-80 and I-580, State Route 4 (SR-4), as well as major surface streets including San Pablo Avenue and Richmond Parkway. The West County High-Capacity Transit (HCT) Study will also include analysis of travel markets to the west of the study area along I-580, south along I-80 to Alameda County and the Bay Bridge, east along SR-4, and north along I-80 across the Carquinez Bridge to Solano County.

1.2 Study Purpose

The purpose of this study is to identify and evaluate the feasibility and effectiveness of HCT options in West Contra Costa County for WCCTAC's consideration. This will require understanding existing travel markets and future demand for HCT in the area as part of the larger regional transit network, identifying and evaluating HCT options, and assessing the costs and potential funding sources for these options. Central to the study purpose is providing WCCTAC with the analyses necessary to determine and advance the most promising HCT alternative(s). The study will consider multimodal transit options including, but not limited to: freeway-based express bus, bus rapid transit (BRT), light rail transit (LRT), extension of BART service, including diesel multiple unit (DMU) options in BART corridors, and commuter rail improvements. Study findings will guide future planning, investment priorities, and funding efforts for WCCTAC.

Figure 1-1: Study Area



Source: WSP | Parsons Brinckerhoff, Kimley-Horn, 2015

1.3 Purpose of this Technical Memorandum

This technical memorandum proposes evaluation criteria and methodologies to evaluate the individual performance of transit alternatives for the West Contra Costa HCT Study. Evaluation will consist of a two-step process based on adopted study goals and objectives outlined previously in Technical Memorandum #2. The first step, initial screening, will be focused on a qualitative assessment of the eight alternatives defined in Technical Memorandum #8. The second screening step will be a quantitative assessment that refines and builds on the most promising initial alternatives to further develop engineering and operation definitions and evaluate the potential benefits and costs of improvements.

2 SUMMARY OF GOALS AND OBJECTIVES

The goals and objectives identified for this study serve as the framework for the study's development and evaluation of long-term HCT improvements. The goals and objectives specific to this study are as follows:

Goal #1: Increase transit ridership by providing efficient, frequent, and reliable service

- Objective 1a: Improve high-capacity transit service, travel times, and connections.
- Objective 1b: Improve access to existing and proposed transit hubs by all modes of transportation and increase the total number of trips taken by transit.

Goal #2: Improve connections between transit systems and services

- Objective 2a: Connect communities in the corridor to the regional transit network and other regional centers.
- Objective2b: Provide user-friendly connections between regional and local transit services.

Goal #3: Expand transit in competitive corridors to new and underserved travel markets

- Objective 3a: Identify opportunities to match transit improvements with unmet and anticipated future needs in local, regional, and inter-regional markets.

Goal #4: Protect and enhance the environment and maintain a high quality of life

- Objective 4a: Avoid impacts to existing natural and cultural resources in the corridor.
- Objective 4b: Improve air quality and decrease greenhouse gas emissions by reducing the reliance on single-occupant vehicles.
- Objective 4c: Reduce transportation energy demand (per vehicle mile of travel) by increasing the use of high-capacity transit.
- Objective 4d: Take into account risks related to sea level rise and the effects of climate change in the location and design of transit facilities.
- Objective 4e: Be compatible with local plans and policies.

Goal #5: Support sustainable urban growth

- Objective 5a: Support economic and transit-oriented development in the corridor.
- Objective 5b: Support development and transit-oriented development in the corridor to advance the regional Sustainable Communities Strategies and Priority Development Area policies that support them.

Goal #6: Provide equitable access for residents and businesses

- Objective 6a: Improve transit access to jobs, housing, education, and other regional resources for a broad cross-section of socio-economic groups, ethnicities, and household types especially for transit-dependent populations.
- Objective 6b: Preserve mobility of people and goods throughout the corridor.

Goal #7: Make efficient use of public financial resources

- Objective 7a: Identify high-capacity transit investments that are cost-effective.
- Objective 7b: Seek public input on proposed transit investments.

3 METHODOLOGY

This section reviews the process for developing HCT alternatives for West Contra Costa County and then assessing their performance against a number of evaluation criteria. The criteria were developed to help the public and decision-makers determine how well alternatives perform in meeting the study's goals and objectives summarized in the previous section. Alternatives that best achieve the goals and objectives will be advanced for additional review, with the best performing alternatives recommended for further study and possible implementation.

