



High Capacity Transit System and Finance Plan

July 10, 2012





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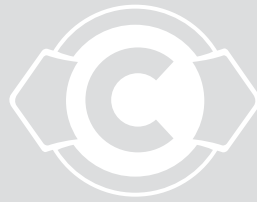
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Section 1

Columbia River Crossing Light Rail Transit System Plan Summary



TRANSIT

The transit element of the LPA is primarily an extension of light rail to Clark College in Vancouver from the Expo Center in north Portland, where the MAX Yellow Line currently terminates. To accommodate and complement this major addition to the region’s transit system, a variety of additional improvements are also included in the project. These include park and ride facilities in Vancouver, expansion of the current TriMet light rail maintenance base in Gresham, changes to C-TRAN local bus routes, and upgrades to the existing Steel Bridge light rail crossing over the Willamette River in Portland.

Light Rail Alignment and Stations

Operating Characteristics» The project would include a 2.9-mile extension of the existing MAX Yellow Line from the Expo Center station across the North Portland Harbor, over Hayden Island, across the Columbia River, and through downtown Vancouver, ending near Clark College (Exhibit 1-2). Nineteen new light rail transit vehicles (LRVs) would be purchased as part of the CRC project to operate this extension of the MAX Yellow Line. These vehicles would be similar to those currently used on the MAX light rail transit system. Trains would operate in a two-car configuration. Exhibit 1-1 compares the size and capacity of LRVs to typical buses.

EXHIBIT 1-1
Transit Vehicle Characteristics

Vehicle Type		Length	Seats	Average Vehicle Passenger Capacity ^a
Standard Local Bus		40 feet	43	61
Articulated Bus		62 feet	60	100
Light Rail Transit	Single Train	90 feet	64	133
	Two-Car Train	180 feet	128	266

A Average vehicle capacity is the total number of seats, plus the floor area of the transit vehicle divided by 3 persons per square meter.

With the LPA, LRVs in the new guideway and in the existing Yellow Line alignment would be planned to operate with 7.5-minute headways during the “peak of the peak” (the 2-hour period within the 4-hour morning and afternoon/evening peak periods when demand for transit is the highest) and with 15-minute headways at all other times. This compares to 12-minute headways in “peak of the peak” and 15-minute headways at all other times for the existing Yellow Line (and No-Build Alternative).

Oregon Light Rail Alignment and Station» A double-track light rail guideway for north and southbound trains would be constructed to extend northward from the existing Expo Center MAX station. The alignment would curve eastward toward I-5 as it passes beneath a newly reconstructed Marine Drive. North of Marine Drive the profile would rise as the guideway transitions onto a bridge structure to cross North Portland Harbor. The two-way guideway over Hayden Island would be elevated at approximately the height of the rebuilt mainline of I-5. A station would be constructed on Hayden Island immediately west of the reconstructed I-5/Hayden Island interchange. The alignment would extend northward on Hayden Island, along the western edge of I-5, until it transitions into the new bridge over the Columbia River. It would be located on the lower deck of the western bridge, which would service southbound highway traffic on the top deck.

Downtown Vancouver Light Rail Alignment and Stations» After crossing the Columbia River, the light rail alignment would curve slightly west, off of the highway bridge and onto its own smaller structure over the Burlington Northern Santa Fe (BNSF) rail line. The double-track guideway would descend on structure and touch down on Washington Street south of 5th Street, continuing north on Washington Street to 7th Street. The elevation of 5th Street would be raised to allow for an at-grade crossing of the tracks on Washington Street. Between 5th and 7th Streets, the two-way guideway would run down the center of the street. Traffic would not be allowed on Washington between 5th and 6th Streets and would be two-way between 6th and 7th Streets. There would be a station on each side of the street on Washington between 5th and 6th Streets.

At 7th Street, the light rail alignment would divide into a couplet. The single-track northbound guideway would turn east for two blocks, then turn north onto Broadway Street, while the single-track southbound guideway would continue on Washington Street. Seventh Street would be converted to one-way traffic eastbound between Washington and Broadway, with light rail operating on the north side of 7th Street. This couplet would extend north to 17th Street, where the two guideways would join and turn east.

The light rail guideway would run on the east side of Washington Street and the west side of Broadway Street, with one-way traffic southbound on Washington Street and one-way traffic northbound on Broadway Street. On station blocks, the station platform would be on the side of the street at the sidewalk. There would be two stations on the Washington-Broadway couplet, one pair of platforms near Evergreen Boulevard, and one pair near 15th Street.

Proposed LPA Transit Alignment and Street Cross Sections (1 of 2)

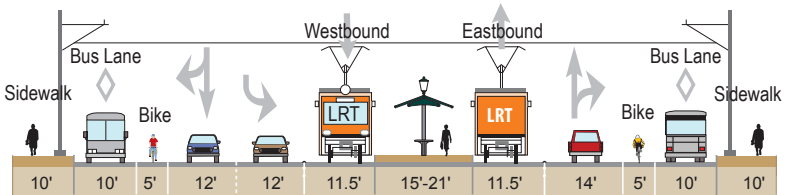


Dimensions are approximate.

A. Terminus

Station block with center platform

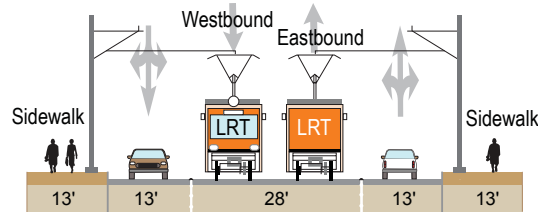
Double track in median and center platform



B. 17th Street

Non-station block from Broadway to G Streets

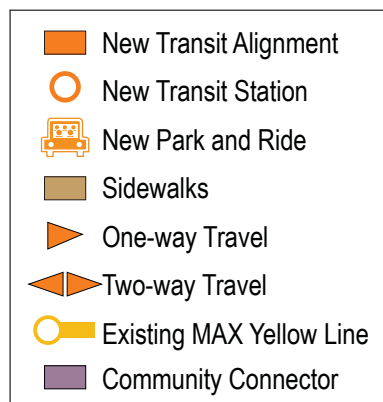
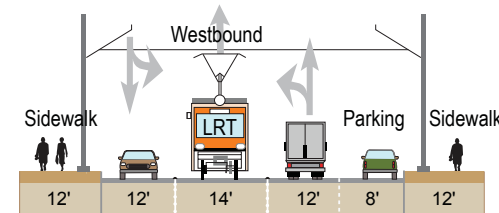
Double track in median



C. 17th Street

Non-station block from Washington to Main

Single track in median with parking lane



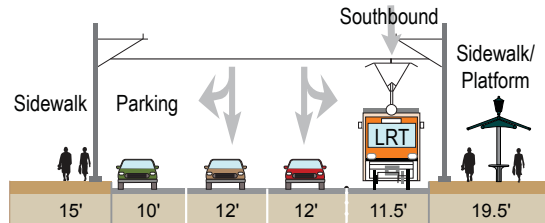
Not to scale. Conceptual designs.

Proposed LPA Transit Alignment and Street Cross Sections (2 of 2)

D. Washington Street

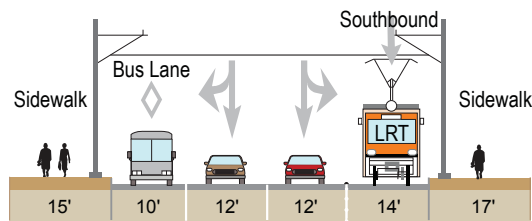
Station block with side platform

Inside single track with one-way traffic
and bus or parking lane (depending on block)



Non-station block

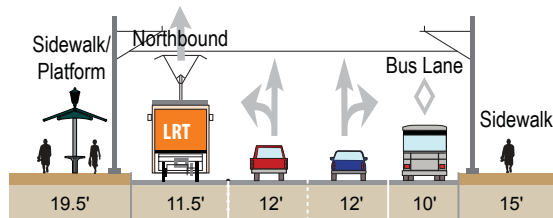
Inside single track with one-way traffic
and bus or parking lane (depending on block)



E. Broadway Street

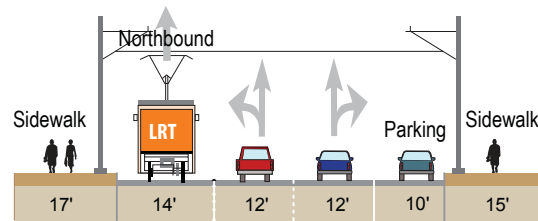
Station block with side platform

Inside single track with one-way traffic
with bus or parking lane (depending on block)



Non-station block

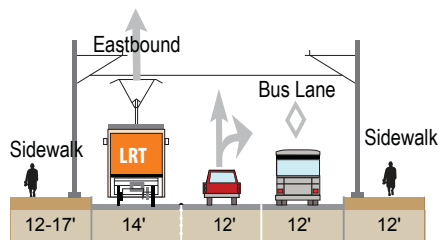
Inside single track with one-way traffic
and bus or parking lane (depending on block)



F. 7th Street

Between Washington and Main Streets

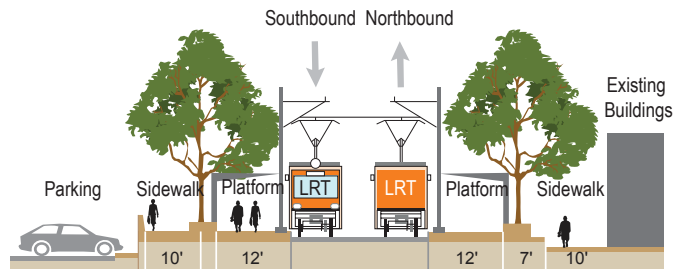
Single track with one-way traffic
and bus lane



G. Washington Street

Station block between 5th and 6th

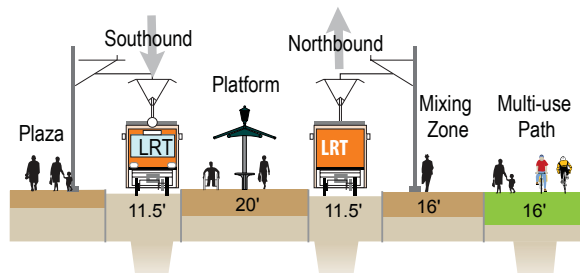
Double track with no traffic



H. Hayden Island

At Tomahawk Island Drive

Elevated station at plaza



East-West Light Rail alignment and Terminus Station» Both north and southbound alignments of the couplet would become a two-way guideway traveling east-west on 17th Street. The double-track,center-running guideway on 17th Street would run until G Street, then curve north to McLoughlin Boulevard, and then continue east through the existing underpass beneath I-5. The underpass would be widened and the road bed lowered to accommodate the light rail trains and overhead catenary system. The guideway would end at a station and park and ride structure east of I-5, on the western boundary of Clark College and across from the Marshall Community Center, Luepke Senior Center, and Marshall Park.

Park and Rides

Three park and rides would be built in Vancouver along the light rail transit alignment (Exhibit 1-3).

EXHIBIT 1-3

Proposed Park and Rides Included in the LPA

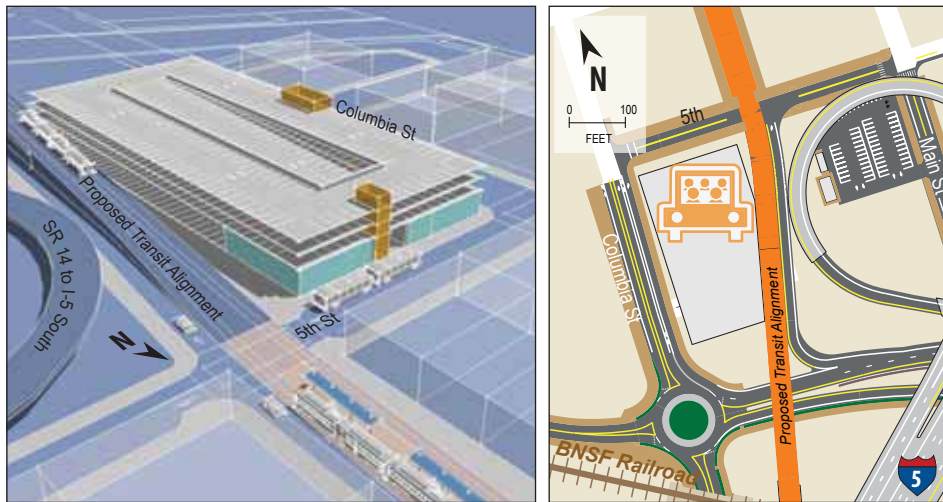
Site Location	Columbia Park & Ride West side of Washington Street between 4th and 5th Streets	Mill Park & Ride East side of Washington Street from 15th to 16th Streets	Clark Park & Ride Northeast of McLoughlin Boulevard and I-5
Size (parking spaces)	570	420	1910
Number of Levels	5	4	5
Footprint (SF)	50,000	42,000	128,000
Retail Space Included Inside Structure	Yes	Yes	No

Columbia Park and Ride» A park and ride would be bounded by Washington, Columbia, and 5th Streets, and half the block between 3rd and 4th Streets. This facility would have five floors above ground and would contain approximately 570 parking spaces (Exhibit 1-4). Active uses would be included on the ground floor.

Mill Park and Ride» A smaller park and ride would be built in the block surrounded by Washington and Main Streets and 15th and 16th Streets (Exhibit 1-5). This facility would have four floors, with active use space (which could include retail) on the ground floor. The current design includes 420 parking spaces.

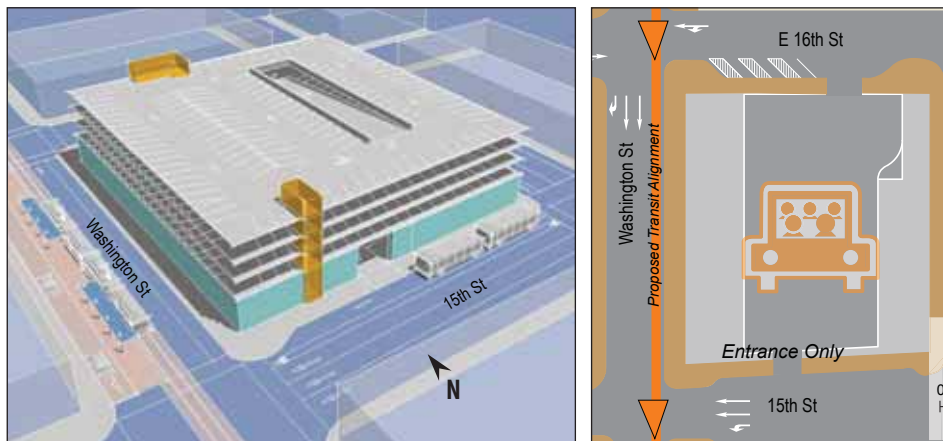
Clark Park and Ride» The largest park and ride would be built at the Clark College terminus. This facility would have five floors, and contain approximately 1,910 parking spaces (Exhibit 1-6).

EXHIBIT 1-4 • Columbia Park & Ride



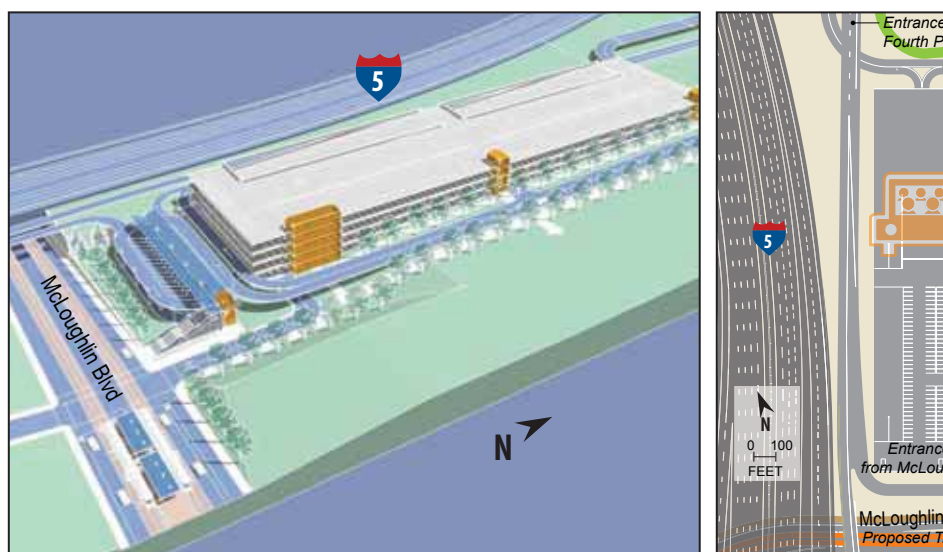
Conceptual designs. Dimensions are approximate.

EXHIBIT 1-5 • Mill Park Park & Ride



Conceptual designs. Dimensions are approximate.

EXHIBIT 1-6 • Clark Park & Ride



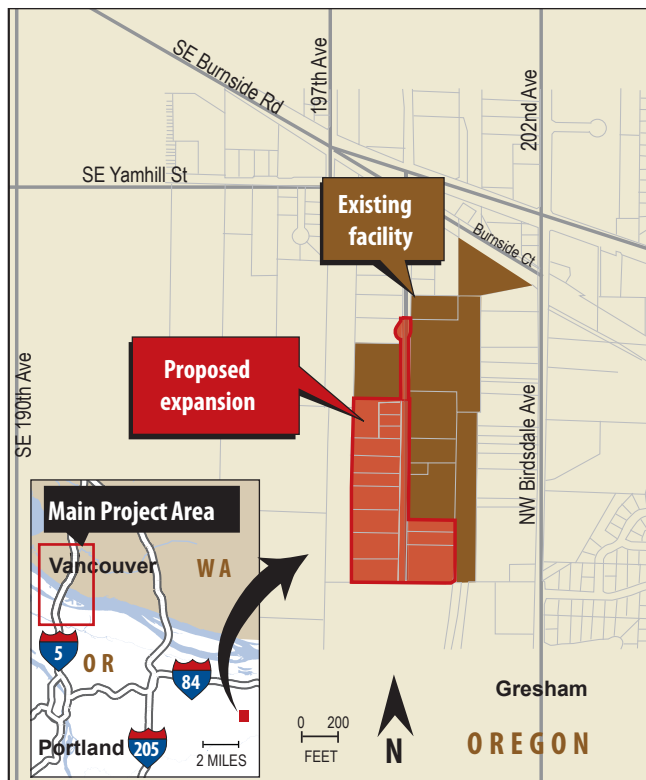
Conceptual designs. Dimensions are approximate.

Ruby Junction Maintenance Facility Expansion

The CRC project would expand the existing Ruby Junction Maintenance Facility in Gresham, Oregon to accommodate the additional LRVs associated with the operations of the CRC project(Exhibit 1-7). The proposed expansion of the Ruby Junction facility would also accommodate the additional LRVs associated with the separately proposed Portland-Milwaukie Light Rail Project. Improvements would include additional storage for LRVs, maintenance equipment and materials, an expansion of LRV maintenance bays, and expanded parking for additional personnel. The Portland-Milwaukie Light Rail

EXHIBIT 1-7

Ruby Junction Maintenance Base Facility



Dimensions are approximate.

Project is considering phasing the maintenance facility expansion to first build only the capacity required for their initial operations, as described in the Portland-Milwaukie Final EIS (FTA 2010). Their initial phase would expand the facility to the west but defer the development of some track, internal roadway, parking facilities, and other structures. If the Portland-Milwaukie project implements phased construction, that would not change the total impacts at the site, but it would change the timing of some of the impacts. Phasing will be determined by the Portland-Milwaukie Light Rail Project and its timing relative to the CRC project construction. A new operations command center would be located at the existing TriMet Center Street location. This would not require any new building construction or expansion of the existing Center Street facility.

Local Bus Route Changes

As part of the CRC project, several C-TRAN local bus routes would be changed in order to better complement the new light rail transit system and reduce redundancies. Most of these changes truncate bus lines in downtown Vancouver where riders could transfer to light rail transit. Express routes, other than those listed below, are expected to continue service between Clark County and downtown Portland. The following exhibit shows the anticipated changes to future bus routes compared to the No-Build Alternative (Exhibit 1-8).

EXHIBIT 1-8

Proposed C-TRAN Bus Route Comparison

C-TRAN Bus Route	Route Changes
#4 Fourth Plain	Route truncated in downtown Vancouver
#41 Camas / Washougal Limited	Route truncated in downtown Vancouver
#44 Fourth Plain Limited	Route truncated in downtown Vancouver
#47 Battle Ground Limited	Route truncated in downtown Vancouver
#105 I-5 Express	Route truncated in downtown Vancouver
#105S I-5 Express Shortline	Route eliminated with LPA (No-Build runs articulated buses between downtown Portland and downtown Vancouver on this route)

Steel Bridge Improvements

In addition to extending the MAX Yellow line, the CRC project would include minor modifications to a critical element of the existing MAX light rail transit system located outside the main project area. These modifications would improve the existing light rail transit track and electrical system on the Steel Bridge, which is located approximately 4 miles south of the crossing of the Columbia River. These improvements would allow the Yellow Line trains, as well as all other MAX line trains that would use these tracks, to increase their travel speed over the Steel Bridge.

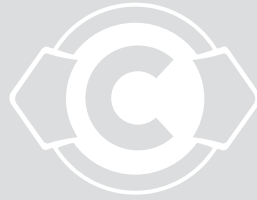
Since the publication of the DEIS, a Documented Categorical Exclusion (DCE) from the NEPA process was requested for the work on Steel Bridge. The DCE evaluation determined that there would be minimal environmental impacts from improvements to the bridge trackway and controls. A determination that the work would be excluded from the NEPA process was made by FTA in February 2011. The Steel Bridge improvements were included in the CRC 2008 Federal New Starts application.

Currently, all light rail transit lines within the regional MAX system cross the Willamette River in downtown Portland via the Steel Bridge. The Steel Bridge was built in 1912 and was retrofitted in 1984 to receive LRVs. When the first light rail line opened in 1986, 40 LRVs crossed the bridge during the 4-hour PM peak period; in 2007, with the Red and Yellow Lines opened, 116 LRVs crossed the bridge during the 4-hour PM peak period. In 2009, TriMet opened the I-205 South Corridor Project, increasing the number of vehicles that cross the Steel Bridge to 152 during the 4-hour PM peak

period. With a “peak of the peak” headway of 7.5 minutes, the CRC project would increase the number of LRVs that cross the Steel Bridge in 2030 during the 4-hour PM peak period to 176 trains. To accommodate these additional trains, the CRC project would retrofit the existing rails on the Steel Bridge to increase the allowed light rail transit speed over the bridge, increasing the LRV throughput of the bridge.

The Steel Bridge has a lift span that requires lift joints in the MAX rails within the track bed. These lift joints limit the crossing speed of LRVs to no more than 10 miles per hour (mph). This limitation is because the vibrations at these joints disrupt the signaling and electrification system. Modifications to reduce the wheel rise from the lift joint would decrease the bridge vibration, allowing MAX trains a maximum speed of 15 mph on the Steel Bridge, thus improving the speed of all MAX lines crossing the bridge. There is also an existing signal case on the lift span that cannot withstand high levels of vibration. The overhead catenary system (OCS) that supplies electrical power to the trains is also not designed to withstand the high levels of vibration that are generated with speeds above 10 mph. The work needed to increase the speed limits from 10 mph to 15 mph over the Steel Bridge lift spans would include the following:

- 1.** Grind the transit rails within the track bed to remove the lift joint bumps, rail corrugation, and any rough field welds.
- 2.** Install a vibration pad under the signal case to dissipate vibration.
- 3.** Stiffen the OCS brackets to allow for greater impact as the catenary transfers from the fixed to movable span.



Section 2

Fourth Plain Transit Improvement Project System Plan Summary



ALTERNATIVES ANALYSIS PROCESS

The Fourth Plain TIP AA was developed by C-TRAN working in collaboration with RTC and the City of Vancouver, while also coordinating with the Washington State Department of Transportation (WSDOT), Clark County, and the Columbia River Crossing Project. C-TRAN and their partners were supported by an extensive public process that engaged the various communities of interest within the project corridor.

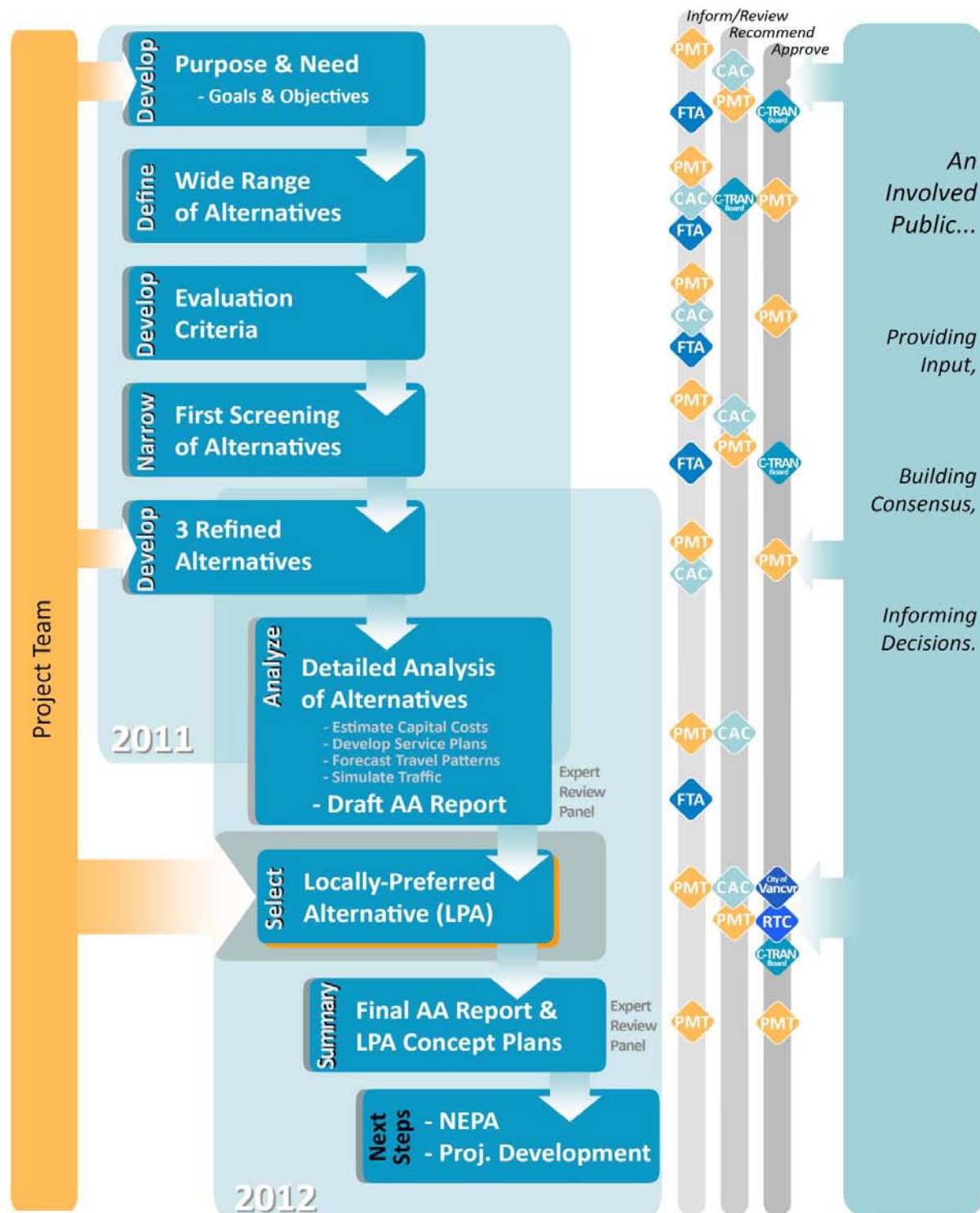
The AA process used for the Fourth Plain TIP was recommended by FTA. A flow-chart showing the AA process is included as Figure 2-1. The following describes the major steps that were included in the Fourth Plain TIP AA process:

- **Alternatives Previously Considered»** This is a report that documents the results of previous studies and policy decisions regarding HCT in the Fourth Plain corridor. It includes a summary of the steps taken to evaluate a range of alternatives for transit modes and corridors, develop a system plan for Clark County, and narrow to a preferred mode and corridor.
- **Purpose and Need»** This document describes the purpose for pursuing the project as well as the problems in the corridor that should be addressed in order to ensure the long-term vitality of the Fourth Plain Boulevard corridor. The Purpose and Need was prepared consistent with what is required for a National Environmental Policy Act (NEPA) Purpose and Need Statement. The Purpose and Need can be found in Section 2 of Appendix B.
- **Goals and Objectives»** The project goals and objectives for the Fourth Plain TIP are based on the Purpose and Need, but provide greater specificity regarding the desired outcomes for the project.
- **Wide Range of Alternatives»** This defines the set of alternatives that could address the transit needs for the Fourth Plain corridor. The wide range of alternatives was a product of the Clark County HCT study process that was used to evaluate the alternatives previously considered, as well as ongoing ideas and suggestions from the public and from local agencies and officials.
- **Alternatives Development»** This describes the initial, planning-level evaluation conducted on the wide range of alternatives. The wide range of alternatives was evaluated against the Purpose and Need as well as Goals and Objectives of the project. Any alternatives that did not meet the project's Purpose and Need and Goals and Objectives were eliminated. The result of this process was the set of Most Promising Alternative Concepts. The set of Most Promising Alternative Concepts was developed and refined further by working with the project team, the community, and corridor stakeholders to develop detailed descriptions of the small set of promising alternatives. The alternatives development process and results are described in Section 3.1 of Appendix B.
- **Evaluation of Promising Alternatives»** This is the detailed evaluation of the small set of promising alternatives described in Section 3.2 of Appendix B. An environmental analysis, transportation analysis, and conceptual design and cost analysis were all conducted for each promising alternative in order to evaluate the alternatives against the goals, objectives, and evaluation measures of the project. Conceptual designs have been prepared in sufficient detail to conduct analysis and make choices among them, but do not yet represent actual plans.

- **Selection of the Locally Preferred Alternative»** The selection of the Locally Preferred Alternative (LPA) will be based on the evaluation described above and will be consistent with the decision-making process described in Section 1.4 of Appendix B. The LPA will be developed in further detail.

FIGURE 2-1

Fourth Plain Alternatives Analysis (AA) Process (Draft)



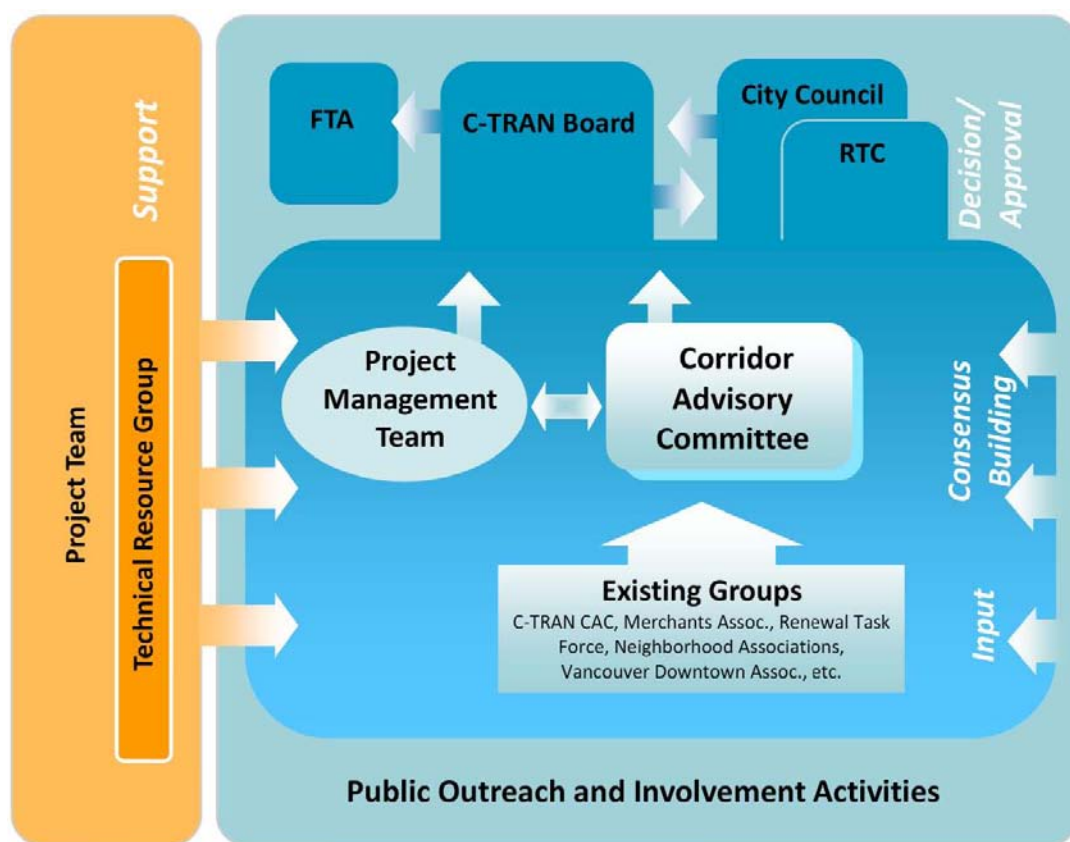
DECISION-MAKING PROCESS AND PUBLIC INVOLVEMENT

Groups and Committees

The decision-making process for the Fourth Plain TIP has been a collaborative effort between several groups and committees with an interest in the project.

The C-TRAN Board of Directors is the decision-making body that selects and approves the LPA. The Vancouver City Council and the RTC Board will review and approve the LPA prior to it going to the C-TRAN Board for final adoption. After the C-TRAN Board adopts the LPA, it will be transmitted to the RTC Board for amendment of the MTP. Figure 2-2 displays the decision-making process and the technical and advisory committees that support the process.

FIGURE 2-2
Decision-Making Process



The project committee structure that was designed to complete the technical analysis and support the decision-making process is described below:

- **Project Management Team (PMT)**» This group provided management and oversight for all aspects of the project. The PMT is comprised of representatives from RTC, the City of Vancouver and C-TRAN. Key members of the consultant team participated in the semi-monthly and monthly PMT meetings.

- **Corridor Advisory Committee (CAC)**» This committee included members of area neighborhoods, the Fourth Plain Merchants Association, Fourth Plain Renewal Task Force, bus riders, business owners, the disabled community, schools, community service agencies, bike and pedestrian interests and others. The committee met regularly and was a major source for community input and provided feedback to the PMT and elected officials on key issues and recommendations on the milestone decisions.
- **Technical Resource Group**» This was an ad hoc group of technical specialists who were called upon to provide analysis and support on an as-needed basis.
- **Existing Corridor Groups**» These groups included the established network of neighborhood and business groups in the corridor. The project team attended regularly scheduled meetings of these groups in order to provide updates on the study progress.

Public Involvement and Community Outreach

Public involvement and community outreach was an important aspect of the decision-making process. The purpose of the public involvement and community outreach tasks is to proactively engage a diverse cross-section of the community along the corridor, including residents, businesses, schools, commuters and transit users, community leaders and the broad general public. A Community Outreach Plan was prepared and implemented that included a variety of tools used to inform and engage the community along the Fourth Plain TIP corridor. The CAC, described above, was an effective way for the community to provide consensus-based advice regarding the project. Additional tools include:

- **Project website and Facebook page**» C-TRAN established a project website and Facebook page early in the process. These sites became the central location for project information and served as a resource for the public to obtain project updates and provide feedback. A schedule of CAC meetings and meeting materials is maintained on the website and Facebook page.
- **Web surveys**» Three online surveys were conducted to gather the public's perspective and feedback regarding project issues such as project values and concerns, the range of possible transit alternatives, various design options, and the most viable alternatives. The first survey was conducted from August 22 through September 4, 2011, and the second from October 17 through October 23, 2011, and a third survey from April 12 through 22, 2012. The purpose of the first survey was to generate feedback about issues and values that would inform the project's Goals and Objectives and collect input regarding the various bus transit options to be considered as part of the wide range of alternatives. The purpose of the second survey was to generate feedback about the public's preferences for the various lane configuration concepts. The purpose of the third and final survey was to gather community input regarding the lane configurations and routing alternatives on Fourth Plain and Fort Vancouver Way as well as the eastern terminus. The feedback collected is intended to inform the selection of the Locally Preferred Alternative. Full versions of the survey questionnaires can be found in the appendix.
- **Information materials**» Materials included a BRT Planning Guide which included educational information regarding how BRT systems work, and a design visualization presentation video that graphically demonstrated how

BRT stations and lane configurations would operate along the corridor. These materials were available on-line and at public meetings. Additionally, the project goals and objectives were translated into Russian, Vietnamese, Korean, and Spanish for distribution to businesses along the corridor through the Fourth Plain Merchants Association.

- **Informational kiosks at key locations»** A traveling display that included a project overview, renderings of the project area, and potential lane configurations was placed in areas highly trafficked by pedestrians. Kiosk locations and dates were as follows:

- » October 19 through October 25, 2011—Clark College
- » October 19 through October 25, 2011—Clark County Health Department
- » November 9 through November 21, 2011—Clark College Town Plaza
- » November 9 through November 21, 2011—Clark County Health Department

- **C-TRAN Table»** C-TRAN hosted an information table on the transit platform at Westfield Vancouver Mall on August 29, 2011. Over 50 people stopped by the table for questions and discussion regarding the project.

- **Design Workshops»** C-TRAN held two public design workshops on November 16 and November 19, 2011. The purpose of these events was to gather community input to inform the development of BRT design alternatives and a Transportation System Management (TSM) alternative. Approximately 30 people total attended at least one workshop, in addition to staff from C-TRAN, the consultant team and local media.

- **Tabling at community events»** Project team members staffed informational displays at popular community venues in order to engage residents who typically would not attend public meetings. Approximately 200 people attended these events. Dates and locations were as follows:

- » October 17, 2011—Clark College Town Plaza location
- » October 18, 2011—Clark College Main Campus (Gaiser Hall)
- » October 19, 2011—Clark County Public Health Department
- » October 20, 2011—Fort Vancouver Regional Library

- **Public meetings»** Two open houses on August 22 and August 31, 2011 were held to provide project information to the public and answer questions. Approximately 16 people attended both meetings. The purpose of these events was to introduce the Fourth Plain Transit Improvement project, present the transit-related issues noted to date and identify others which may need to be addressed, develop a common understanding of the project purpose and need, and to solicit public input that informs the project goals and objectives and the wide range of alternatives. Two additional open houses were held on April 14 and April 18, 2012 to provide information on the technical analysis of the most promising alternatives and to solicit opinions from the public on preferences for the alternatives.

- **Door-to-door outreach to businesses»** C-TRAN staff walked the Fourth Plain section of the corridor and met one-on-one with businesses fronting the corridor. This outreach was conducted in winter and spring of 2011 and provided the businesses with a preview of the study and an invitation to participate in the process.

- **Door-to-door outreach to multi-cultural communities»** C-TRAN staff, along with an interpreter, conducted

door-to-door outreach of Spanish-speaking businesses on the corridor in the spring of 2011. Twenty-one businesses were contacted. Additionally, the project team partnered with Vancouver School District (Fort Vancouver and Hudson's Bay high schools) to recruit youth to serve as interns, assisting with door-to-door education and outreach along the corridor. This outreach effort took place from April 16 to April 20, 2012. Over 100 businesses were contacted, including several Spanish-speaking businesses and sixteen apartment complexes.