3.1 Study Process

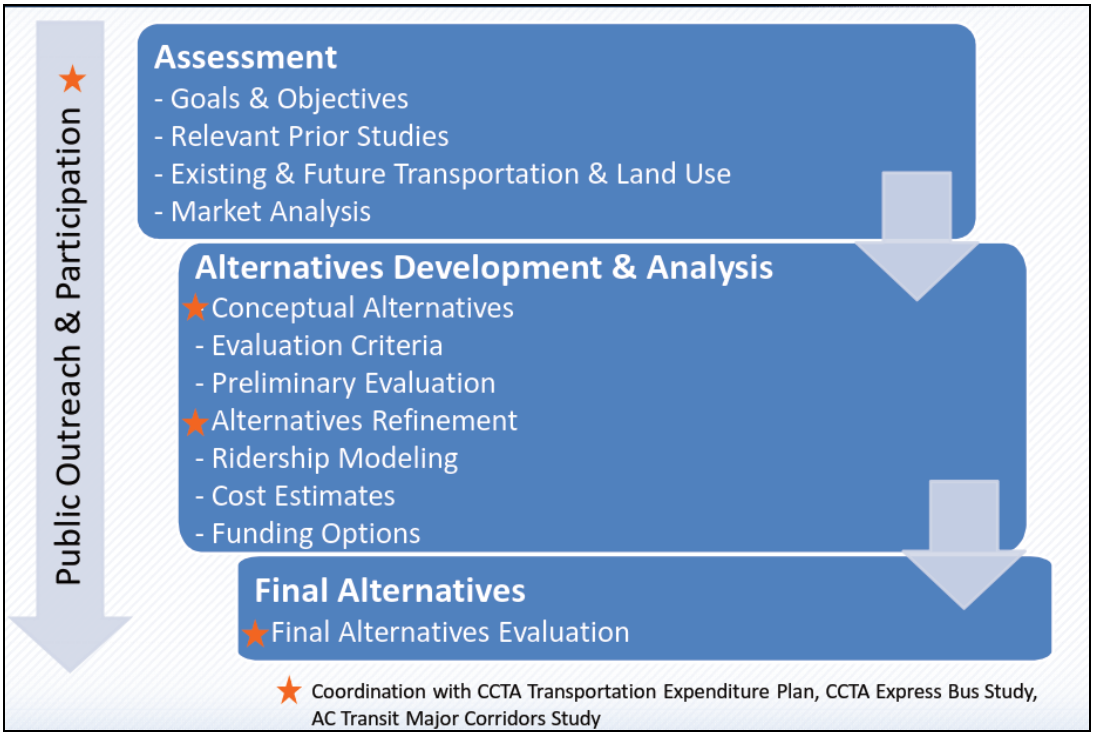
At the start of the West Contra Costa High-Capacity Transit Study, guiding goals and objectives were drafted by the consultant team and reviewed by the WCCTAC Technical Advisory Committee (TAC) then approved by the WCCTAC Board at its September 2015 meeting. The initial set of HCT alternatives identified for consideration in this study were developed using these goals and objectives as a framework. The alternatives were developed with guidance from the background analysis conducted, including identification of travel markets, land use patterns, and demographic trends within West County, and are consistent with state-of-the industry transit technologies and services that have demonstrated their capability and reliability in meeting mobility needs.

In earlier phases of the project, the study team collected information and analyzed existing and projected demographic and socioeconomic conditions in the study area and identified the major travel markets, including major internal and external destinations of West County residents. The project team also documented the study's existing transportation network, including transit services, and reviewed the recommendations of prior studies to understand previous attempts at serving the growing travel needs of West County residents and businesses. The study process is illustrated in **Figure 3-1**.

Taking into account all of this information, the study team developed an initial "long list" of transit alternatives for consideration in this study. The initial list was not artificially constrained to avoid prematurely excluding improvements that might otherwise be determined to have major travel benefits when more information on travel demand, modal opportunities and constraints becomes available. Requirements for alternatives to be included in the initial list were that they serve the documented travel markets, represent proven modes of transit travel,

and offer HCT options for West County residents and employees, consistent with the overarching purpose of this study.

Figure 3-1: HCT Study Process



Modal options determined to be the most practicable included:

- **Bus** – both express bus and bus rapid transit (BRT)/rapid bus.
- **Rail** – conventional BART extensions to the existing Fremont-Richmond and San Francisco-Richmond lines; diesel multiple unit (DMU) trains similar to that of eBART service under development in eastern Contra Costa County; commuter rail similar in nature to the existing Capitol Corridor service; light rail transit (LRT) similar to the Muni Metro service in San Francisco.

Ferry service is also an option for expanded transit service in the study area, but enhancements to the ferry service are already programmed and moving ahead, so it is not identified as a specific new project alternative.

The consultant team, working in consultation with WCCTAC staff, developed the initial list of possible HCT alternatives, which are documented in Technical Memorandum #8 and listed in Attachment A. The alternatives are those that appeared most viable for meeting the mobility needs of West County residents and businesses and meet the criteria noted above. The alternatives include options for different termini and potentially different modal options. Multiple termini or destinations will be evaluated for ridership potential and then refined to

reflect a primary terminus or primary and secondary termini. This level of analysis will occur later in the study.

Dual modal options are under consideration for (1) BRT corridors that lend themselves to upgrade to rail when transit demand increases with more intensive development along the BRT corridors, and (2) BART extensions, where DMU is an alternative modal option that offers greater flexibility to meet current grade constraints and could be upgraded to a higher capacity mode (based on potential train frequencies and total train capacity) like conventional BART in the future if warranted by increased ridership. Like LRT, BART is a more cost-effective mode when transit demand increases and frequent, very high-capacity train service is required to accommodate demand – and when funding becomes available. The level of investment to construct conventional BART and the annual costs to operate conventional BART service are typically substantially greater than the costs to construct and operate DMU service. Land uses and person-density are also another consideration. Generally, higher urban densities accompanied by pedestrian-friendly environments have been shown to generate higher ridership.[1] Additionally, more intensive transportation investments in higher-density areas may be more competitive for funding.[2] The costs for conventional BART are probably only justified when they can be spread over a high number of riders in relatively densely populated areas that can support all-day, high-capacity transit.

The next steps in the study process will include screening the list of promising alternatives down to the most viable alternatives by applying the evaluation criteria described in this memorandum. The alternatives that best meet the study purpose, as reflected in their attainment of study goals and objectives, will be defined in more detail and subjected to a second step evaluation to identity the preferred alternative or alternatives for further studies that would establish the foundation for their possible implementation. The refinement of alternatives will include additional detail on each mode's physical features, including routes, termini and stations; capital and operating costs; preliminary environmental impacts; and ridership in the context of current and future (2040) land use and socio-economic conditions.[3]

The entire process of developing, evaluating, refining, and re-evaluating HCT alternatives for West County to identify one or more preferred projects for implementation will be informed by extensive outreach to obtain feedback from the public, stakeholders, the project's Study Management Group, the WCCTAC TAC, and the WCCTAC Board of Directors. Alternatives proposed for the second step of screening and the final alternatives recommended for possible

[1] Cervero & Guerra, 2011, "Urban Densities and Transit: A Multi-dimensional Perspective." http://www.its.berkeley.edu/publications/UCB/2011/VWP/UCB-ITS-VWP-2011-6.pdf

[2] MTC's Resolution 3434 outlines housing density thresholds that must be met before it programs funds for a BRT or light rail project.