- **Community briefings»** The project team conducted project briefings to identified groups and organizations with an interest in the project. Thirty-nine briefings have been held or are scheduled between February 16, 2011 and May 24, 2012.
- **Project notifications»** E-mail notifications at key project milestones were sent to approximately 350 individuals or organizations who expressed interest in the project. One postcard mailing was conducted on January 19, 2012 to over 800 property owners along the corridor, notifying them of the project and providing a link to the project website. A second mailing was distributed to over 6,000 corridor residents and businesses on April 11, 2012.
- **Press releases»** C-TRAN distributed two press releases: one on August 15, 2011 for the project kick-off, and the second on October 19, 2011 for the fourth CAC meeting.
- **News media»** The Columbian Newspaper has published seven articles to date on various project topics. Additionally, the Oregonian and some local opinion blogs have written about the project.

DECISION POINTS AND REPORT ORGANIZATION

The Fourth Plain TIP includes numerous mode, alignment and operational choices. The fundamental decision is the choice among the No Build, Transportation System Management (TSM), or BRT alternatives.

Additional choices for the BRT alternative relate to the lane configurations and eastern terminus. The technical analysis that compares and informs these choices make up the bulk of this report and are referred to throughout the report as the Full Analysis Choices (see Figure 2-3). The term "Full Analysis Choice" is used because these decision points utilize the full range of technical analysis tools including travel demand model forecasting, traffic analysis, and detailed environmental evaluation. These alternatives are described in detail in Section 3 of Appendix B. The following lists the Full Analysis Choices:

- No Build Alternative
- TSM Alternative
- BRT Alternative
 - » Lane Configurations on Fort Vancouver Way
 - » Lane Configurations on Fourth Plain Boulevard
 - » Eastern Terminus

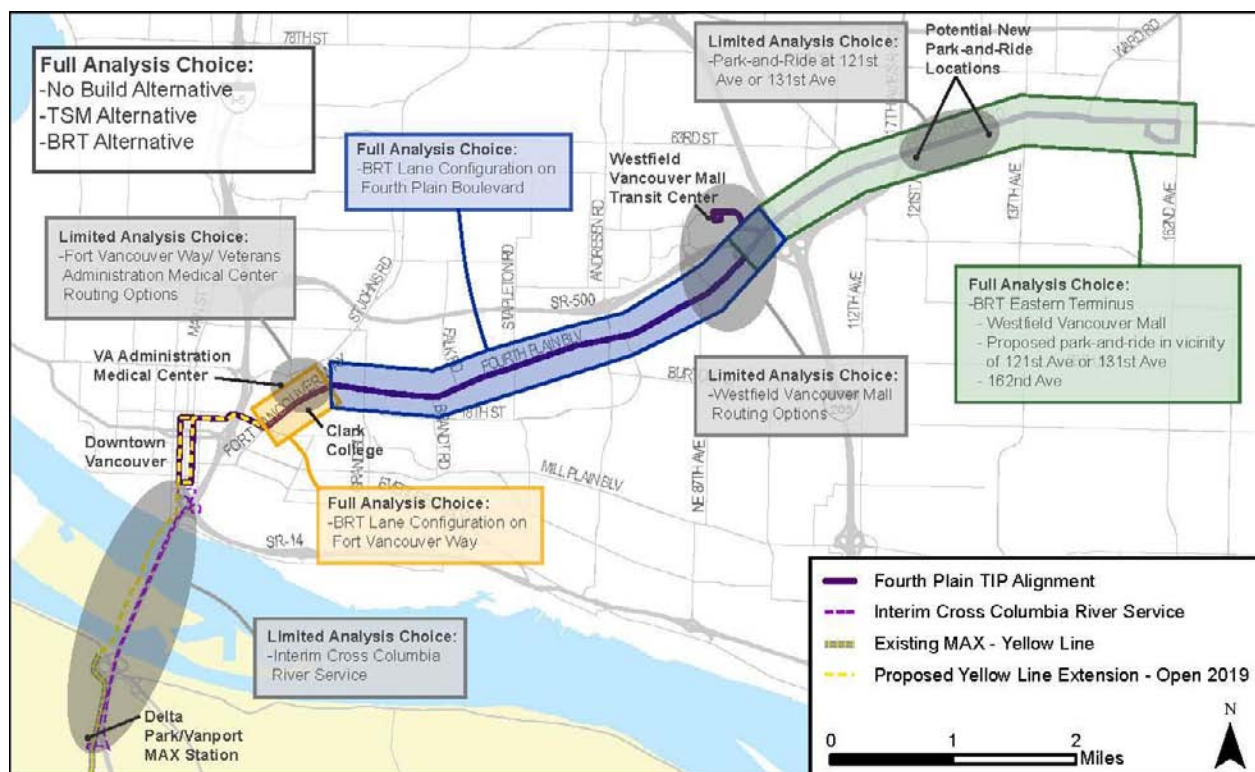
Beyond these decision points that depend on travel forecasting and modeling are several additional decision points

regarding details on what the BRT alternative would look like and how it would operate. These are generally independent choices from the Full Analysis Choices and would be interchangeable with any of the BRT lane configuration and terminus options defined as part of the Full Analysis Choices. Referred to in this report as the Limited Analysis Choices (also shown in Figure 2-3), these decision points are described separately from the Full Analysis Choices and relied on less detailed technical analysis. The following lists the Limited Analysis Choices:

- Westfield Vancouver Mall Transit Center Routing Options
- Fort Vancouver Way/Veterans Administration Medical Center Routing Options
- Interim Cross Columbia River Service Options
- Park-and-Ride at 121st Avenue or 131st Avenue

FIGURE 2-3

Fourth Plain TIP Decision Points





Section 3

C-TRAN 2012 Financial Plan



C-TRAN High Capacity Transit 2012 Financial Plan: June 1, 2012

The Financial Plan, transmitted to the Expert Review Panel (ERP), reflects the funding for all transit programs approved by the voters in 1980, 2005, and 2011. The Financial Plan includes the Columbia River Crossing (CRC) Light Rail Transit (LRT) extension from Expo Center (Portland, Oregon) to the future Clark College Park and Ride in Vancouver and bus rapid transit (BRT) along Fourth Plain Boulevard with a Vancouver Mall terminus. It addresses capital replacement and operating requirements on a cash-flow basis through the year 2035.

The Financial Plan is based on a number of policies approved by the C-TRAN Board of Directors. These policies continue the preservation of Fixed Route bus service and meet the anticipated growth of C-TRAN's Paratransit service C-VAN. The Sources and Uses table summarizes the results of the financial forecasts from 2013 to 2035. This financial forecast maintains financial policies and controls, as well as adequate reserves and cash balances.

FINANCIAL POLICY

The financial policies provide the framework for responsibly completing all High Capacity Transit (HCT) programs and are tools used by management and the Board of Directors to respond to future economic conditions. The key financial policies are as follows:

- Maintain a 90 Days Cash on Hand operating cost reserve called Working Capital Reserve.
- Carry on the policy of making annual but modest increases and adjustments to fares.
- Sustain a self insurance reserve. This currently includes the public liability claims and underground storage tank system. The public liability claims self insurance reserve will be released in 2014 since C-TRAN is no longer self insured effective January 1, 2011.
- Continue financial oversight to be accountable to the public.
 - » At the close of each fiscal year on December 31, management produces a Comprehensive Annual Financial Report for independent auditors to issue a formal opinion. In addition, the independent auditors review for compliance with U.S. Office of Management and Budget Circular A-133 and issue a single audit report. They also conduct an accountability review of internal controls and procedures annually.
 - » At a minimum of three-year intervals, the Federal Transit Administration (FTA) conducts a review to ascertain C-TRAN compliance with 23 functional requirements of agencies receiving federal funds. This includes activities such as procurement, fare policy, drug free workplace, financial control, and disadvantaged business enterprise, among others.
- Remain long-term debt free.
- Improve long-range planning with a focus on cost containment.
- Use financial instruments to manage risk of fuel prices.

Financial Plan Assumptions and Methodology

The Financial Plan is based on a number of assumptions and projections of key variables such as; cost inflation, revenue growth, interest rates, and availability of federal funds. These assumptions and projections are subject to change based on further analysis and information. Although adequate contingency factors have been included in these key variables, the financial forecasts are still vulnerable to periods of economic recession and/or “spikes” in costs of labor and materials. This Financial Plan reflects adequate cash flow and cash reserves to meet all financial obligations; however, a worsening downturn in the economy beyond that already factored in to the Financial Plan would most likely require a delay in implementing portions of the system expansion in the plan.

Three cash flow alternatives were considered: Optimistic, Pessimistic and Realistic (Base). The Optimistic cash flow closely follows C-TRAN’s policies and historical trends. This cash flow was presented to the ERP on May 9, 2012 in which they provided feedback to C-TRAN staff and requested adjustments. The Pessimistic cash flow includes assumptions as if factors worsened greatly for C-TRAN to demonstrate the sacrifices the agency would make to continue to remain solvent but still have a 60 day working capital reserve. The Realistic (Base) cash flow includes assumptions between the Optimistic and Pessimistic cash flows. The assumptions are adjusted to be a bit worse than C-TRAN has experienced historically, but not so bad that the agency is not able to meet many of the long term goals. The Realistic cash flow is used as the Base cash flow.

The long-term Financial Plan is produced in accordance with the FTA “Guidance for Transit Financial Plans.” The plan is maintained on a cash basis. It states and projects all agency sources and uses of funds for the period 2013-2035. The Plan presents the agency’s operating statements, sources and uses statements, and capital replacement funding schedules for the period 2013-2035. More detailed assumptions for Optimistic, Pessimistic and Realistic (Base) cash flows are in Attachments 3-1 and 3-2. The cash flows are in Attachment No. 3-3.

Inflation Forecasting

Each major source and use of funds was evaluated independently for inflation forecasting. C-TRAN uses indices to inflate costs over time in its cost estimates and long-range financial plan. The Consumer Price Index (CPI-U Portland Salem) is applied to many operating and capital expenditures. The historical CPI index was used to grow at an average annual rate of 2.54 percent from 2013-2035. Historical information or current conditions were used where the CPI index was not appropriate.

Sources of Funds

C-TRAN Sales & Use Tax Revenue» C-TRAN is funded primarily by sales and use tax operated in accordance with Chapter 36.57A of the Revised Code of Washington (RCW). The current tax rate is 0.7 percent (increased from 0.5 percent by Proposition 1 effective April 1, 2012). In addition to the current funding, it is anticipated that HCT operations would be funded from an additional 0.1 percent sales and use tax authorized by Chapter 81.104 RCW for HCT.

This sales and use tax increase is subject to voter approval.

Federal Grant Support» In addition to tax revenues, the agency expects to receive a Small Starts grant from the Federal Transit Administration (FTA) to fund the BRT capital costs. C-TRAN expects to continue to receive both FTA 5307 Formula Grants and FTA competitive grants to support the capital program.

State Assistance» C-TRAN expects to continue to receive State grant support for regular operations.

Passenger Fares» The Financial Plan includes fare revenue based on ridership and average fare per passenger by route type. C-TRAN Ridership historically has increased greater than county population growth which was used to forecast ridership. The Board of Directors' policy of making annual but modest fare increases was assumed throughout the 20 years.

Other Revenues» This category includes revenues such as advertising on buses, rental income, warranty reimbursements, and scrap metal sales.

Bonding» C-TRAN is currently debt free and this Financial Plan continues to assume no debt.

Uses of Funds

Fourth Plain BRT Capital Program» Capital costs for the Fourth Plain BRT project are estimated below and include (2010 Dollars):

- BRT vehicles—Ten 60-foot Hybrid articulated at \$1,000,000 each
- Right of Way—Based on an engineer's estimate of \$1,300,000
- Stations & Pavement Widening—Twenty three stations at \$500,000 each
- Site work & Special Conditions—Based on an engineer's estimate of \$4,500,000
- Street Improvements—Based on an engineer's estimate of \$2,800,000
- Systems: TSP, Station Information & Communication, etc.—Based on engineer's estimate \$5,300,000
- Professional Services—35 percent of Stations, Site work and Systems at \$7,455,000
- Maintenance Facility upgrades for BRT—Estimated at \$4,000,000 (2014 Dollars)
- Revision & Relocation of Van Mall Transit Center for BRT—Estimated at \$2,500,000 (2014 Dollars)
- Unallocated Contingency & Mitigation—Based on engineer's estimate of \$1,000,000

Fourth Plain BRT Operations and Maintenance» The new Fourth Plain BRT will replace the existing C-TRAN Routes 4 and 44. Using RCW 81.104 funding for the BRT will allow C-TRAN to reinvest the old Routes 4 and 44 service hours back into the system. The Financial Plan includes BRT service from Downtown Vancouver to the Van Mall Terminus at an estimated cost of \$140 million for 2015-2035 operations and maintenance. Expenses included in the BRT service beyond that of regular Fixed Route service include:

- Additional vehicle maintenance costs for maintaining and cleaning a larger vehicle. This includes labor, parts & materials, fuel, tires, and lubricants.
- Additional facility maintenance costs for maintaining and cleaning larger platforms and increased number of stops

with amenities. This includes labor and parts.

- Additional personnel to perform training for Operators and Maintenance, component management, information technology management, and route analysis duties. The full-time equivalent (FTE) is 1.75.
- Operations and maintenance of ticket vending machines and the related off board fare collection costs.
- Fare Inspectors at a ratio of 0.39 FTE per 1,000 daily riders.
- Marketing and travel demand management costs for the year prior to opening, opening year and the year after opening.

Yellow Line Extension to Clark Park and Ride (CRC LRT) Terminus Operations and Maintenance» The operations and maintenance of the CRC LRT extension will be undertaken and paid for in accordance with an agreement between C-TRAN and TriMet. Service policies for the CRC LRT will be set by mutual agreement of C-TRAN and TriMet. Fare-box revenues will be shared between C-TRAN and TriMet in accordance with a general revenue sharing formula for intersystem transit trips. C-TRAN and TriMet will each be responsible for performing and paying for routine activities within each of their districts, such as general management and administration, marketing/community relations, routine maintenance-of-way, operations and maintenance of park and ride facilities and stations, and utility costs within their districts. TriMet will perform specialized light rail activities such as light rail vehicle (LRV) maintenance; LRV operations, supervisors, fare inspectors, and on-board security; track maintenance; operations and maintenance of electrification, communications, and signal systems; maintenance-of-way on main river crossing; and capital maintenance. The cost of these activities will be shared by C-TRAN and TriMet in accordance with a formula set in the agreement between C-TRAN and TriMet. Assuming C-TRAN current policy regarding cost, the total C-TRAN's share of CRC LRT O&M costs through the year 2035 is estimated to be about \$107 million in year of expenditure dollars.

The Final Environmental Impact Statement (FEIS) submitted for the CRC project included gross Operations & Maintenance (O&M) costs for 2030 of \$5.01 million in 2010 dollars. Using a service and inflation factor of 4.29% this estimates gross O&M costs to be \$11.6 million in year of expenditure dollars. Additionally, C-TRAN's position has been to divide the LRT O&M at the state line which would allocate 64.87% of the costs to C-TRAN.

Transit Operations and Maintenance» C-TRAN uses a fleet of 108 vehicles to provide Fixed Route service on 422.05 route miles and 58 vehicles to provide demand response Paratransit service within the Vancouver Urban Growth Boundary and the Cities of Battle Ground, Camas, and Washougal. C-TRAN's Paratransit service is described in greater detail below. C-TRAN also utilizes a fleet of 20 vehicles to provide vanpool service for customers originating in Southwest Washington. In addition, C-TRAN provides a Dial-a-Ride and Connector Service in the cities of Camas, Ridgefield, and La Center using a mixture of vehicles from the above-referenced fleets.

C-TRAN's 20-Year Plan, adopted on June 8, 2010, provides a framework for what steps need to be taken in order to achieve the agency's long-term vision. The 20-Year Plan "C-TRAN 2030" is a comprehensive strategy for enhancing public transportation for Clark County residents over the next 20 years. Guided by the Board of Directors' 50-Year Vision, "C-TRAN 2030" is designed to respond to growing transportation needs and the need to provide expanded, reli-

able, and safe service. Maintaining and expanding transit service is vital for ensuring the economic vitality and quality of life in the region.

Over the 20 years of “C-TRAN 2030”, the agency would need to raise revenue equivalent to an additional 0.5 (five tenths) percent sales tax. Two tenths was recently approved by Proposition 1 and is effective April 1, 2012. The total five tenths would fund Fixed Route bus service improvements, anticipated growth of C-TRAN’s Paratransit service, and introduce HCT to C-TRAN’s system, including both Columbia River Crossing (CRC) light rail operating costs and the operating and capital costs for the Fourth Plain BRT Project. The introduction of BRT leverages the hours available for Fixed Route bus service since those hours currently assigned to the Fourth Plain route could be reinvested in Fixed Route service.

Paratransit Operations and Maintenance» C-TRAN’s complementary ADA Paratransit service (C-VAN) is not limited by a budget but must be adequate to meet all demand without exception according to FTA.

Ride denials are not allowed. In order to control costs C-TRAN has implemented a more stringent screening process for client eligibility certification, provided a Travel Training Program, made fare policy changes, and purchased smaller vehicles. In 2011 Integrated Voice Recognition software was implemented to remind customers of their rides and that C-VAN is on its way. Also in 2011 C-VAN moved to next day scheduling which assists in reducing no shows and cancellations.

Prior to these changes C-VAN was experiencing double digit growth in service; however, growth has been minimized over the last few years. This forecast assumes an average annual growth rate for C-VAN service of about 2.9 percent, reflecting the projected growth in district population over 65 years of age and the declining rate of disabilities in the senior population.

System-wide Capital Program:» The objective of the capital program is for C-TRAN to maintain, replace, and upgrade current facilities, equipment and systems based on customary and reasonable public transportation and engineering practices and the anticipated use of such facilities, equipment and systems. Maintaining and upgrading existing capital facilities and infrastructure minimizes total program costs and maintains efficient, safe and reliable operations. Maintenance and upgrades of transit infrastructure are consistent with strategic planning objectives to design and modify service and infrastructure to be more efficient and effective. The capital program includes investing in:

- Rolling Stock—replacement of Fixed Route, Paratransit, Vanpool, Maintenance & Utility, and Field Support vehicles on a routine basis.
- Facilities—maintenance facility expansion beyond what is needed for BRT, park & ride expansion, and routine capital facility replacements.
- Equipment—passenger amenities, equipment on buses, computer systems, and routine equipment replacements.

Contributions to Reserves» The Board of Directors established a working capital reserve of a minimum 90 Days Cash on Hand to create sufficient resources to cover cash flow until tax and grant revenues are collected. In addition, one million dollars was set aside to self-insure the underground storage tank system and two million for self-insured retention associated with excess liability policy for public liability claims. C-TRAN has since joined the Washington State Transit Insurance Pool (WSTIP) effective January 1, 2011 and will release the two million reserves in 2014 once the statute of

limitation has expired on public liability claims.

The Optimistic cash flow retains the 90 Days Cash on Hand working capital reserve. Due to feedback received from the Expert Review Panel the Realistic (Base) and Pessimistic cash flows reduce the working capital reserve to 60 Days Cash on Hand by 2035. This uses cash as a “rainy day fund” as a way to mitigate potentially worse outcomes than the Optimistic cash flow presents.

KEY FINANCIAL ISSUES

In order to gauge the vulnerability of C-TRAN’s Financial Plan to risk factors, stress tests on the financial model were conducted. These tests confirm that in overall terms the agency has reasonable capacity to withstand adverse financial shocks. However, certain financial factors are susceptible to negative financial developments. The following are the key risk areas:

Federal Funding» C-TRAN has been fairly successful in competitive grant awards; however the agency cannot be absolutely certain of any FTA discretionary funding in the future. Delay in receipt of federal funds, or no awards, will force the agency to reprioritize the capital program and potentially not move infrastructure projects forward.

Local Tax Revenue Growth» The tax revenue has seen negative growth in 2006—2009. The agency has seen a slow recovery in 2010 (4.0 percent growth) and 2011 (3.4 percent growth). The Optimistic cash flow assumes 2.5 percent growth through 2015 with the growth rate back to historical annual averages of 4.2 percent beginning in 2016. The forecast does not anticipate another recession through 2035 that will be similar in impact to the recent declines. If revenue growth were to fall significantly below the forecast, then local tax revenues would have a negative impact on the agency’s financial condition.

C-VAN Growth» Complementary ADA Paratransit service is not limited by a budget but must be adequate to meet all demand without exception according to FTA. C-TRAN put a number of cost containment measures in place to mitigate the significant growth rates experienced in the early to mid 2000’s. To the extent the C-VAN annual growth rates exceed the assumed 2.9 percent, additional cost containment measures, such as refining eligibility requirements to the minimal required by law, may be enacted.

Inflation» The Financial Plan incorporates long-term consumer price inflation. If inflation were to rise significantly beyond this forecast, C-TRAN’s capital and operating costs would also rise beyond current forecasts. If sales tax revenues increase along with rising prices, the increase in tax revenue might be sufficient to offset some portion of rising program costs. However, if the economy were to enter into a period of “stagflation” where prices rise and economic activity slows, the agency would be faced with rising program costs and declining revenues. This economic environment is seen as unlikely in the near to medium term.

Operating and Maintenance Costs» The Financial Plan utilized O&M cost history rates (cost per platform hour) to project services. The costs of BRT are developed from experiences of other transit agencies operating similar service. The costs of LRT are cost estimates from the CRC Project. It is recognized that O&M costs are affected by many factors, including partnership operating agreements and changes in operating efficiency. Fuel and power costs are subject to change depending on regional and even international market conditions. Adverse changes in these other factors may lead to higher O&M costs than projected in the Financial Plan, reducing financial capacity and flexibility.

Sensitivity Analysis

Three cash flows were produced to demonstrate a sensitivity analyses (“stress tests”) in order to gauge the vulnerability of C-TRAN’s Financial Plan to various risk factors. These tests analyzed the agency’s financial capacity through 2035.

Optimistic Cash Flow» The Optimistic cash flow closely follows C-TRAN’s policies and historical trends. This cash flow was presented to the ERP on May 9, 2012 in which they provided feedback to C-TRAN staff and requested adjustments. Major assumptions include:

- Sales Tax revenue annual increase = 4.2%
- Inflation rate = 2.54%
- Platform hours = Fixed Route matched with 20 year plan (373,570 hours in 2035) & C-VAN matched with population over 65 growth modified 1.35% (168,745 hours in 2035)
- Ridership increases = matched with county population growth
- BRT Farebox Recovery = 40% of operating and system costs
- Capital Program = those projects funded by grants were assumed to be 80% grant funded
- Working Capital Reserve = 90 days

Pessimistic Cash Flow» The Pessimistic cash flow includes assumptions as if factors worsened greatly for C-TRAN to demonstrate the sacrifices the agency would make to continue to remain solvent but still have a 60 day working capital reserve. Major assumptions include:

- Sales Tax revenue annual increase = 3.8%
- Inflation rate = 3.00%
- Platform hours = Fixed Route hours reduced to 302,557 in 2035 & C-VAN matched with population over 65 growth modified 1% (183,715 hours in 2035)
- Ridership increases = half of county population growth
- BRT Farebox Recovery = 30% of operating and system costs
- Capital Program = coaches to be funded at 70% and other projects funded by grants were assumed to be 50% grant funded
- Working Capital Reserve = 60 days

Realistic (Base) Cash Flow» The Realistic (Base) cash flow includes assumptions between the Optimistic and Pes-

simistic cash flows. The assumptions are adjusted to be a bit worse than C-TRAN has experienced historically, but not so bad that the agency is not able to meet many of the long term goals. Major assumptions include:

- Sales Tax revenue annual increase = 4.0%
- Inflation rate = 2.75%
- Platform hours = Fixed Route hours reduced to 325,018 in 2035 & C-VAN matched with population over 65 growth modified 1.35% (168,745 hours in 2035)
- Ridership increases = half of county population growth
- BRT Farebox Recovery = 33% of operating and system costs
- Capital Program = projects funded by grants were assumed to be 70% grant funded
- Working Capital Reserve = 60 days

More detailed assumptions for Optimistic, Pessimistic and Realistic (Base) cash flows are in Attachment 3-1 and 3-2. The cash flows are in Attachment No. 3-3.

Mitigation of Cost Increases or Funding Shortfall

In the event of cost increases or funding shortfalls, there are several mitigation strategies that could be implemented and demonstrated in the two additional cash flows.

Changes to financial policies and financial planning assumptions» The agency's financial policies and financial planning assumptions such as service levels, reserve levels, fare policy, and adjustment to labor agreements over time, could be altered within prudent financial parameters to make additional resources available.

Extending the capital schedule or delaying projects» Extending the schedule could generate additional resources by postponing new service deployment and the related cash requirement for the capital expenditure.

Control O&M costs» If growth of O&M costs increase significantly above inflation, C-TRAN could reduce the level of service on routes/runs that have low ridership performance.

2013-2035 Financial Plan Cash Flow Assumptions

2013-2035 Financial Plan Cash Flow Assumptions			
Factor	Realistic (Base)	Optimistic	Pessimistic
Working Capital Reserve	2 months in response to ERP advice should the Board Policy require adjusting.	3 months, consistent with Board Policy	2 months
Inflation Rate	20 year CPI for Portland/Salem = 2.54%. Used 2.75% in this cash flow	Based on 20 year CPI for Portland/Salem = 2.54%	3.00%
Ridership	20 year historical demonstrates that ridership increases greater than county population. In response to ERP concerns annual rate 1/2 of county population growth.	Increases with service hour increases and county population growth projected by OFM. Express extra 3% increase 2014 for 5 years for economic recovery.	Same as Realistic
Platform Hours	Fixed Route increase adjusted from the 20 year plan estimates due to new economic conditions. C-VAN increases by over 65 population growth modified by 1.35%. LRT 29,003 in 2030 & BRT 42,089 in 2035.	Fixed Route increase with the 20 year plan estimates. C-VAN increases by over 65 population growth modified by 1.35%. LRT & BRT same as Realistic.	Fixed Route extremely constrained. C-VAN increases by over 65 population growth modified by 1%. LRT & BRT same as Realistic.
Sources of Funds - Operating			
Sales Tax Revenue	C-TRAN's 20 year historical average = 4.2% annual increase. Annual growth rate 2013-2015 2.5%, 2016-2035 4.0%. RCW 36.57A sales tax 0.2% increase in 2022.	C-TRAN's 20 year historical average = 4.2% annual increase. Annual growth rate 2013-2015 2.5%, 2016-2035 4.2%. RCW 36.57A sales tax 0.2% increase in 2019.	Annual growth rate 2013-2015 2.5%, 2016-2035 3.8%. RCW 36.57A sales tax 0.2% increase in 2022.
Federal Grant Support	5307 formula funds annual growth rate 2013 0%, 2014-2035 1%.	Same as Realistic	Same as Realistic
State Assistance	Growth tied to inflation rate.	Growth tied to inflation rate.	Growth tied to inflation rate.
Passenger Fares	Fixed Route & C-VAN increases annually 5 cents 2013-2015, 10 cents 2016-2035. Express 10 to 20 cents 2012-2029 (varies by year), 20 cents 2030-2035. LRT fare revenue forced to be 40% of Operating Costs. BRT fare revenue forced to be 33% of Operating & System Costs	Fixed Route & C-VAN increases annually 5 cents 2013-2015, 10 cents 2016-2035. Express 10 to 20 cents 2012-2029 (varies by year), 20 cents 2030-2035. LRT 40% of Operating Costs. BRT 40% of Operating & System Costs.	Fixed Route, BRT & C-VAN increases annually 5 cents 2013-2019, 10 cents 2020-2035. Express 15 cents 2012-2029 (varies by year), 20 cents 2030-2035. LRT fare revenue forced to be 40% of Operating Costs. BRT fare revenue forced to be 30% of Operating & System Costs
Other Revenues	Advertising - based on current contract until expired then proportional growth based on number of buses and CPI for inflation. Miscellaneous - based on historical after removing one-time/non-recurring revenues then inflation with CPI. Growth tied to inflation rate	Growth tied to inflation rate.	Growth tied to inflation rate.
Uses of Funds - Operating			
Wages	Based on historical expenses and adding frozen positions not in the historical information. Annual growth rate of 3.5%.	Same as Realistic	Same as Realistic

2013-2035 Financial Plan Cash Flow Assumptions

2013-2035 Financial Plan Cash Flow Assumptions			
Factor	Realistic (Base)	Optimistic	Pessimistic
Benefits	Based on historical expenses and adding frozen positions not in the historical information. Annual growth rate 2013-2014 6%, 2015-2019 5.25%, 2020-2024 4.5%, 2025-2035 4%	Same as Realistic	Same as Realistic
Services	Based on historical expenses with increases and decreased due to known events. Increases tied to inflation rate.	Growth tied to inflation rate.	Growth tied to inflation rate.
Fuel	Based on historical expenses. Actual annual rates fluctuated quite a bit but average annual increases were close to historical CPI. Increases tied to inflation rate	Growth tied to inflation rate.	Growth tied to inflation rate.
Other Supplies	Based on historical expenses. Actual annual rates fluctuated quite a bit but average annual increases were close to historical CPI. Increases tied to inflation rate	Growth tied to inflation rate.	Growth tied to inflation rate.
Utilities	Based on historical expenses and used inflation rate for annual increases.	Growth tied to inflation rate.	Growth tied to inflation rate.
Insurance	The agency moved to Washington State Transit Insurance Pool (WSTIP) in 2011 and used inflation rate for annual increases.	Growth tied to inflation rate.	Growth tied to inflation rate.
Leases	Based on historical expenses and used inflation rate for annual increases.	Growth tied to inflation rate.	Growth tied to inflation rate.
Miscellaneous	Based on historical expenses and used inflation rate for annual increases.	Growth tied to inflation rate.	Growth tied to inflation rate.
Contracted Services	Cost estimates for LRT from CRC 2019-2030 for state line. Annual growth rate 2031-2035 4%. Assumes TriMet picks up all costs for LRT over the cost estimates from CRC.	Same as Realistic	Same as Realistic
Additional BRT	Increases tied to inflation rate. See Fourth Plain BRT Operations and Maintenance for detailed assumptions.	Growth tied to inflation rate.	Growth tied to inflation rate.
Innovative Programs	Includes Vanpool and other innovative programs. Annual growth rate: Vanpool 5% and Other programs 5%.	Annual growth rate: Vanpool 5% and Other programs 10%.	Vanpool remains but other programs are eliminated.

2013-2035 Financial Plan Cash Flow Assumptions

2013-2035 Financial Plan Cash Flow Assumptions			
Factor	Realistic (Base)	Optimistic	Pessimistic
Sources & Uses of Funds - Capital Program			
Fixed Route & Paratransit Coaches	Calculation based on service hours and vehicle replacement life. Fixed Route replacement life 16 years & 70% grant. C-VAN replacement life 11 years & 100% local. Alternative Fuel Technology for Fixed route for 1/2 of purchases, funded 100% grant up to \$1,000,000.	Calculation based on service hours and vehicle replacement life. Fixed Route replacement life 16 years & 80% grant. C-VAN replacement life 11 years & 100% local. Alternative Fuel Technology for Fixed route for 1/2 of purchases, funded 100% grant up to \$1,000,000.	Same as Realistic
Major Engine Component Replacements	\$125,000 per year & 100% local	Same as Realistic	Same as Realistic
Maintenance & Support Vehicles	\$110,000 per year & 100% local	Same as Realistic	\$55,000 per year & 100% local
Vanpool Vehicles	\$2,240,000 total & 50% grant	Same as Realistic	Same as Realistic
Park & Ride @ I-5/219th Interchange	Not built	\$16,200,000 total & 80% grant. Completed in 2022	Not built
Park & Ride @ I-205/18th Interchange	\$14,600,000 & 70% grant. Completed in 2030	\$14,600,000 & 80% grant. Completed in 2023	Not built
Park & Ride Fisher's Landing Expansion	\$7,500,000 & 70% grant. Completed in 2016	\$7,500,000 & 80% grant. Completed in 2016	\$7,500,000 & 50% grant. Completed in 2022
Admin, Ops, Maint. Facility Upgrades	\$22,725,000 & 70% grant. Completed in 2027	\$22,725,000 & 80% grant. Completed in 2020	Not built
Facility Capital Maintenance	\$645,000 per year & 100% local	Same as Realistic	\$600,000 per year & 100% local
Passenger Amenities	\$1,125,000 per year & 100% local	\$2,250,000 per year & 100% local	\$500,000 per year & 100% local
Office Equipment/Computer Systems/Printers	\$218,250 per year & 100% local	\$500,000 per year & 100% local	\$100,000 per year & 100% local
Miscellaneous Capital Repair/Replacement	\$250,000 per year & 100% local	\$250,000 per year & 100% local	\$250,000 per year & 100% local
BRT Improvements	\$48,047,137 total & 70% grant	\$48,047,137 total & 80% grant	\$48,047,137 total & 50% grant
BRT Coach Replacement	1 replacement coach in 2035 & 70% grant	1 replacement coach in 2035 & 80% grant	Same as Realistic

2013-2035 Financial Plan Capital Cash Flow Assumptions

2013-2035 Financial Plan Capital Cash Flow Assumptions									
Capital Program in 2010 dollars									
Project Description	Realistic (Base)			Optimistic			Pessimistic		
	Year	Amount	Grant	Year	Amount	Grant	Year	Amount	Grant
Fixed Route & Paratransit Coaches	2014-2035	\$ 96,314,000	\$ 61,120,099	2014-2035	\$ 117,386,000	\$ 84,671,051	2014-2035	\$ 95,908,000	\$ 59,596,751
Major Engine Component Replacements	2013-2035	\$ 2,875,000		2013-2035	\$ 2,875,000		2013-2035	\$ 2,875,000	
Maintenance & Support Vehicles	2013-2035	\$ 2,530,000		2013-2035	\$ 2,530,000		2013-2035	\$ 1,265,000	
Vanpool Vehicles	2013-2035	\$ 2,240,000	\$ 1,120,000	2013-2035	\$ 2,240,000	\$ 1,022,948	2013-2035	\$ 2,240,000	\$ 1,022,948
Park & Ride @ I-5/219th Interchange				2021-2023	\$ 16,200,000	\$ 12,960,000			
Park & Ride @ I-205/18th Interchange	2029-2030	\$ 14,600,000	\$ 10,220,000	2022-2023	\$ 14,600,000	\$ 11,680,000			
Park & Ride Fisher's Landing Expansion	2015-2016	\$ 7,500,000	\$ 5,250,000	2015-2016	\$ 7,500,000	\$ 6,000,000	2021-2022	\$ 7,500,000	\$ 3,750,000
Admin, Ops, Maint. Facility Upgrades	2026-2027	\$ 22,725,000	\$ 15,907,500	2019-2020	\$ 22,725,000	\$ 18,180,000			
Facility Capital Maintenance	2013-2035	\$ 14,835,000		2013-2035	\$ 14,835,000		2013-2035	\$ 13,800,000	
Passenger Amenities	2013-2035	\$ 25,875,000		2013-2035	\$ 51,750,000		2013-2035	\$ 11,500,000	
Office Equipment/Computer Systems/Printers	2013-2035	\$ 6,468,750		2013-2035	\$ 11,500,000		2013-2035	\$ 2,300,000	
Miscellaneous Capital Repair/Replacement	2013-2035	\$ 5,750,000		2013-2035	\$ 5,750,000		2013-2035	\$ 5,750,000	
BRT Improvements	2013-2014	\$ 48,047,137	\$ 33,632,996	2013-2014	\$ 48,047,137	\$ 38,437,710	2013-2014	\$ 48,047,137	\$ 24,023,569
BRT Coach Replacement	2035	\$ 1,035,131	\$ 724,592	2035	\$ 1,035,131	\$ 828,105	2035	\$ 1,035,131	\$ 724,592
Total		\$ 250,795,018	\$ 127,975,187		\$ 318,973,268	\$ 173,779,814		\$ 192,220,268	\$ 89,117,860

Realistic (Base)—Sources & Uses Summary

[Year of Expenditure (YOE) Dollars in

Thousands]

Total Estimated Activity for the Period

2013-2035

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Sources of Funds														
Sales & Use Tax Revenue	35,424	37,480	38,417	39,954	41,552	43,214	48,854	43,402	45,138	58,679	61,027	63,468	66,006	68,647
Operating Grants	4,802	4,862	4,922	4,984	5,046	5,109	5,174	5,239	5,305	5,373	5,441	5,511	5,581	5,653
Federal Grant Support - Capital	-	40,705	4,444	7,450	2,999	3,523	3,620	3,719	3,822	3,927	4,248	4,365	4,485	12,172
Passenger Fares	8,049	8,463	9,206	9,800	10,553	11,949	14,387	15,271	16,092	16,998	17,874	18,838	19,772	20,819
Miscellaneous	1,449	1,505	1,286	1,507	1,715	2,009	2,238	2,343	2,113	1,859	2,043	2,199	2,351	2,477
Total Estimated Sources	49,724	93,014	58,277	63,694	61,865	65,805	74,272	69,974	72,470	86,835	90,633	94,381	98,196	109,767
Uses of Funds														
Capital Expenditures														
Fourth Plain BRT	-	55,135	-	-	-	-	-	-	-	-	-	-	-	-
Yellow Line LRT Extension	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rolling Stock	6,052	5,030	4,563	4,576	5,047	5,837	5,876	6,287	6,076	6,506	7,247	7,307	7,651	7,568
Facilities	700	719	3,029	7,231	780	801	823	846	869	893	918	943	969	11,800
Equipment	1,797	1,846	1,897	1,949	2,003	2,058	2,114	2,172	2,232	2,294	2,357	2,421	2,488	2,556
Total Capital	8,549	62,731	9,489	13,757	7,829	8,696	8,814	9,305	9,177	9,692	10,521	10,671	11,108	21,924
O&M Expenditures														
Fourth Plain BRT	-	50	3,680	3,907	4,096	4,346	4,608	4,878	5,161	5,459	5,772	6,101	6,439	6,794
Yellow Line LRT Extension	-	-	-	-	-	-	3,239	3,538	3,865	4,224	4,618	5,048	5,521	6,040
Transit Operations	31,550	32,871	30,777	32,036	33,744	37,501	40,454	42,034	43,678	45,386	47,163	49,010	50,875	52,810
Paratransit Operations	9,528	10,287	11,071	11,923	12,834	13,794	14,806	15,843	16,887	17,982	19,130	20,331	21,559	22,704
Total O&M	41,078	43,208	45,528	47,867	50,674	55,642	63,107	66,292	69,591	73,052	76,682	80,490	84,394	88,347
Change in Cash	97	(12,925)	3,259	2,071	3,361	1,468	2,352	(5,624)	(6,298)	4,091	3,429	3,219	2,695	(504)
Total Estimated Uses	49,724	93,014	58,277	63,694	61,865	65,805	74,272	69,974	72,470	86,835	90,633	94,381	98,196	109,767

ATTACHMENT 3-3 (continued)

Realistic (Base)—Sources & Uses Summary

[Year of Expenditure (YOE) Dollars in

Thousands]