[3] Evaluation of a project's ridership potential given current land use, population, and employment, is a requirement if federal funding under MAP-21 is to be solicited.

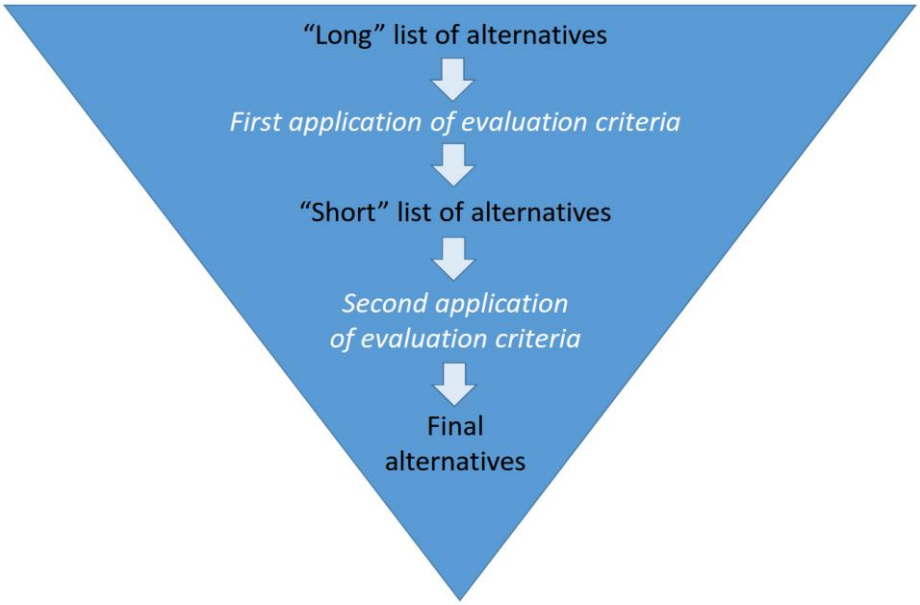
implementation will be discussed with the public and stakeholders as further public outreach proceeds.

It is important to note that before any major HCT alternative can be implemented, the alternative must proceed through additional project development and review that would occur after this study's completion. This will include conceptual engineering and environmental review and clearance. Based on the findings of these studies and taking into account funding availability, WCCTAC may authorize detailed engineering documents and construction.

3.2 Two-Step Evaluation of Preliminary List of Alternatives

As noted above, the consultant team, in coordination with WCCTAC staff, developed a "long" list of promising alternatives defined in terms of alignments and modes that will be evaluated using the recommended screening criteria. This list will be distilled down to a "short" list of viable alternatives for further review, and then a second screening of the "short" list will identify the preferred alternative or alternatives to advance to the next phase of project development. The process of screening from the "long" list of promising alternatives to the preferred alternative or alternatives will be completed in two steps, as shown in **Figure 3-2**. The study team will apply evaluation criteria developed from the goals and objectives to the alternatives under consideration at each step.

Figure 3-2: Evaluation Process



To support a rigorous, transparent evaluation process, and provide information that supports the elimination of certain alternatives and the advancement of others, the study team has recommended that the evaluation criteria be applied in two steps. Step 1 of the evaluation will

be more qualitative in its approach than the second step, as the level of detail for the alternatives is very general at this time. The "long" list of viable alternatives will be defined at a high level. Ridership forecasts and cost estimates will be provided based on order of magnitude comparisons. The evaluation criteria have been designed to support reasonable qualitative comparisons of alternatives consistent with the information available in the Step 1 evaluation, not just within a mode, but among modes.

As high-capacity improvements are advanced and better defined, the comparisons of performance, including estimates of ridership potential and capital and operating costs, among other factors, will be more detailed in the second step. When possible, evaluation criteria will support quantitative comparisons of performance in addition to the qualitative comparisons. For quantitative comparisons of performance, this means evaluation criteria can be characterized using numerical data or values.

Another reason to use evaluation criteria that lend themselves to both qualitative and quantitative values is that the Federal Transit Administration (FTA) applies both types of criteria when rating projects for federal funding eligibility as part of its New Starts program (formally entitled the Capital Investment Grant Program). Projects are rated in two general areas: Project Justification and Local Financial Commitment. FTA's key Project Justification metrics include:

- Mobility Improvements (total trips on project),
- Environmental Benefits (reduction in air pollutants and greenhouse gases, savings in energy use, and improvements in transportation safety),
- Cost-Effectiveness (cost per rider),
- Land Use (existing characteristics), and
- Economic Development effects (the potential of a project to induce transit supportive development; plans and policies promoting integration of transit and future development).

The first three measures are quantitative, while the latter two are largely qualitative.

The other FTA project rating criteria fall into the category of Local Financial Commitment. They pertain to:

- Local (and state) funding committed for project construction,
- Federal funding likely to be requested,
- Financial condition of the project sponsor and its capacity to fund and operate a project,
- Reasonableness of project cost estimates and the financial plan.

At this phase of the West County project – or projects – it is premature to identify a project operator and a formal financial plan, and the Local Financial Commitment measures are relevant only for the purpose of understanding the potential future criteria against which the project may be evaluated.

Since WCCTAC may pursue federal funding in the future to assist with the implementation of recommended transit alternative(s) from this study, it is prudent to include evaluation criteria that indicate how well alternatives perform relative to the FTA Project Justification criteria as well as the study goals and objectives. Therefore, several of the evaluation criteria have been defined to allow WCCTAC to identify projects that would be most competitive if subjected to FTA evaluation in the Mobility Improvements, Environmental Benefits, Cost-Effectiveness, Land Use, and Economic Development categories. Due to data limitations, the study evaluation criteria may be calculated somewhat differently than how the FTA metrics are calculated, but the end result will provide reasonably accurate reflections of how a project will perform when the FTA metrics themselves are applied should a project be proposed for New Starts funding.