Total Estimated Activity for the Period

2013-2035

	2027	2028	2029	2030	2031	2032	2033	2034	2035
Sources of Funds									
Sales & Use Tax Revenue	71,393	74,248	77,218	80,307	83,519	86,860	90,334	93,948	97,706
Operating Grants	5,726	5,800	5,875	5,952	6,029	6,109	6,189	6,271	6,354
Federal Grant Support - Capital	22,193	4,817	12,366	14,633	5,013	5,151	5,292	5,438	7,015
Passenger Fares	21,808	22,764	23,679	26,176	27,148	28,205	29,283	30,381	31,502
Miscellaneous	2,472	2,247	2,333	2,302	2,151	2,099	2,048	1,967	1,861
Total Estimated Sources	123,591	109,875	121,472	129,371	123,861	128,423	133,147	138,004	144,437
Uses of Funds									
Capital Expenditures									
Fourth Plain BRT	-	-	-	-	-	-	-	-	-
Yellow Line LRT Extension	-	-	-	-	-	-	-	-	-
Rolling Stock	8,077	7,892	7,707	8,083	8,977	8,706	9,122	9,373	11,484
Facilities	25,962	1,051	11,963	15,045	1,140	1,172	1,204	1,237	1,271
Equipment	2,627	2,699	2,773	2,849	2,928	3,008	3,091	3,176	3,263
Total Capital	36,666	11,642	22,444	25,977	13,045	12,886	13,417	13,786	16,018
O&M Expenditures									
Fourth Plain BRT	7,163	7,552	7,957	8,385	8,829	9,295	9,786	10,297	10,836
Yellow Line LRT Extension	6,610	6,902	7,210	7,534	7,836	8,149	8,475	8,814	9,167
Transit Operations	54,821	56,907	59,074	63,532	65,745	68,036	70,409	72,865	75,409
Paratransit Operations	23,888	25,127	26,415	27,755	29,945	31,589	33,299	35,080	36,932
Total O&M	92,481	96,488	100,656	107,206	112,355	117,069	121,969	127,056	132,343
Change in Cash	(5,556)	1,745	(1,628)	(3,812)	(1,539)	(1,532)	(2,240)	(2,838)	(3,923)
Total Estimated Uses	123,591	109,875	121,472	129,371	123,861	128,423	133,147	138,004	144,437

ATTACHMENT 3-3 (continued)

Optimistic—Sources & Uses Summary

[Year of Expenditure (YOE) Dollars in

Thousands]

Total Estimated Activity for the Period

2013-2035

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Sources of Funds														
Sales & Use Tax Revenue	35,424	37,480	38,417	40,031	41,712	43,464	60,501	55,713	58,052	60,491	63,031	65,679	68,437	71,311
Operating Grants	4,799	4,857	4,916	4,976	5,037	5,098	5,161	5,224	5,288	5,353	5,419	5,487	5,555	5,624
Federal Grant Support - Capital	-	46,004	5,413	8,805	3,784	4,223	15,221	22,030	12,085	21,796	14,134	5,287	6,865	5,559
Passenger Fares	8,997	9,632	11,220	12,112	12,988	14,703	17,056	19,261	20,324	21,499	22,629	23,566	26,667	28,077
Miscellaneous	1,270	1,537	1,395	1,545	1,695	1,912	2,005	2,270	2,155	2,158	2,045	1,995	2,069	2,088
Total Estimated Sources	50,490	99,511	61,361	67,469	65,216	69,400	99,943	104,497	97,904	111,297	107,259	102,013	109,592	112,658
Uses of Funds														
Capital Expenditures														
Fourth Plain BRT	-	55,135	-	-	-	-	-	-	-	-	-	-	-	-
Yellow Line LRT Extension	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rolling Stock	361	4,989	5,116	5,136	5,606	6,247	11,090	8,431	6,637	7,063	7,789	7,852	9,995	8,114
Facilities	695	713	2,998	7,143	769	788	9,581	21,037	10,074	22,085	12,116	916	940	964
Equipment	3,234	3,317	3,401	3,487	3,576	3,667	3,760	3,855	3,953	4,054	4,157	4,262	4,370	4,481
Total Capital	4,291	64,154	11,515	15,766	9,950	10,702	24,431	33,324	20,665	33,202	24,062	13,031	15,305	13,559
O&M Expenditures														
Fourth Plain BRT	-	50	3,676	3,901	4,087	4,334	4,592	4,859	5,139	5,433	5,741	6,065	6,398	6,747
Yellow Line LRT Extension	-	-	-	-	-	-	3,239	3,538	3,865	4,224	4,618	5,048	5,521	6,040
Transit Operations	34,318	35,630	34,412	35,598	37,265	42,352	46,921	49,847	51,526	53,266	55,069	56,589	60,606	62,605
Paratransit Operations	9,520	10,275	11,054	11,900	12,804	13,757	14,761	15,789	16,824	17,910	19,046	20,235	21,451	22,583
Total O&M	43,838	45,955	49,141	51,398	54,155	60,443	69,513	74,033	77,354	80,832	84,474	87,937	93,977	97,975
Change in Cash	2,361	(10,598)	704	305	1,110	(1,745)	5,999	(2,859)	(115)	(2,737)	(1,277)	1,045	310	1,124
Total Estimated Uses	50,490	99,511	61,361	67,469	65,216	69,400	99,943	104,497	97,904	111,297	107,259	102,013	109,592	112,658

ATTACHMENT 3-3 (continued)

Optimistic—Sources & Uses Summary

[Year of Expenditure (YOE) Dollars in

Thousands]

Total Estimated Activity for the Period

2013-2035

	2027	2028	2029	2030	2031	2032	2033	2034	2035
Sources of Funds									
Sales & Use Tax Revenue	74,306	77,427	80,679	84,068	87,599	91,278	95,111	99,106	103,269
Operating Grants	5,694	5,765	5,838	5,911	5,986	6,061	6,138	6,216	6,296
Federal Grant Support - Capital	5,700	5,798	5,752	8,199	6,729	6,900	7,075	7,255	8,236
Passenger Fares	29,393	30,940	32,204	34,691	36,218	37,738	39,289	40,720	42,169
Miscellaneous	2,140	2,192	2,262	2,374	2,410	2,425	2,466	2,505	2,538
Total Estimated Sources	117,234	122,122	126,735	135,243	138,942	144,402	150,080	155,803	162,507
Uses of Funds									
Capital Expenditures									
Fourth Plain BRT	-	-	-	-	-	-	-	-	-
Yellow Line LRT Extension	-	-	-	-	-	-	-	-	-
Rolling Stock	8,611	8,438	8,265	11,552	10,391	10,160	10,587	10,856	11,901
Facilities	988	1,013	1,039	1,065	1,092	1,120	1,148	1,178	1,208
Equipment	4,595	4,712	4,832	4,954	5,080	5,209	5,342	5,477	5,616
Total Capital	14,195	14,163	14,136	17,571	16,563	16,489	17,077	17,511	18,725
O&M Expenditures									
Fourth Plain BRT	7,110	7,494	7,892	8,313	8,750	9,208	9,691	10,193	10,722
Yellow Line LRT Extension	6,610	6,902	7,210	7,534	7,836	8,149	8,475	8,814	9,167
Transit Operations	64,675	67,056	69,283	73,471	75,927	78,471	81,108	83,843	86,675
Paratransit Operations	23,753	24,977	26,250	27,574	29,741	31,365	33,054	34,812	36,640
Total O&M	102,149	106,429	110,636	116,892	122,253	127,193	132,328	137,661	143,203
Change in Cash	890	1,531	1,963	780	125	720	675	631	579
Total Estimated Uses	117,234	122,122	126,735	135,243	138,942	144,402	150,080	155,803	162,507

ATTACHMENT 3-3 (continued)

Pessimistic—Sources & Uses Summary

[Year of Expenditure (YOE) Dollars in

Thousands]

Total Estimated Activity for the Period

2013-2035

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Sources of Funds														
Sales & Use Tax Revenue	35,424	37,480	38,417	39,877	41,393	42,965	48,531	42,986	44,620	57,894	60,094	62,378	64,748	67,208
Operating Grants	4,806	4,867	4,930	4,993	5,057	5,123	5,190	5,257	5,326	5,396	5,467	5,540	5,613	5,688
Federal Grant Support - Capital	-	30,287	2,876	2,962	3,051	3,079	3,171	3,267	4,749	7,964	4,385	4,516	4,652	4,791
Passenger Fares	8,063	8,459	9,141	9,559	9,975	11,157	12,694	13,446	14,190	15,503	16,987	17,863	18,765	19,721
Miscellaneous	1,326	1,684	1,226	1,502	1,810	2,154	2,393	2,652	2,575	2,444	2,498	2,650	2,770	2,863
Total Estimated Sources	49,618	82,777	56,590	58,893	61,285	64,478	71,979	67,609	71,460	89,201	89,431	92,946	96,549	100,271
Uses of Funds														
Capital Expenditures														
Fourth Plain BRT	-	55,135	-	-	-	-	-	-	-	-	-	-	-	-
Yellow Line LRT Extension	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rolling Stock	306	5,018	4,555	4,691	5,183	5,332	5,244	5,657	5,563	6,755	7,398	7,620	7,849	7,780
Facilities	656	675	696	716	738	760	783	806	3,599	8,697	881	908	935	963
Equipment	929	957	985	1,015	1,045	1,077	1,109	1,142	1,177	1,212	1,248	1,286	1,324	1,364
Total Capital	1,890	61,785	6,236	6,423	6,966	7,169	7,136	7,605	10,339	16,664	9,528	9,814	10,108	10,106
O&M Expenditures														
Fourth Plain BRT	-	50	3,690	3,921	4,113	4,368	4,634	4,909	5,198	5,502	5,821	6,156	6,501	6,864
Yellow Line LRT Extension	-	-	-	-	-	-	3,239	3,538	3,865	4,224	4,618	5,048	5,521	6,040
Transit Operations	31,154	32,366	30,204	31,397	32,639	36,316	35,668	37,026	38,436	43,062	45,964	47,710	49,467	51,290
Paratransit Operations	9,615	10,435	11,288	12,220	13,223	14,287	15,416	16,573	17,747	18,987	20,293	21,668	23,069	24,391
Total O&M	40,770	42,851	45,183	47,538	49,975	54,971	58,957	62,045	65,246	71,774	76,696	80,582	84,559	88,585
Change in Cash	6,958	(21,859)	5,172	4,932	4,344	2,339	5,887	(2,041)	(4,125)	762	3,207	2,550	1,882	1,580
Total Estimated Uses	49,618	82,777	56,590	58,893	61,285	64,478	71,979	67,609	71,460	89,201	89,431	92,946	96,549	100,271

ATTACHMENT 3-3 (continued)

Pessimistic—Sources & Uses Summary

[Year of Expenditure (YOE) Dollars in

Thousands]

Total Estimated Activity for the Period

2013–2035

	2027	2028	2029	2030	2031	2032	2033	2034	2035
Sources of Funds									
Sales & Use Tax Revenue	69,762	72,413	75,165	78,021	80,986	84,064	87,258	90,574	94,016
Operating Grants	5,765	5,842	5,921	6,002	6,084	6,167	6,252	6,338	6,426
Federal Grant Support - Capital	4,935	5,032	4,972	5,122	5,275	5,433	5,596	5,764	7,454
Passenger Fares	20,676	21,537	22,415	23,316	24,143	25,063	26,004	26,964	27,945
Miscellaneous	2,943	2,973	2,986	2,989	2,940	2,802	2,623	2,392	2,102
Total Estimated Sources	104,081	107,798	111,460	115,449	119,428	123,529	127,734	132,032	137,944
Uses of Funds									
Capital Expenditures									
Fourth Plain BRT	-	-	-	-	-	-	-	-	-
Yellow Line LRT Extension	-	-	-	-	-	-	-	-	-
Rolling Stock	8,484	8,475	8,142	8,729	9,344	9,443	9,726	10,018	12,485
Facilities	992	1,021	1,052	1,084	1,116	1,150	1,184	1,220	1,256
Equipment	1,405	1,447	1,490	1,535	1,581	1,629	1,678	1,728	1,780
Total Capital	10,881	10,943	10,684	11,348	12,042	12,221	12,588	12,965	15,521
O&M Expenditures									
Fourth Plain BRT	7,241	7,640	8,054	8,492	8,948	9,426	9,929	10,454	11,007
Yellow Line LRT Extension	6,610	6,902	7,210	7,534	7,836	8,149	8,475	8,814	9,167
Transit Operations	53,181	55,141	57,174	59,284	61,370	63,530	65,767	68,084	70,483
Paratransit Operations	25,765	27,210	28,719	30,296	32,816	34,755	36,782	38,902	41,118
Total O&M	92,798	96,892	101,157	105,606	110,970	115,860	120,954	126,254	131,775
Change in Cash	403	(38)	(382)	(1,504)	(3,583)	(4,552)	(5,808)	(7,187)	(9,353)
Total Estimated Uses	104,081	107,798	111,460	115,449	119,428	123,529	127,734	132,032	137,944



Appendix A

Columbia River Crossing 2011 New Starts Definition of Alternatives



COLUMBIA RIVER CROSSING

Brief Project Description

The CRC Project is a combined bridge, transit, and highway improvement project designed to address the congestion and mobility problems on Interstate 5 (I-5) between State Route (SR) 500 in Vancouver, Washington, and N/NE Columbia Boulevard in Portland, Oregon. The primary transportation improvements included are:

- The new river crossing over the Columbia River and the I-5 highway improvements, including seven interchanges, north and south of the river.
- Extension of light rail from the Expo Center in Portland to Clark College in Vancouver, and associated transit improvements, including transit stations, park and rides, bus route changes, and expansion of a light rail transit maintenance facility.
- Bicycle and pedestrian improvements throughout the project corridor.
- A new toll on motorists using the river crossing.
- Transportation demand and system management measures to be implemented with the project.

Brief Description of Baseline Alternative as modeled under direction by FTA

The Baseline Alternative includes:

- The same river crossing over the Columbia River and the I-5 highway improvements included in the Build, including seven interchanges, north and south of the river.
- No light rail, but it does include the following transit improvements
 - » Park and rides, at the same location as the Build project, specifically:
 - ♦ SR 14 Park & Ride, 570 spaces
 - ♦ Mill Plain Park & ride, 420 spaces
 - ♦ Clark College Park & Ride, 1,432 spaces (compared to 1,910 spaces in the Build)
 - » Enhanced bus service, equilibrated to meet the projected demand
 - » Articulated buses and maintenance facility expansion
- The same bicycle and pedestrian improvements throughout the project corridor as in the Build.
- The same toll on motorists using the river crossing as in the Build
- The same transportation demand and system management measures to be implemented with the project.

APPENDIX A
CRC Light Rail Alignment



APPENDIX A
CRC Project Area Map



1. INTRODUCTION

The purpose of this report is to describe the physical and operational characteristics of the transit systems for the multimodal Baseline Alternative and the multimodal Build Alternative, also referred to as the Locally Preferred Alternative (LPA)¹, for the Columbia River Crossing (CRC) project's September 2008 Preliminary Engineering (PE) Application and New Starts submittal. This report briefly describes the purpose and need of the CRC Project, and summarizes the roadway and transit capital improvements and the transit characteristics that would occur as part of the multimodal Build Alternative (Section 1.1). As a reference point, this report also describes the current (i.e., existing conditions) roadway and transit networks' facilities and operational characteristics in the project study area and how those conditions would change in the forecast year of 2030 under the multimodal No Build² (Section 2.0). Finally, this report provides a description of the multimodal Baseline and LPA alternatives (sections 3.0 and 4.0, respectively).

This report responds to the guidance regarding development of the Baseline Alternative provided in the *Reporting Instructions for the Section 5309 New Starts Criteria, July 2008*, the guidance in *Advancing Major Transit Investments through Planning and Project Development, 2003*, and through communication with Federal Transit Administration (FTA) staff. The Baseline Alternative is defined in the July 2008 *Reporting Instructions* as the “best that can be done” to improve transit service in the project corridor without a major capital investment in new guideway infrastructure (FTA, 2007. p. 12). As stated in Appendix A of Version 1.1 of *Advancing Major Transit Investments through Planning and Project Development*, “where the multimodal New Starts project is a part of a multimodal alternative that includes major highway components, the New Starts Baseline Alternative will be the proposed multimodal alternative without the New Starts project and its associated transit services” (FTA, 2003. p. 1–2). The multimodal Build Alternative is part of a multimodal project that includes major highway and highway bridge capital improvements, as well as the proposed transit fixed-guideway investment. Therefore, as discussed in this report, the New Starts Baseline Alternative is defined as: the multimodal project, including the bridge, highway, pedestrian, and bicycle improvements, but not including the New Starts transit component, with one exception. Upon direction from FTA staff, the park-and-ride spaces included in the multimodal Build are also included in the New Starts Baseline Alternative.

Section 1.1 includes an overall description of the CRC Project, including the project's Purpose and Need Statement,

1 The region has adopted a Locally Preferred Alternative (LPA), also referred to as the multimodal Build Alternative.

2 The multimodal No Build Alternative is generally defined as the transportation network that would occur in the region in 2030 based on implementation of the financially constrained Regional Transportation Plans, except for the Portland-Milwaukie Light Rail Project. A description of the multimodal No Build Alternative is provided as a reference point to better understand the purpose and need of the multimodal Build Alternative (which is described in Section 1.1 and which includes proposed roadway, bicycle, pedestrian, and fixed-guideway transit improvements).

followed by a description of existing and multimodal No Build³ conditions in the corridor. This report concludes with a description of the physical and operational characteristics of the multimodal Baseline Alternative and the multimodal Build Alternative. Appendix A of the *2011 New Starts Definition of Alternatives* provides a complete transit line listing (including route distances, headways, and number of peak vehicles) for the multimodal No Build, multimodal Baseline, and multimodal Build Alternatives.

1.1 Columbia River Crossing Project Description

The CRC Project is a combined bridge, transit, and highway improvement project designed to address the congestion and mobility problems on Interstate 5 (I-5) between SR 500 in Vancouver, Washington, and N/NE Columbia Boulevard in Portland, Oregon. Consistent with the Vancouver/Portland region general practices, the CRC Project has evaluated and includes proposed and alternative increases in transportation capacity for all relevant modes (i.e., automobiles, trucks, buses, high-capacity transit, bicycles, and pedestrians).

Figure 1-1 illustrates the CRC Project's highway project construction area, referred to as the Bridge Influence Area (BIA). The transit study area encompasses the greater region, including the major transit markets. Figure 1-2 illustrates the primary physical improvements that would occur with the multimodal Build Alternative (including highway, transit, bicycle, and pedestrian improvements).

I-5 is the only continuous north-south interstate highway on the West Coast, linking the United States with Canada and Mexico. In the Vancouver/Portland region, I-5 is one of two major north-south highways that provide interstate connectivity and mobility. I-5 directly connects the central cities of Vancouver and Portland. The only transit connections between Vancouver and Clark County, Washington, and the Portland metropolitan area in Oregon are bus lines across the I-5 bridge and across the I-205 bridge, which is approximately 6½ miles to the east of I-5. There are no other crossings of the Columbia River for traffic or transit in the region. Traffic conditions on the I-5 crossing over the Columbia River are influenced by the five-mile section of I-5 between SR 500 in Vancouver and Columbia Boulevard in Portland. This section includes six interchanges that connect three state highways and several major arterial roadways. These interchanges serve a variety of land uses and provide access to downtown Vancouver, two international marine ports, industrial centers, residential neighborhoods, retail centers, and recreational areas.

High-capacity transit applications in the I-5 corridor through north Portland and Vancouver have been studied periodically for over a decade. In 1993, the FTA, in cooperation with Metro, began studying high-capacity transit in the "South/North Corridor," which stretches from Milwaukie, Oregon to Vancouver, Washington. FTA and Metro published the South/North Corridor Project Draft Environmental Impact Statement in 1998. This study identified a variety of alignments

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3 The CRC Project's current forecast year is 2030. The project's FEIS includes a No Build Alternative, which includes no roadway, transit, bicycle or pedestrian improvements other than those already in the region's financially constrained regional transportation plans. Thus, the multimodal Baseline Alternative includes the roadway, bicycle and pedestrian facilities of the multimodal Build Alternative and the transit facilities and operational characteristics of the multimodal No Build Alternative. The only exception to this rule are the park-and-ride facilities of the multimodal Build Alternative, which are also included in the multimodal Baseline Alternative, per the request of FTA staff. The CRC FEIS's No Build Alternative is similar to the multimodal No Build Alternative described here, except that the background bus service differs slightly.

and length options for a light rail corridor connecting Milwaukie, downtown Portland, North Portland, and downtown Vancouver. Subsequent funding challenges didn't allow construction of the entire corridor assessed in the South/North project, but did allow construction of the MAX Yellow Line through North Portland to the Expo Center in 2004. The new light rail alignment recently completed along the downtown Portland transit mall (Green Line MAX) accommodates Yellow Line light rail service and can accommodate the extension of light rail south to Milwaukie, Oregon; a Record of Decision was signed on November 29, 2010 by FTA Regional Administrator R. F. Krochalis, approving the proposed Portland-Milwaukie light rail extension. The FTA Final Funding Grant Agreement is expected in the Spring of 2012.

1.1.1 Project Purpose

The Purpose and Need Statement for the CRC Project was developed by building upon previous planning studies, solicitation of public input, and coordination with stakeholder groups. More than a decade's worth of planning and prior studies

FIGURE 1-1
CRC Highway Network



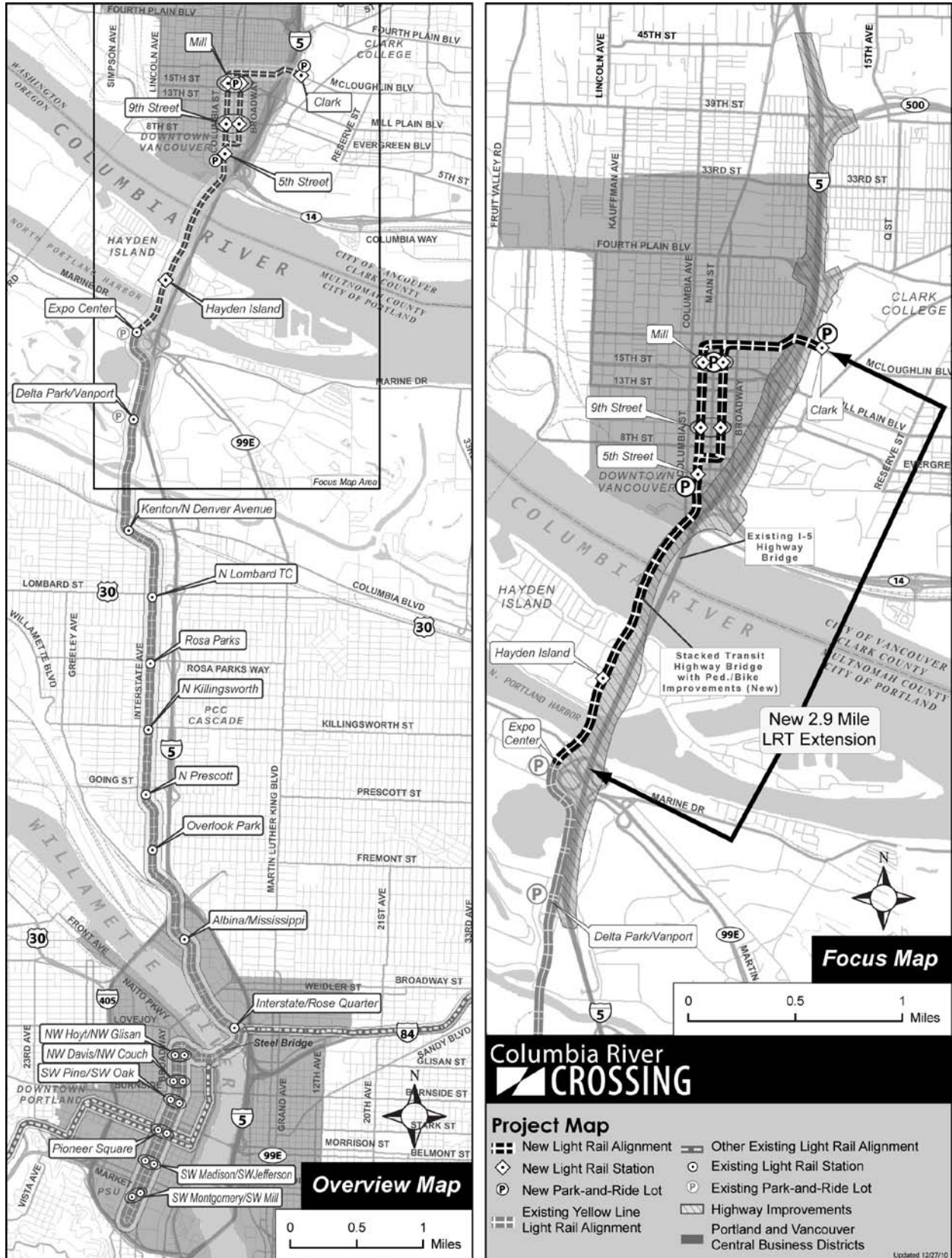
have evaluated potential solutions to the transportation deficiencies in the I-5 CRC project area. These studies have identified a variety of transportation mobility and safety problems, many of which have been passed on to the I-5 CRC Project to correct.

The purpose of the proposed multimodal project is to improve I-5 corridor mobility across all modes by addressing present and future travel demand and mobility needs in the Columbia River Crossing BIA for highway, bicycle, and pedestrian improvements, and the I-5 corridor transit travel markets in the Vancouver/Portland area for transit improvements. The BIA extends from approximately Columbia Boulevard in the south to SR 500 in the north (Figure 1-1). The key transit travel markets cover a larger geographic area with trips between the Portland Central City and the City of Vancouver and Clark County, trips between North/Northeast Portland and the City of Vancouver and Clark County, and trips connecting the City of Vancouver and Clark County with the regional transit system in Oregon.

The multimodal Build Alternative (Figure 1-2) is intended to achieve the following objectives: a) improve travel safety and traffic operations on the I-5 bridges and associated interchanges; b) improve connectivity, reli-

FIGURE 1.2

Multimodal Build Alternative Project Map



ability, travel times, and operations of public transportation modal alternatives in the Vancouver/Portland I-5 corridor; c) improve highway freight mobility and address interstate travel and commerce needs in the BIA; and d) improve the structural integrity of the I-5 bridges.

1.1.2 Project Need

The specific needs to be addressed by the proposed action as reported in the Columbia River Crossing Draft Environmental Impact Statement (DEIS) include:

Growing travel demand and congestion» Existing travel demand exceeds capacity in the I-5 Columbia River Crossing and associated interchanges. This corridor experiences heavy congestion and delay lasting 2 to 5 hours during both the morning and afternoon peak travel periods and when traffic accidents, vehicle breakdowns, or bridge lifts occur. Due to excess travel demand and congestion in the BIA, many trips divert to the longer I-205 route across the river. The I-205 bridge, approximately six and a half miles east of I-5, is the only other crossing of the Columbia River within the region. Spillover traffic from I-5 onto parallel arterials such as Martin Luther King Jr. Boulevard and Interstate Avenue increases local congestion. The two crossings currently carry over 260,000 trips across the Columbia River daily. Daily traffic demand over the I-5 crossing is projected to increase by 40 percent during the next 20 years, with stop-and-go conditions increasing to at least 15 hours each day (7.25 hours southbound and 7.75 hours northbound) if no improvements are made.

Impaired freight movement» I-5 is part of the National Truck Network, and the most important freight freeway on the West Coast, linking international, national, and regional markets in Canada, Mexico, and the Pacific Rim with destinations throughout the western United States. In the center of the project area, I-5 intersects with the Columbia River's deep water shipping and barging as well as two transcontinental rail lines. The I-5 crossing provides direct highway connections to the Port of Vancouver and Port of Portland facilities located on the Columbia River as well as the majority of the area's freight consolidation facilities and distribution terminals. Freight volumes moved by truck to and from the area are projected to more than double over the next 25 years. Vehicle-hours of delay on truck routes in the Vancouver/Portland area are projected to increase by more than 90 percent over the next 20 years. Growing demand and congestion will result in increasing delay, costs and uncertainty for all businesses that rely on this corridor for freight movement. Bridge lifts also disrupt truck freight by increasing congestion and impacting travel time reliability.

Limited public transportation operation, connectivity, and reliability» Due to limited public transportation operations, a number of transportation markets are not well served. The key transit markets include:

- trips between the Portland Central City and the City of Vancouver and Clark County;
- trips between North/Northeast Portland and the City of Vancouver and Clark County; and
- trips connecting the City of Vancouver and Clark County with the regional transit system in Oregon.

Current congestion in the corridor adversely impacts public transportation service reliability and travel speed. Southbound bus travel times across the bridge are currently up to three times longer during parts of the AM peak compared

to the off-peak. Travel times for public transit using general purpose lanes on I-5 between Vancouver and Portland are expected to increase substantially by 2030.

Safety and Vulnerability to Incidents» The I-5 bridge and its approach sections experience crash rates nearly 2.5 times higher than statewide averages for comparable facilities. Incident evaluations generally attribute these crashes to traffic congestion and weaving movements associated with closely spaced interchanges. Without breakdown lanes or shoulders, even minor traffic accidents or stalls cause severe delay or more serious accidents.

Substandard bicycle and pedestrian facilities» The bike/pedestrian lanes on the I-5 Columbia River bridges are 6 to 8 feet wide, narrower than the 10-foot standard, and are located extremely close to traffic lanes, thus impacting safety for pedestrians and bicyclists. Direct pedestrian and bicycle connectivity are poor in the BIA.

Seismic vulnerability» The existing I-5 bridges are located in a seismically active zone. They do not meet current seismic standards and are vulnerable to failure in an earthquake.

The following bullet points highlight the most important points of the purpose and need that pertain to transit:

The purpose of the CRC Project for transit is to implement a major fixed-guideway transit investment that will:

- Improve connectivity, reliability, travel times and operations of public transportation;
- Help reduce vehicular demand on the limited roadway capacity across the Columbia River;
- Respond to increasing population and employment;
- Improve transit access: 1) between the region's two largest CBDs—the Vancouver Central City and the Portland Central City; 2) between the high-growth employment center of the Vancouver Central City and the established north Portland residential areas; and 3) between the high-growth residential areas in Clark County and the high-growth employment areas in the Portland Central City; and
- Support state, regional and local land use plans and goals.

2. EXISTING AND MULTIMODAL NO BUILD CONDITIONS

This chapter provides a description of the transportation system and its operational and physical characteristics under existing and future (2030) multimodal No Build conditions. These descriptions are provided as a reference point to better understand the existing and future transportation problems in the corridor and to better understand how and why the multimodal Baseline and LPA alternatives were designed as they are described within this report.

2.1 Existing Conditions

This section provides a summary of the existing transportation capital facilities and transit operations in the project area. For the roadway, bicycle, and pedestrian capital facilities, the focus is on the BIA. For transit, the capital facilities and the operational characteristics of the transit networks in the project major transit market areas of Clark County and North Portland are reviewed.

2.1.1 CAPITAL FACILITIES

This section describes the existing bridge and roadway capital facilities in the CRC BIA, followed by a description of the transit, bicycle, and pedestrian facilities.

2.1.1.1 Roadway Capital Facilities

Bridge» The existing I-5 crossing is comprised of two separate, lift span bridges with a total of six travel lanes—three northbound and three southbound. The bridges do not meet current design standards with no shoulders, narrow lanes, and reduced sight distance due to the vertical grade changes designed to accommodate the Columbia River shipping channel.

Roadway» The CRC Project evaluated potential improvements to I-5 from SR 500/39th Street in Vancouver to near Interstate Avenue/Victory Boulevard in Portland. There are seven I-5 interchanges within the five-mile CRC BIA:

- SR 500 Interchange
- Fourth Plain Boulevard Interchange
- Mill Plain Boulevard Interchange
- SR 14/City Center Interchange
- Hayden Island Interchange
- Marine Drive Interchange
- Victory Boulevard Interchange

These interchanges do not meet current highway standards for spacing, geometry, and/or ramp length.

2.1.2 Transit, Bicycle, and Pedestrian Capital Facilities

There are five major park-and-ride lots in Clark County today, three in the I-5 corridor, and two in the I-205 corridor. On the Oregon side of the river, two park-and-ride lots exist along the existing Yellow Line MAX (light rail) at Delta Park/Vanport and Expo Center Stations. Table 2-1 details the number of available parking spaces at each location.

TABLE 2-1

Existing Transit Facility Summary

	Park & Ride Facilities	Parking Spaces Available
Clark County I-5	Salmon Creek	513
	99th Street	600
	BPA/Ross	175
	Total	1,288
Clark County I-205	Fisher's Landing	586
	18th Street	N/A
	Evergreen	271
	Total	857
Portland I-5	Expo Center	300
	Delta Park/Vanport	304
	Total	604

TriMet and C-TRAN currently operate 117 and 119 buses including spares within North Portland and Clark County, respectively. TriMet operates 19 light rail cars including spares (See Table 2-2 for details) on the Yellow Line.

TABLE 2-2

Existing Transit Vehicles

Transit Characteristic	TriMet ^a	C-TRAN
Clark County I-5	Fixed Route Buses	117
	Light Rail Cars	19

A TriMet bus data are for North Portland buses only (4 Fessenden, 6 MLK Jr Blvd, 8 NE 15th Ave, 16 NE Front Ave/ St. Johns, 33 Fremont, 35 Greeley, 44 Mocks Crest, 72 NE 82nd Ave/ Killingsworth, and 75 NE 39th Ave/ Lombard); LRT data are for the Yellow Line MAX only. For systemwide information, please refer to the "Columbia River Crossing Project Capital and Operating Finance Plan for Transit." This document shows that TriMet currently operates 631 buses and 105 light rail cars systemwide.

Bicycle and Pedestrian Facilities» The existing pedestrian and bicycle route between downtown Vancouver, Hayden Island, and the Marine Drive area is circuitous and requires users to navigate local street intersections. On the south side of the Columbia River, connections to the large Portland bikeway network exist via Marine Drive to the west and

east, Martin Luther King Jr. Boulevard to the southeast, and Expo Road to the south. Numerous connections to regional pedestrian and bikeway facilities exist throughout Vancouver. Pedestrian and bicycle facilities on the bridge are sub-standard, four feet wide in most places, and extremely close to traffic and the steel trusses.

2.1.3 Operational Characteristics

This section provides a description of the operational characteristics of C-TRAN's and TriMet's existing transit systems in the project area:

- between the Portland Central City and the City of Vancouver and Clark County;
- between North/Northeast Portland and the City of Vancouver and Clark County; and
- between the City of Vancouver and Clark County and the regional transit system in Oregon.

Figure 2-1 illustrates the multimodal transit network for the project area. Table 2-3 summarizes the existing (2007) annual vehicle hours for bus and light rail that are operated by TriMet and C-TRAN.

TABLE 2-3
Summary of 2007 Transit Operational Characteristics

Transit Characteristic		TriMet ^a	C-TRAN
Annual Platform Hours	Fixed Route Buses	422,000	294,900
	Light Rail	49,814	0

A TriMet bus data are for North Portland buses only; LRT data are for the Yellow Line MAX only. C-TRAN bus data reflect the entire C-TRAN system.

2.1.3.1 Bus

C-TRAN» C-TRAN currently operates bus line #4 between downtown Vancouver and the Delta Park/Vanport Station, via the I-5 Bridge and Hayden Island. The #4 operates with 15-minute headways in both the weekday peak periods and off peak periods. C-TRAN also currently operates three peak-only lines (i.e., #44 Fourth Plain Limited, #41 Camas/Washougal Limited, and #47 Battle Ground Limited) that serve downtown Vancouver and the Delta Park/Vanport Light Rail Transit (LRT) Station. These lines connect suburban Clark County and downtown Vancouver to North Portland and downtown Portland via a transfer to the Yellow Line MAX.

Another group of lines provides service between suburban Vancouver and downtown Portland with peak only service across the I-5 Bridge (i.e., #134 Salmon Creek Express, #157 Lloyd District Express, #190 Marquam Hill Express, and #199 99th Street Express). One line, the #105 I-5 Express, serves downtown Portland, downtown Vancouver, and two suburban transit centers/park-and-ride lots with peak and off-peak service.

FIGURE 2-1



TriMet» In the CRC project area in North Portland, TriMet operates three local bus lines: Line 6 Martin Luther King Jr. Boulevard, Line 8 Northeast 15th Avenue, and Line 16 Front Avenue/St. Johns. Line 6 runs from downtown Portland to Hayden Island and is one of TriMet's frequent service lines, with 15-minute headways all day on weekdays and week-

ends. Line 8 provides service to Middlefield east of I-5 and facilitates a transfer to Line 16, which travels along Marine Drive, stopping at the Expo Center light rail station and the Rivergate area of Portland. Line 8 is also one of TriMet's frequent service lines. Line 16 operates at 30-minute headways in the weekday peak periods and 120-minute headways in the off-peak periods.

2.1.3.2 Light Rail

TriMet operates three light rail lines in the Portland metropolitan area, including the Yellow Line, which extends from downtown Portland, through North Portland to the existing Expo Center Station. The Yellow Line includes 10 stations between the Rose Quarter and its northern terminus at the Expo Center. The Yellow Line currently operates with approximately 12-minute headways during the peak periods and 15-minute headways during the off-peak periods.

2.2 The Multimodal No Build Alternative

This section provides a summary of the transportation capital facilities and transit operations in the project area under the multimodal No Build Alternative. For the roadway, bicycle, and pedestrian capital facilities the focus is on the BIA. For the transit, the capital facilities and the operational characteristics of the transit networks focus on the major market areas.

2.2.1 CAPITAL IMPROVEMENTS

This section describes the roadway capital facility improvements that would occur in the CRC BIA under the multimodal No Build Alternative, followed by a description of the transit facility improvements that would occur with the multimodal No Build Alternative in the greater project area.

2.2.1.1 Roadway Capital Facilities

In general, there would be no new roadway capital facilities in the project's BIA under the multimodal No Build Alternative when compared to existing conditions, except for those identified in the adopted, regional, financially-constrained plans.⁴ The Portland-Milwaukie Light Rail Project is the only large capital project included in the financially constrained, regional transportation plans not included as part of the multimodal No Build Alternative. Of note for the CRC Project under the multimodal No Build Alternative, I-5 would be widened to three lanes (from two existing lanes) in the southbound direction between Victory Boulevard and Lombard Street, which is located immediately south of the CRC Project's BIA.

2.2.1.2 Transit, Bicycle, and Pedestrian Capital Facilities

This section provides a description of C-TRAN's and TriMet's transit capital improvements and the bicycle and pedestrian improvements that would occur under the multimodal No Build Alternative. Under the multimodal No Build Alternative, there would be some minor increases in park-and-ride capacity compared to existing conditions. As there currently are, there would be five major park-and-ride lots in Clark County under the multimodal No Build Alternative.

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⁴ Southwest Washington Regional Transportation Council's Metropolitan Transportation Plan and Metro's Regional Transportation Plan.

tive; three in the I-5 corridor and two in the I-205 corridor. The Evergreen Park-and-Ride would be replaced by the 18th Street Park-and-Ride, which adds capacity and is more accessible from I-205 when a new highway interchange is built at 18th Street. Fisher's Landing Park-and-Ride would be expanded by 250 spaces in accordance with the current financially constrained Metropolitan Transportation Plan published by the Southwest Washington Regional Transportation Council. On the Oregon side of the Columbia River, there would be two park-and-ride lots along the existing Yellow Line MAX at Delta Park/Vanport and Expo Center Stations, as currently exist. Table 2-4 details the number of available parking spaces at each location.

TABLE 2-4

Multimodal No Build Transit Facility Summary

	Park & Ride Facilities	Parking Spaces Available
Clark County I-5	Salmon Creek	513
	99th Street	600
	BPA/Ross	175
	Total	1,288
Clark County I-205	Fisher's Landing	836
	Evergreen	N/A
	18th Street	500
	Total	1,336
Portland I-5	Expo Center	300
	Delta Park/Vanport	304
	Total	604

The number of vehicles that C-TRAN and TriMet would operate under the multimodal No Build Alternative would be very similar to today with minor changes to C-TRAN's fleet to account for the addition of six 60-foot, articulated buses for line #105S I-5 Express Shortline. The number of 40-foot buses would also increase to 121 (including spares) for this alternative due to the added service and increased congestion, which requires C-TRAN to add vehicles in order to maintain the same level of service. The number of light rail vehicles on the Yellow Line remains the same as existing conditions at 19 vehicles.