In summary, a number of the criteria proposed for the evaluation of high-capacity transit alternatives for this study support both qualitative and quantitative comparisons of performance.

Evaluation Scale (Rating of Alternatives)

To rate the performance of alternatives and provide a means of comparing alternatives, including a no-build alternative (i.e., the no project condition), scaling of performance relative to the adopted evaluation criteria is necessary. This implies adoption of a common scale that facilitates comparisons of performance across all alternatives.

The proposed system for rating the performance of HCT alternatives under consideration in this study is proposed to be a five-point scale, as shown below.

Evaluation Scale:

1 2 3 4 5

Lower Performing ⟶ *Higher Performing*

A five-point scale is consistent with the number of performance categories FTA uses to rate project performance, which include: Low; Medium-Low; Medium; Medium-High; and High. However, for this study the FTA terminology will not be used. A graphical scale representing the five rating categories will be utilized for each category, consistent with the high-level nature of the evaluation at this stage in the planning process.

The same scale will be used for both the initial Step 1 and subsequent Step 2 evaluations of alternatives. More detailed information will become available by the time the Step 2 evaluation (of the short list of HCT alternatives) is performed. Therefore, the rating levels will be more strongly supported by data. However, as long as the rationale for a project rating is explained, and how the rating levels have been established is transparent, it will be possible to apply the five-level scale during both steps.

The range of performance reflected in the scale will be based on quantitative data when available. Quantitative data will be used to establish the points, or values, along the project performance rating scale, which distinguish lower (or poor) performance from higher (or good) performance. Certain values will be designated as thresholds marking the change from one rating level to the next (either higher or lower) level. These thresholds are referred to as the breakpoints.

An example helps to make this clear. When the preliminary list of promising HCT transit alternatives is screened to a ”short” list of viable alternatives in the Step 1 evaluation, ridership forecasts will not yet be available. The study team proposes to estimate ridership by mode for each alternative based on other studies and also by looking at the performance of comparable transit improvements. Other bus, BRT, and BART studies in the Bay Area have developed detailed ridership for what are expected to be comparable improvements; in addition, there is ridership data for existing bus, BART and commuter rail lines in the Bay Area and rail lines elsewhere in California. Thus ridership potential for a proposed alternative will be order-of-magnitude in the Step 1 evaluation. Qualitative comparisons of performance across alternatives are defensible at this conceptual level, while detailed quantitative comparisons would be premature.

When the ”short” list of alternatives recommended from the initial screening are advanced to the Step 2 evaluation, ridership potential will be quantified using the Contra Costa Transportation Authority’s Countywide Travel Demand Model. Daily and annual ridership estimates for each alternative can then be compared to daily and annual ridership against other alternatives. Low absolute ridership would still rate as “poor” and high ridership as “good” performance. However, the breakpoints assumed in the scale will be derived directly from model outputs; an alternative’s position on the scale will be based on a specific forecast of daily/peak period transit trips. Thus, the breakpoints can be more precise and refined, compared to the order-of-magnitude breakpoints that will be used in the Step 1 evaluation.

The breakpoints will be defined when more information is available. Ratings based on quantitative values will be documented.

More detail on the specific evaluation criteria proposed for this study, their definition, and the general method by which they are derived and applied in rating the performance of alternatives, is provided in the following section.

3.3 Evaluation Criteria

Evaluation criteria have been established that align with the seven goals and 16 corresponding objectives adopted for this study**. Table 3-1**, at the close of the narrative portion of this report, lists the criteria and their definitions to be applied in the screening of transit alternatives. The table indicates where additional information will be available during the Step 2 evaluation to support a more quantitative approach for measuring performance.

For certain study objectives, two or more evaluation criteria are proposed because the objective as defined has two or more distinct elements and/or there is more than one way to measure the objective. For example, *Objective 1a: Improve high-capacity transit service, travel times, connections,* involves the evaluation of changes in travel time, improvements in service reliability, and the opportunities for multimodal connections resulting from the transit investment. *Objective 4b: Improve air quality; reduce greenhouse gas (GHG) emissions,* is best evaluated by examining the change in commonly accepted air pollutants separate from the change in GHG emissions. The former includes traditional transportation-generated pollutants such as carbon monoxide, nitrous oxide, volatile organic compounds, and particulates. The latter includes gases such as carbon dioxide (the primary GHG emission of autos, trucks and buses), not a pollutant per se but a cause of climate change if emitted at high levels.

For two of the 16 objectives, the same criterion is proposed as it is an effective measure of performance for both objectives.

The evaluation criteria to be applied do not change from the Step 1 to Step 2 screening of alternatives; however, the method for calculating the measures of performance underpinning the evaluation criteria will sometimes differ from Step 1 to Step 2. In instances where measures differ from the Step 1 analysis, it is because more detailed information will become available to support quantitative comparisons of alternatives in the second step of screening.

The tables summarize the general descriptions, or definitions, of evaluation criteria, the method of their calculation, and the general rationale for their application in this study. More background information follows:

<u>Goal #1: Increase transit ridership</u>

This goal was geared toward making improvements that would increase general transit ridership, and the objectives created to meet this goal focused on characteristics that are often

associated with ridership: service frequency and service coverage.[4] Other variables, such as car ownership and unemployment, which factor into transit ridership are captured in other goals and objectives.

Two objectives were established to reinforce the goal of increasing transit ridership through HCT improvement in West County. They include *Objective 1a: Improve HCT service, travel times and connections*, and *Objective 1b: Improve access to existing and proposed transit hubs by all modes of transportation and increase the total number of trips taken by transit*. Four evaluation criteria are proposed to gauge how effectively the proposed transit alternatives achieve the objectives.