As shown in Table 2-5, an expansion to the existing C-TRAN maintenance facility would have to be made to accommodate the twelve additional sixty-foot articulated buses including two maintenance bays. Existing yard capacity can accommodate the additional buses. Only the maintenance bays would have to be constructed.

The appendix to the *2011 New Starts Definition of Alternatives* provides detailed information on how the peak vehicle requirements were calculated. Appendix A also shows the overall regional system including all C-TRAN, TriMet and other agency transit lines, with headways, revenue trip distances, revenue trip times, and the number of peak vehicles

required for each line. At the bottom of the line listing, the peak vehicle requirements are totaled. Peak vehicle calculations for the system as a whole are included in the financial projection tables of the finance plan and fleet management plan.

The line-by-line listing in Appendix A of the *New Starts Definition of Alternatives* represents bus lines as they are in the regional travel demand model. In practice, many TriMet lines are interlined, especially through downtown, but also through transit centers throughout the region. This interlining reduces peak vehicle requirements and allows layovers to be consolidated in the most efficient manner possible. Out of 93 total bus lines operated by TriMet, 50 of them are interlined, with 26 of those interlines occurring in downtown Portland, where the savings are greatest. This nuance of interlining is not represented in the regional demand model and the results from a system-wide calculation based on these data would systematically overstate the actual number of vehicles needed. This issue does not exist for light rail because each line is modeled with interlines intact.

The number of TriMet peak bus vehicles required for the corridor buses is 124 and the number of C-TRAN vehicles 133 (121 forty-foot buses and 12 sixty-foot buses) for the multimodal No Build Alternative.

TABLE 2-5
Multimodal No Build Transit Vehicles and Maintenance Facilities

Transit Characteristic		TriMet ^a	C-TRAN
Vehicles (including spares)	Fixed Route Buses	124	121
	Articulated Buses	0	12
	Light Rail Cars	19	0
Maintenance Facilities (square footage)	Buses	Same as existing conditions (with capacity increases to meet demand)	2 bus bays for 60-ft articulated buses ^b
	Light Rail	Same as existing conditions (with capacity increases to meet demand)	N/A

A TriMet bus data are for North Portland buses only; LRT data are for the Yellow Line MAX only. For systemwide information, please refer to Table 1 of Appendix A of the "Capital and Operating Finance Plan, Columbia River Crossing Project." This document shows that TriMet would operate 659 buses and 135 light rail cars systemwide in the multimodal No Build Alternative.

B Assumes one new bay for every 6-8 sixty-foot articulated buses.

Some bicycle and pedestrian improvements would be made in the BIA under the multimodal No Build Alternative, but none would improve the Columbia River Crossing facilities.

2.2.1.3 Bus

C-TRAN» Compared to existing conditions, the capital improvements that would occur under the multimodal No Build Alternative would include: 1) the purchase of 12 sixty-foot articulated buses to serve line #105S I-5 Express Shortline (generally providing express bus service between downtown Vancouver and downtown Portland via I-5), 2) improvements to the C-TRAN bus maintenance facility to service the new 60-ft articulated buses (includes two new bus bays), and 3) purchase of 2 forty-foot standard buses to serve the fixed route bus fleet.

No major improvements would be made to C-TRAN's bus stops or other transit capital facilities within the project corridor (outside of regular maintenance) under the multimodal No Build Alternative.

TriMet» Compared to existing conditions, TriMet would make no major bus capital improvements in the corridor (outside of regular maintenance) under the multimodal No Build Alternative. TriMet's bus capital improvements over existing conditions outside of the CRC study area would be those included in Metro's financially constrained Regional Transportation Plan (RTP), including the purchase of additional fixed-route buses needed to accommodate demand.

2.2.1.4 Light Rail

TriMet's light rail system capital facilities under the multimodal No Build Alternative would include the existing light rail facilities, including the newly constructed Green Line serving the downtown Portland transit mall and the I-84 and I-205 corridors including the Lloyd District, Gateway, and Clackamas Town Center. The Portland to Milwaukie Light Rail Project is not included in the multimodal No Build Alternative per FTA direction for this New Starts update.

2.2.2 OPERATIONAL CHARACTERISTICS

This section provides a description of the operational characteristics of C-TRAN's and TriMet's transit systems for the multimodal No Build Alternative. Figure 2-2 illustrates the multimodal transit network for the BIA which is very similar to the existing transit network shown in Figure 2-1. Table 2-6 summarizes the annual systemwide platform hours for bus and light rail that would be operated by TriMet and C-TRAN in 2030 under the multimodal No Build Alternative.

Platform hours were calculated based on the CRC Project traffic analysis performed in VISSIM software for travel speeds under 2030 No Build conditions. Vehicle hours traveled were estimated by the regional travel demand model for buses off I-5. Because it is most logical to use platform hours for C-TRAN, the agency with all of the changes in bus service in each alternative, the assumption was made that it would be clearer to also report the hours for TriMet in platform hours for consistency's sake.

TriMet's bus networks and bus O&M costs are identical in the multimodal No Build, multimodal Baseline, and multimodal Build Alternatives, therefore the hours presented for TriMet, no matter what unit of measure is used, do not vary between alternatives. The multimodal No Build Alternative has slightly more hours than the multimodal Baseline and the multimodal Build Alternatives due to congestion because there is not a new bridge included in the multimodal No Build Alternative.

Table 2-6 shows 351,500 platform hours for TriMet North Portland buses and 49,814 platform hours for the Yellow Line LRT. Because many of TriMet's lines are interlined in downtown Portland and through regional transit centers, the regional travel demand model overestimates the revenue hours traveled. As shown in the financial projection tables of the operations and maintenance cost model memo as well as in the finance plan and fleet management plan for TriMet system bus platform hour estimates, the total TriMet system platform hours would be 2,146,000 for the 2030 multimodal No Build Alternative. C-TRAN bus total-system platform hours would be 336,800 for the multimodal No Build Alternative.

Revenue hours include those hours during which transit is in revenue service. Platform hours include additional time necessary to provide the service, such as deadhead time. Each agency has a typical practice of using the different measures for internal reporting. However, for this report, Table 2-6 and all others similar to it have been updated to reflect platform hours for both TriMet and C-TRAN. TriMet revenue hours have been converted to platform hours using a conversion rate based on current service to provide comparable statistics.

TABLE 2-6

Summary of Multimodal No Build Alternative Operational Characteristics^a

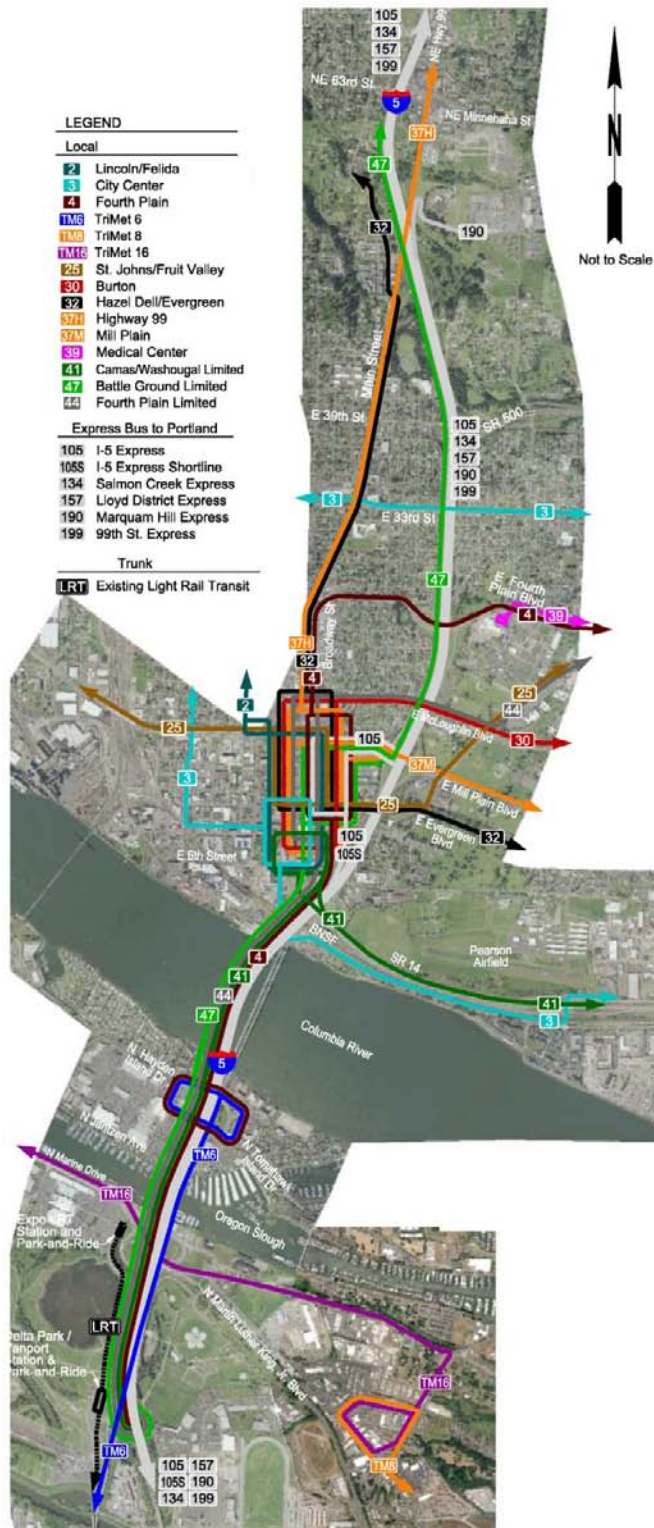
Transit Characteristic		TriMet ^b	C-TRAN
Annual Systemwide Platform Hours	Fixed Route Buses (North Portland TriMet and C-TRAN systemwide)	351,500	336,800
	Light Rail (Yellow Line only)	49,814	0

A Under all alternatives, TriMet's bus revenue hours are the same because there are no changes across all alternatives to TriMet's bus networks. Light rail revenue hours under the multimodal No Build and multimodal Baseline are the same because the light rail operational characteristics are the same for those two alternatives.

B Under all alternatives, TriMet's bus revenue hours are the same because there are no changes across all alternatives to TriMet's bus networks. Light rail revenue hours under the multimodal No Build and multimodal Baseline are the same because the light rail operational characteristics are the same for those two alternatives.

The *2011 New Starts Definition of Alternatives* also includes an appendix showing a detailed line listing for all transit lines in the region, with headways, route distance and travel time, and peak vehicle requirements. This section provides an overview of key service characteristics. Please check the detailed line listings for information about other lines.

FIGURE 2-2.
Multimodal No Build Alternative Transit Network Map



2.2.2.1 Bus Network

C-TRAN» The C-TRAN bus network under the multimodal No Build Alternative would be the same as existing conditions, with the following exceptions:

- Buses would operate in a couplet in downtown Vancouver, southbound on Washington Street and northbound on Broadway to reflect routing changes anticipated when the City of Vancouver changes the directionality of streets in downtown from mostly one-way to mostly two-way for increased access.
- New bus line #105S would be added at 12-minute peak/120-minute off-peak headways using 60-foot, articulated buses. This line would be a shorter version of the existing line #105 which runs 40-foot buses since it would not be necessary according to the 2-hour peak load output from the Metro model. Line #105S would provide service between downtown Vancouver and downtown Portland only.
- Frequency of service would decrease on the #134 to 25-minute, peak-only headways from 10-minute peak-only headways today because this service was equilibrated to meet projected demand levels and the resources shifted to the #105S which shows greater demand in travel demand forecasts.
- Frequency of service would decrease for the #199 to 20-minute, peak-only headways from 10-minute, peak-only service today. Similar to the #134, the frequency was equilibrated to meet projected demand levels and the resources shifted to the #105S.

The reduction in peak headways for bus lines #134 and #199 was due to limited demand on these lines. The reduction in service on these two lines was reallocated to the #105S in the multimodal No Build and multimodal Baseline Alternatives. The local and express bus networks were kept constant (other than the changes noted above) in order to compare the multimodal Baseline to the multimodal Build in the SUMMIT modeling. These headways were included in the travel model and the results. Please see the transit networks spreadsheet in Appendix A of the *2011 New Starts Definition of Alternatives* for more detail.

TriMet» Under the multimodal No Build Alternative, TriMet would operate the same bus lines in the project study area as it currently does, with increases in frequency to accommodate increases in transit demand. Congestion would add delay to buses in the corridor due to the lack of highway improvements on I-5

2.2.2.2 Light Rail

Under the multimodal No Build Alternative, TriMet would operate the same light rail lines in the region as it currently does (including the Yellow Line to North Portland). There would be some increases in frequency to accommodate increases in transit demand.

3. NEW STARTS MULTIMODAL BASELINE ALTERNATIVE

This section describes the capital improvements and operational characteristics of the New Starts multimodal Baseline Alternative. As noted previously, the multimodal Baseline Alternative associated with this project is the proposed multimodal alternative without the New Starts project and its associated transit services, consistent with the guidance in *Advancing Major Transit Investments through Planning and Project Development* (FTA, 2003, p. 1-2).

The multimodal Baseline alternative is the multimodal No Build plus the park-and-rides provided in the multimodal Build alternative. The multimodal Baseline also includes additional bus service, buses, passenger facilities, and operations and maintenance facilities needed to meet projected demand. In addition, the highway, bicycle, and pedestrian facilities provided in the multimodal Build alternative are included. As is the case in all of the New Starts alternatives, transit service supply is equilibrated to demand.

3.1 Capital Improvements

This section provides a summary of the transportation capital facilities and transit operations in the project area for the multimodal Baseline Alternative. For the roadway, bicycle, and pedestrian capital facilities the focus is on the BIA. For the transit, the capital facilities and the operational characteristics of the transit networks in the project major market areas are reviewed.

3.1.1 ROADWAY CAPITAL FACILITIES

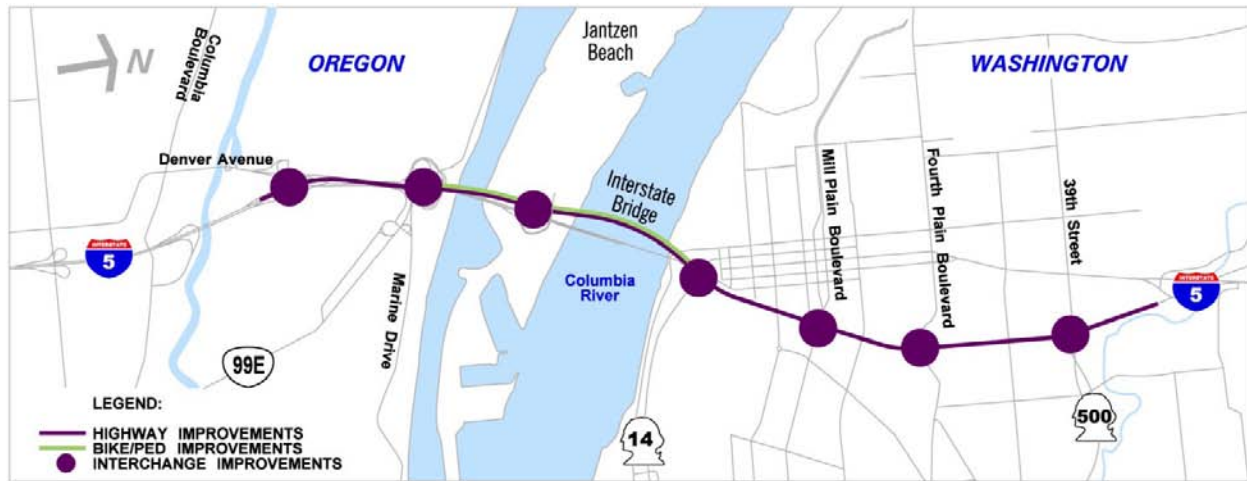
A replacement river crossing (Figure 3-1) would include removing the existing I-5 bridge structures and building a new bridge on two structures west of the existing I-5 bridge. Two new structures would carry north and southbound interstate traffic as a replacement I-5 bridge.

The roadway surface of the new bridge would be wide enough for five lanes in each direction⁵, and would include safety shoulders on both sides. Each lane, and the safety shoulders, would be the standard 12-feet wide. Three lanes would carry through-traffic, with three additional auxiliary lanes allowing for merge and weave movements. Interchange improvements would be made to all seven interchanges in the BIA in order to accommodate the additional traffic volumes of 2030. Buses would operate in general purpose lanes on the new bridge and benefit from the lesser congestion.

5 The number of lanes on the bridge is five in each direction as documented in the Final Environmental Impact Statement (FEIS). The multimodal Baseline alternative includes the same bridge size as the multimodal Build alternative.

FIGURE 3-1.

Build Highway, Bicycle, and Pedestrian Improvements



3.1.2 TOLLS

The new bridge in the multimodal Baseline Alternative would likely be tolled at varying rates with the highest rates applied to periods of peak demand. The toll rates used in the Final Environmental Impact Statement (FEIS) are shown in Table 3-1. The Metro regional travel-demand model was used to determine when the higher rates should be applied in the model. The model uses assignments from a 2-hour PM peak period and 1-hour midday off-peak period as inputs into the demand model. The PM 2-hour period is 4:00 to 6:00 PM, while the midday is noon to 1:00 PM. The two toll rates of concern for modeling purposes are the highest peak rates (3:00 to 7:00 PM) and lowest off-peak rates (8:00 PM to Midnight)—both highlighted in Table 3-1. The CRC Tolling team determined that the floor rates in the off-peak scenario were more appropriate to use within the demand model than the higher ‘noon’ rates. To convert the toll rates into time penalties for assignment purposes, two values of time are assumed: \$19.35/hr for autos (2005\$) and \$35/hr for trucks (2005\$). These values are converted to 1994\$ for use in the model (\$14.68/hr and \$26.60/hr, respectively).

Tolls are assumed to vary by time of day, vehicle class, and use of automatic payment radio transponders. Work trips are assumed to have 100 percent transponder use. Therefore, all work trips see the ‘lower’ toll rates (\$2.00 peak, \$1.00 off-peak). All other trips would have a 75 percent / 25 percent split on transponder / non-transponder use. These trips would have a toll rate of \$2.25 peak, \$1.25 off-peak.

TABLE 3-1

Tolls for I-5 Columbia River Bridge Crossing by Time of Day and Vehicle Type

Toll Rates for Autos in Each Direction^{a,b,c,d}		
Time Period	Post-completion Toll Rate Structure for Autos^e (with Added Price Point)	Pre-completion Toll Rate Structure for Autos^f
12 AM–5 AM	\$1.00	\$0.00
5 AM–6 AM	\$1.50	\$1.50
6 AM–7 AM	\$2.00	\$2.00
7 AM–9 AM	\$2.50	\$2.00
9 AM–10 AM	\$2.00	\$2.00
10 AM–3 PM	\$1.75	\$1.50
3 PM–4 PM	\$2.00	\$2.00
4 PM–6 PM	\$2.50	\$2.00
6 PM–7 PM	\$2.00	\$2.00
7 PM–8 PM	\$1.50	\$1.50
8 PM–12 AM	\$1.00	\$0.00
Pay-by-Plate Surcharge ^g	\$1.22	\$1.22

A Toll rates are shown in 2006 dollars. Toll rates are assumed to escalate at 2.5% per year. Thus, for example, a \$2.00 toll in 2006 dollars would be about \$2.21 in 2010 dollars.

B Medium trucks, defined as vehicles with three or four axles, are assumed to have a toll rate that is twice the rates shown above for autos.

C Large trucks, defined as vehicles with five or more axles, are assumed to have a toll rate that is four times the rates shown above for autos.

D The actual toll rates imposed through the formal toll setting may differ from these scenarios.

E Toll rates charged after the new southbound I-5 bridge is opened for traffic operations.

F Toll rates on existing I-5 bridges, prior to completion of the new southbound I-5 bridge

G The pay-by-plate surcharge, shown in 2006 dollars, is applicable to all types of vehicles and does not change by time of day. The surcharge represents an average of the anticipated added cost to collect these tolls compared to costs for vehicles with transponders. The surcharge would change as the cost to collect these tolls increases; the escalation rate is anticipated to be lower than the cost of inflation.