Travel time improvement and travel time reliability are proposed to measure attainment of Objective 1a. Faster transit trips and highly reliable service are key factors in attracting riders to transit, particularly commuters. Potential users of high-capacity modes will typically be destined to or from employment centers and, in general, are more travel time sensitive than non-commuters.

For the Step 1 evaluation, transit travel times for a HCT alternative can be calculated from the average speed of the transit vehicle, with provisions for access time to transit. The access time to transit depends upon the frequency of service as well as the time to get to transit itself. For simplification, and because an individual's trip origin cannot be easily determined, access time is limited to the wait time for transit, calculated as equivalent to one-half the service headway of transit in minutes. (Egress time from transit to an individual's final destination is not affected by transit service frequencies. Also, for simplification, it can be assumed to be comparable across alternatives if they serve approximately the same destinations and thus ignored for the analysis.)

For the Step 2 evaluation of alternatives, estimated transit travel times can be compared to travel model projections of travel times. Transit travel times under the build alternatives can be compared to transit travel times absent any transit improvements, the change in times expressed as a percentage change relative to the no-build alternative. It is assumed transit improvements will produce travel time improvements, and alternatives that save riders the most time compared to the no-build alternative would have the greatest capacity to increase transit ridership.

Transit reliability can be determined from the length of the transit alignment that has exclusive right-of-way and/or dedicated transitways. Transit vehicles will be able to operate at a consistent speed, unaffected by unpredictable conditions caused by interactions with mixed-flow traffic.

[4] Transit Cooperative Research Program, Report 111, "Elements Needed to Create High Ridership Transit Systems," http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_111.pdf

For Objective 1b, determining how well alternatives provide access to major transit or employment hubs, the number of hubs where connections to other services are offered (thereby expanding users' abilities to reach more destinations conveniently by transit) will be quantified. Connecting to more transportation hubs improves the rating of an alternative.

The fourth evaluation criterion (*Objective 1b)*, designed to measure a HCT alternative's potential to increase the absolute number of transit trips in West County is defined as transit market potential. For the Step 1 screening of alternatives, the transit suitability index (TSI) will be calculated for each alternative in the absence of travel model forecasts. The TSI provides a basis for qualitatively assessing the transit market for an alternative. The TSI will be based on a reasonable capture area around stations for each alternative. The size of the capture area will vary based on the mode in each alternative. The capture area for major rail and express bus projects is a half mile around station areas and for BRT alignments is a quarter mile around stops.

The half-mile mile capture area for express bus alternatives is the same as for rail alternatives because, operationally, the service is similar to that of rail systems, particularly commuter rail (i.e., few stations, relatively far apart with auto parking or auto drop-off a major mode of station access). BRT service, in contrast, is similar to local bus service when BRT is proposed in major urbanized corridors, as for this study. The generally accepted standard for determining accessibility is being within one-quarter mile of a bus stop or BRT station. Drive access to BRT stations is not a significant mode of access.

Using the TSI, capture areas of alternatives may overlap, as the tool cannot distinguish between alternatives in the catchment area. It does, however, provide an estimation of ridership by alternative, in the form of a transit potential index, with a higher value indicating greater propensity to use transit in the area under study. This relative approach for estimating potential for ridership is appropriate for Step 1 screening of alternatives. More detailed analysis will be undertaken in Step 2.

For the Step 2 screening, each alternative advancing to detailed evaluation will be coded into the Countywide Travel Demand Model. Quantitative estimates of daily and total annual riders (in the form of transit boardings) will be generated. Direct comparisons of transit market potential are then possible across alternatives. The ridership estimates will also be important inputs in evaluation measures covering transit-dependent populations served by an alternative (Goal #3) and project cost-effectiveness (Goal #7).

<u>Goal #2: Improve transit connections</u>

Transit ridership potential and overall effectiveness are enhanced if transit lines offer safe, convenient connections to other major transit lines and multimodal transportation facilities. Access to transit hubs is addressed as part of *Objective 1a* under Goal #1. Transit in West

County is focused around several major regional hubs where services from different communities and operators connect to provide regional mobility. These hubs include the Richmond Parkway Transit Center, Hilltop Mall, Hercules Transit Center, and the El Cerrito Del Norte and Richmond BART stations. Some of these hubs provide only transfer connections because they are largely isolated from surrounding development; others, such as BART stations, are located in major activity centers. While this evaluation criterion focuses on connectivity, not access to activity centers, which is captured in other evaluation criteria, the ability to access nearby activity centers at transit hubs would be noted.

For *Objective 2a, Connect communities in the corridor to the regional transit network and other regional centers,* the connectivity of each alternative to regional hubs will be assessed. The evaluation will focus on the quality of these connections.

High-quality connections (e.g., safe and secure for transit users and offering convenient transfer opportunities; facilities with good transit user amenities) to other regional transit services are important. However, transfer opportunities to local or subregional transit services are equally important. These points for connections have been identified in work performed to date for this study. For *Objective 2b*, the number and types of connections offered by each HCT alternative will be quantified and compared across alternatives. For both the Step 1 and Step 2 screenings, the evaluation of connections will be primarily qualitative. However, the number of connections offered will be an important element of this evaluation.

Goal #3: Expand transit to new and underserved markets

In support of this goal, *Objective 3a: Match transit improvements with unmet needs in all markets* will focus on where to make transit investments to expand transit markets. A HCT improvement alternative should improve transit service to areas (1) with substantial underserved or unmet needs, and (2) lacking convenient connections to other transit services, in particular those services providing direct access to jobs and major activity centers. Two evaluation criteria are proposed to assess how well alternatives perform in meeting this objective.

The first criterion is the number of low-income households within a half-mile of station areas. It provides a means for assessing whether areas with likely high transit dependency will be served by an alternative. Transit alternatives that improve travel opportunities in areas (defined in terms of census tracts or traffic analysis zones [TAZ]) with high concentrations of low-income households will be rated higher than alternatives that provide fewer opportunities. Low-income riders are those from households in the lowest income category, a surrogate measure for transit dependency. Transit-dependent riders served by a transit project are an important MAP-21 measure of project performance.

A second evaluation criterion, new growth areas within a half-mile catchment area of stations, is proposed to assess whether an alternative will serve new markets with significant transit potential. Major growth areas will be identified. A quantitative analysis of whether the proposed transit alternatives improve transit options for major growth areas will be made, complemented by a qualitative assessment of whether other local transit services can be improved to enhance their integration with a new HCT mode. The assessment will also take into account the analysis of transit suitability and connectivity performed under Goals #1 and #2.

Goal #4: Protect and enhance the environment

There are five objectives under Goal #4, each with a corresponding evaluation criterion. A high-level environmental scan to identify potential impacts on neighborhoods and the natural environment will be performed to assess how well investment alternatives achieve *Objective 4a: Avoid impacts to natural and cultural resources*. Alternatives with potential major impacts are less attractive for further study than alternatives that have limited or no adverse impacts or have a net beneficial impact. To evaluate *Objective 4b: Improve air quality* and *Objective 4c: Reduce energy demand,* the potential of alternatives to reduce vehicle miles of travel (VMT) will be assessed. Emissions both of pollutants and GHG and also energy use are directly related to miles of travel. Quantitative estimates of each alternative's effects on regional VMT can be obtained from the Countywide Travel Demand Model for Step 2 screening.

Objective 4d: Consider risks of sea level rise and climate change will be evaluated by examining topography and determining an alternative's vulnerability to flooding from storms and, in the long term, partial inundation of facilities by bay tides. Those with that vulnerability will be rated poorly as long-term investments. The final objective is *4e: Compatibility with local plans and policies.* This can be determined by examining an alternative's general correspondence with local jurisdictions' blueprints for development and transportation strategies. This type of analysis is part of the formal environmental review process for projects subject to the National Environmental Policy Act and California Environmental Quality Act.

Goal #5: Support sustainable urban growth

The first of two objectives under this goal is *5a: Support economic and transit-oriented development.* Sustainable urban growth can be reflected in a transit alternative's capacity to facilitate development in targeted areas – notably in Priority Development Areas (PDAs) designated in the 2040 Regional Transportation Plan and to a lesser extent in local zoning and growth policies of study area cities and Contra Costa County. Using Geographic Information System (GIS) tools, it is possible to accurately estimate the degree to which PDAs are served, by total area, and/or by a transit alternative. Areas must be within the service area of an alternative, represented by the land area within a half-mile of station areas on major rail and express bus projects and within a quarter-mile of stops along BRT alignments.

Objective 5b: Support compact, mixed-use sustainable communities can be measured by quantifying the amount of developable land in the service area of a transit alternative, particular where infill development can occur and proximity to PDAs. This can also be calculated from electronic land use maps using GIS. Alternatives that serve more targeted growth areas and/or have the potential for concentrated mixed-use development near transit will rate higher than alternatives that are not aligned to serve these areas.

Goal #6: Provide equitable access for residents and businesses

Two objectives have been established in the study to represent this goal. A transit investment should achieve *Objective 6a: Improve transit access to jobs, housing, education, and other regional resources.* Attainment of this objective is gauged by the total number of households, population and jobs served by the proposed transit improvement in the current year and for the 2040 time horizon of this study. *Objective 6b: Preserve mobility of people and goods throughout the corridor*, can be measured by an alternative's effect on regional congestion. An alternative that reduces VMT, or slows the growth in VMT, compared to the no-build alternative is assumed to reduce congestion. Mobility is maintained or even improved if congestion does not worsen significantly or is, in fact, reduced in a corridor.

For the Step 2 analysis, travel forecasts will allow the study team to calculate the net effect on VMT of transit alternatives.

Goal #7: Make efficient use of public resources

The goal of an efficient use of public resources is associated with two objectives*: Objective 7a: Identify HCT investments that are cost effective*, and *Objective 7b: Seek public input on proposed transit investments*. Three criteria are proposed to evaluate these objectives, two for 7a and one for 7b. For *Objective 7a*, cost-effectiveness is defined as the cost relative to ridership benefits. The cost of a project includes capital costs required to implement the project and operating and maintenance costs, an ongoing requirement to continue operating the project. This study will consider the cost per rider for both capital and operating and maintenance costs.

Cost-effectiveness measures are calculated by dividing annualized costs in current dollars by annual riders. This study will evaluate each measure separately (annualized capital cost per rider; annual operating cost per rider) and then combined (annualized capital *and* operating costs per rider). The combined measure will only be calculated for alternatives advancing to Step 2, at which point sufficiently detailed information will be available to support accurate estimation of the cost-effectiveness. The combined measure is used by FTA when evaluating projects for funding eligibility. A project must have a cost per rider below a certain threshold, revised periodically, for FTA to find it eligible for federal funding. Because a major HCT investment in West County is expected to require a combination of funding sources – federal,

state and local – it is useful to ascertain how cost effective alternatives are from FTA's perspective.

Public and agency support for a project alternative, measured for *Objective 7b*, will become evident from the feedback, both the quantity and type of written and verbal comments, offered at public, stakeholder and other meetings and on the project website. Elected officials will also provide input to the HCT study and the WCCTAC Board will make the final decision as to which alternatives are advanced for further study. This objective is also related to compatibility with local plans and policies, which is an objective under Goal #4.

THIS PAGE INTENTIONALLY BLANK

Table 3-1: Evaluation Criteria and Measures of Performance

HCT Study Goals	Objectives	Evaluation Criteria	Definition & Methodology: Step 1 Evaluation	Definition & Methodology: Step 2 Evaluation	Comment
1. Increase transit ridership	1a: Improve high capacity transit service, travel times, connections	Travel time improvement	Based on average speed of modal alternative, compare change in travel time with and without project improvements. Expressed as percentage change (decrease) in travel time between origins and destinations.	Change in travel times between major origins and destinations in corridor served by proposed transit improvements; derived from Countywide Travel Demand Model.	The greater the potential improvement in travel time, the higher the rating of the alternative. Travel time to major destinations outside the study area is calculated for alternatives serving employment districts of Alameda and San Francisco counties. Travel model forecasts support quantitative comparison of peak hour travel times, build versus no-build alternatives in Step 2.
		Travel time reliability	Based on length of alignment in exclusive guideway and/or dedicated transit lanes.	Same as Step 1	More miles in exclusive guideway or dedicated transit lanes are an indicator of better transit reliability. Evaluation takes account of congestion along running way prior to implementing transit improvements.
	1b: Improve access to transit hubs	Regional transit centers served	Number of BART stations, multimodal transit centers, and major business districts with high levels of transit that are directly served by the alternative.	Same as Step 1	More centers served indicate greater transit connectivity and potential for increased transit ridership. Regional transit centers will include employment centers in the East Bay and San Francisco, if served directly.
	1.b cont.: Increase total number transit trips	Transit market potential	Transit ridership potential based on calculated transit suitability index (TSI) of corridor served by alternative.	Ridership projections from Countywide Travel Model, 2013 and 2040; total transit trips and new transit trips compared to no-build alternative.	For Step 1, the TSI evaluates demographic and economic conditions along a corridor that support transit use. The higher the TSI of an alternative, the greater the potential for transit to effectively serve an area. For Step 2, alternatives will be evaluated in context of existing and future land use and demographic conditions to estimate average weekday and annual transit trips. Ridership potential is compared to no-build transit ridership, as estimated by the travel model.
2. Improve transit connections	2a: Connect communities to regional transit and other centers	Regional centers served	See Goal #1, Objective 1b, above.	See Goal #1, Objective 1b, above.	
	2b: Provide user-friendly regional and local transit connections	Quality of connections to existing transit systems and facilities	Ease of connections to other modes (multimodal transfer opportunities) and to same mode (intramodal transfer opportunities) provided along alignment of alternative. Qualitative assessment of connections at center served.	Same as Step 1	Alternatives that provide convenient transfers to other transit services will tend to generate more transit trips. Transfer facilities should be safe and secure and offer high levels of passenger amenities.

Table 3-1: Evaluation Criteria and Measures of Performance

HCT Study Goals	Objectives	Evaluation Criteria	Definition & Methodology: Step 1 Evaluation	Definition & Methodology: Step 2 Evaluation	Comment
3. Expand transit to new and under-served markets	3a: Match transit improvements with unmet needs in all markets	Service to low-income areas	Number of low-income households within a one-half mile radius of stations, derived from Census data.	Average weekday and total annual transit trips by low-income households.	In Step 1, derived by using GIS to estimate number of low-income households within a one-half mile radius of transit stations. For BRT alternatives with multiple local stops, calculation is based on a one quarter-mile accessibility to the transit alignment. In Step 2, derived from Countywide Travel Demand Model forecasts. Low-income riders are those from households in lowest income category and are an important MAP-21 measure of project performance.
		Service to markets currently lacking major transit connections	Serves existing areas and/or new growth areas with strong transit potential but currently lacking convenient or sufficient service. Qualitative assessment of number and character of growth areas with direct service.	Same as Step 1	Measure reflects an alternative's capacity to improve service where needed and attract choice and other new riders.
4. Protect and enhance the environment and maintain a high quality of life	4a: Avoid impacts to natural and cultural resources	Potential significant environmental impacts, both socio-economic and natural resources	Identification of environmental issues potentially resulting from implementation of an alternative.	Same as Step 1	Major environmental concerns flagged in an environmental scan. Alternatives that could adversely affect the natural environment, cultural and historic resources, community cohesion, etc. are rated lower than those with limited or no major impacts.
	4b: Improve air quality; reduce greenhouse gas (GHG) emissions	Change in total Air Quality Criteria Pollutants including CO, NOx, VOC, and $PM_{2.5}$ Change in GHG emissions	Estimated change in primary transportation air pollutants and GHG resulting from net reduction in VMT (auto and transit). The changes in two types of emissions will be estimated separately.	Same as Step 1 except VMT reduction for individual alternatives is derived from Countywide Travel Model.	VMT reduction assumed to be proportional to mode shift in travel, that is, from low capacity auto to high capacity transit. Mode of access to transit and trip length are also factors. For Step 1 evaluation, VMT reduction is estimated by extrapolating from other studies while model forecasts will be available for Step 2. Change in emissions calculated using FTA tables correlating VMT with air pollutants and GHG.
	4c: Reduce transportation energy demand	Transportation energy use	Estimated change in total energy use from net reduction in VMT (auto and transit).	Same as Step 1 except VMT reduction is derived from Countywide Travel Model.	Similar to the Step 1 analysis for GHG, potential VMT reduction will be order of magnitude, estimated from other studies. Energy savings are estimated using FTA tables correlating VMT and energy use. In Step 2 model date will be available.
	4d: Consider risks of sea level rise and climate change	Avoidance of low-lying (tidal or flood-prone) areas	Length in feet of alignment in low elevation areas subject to sea level surges and sea level rise over time.	Same as Step 1.	Investment in facilities that could be damaged by flooding or be partially submerged before reaching their useful lives should be identified. Topographic maps in combination with data from adaptingtorisingtides.org will be used to identify the low-lying areas through which some investment alternatives travel.
	4e: Be compatible with local plans and policies	Policies in local jurisdictions' general plans	Consistency with local plans and policies is part of environmental review activities.	Same as Step 1	The study's data collection efforts included review of background documents. Public and stakeholder outreach (see Goal #7) will also garner feedback from community members and municipal staff.

Table 3-1: Evaluation Criteria and Measures of Performance

HCT Study Goals	Objectives	Evaluation Criteria	Definition & Methodology: Step 1 Evaluation	Definition & Methodology: Step 2 Evaluation	Comment
5. Support sustainable urban growth	5a: Support economic and transit oriented development	West County PDAs served	Area in square miles of designated West County PDAs accessible from transit stations.	Same as Step 1	Total area of PDAs in MTC's current San Francisco Bay Area Regional Transportation Plan within station catchment areas (e.g., one half-mile radius) provides an indication of potential to facilitate transit oriented development and economic development in general. The more areas served, the better the performance.
	5b: Support compact, mixed-use sustainable communities	Availability and type of developable land served by transit	Area in square miles within a half mile of stations.	Same as Step 1	Total developable area in vicinity of stations reflects an alternative's capacity to help promote higher density development.
6. Provide equitable access for residents and businesses	6a: Improve transit access to jobs, housing, education and other resources, especially for transit dependents	Population, employment and households with access to (or accessible from) transit stations	Population, households and employment within half-mile radius of stations, current and projected in 2040.	Same as Step 1	An alternative serving more households, population, and employment opportunities offers greater transit access. See Goal #3 for measuring access by transit-dependent populations.
	6b: Preserve mobility of people and goods throughout corridor	Congestion relief based on estimated reduction in VMT	Estimated reduction in VMT. See Goal #4.	Estimated reduction in VMT. See Goal #4. VTA reduction in Step 2 is from Countywide Travel Model.	A reduction in VMT, build versus no-build, should have a beneficial effect on congestion, potentially reducing the absolute levels of average vehicle delay or the growth in delay compared to the no-build condition.
7. Make efficient use of public funds	7a: Identify cost-effective investments	Order of magnitude capital costs relative to ridership potential (cost/rider)	Total estimated capital costs (engineering through construction) in current dollars compared to annual ridership; expressed as ratio.	Same as Step 1 except model forecasts of ridership will be used.	Step 1 capital costs are based on representative unit costs for each modal alternative, drawing on other studies. See Goal #1 for Step 1 estimates of ridership potential. In Step 2 costs are more detailed and riders are from Countywide Travel Model.
		Order of magnitude operating and maintenance (O&M) costs relative to ridership potential	Annual O&M costs by alternative in current dollars compared to annual ridership; expressed as a ratio of O&M cost per rider.	Same as Step 1 except model forecasts of ridership will be used.	Step 1 O&M costs are based on representative unit costs for each modal alternative, drawing on other studies. See Goal #1 for Step 1 estimates of ridership potential. In Step 2, O&M costs are refined and riders are from Countywide Travel Model.
		Annualized capital and operating cost per rider	(Not calculated during Step 1 of alternatives evaluation).	Annualized capital costs plus annual operating cost in current dollars divided by total annual linked trips (individual riders). Result is cost per rider.	Combining the above two costs per rider produces the cost-effectiveness measure used by FTA when rating project eligibility for New Starts funding.
	7b:Seek public input on transit investments	Public and stakeholder support for proposed alternative	Number and types of comments received during public and stakeholder meetings and from contacts with elected officials.	Same as Step 1	Public support is necessary for a project to advance through further study and possible implementation. It will be based on feedback from public and stakeholder meetings and outreach to elected officials.

THIS PAGE INTENTIONALLY BLANK

ATTACHMENT A

List of Initial Transit Alternatives for Evaluation

THIS PAGE INTENTIONALLY BLANK

LIST OF INITIAL TRANSIT ALTERNATIVES FOR EVALUATION

Alternative #1 **Express Bus Service** on I-80 from Hercules Transit Center (at Willow Avenue/State Route 4) and on I-580 from Marin County to Alameda County via I-80.

Alternative #2 **San Pablo Avenue/Macdonald Avenue Bus Rapid Transit (BRT)**, from El Cerrito del Norte BART to Richmond Parkway Transit Center and serving Contra Costa College and Hilltop Mall on the San Pablo alignment and to Tweksbury Turnaround and serving the Richmond BART/Capitol Corridor station on Macdonald Avenue. Possible extensions of San Pablo BRT to Hercules Transit Center and to the Hercules Intermodal Transit Center (at Bayfront Boulevard).*

Alternative #3 **23rd Street BRT**, from Richmond Ferry Terminal to Richmond BART/Capitol Corridor station continuing to Contra Costa College, with possible extension along San Pablo Avenue to Hilltop Mall and Hercules.*

Alternative #4 **Union Pacific Railroad (UPRR) Corridor Commuter Rail**, from Richmond BART to Downtown Martinez with an intermediate station at the Hercules Intermodal Transit Center (at Bayfront Boulevard) and with a potential extension to Oakland.

Alternative #5 **UPRR-Burlington Northern Santa Fe (BNSF) Corridor Commuter Rail**, from Richmond BART to Hercules Transit Center (at Willow Avenue/SR-4) with possible east extension to I-680 in Martinez and South Extension to Oakland.

Alternative #6 **BART Extension from Richmond Station to Hercules**, from Richmond BART station along the UPRR right-of-way transitioning to 13th Avenue and Rumrill Boulevard before tunneling under Hilltop Mall then following the I-80 right-of-way to the Hercules Transit Center (at Willow Avenue/SR-4)

Alternative #7.1 **BART Extension from El Cerrito del Norte Station to Hercules** from El Cerrito del Norte BART station to Hercules Transit Center (at Willow Avenue/SR-4) along the I-80 right-of-way.

Alternative #7.2 **DMU Extension from El Cerrito del Norte Station to Hercules** from El Cerrito del Norte BART station to Hercules Transit Center (at Willow Avenue/SR-4) along the I-80 right-of-way.

* Potential for improving to light rail transit in future when demand warrants evaluation