3.1.3 TRANSIT, BICYCLE, AND PEDESTRIAN CAPITAL FACILITIES

This section provides a description of C-TRAN's and TriMet's transit capital improvements and the bicycle and pedestrian capital improvements that would occur under the multimodal Baseline Alternative. As noted in the introduction to this report, as per FTA guidance, the baseline alternative for a multimodal transit project for New Starts assessment purposes is defined as the full proposed multimodal project, minus the proposed transit components that would be funded using Section 5309 New Starts funds.

Based on that approach, under the multimodal Baseline Alternative, there would be no change in the major transit capital improvements in the CRC study area, compared to the multimodal No Build Alternative, with the exception of the park-

and-ride facilities, which are a part of the multimodal Baseline per the request of FTA staff. As under the multimodal No Build Alternative, there would be five major park-and-ride lots in Clark County (which all exist), three in the I-5 corridor and two in the I-205 corridor. The Clark, Mill, and Columbia Park-and-Ride locations would together provide 2,422 new parking spaces for transit access in downtown Vancouver. In the I-205 corridor, the Evergreen Park-and-Ride would be replaced by the 18th Street Park-and-Ride, which adds capacity and is more accessible from I-205 when a new highway interchange is built at 18th Street. Fisher's Landing Park-and-Ride would be expanded by 250 spaces in accordance with the current financially constrained Metropolitan Transportation Plan published by the Southwest Washington Regional Transportation Council. On the Oregon side of the Columbia River, there would be two park-and-ride lots along the existing Yellow Line MAX at Delta Park/Vanport and Expo Center Stations, as currently exist.

Table 3-2 details the number of available parking spaces at each park-and-ride location for the multimodal Baseline. It should be noted that the only change to the park-and-ride capacity compared to the multimodal No Build Alternative is the 2,422 parking spaces added in downtown Vancouver. As noted in Table 3-3, C-TRAN would need to expand its maintenance facility to accommodate 36 additional 60-ft articulated buses, compared to existing conditions. Five new bus bays are included in this expansion, assuming one new bay per 6 to 8 new articulated buses is needed.

TABLE 3-2

Multimodal Baseline Transit Facility Summary

	Park & Ride Facilities	Parking Spaces Available
Clark County I-5	Salmon Creek	513
	99th Street	600
	BPA/Ross	175
	Clark (new ^a)	1,432
	Mill (new ^a)	420
	Columbia (new ^a)	570
	Total	3,710
Clark County I-205	Fisher's Landing	836
	Evergreen	N/A
	18th Street	500
	Total	1,336
Portland I-5	Expo Center	300
	Delta Park/Vanport	304
	Total	604

A These park-and-ride facilities would be constructed as part of the multimodal Baseline and multimodal Build Alternatives.

TriMet and C-TRAN currently operate 117 and 119 buses, respectively (including spares), and TriMet operates 19 light rail cars (including spares) in the corridor (see Table 2-2). Due to the large increase in park-and-ride supply compared

to the multimodal No Build alternative, the number of buses needed to serve demand increases in the multimodal Baseline alternative. This demand is served more efficiently by shortline bus lines traveling between the new park-and-ride lots and downtown Portland because of the substantial highway capital improvements made under the multimodal Baseline Alternative (see Section 3.1.1), which tend to reduce travel times. These shortline buses result in an increase in the number of buses needed to meet demand in an equilibrated condition from 133 to 137 vehicles (101 forty-foot and 36 sixty-foot buses) for C-TRAN.

TABLE 3-3

Multimodal Baseline Systemwide Transit Vehicles and Maintenance Facilities

Transit Characteristic		TriMet^a	C-TRAN
Vehicles (including spares)	Fixed Route Buses	124	101
	Articulated Buses	0	36
	Light Rail Cars	19	0
Maintenance Facilities (square footage)	Buses	Same as multimodal No Build	5 new bus bays ^b
	Light Rail	Same as multimodal No Build	N/A

A TriMet bus data are for North Portland buses only; LRT data are for the Yellow Line MAX only. For systemwide information, please refer to the "Capital and Operating Finance Plan, Columbia River Crossing Project." This document shows that TriMet would operate 659 buses and 135 light rail cars systemwide in the multimodal Baseline Alternative.

B Assumes one new maintenance bay for every 6 to 8 sixty-foot articulated buses.

Bicyclists and pedestrians would use a path included on the northbound bridge structure. The path would range from 16 to 20 feet in width and would provide connections to the regional pedestrian, bicycle, and trail systems in Vancouver, on Hayden Island, and to North Portland.

3.1.3.1 Bus

C-TRAN» The Columbia River Crossing Project includes multi-billion-dollar improvements to the bridge and freeway that all bus services across the Columbia River in the corridor must traverse. The transit improvements for the Project proposed for New Starts funding are one part of an overall integrated project. The project followed FTA guidance as defined in Advancing Major Transit Investments through Planning and Project Development, Appendix A: Selection of the New Starts Baseline Alternative: "where the proposed New Starts project is part of a multimodal alternative that includes major highway components, the New Starts Baseline Alternative will be the proposed multimodal alternative without the New Starts project and its associated transit services." This defines the major capital elements of the multimodal Baseline Alternative. Additionally, in order to complete the multimodal Baseline Alternative, travel demand for lines was tested using the regional travel demand model to match service levels to demand, regardless of any funding constraints that might exist in the No Build.

Thus, the multimodal Baseline Alternative capital improvements match the multimodal Build Alternative for the highway improvements of the project, but do not include the New Starts transit capital component of the Columbia River Crossing Project. The multimodal Baseline Alternative serves the transit markets of the project by providing all of the bus connections for all of the transit connections that would be provided in the multimodal Build Alternative at similar or better frequencies. The frequencies of the bus lines in the multimodal Baseline Alternative were then equilibrated to the demand indicated by travel demand modeling. In most cases, the initially supplied service was adequate to serve the demand, so did not require significant changes or reworking of the frequencies, but frequencies and capacities for all bus lines were checked against demand to ensure the demand was being served in the multimodal Baseline Alternative.

The multimodal Baseline Alternative serves the key transit markets of the project in the following manner:

1. Commute (work and school) from Clark County to downtown Portland

In the multimodal Build Alternative, this market is served by the light rail extension into Vancouver, WA running at 8-minute peak headways and 15-minute off-peak headways. Trips from elsewhere in Clark County are also served by direct express buses from suburban park-and-ride lots to downtown Portland. For the multimodal Baseline Alternative, this market is served by several bus lines running across the Columbia River via I-5 at a combined headway of 2.5-minutes. Lines #105 and #105S provide combined 4.3-minute headways from Vancouver to downtown Portland via I-5, exceeding proposed Yellow Line headways in the multimodal Build Alternative, and traveling on the improved bridge and freeway lanes proposed for the CRC Project. In addition, lines #4 (15-minute headway), #44 (20-minute peak only headway), #44T (30-minute headway), #41 (120-minute headway), and #47 (120-minute headway) provide service from Vancouver to the Yellow Line MAX station at Delta Park allowing for transfers to North Portland and downtown Portland. Between these two sets of lines, and the fixed route C-TRAN bus service in downtown Vancouver, all destinations served in the proposed multimodal Build Alternative are served with comparable or better frequencies in the multimodal Baseline Alternative. Service levels on each of these lines were compared to demand to ensure there would be enough capacity for the demand.

2. Non-commute from Clark County to downtown Portland

This market is served in essentially the same manner as the commute market above. Passengers can ride the lines #4, #41, #44, #44T, or #47 to the Yellow Line MAX station at Delta Park, as well as the #105 and #105S buses direct to downtown Portland into downtown Portland from Salmon Creek, Hazel Dell, Camas, Battle Ground, and downtown Vancouver neighborhoods. During peak periods, the combined headway of these lines is 2.5-minutes. During off-peak periods, the combined headway of these services is approximately 9.5-minutes, more frequent than the 15-minute off-peak service on the Yellow Line MAX extension in the multimodal Build Alternative. Service levels on each of these lines were compared to demand and found to be adequate to serve the demand.

3. Commute from Clark County to N/NE Portland industrial and employment areas

This market is served well by the transfer from bus lines #4, #41, #44, #44T, and #47 to the Yellow Line MAX in the multimodal Baseline Alternative during peak and off-peak periods. These lines traverse the new bridge, and due to freeway improvements included in the multimodal Baseline Alternative, experienced improvements in travel time and reductions in delay.

4. Commute from Portland to Clark County

This market is served by the same buses stated in markets #1 and #3 above, but in the reverse direction. Bus lines #4, #41, #44, #44T, and #47 provide frequent connections from the Delta Park station on the Yellow Line MAX, while the #105 and #105S provide service directly from downtown Portland.

Headways for the #105 and #105S articulated bus lines in the multimodal Baseline Alternative were equilibrated to demand starting with the equivalent headways of light rail (8-minutes peak, 15-minutes off-peak) in the multimodal Build Alternative. The final headways of 30-minutes and 5-minutes, respectively, provide a combined headway of 4.3-minutes across the river as opposed to the light rail headways which offer 8-minute headways. The peak load point file from the multimodal Baseline Alternative did not show enough supply at the original combined headways of 8 minutes in the two-hour PM peak period. Therefore, the model was equilibrated to meet demand, resulting in the final combined headway of 4.3-minutes. This combined headway for service direct to downtown Portland (lines #105 and #105S) are in addition to the combined 6-minute headway of lines #4, #41, #44, #44T, and #47 for an overall combined headway of 2.5-minutes across the Columbia River. Therefore, the final headways for the multimodal Baseline Alternative are comparable or better than the multimodal Build Alternative, with service matched to demand in both cases.

TriMet» Under the multimodal Baseline Alternative, there would be no capital improvements to the TriMet bus system, compared to the multimodal No Build Alternative.

3.1.3.2 Light Rail

Under the multimodal Baseline Alternative, there would be no capital improvements to the TriMet light rail system, compared to the multimodal No Build Alternative.

3.1.4 OPERATIONAL CHARACTERISTICS

This section provides a description of the operational characteristics of C-TRAN's and TriMet's transit systems in the CRC project area under the multimodal Baseline Alternative. Figure 3-2 shows the transit network for the BIA for the multimodal Baseline Alternative.

Multimodal Baseline Alternative Transit Network Map



There are four differences in the transit network of the multimodal Baseline Alternative compared to the multimodal No Build Alternative:⁶

1. Increased headways on #105S (I-5 Express Shortline) from 12-min. peak/120-min. off-peak to 5-min. peak/45-min. off-peak to serve increased park-and-ride demand from 2,900 spaces added to this alternative in downtown Vancouver
2. Line #44T added to serve peak period demand from added downtown Vancouver park-and-ride lots to Delta Park/Vanport MAX station
3. Lines #105, #105S, #44, and #44T all run 60-ft articulated buses
4. Three additional structured park-and-ride lots at: Columbia with 570 spaces, Mill with 420 spaces, and Clark with 1,432 spaces

Table 3-4 summarizes the annual systemwide platform hours for bus and light rail that would be operated by TriMet and C-TRAN in 2030 under the multimodal No Build Alternative.

TABLE 3-4
Summary of Multimodal Baseline Transit System Operational Characteristics

Transit Characteristic		TriMet ^a	C-TRAN
Annual Platform Hours	Fixed Route Buses	349,500	349,000
	Light Rail	49,814	0

A TriMet bus data are for North Portland buses only; LRT data are for the Yellow Line MAX only. For systemwide information, please refer to the "Capital and Operating Finance Plan, Columbia River Crossing Project." This document shows that TriMet would operate with 2,146,000 annual platform hours for buses and 309,800 platform hours for light rail systemwide in the multimodal Baseline Alternative.

The *2011 New Starts Definition of Alternatives* of also includes an attachment showing detailed line listings for all transit lines in the region, with headways, bus line distance and travel time, and peak vehicle requirements. This section provides an overview of key service characteristics. Please check the detailed line listings for information about other lines.

3.1.4.1 Bus

C-TRAN» The operational characteristics of the C-TRAN bus system under the multimodal Baseline Alternative would be the same as under the multimodal No Build Alternative, except that the bus line frequencies in the corridor would be adjusted to meet demand. One new line, the #44T was added to supply service between Clark Park-and-Ride and the Delta Park/Vanport Yellow Line MAX station. Please see Figure 3-2 for the transit network map. The Transit Line Listing spreadsheet in Appendix A of the *2011 New Starts Definition of Alternatives* gives more details on bus and light rail line frequency.

The system of bus lines provides multiple connections and would benefit from a new bridge facility in the multimodal Baseline Alternative. The following lines serve across the I-5 Bridge in the multimodal Baseline Alternative:

.....
6 Please see the Transit Line Listing in Appendix A of the *2011 New Starts Definition of Alternatives* for detailed information regarding bus networks of each alternative.

- **#4 Fourth Plain (15-min. peak/15-min. off-peak):** Local service on Fourth Plain Blvd. from Vancouver Mall through downtown Vancouver, with connections to Hayden Island and terminating at the Delta Park/ Vanport Yellow Line MAX station with direct access from I-5 southbound to the bus bay adjacent to the MAX platform. This bus line is currently C-TRAN's highest ridership line.
- **#41 Camas/Washougal Limited (one peak-only trip):** A limited-stop, peak-only line that serves Camas and Washougal to the east of Vancouver, Fisher's Landing Park-and-Ride, and downtown Vancouver before terminating at the Delta Park/Vanport Yellow Line MAX station.
- **#44 Fourth Plain Limited** (20-min. peak-only): A limited-stop, peak-only line that generally serves the same line as #4, but does not stop at Hayden Island before serving the Delta Park/Vanport Yellow Line MAX station.
- **#44T Fourth Plain Limited Tripper** (30-min. peak-only): A limited-stop, peak-only line that generally serves the park-and-ride lots in downtown Vancouver and the Delta Park/Vanport Yellow Line MAX station, but does not stop at Hayden Island.
- **#47 Battle Ground Limited** (one peak-only trip): A limited-stop, peak-only line that serves Battle Ground to the north of Vancouver, downtown Vancouver and terminates at the Delta Park/Vanport Yellow Line MAX station.
- Six express bus lines that cross the bridge and connect to downtown Portland or nearby.
 - » **#105 I-5 Express** (30-min. peak/60-min. off-peak): Serves Salmon Creek Park-and-Ride, 99th St Transit Center, downtown Vancouver, and downtown Portland.
 - » **#105S I-5 Express Shortline** (5-min. peak/45-min. off-peak): Serves between downtown Vancouver and downtown Portland.
 - » **#134 Salmon Creek Express** (25-min. peak-only): Serves between Salmon Creek Park-and-Ride and downtown Portland.
 - » **#157 Lloyd District Express** (60-min. peak-only): Serves between 99th St. Transit Center and the Lloyd District in Portland.
 - » **#190 Marquam Hill Express** (60-min. peak-only): Serves between BPA Park-and-Ride just north of Vancouver and Marquam Hill just south of downtown Portland. Marquam Hill includes Oregon Health Sciences University, VA Hospital, Doernbecher Children's Hospital, and other health and hospital services.
 - » **#199 99th St Express** (20-min. peak-only): Serves between 99th St. Transit Center and downtown Portland.

TriMet» The operational characteristics of the TriMet bus system under the multimodal Baseline Alternative would be the same as under the multimodal No Build Alternative, except that bus line frequencies in the corridor would be adjusted to meet demand as needed.

The TriMet fixed-route bus service in North Portland, including six lines plus the lines 6, 8, and 16, were analyzed for the level of demand per TriMet's operating policies and financial plan in the multimodal Baseline Alternative. Modeling results show that the demand for these lines does not exceed capacity in the multimodal Baseline Alternative, and therefore service is held constant with the multimodal No Build Alternative.

3.1.4.2 Light Rail

The operational characteristics of the TriMet light rail system under the multimodal Baseline Alternative would be the same as under the multimodal No Build Alternative. The change in demand on the Yellow Line MAX was not high enough compared to the No Build to require additional frequency of service above the No Build level to meet the total projected demand.

4. MULTIMODAL BUILD ALTERNATIVE

The multimodal Build Alternative, which has been officially adopted as the Locally Preferred Alternative (LPA) by the CRC Project partner agencies,⁷ would include the construction of the proposed roadway, bicycle, and pedestrian improvements included in the multimodal Baseline Alternative, with the addition of an approximately 2.9-mile extension of light rail from the existing Expo Center Station in north Portland, across Hayden Island and through downtown Vancouver, terminating at Clark Park-and-Ride Station. The extension of light rail would include construction of the light rail alignment, stations, park-and-ride lots and other related facilities, the purchase of additional light rail vehicles and the expansion of one of TriMet's existing light rail maintenance facilities. This section provides a description of the capital (roadway and transit) improvements and transit operational characteristics that would occur under the multimodal Build Alternative.

4.1 Capital Improvements

This section provides a summary of the transportation capital facilities and transit operations in the project area for the multimodal Build Alternative. For the roadway, bicycle, and pedestrian capital facilities the focus is on the BIA. For the transit, the capital facilities and the operational characteristics of the transit networks in the project major market areas are reviewed.

4.1.1 ROADWAY CAPITAL FACILITIES

The roadway capital improvements that would occur under the multimodal Build Alternative would be the same as under the multimodal Baseline Alternative. The bridge structure is the same in both the multimodal Baseline and multimodal Build Alternatives. The bridge design is termed a deck truss bridge, which will allow the light rail transit vehicles to travel on their own dedicated level of the same structure.

4.1.2 TRANSIT, BICYCLE, AND PEDESTRIAN CAPITAL FACILITY IMPROVEMENTS

This section provides a description of the transit, bicycle, and pedestrian capital improvements that would occur under the multimodal Build Alternative.

Table 4-1 details the number of available parking spaces at each park-and-ride location for the multimodal Build Alternative. The multimodal Build Alternative would have the same number of spaces in Clark County in the I-5 corridor than the multimodal Baseline Alternative.

7 CRC Project partner agencies are the Washington State Department of Transportation (WSDOT), Oregon Department of Transportation (ODOT), City of Vancouver, City of Portland, C-TRAN, TriMet, Metro, and Southwest Washington Regional Transportation Council (RTC). The LPA has been adopted into the financially-constrained regional transportation plans by both Metropolitan Planning Organizations (MPOs) in the region: Metro and RTC, on July 17, 2008 and July 22, 2008, respectively.

TABLE 4-1

Multimodal Build Alternative Transit Facility Summary

	Park & Ride Facilities	Parking Spaces Available
Clark County I-5	Salmon Creek	513
	99th Street	600
	BPA/Ross	175
	Clark (new ^a)	1,910
	Mill (new ^a)	420
	Columbia (new ^a)	570
	Total	4,188
Clark County I-205	Fisher's Landing	836
	18th Street	500
	Total	1,336
Portland I-5	Expo Center	300
	Delta Park/Vanport	304
	Total	604

A These park-and-ride facilities would be constructed as part of the multimodal Baseline and multimodal Build Alternatives.

As with the multimodal Baseline Alternative (see Section 3.1.1), travel times on bus lines would be reduced due to reduced travel times on I-5 resulting from the bridge and highway improvements compared to the multimodal No Build Alternative. This would result in a reduction in the number of buses needed to meet demand in an equilibrated condition from 132 to 106 vehicles for C-TRAN (see Section 4.1.2.1 for an explanation of the changes in vehicle needs under the multimodal Build Alternative compared to the multimodal Baseline Alternative).

TABLE 4-2

Multimodal Build Alternative Systemwide Transit Vehicles and Maintenance Facilities

Transit Characteristic	TriMet^a	C-TRAN
Vehicles (including spares)	Fixed Route Buses	124
	Articulated Buses	0
	Light Rail Cars	37
Maintenance Facilities (square footage)	Buses	Same as multimodal Baseline
	Light Rail	Same as Existing
		0

A TriMet bus data are for North Portland buses only; LRT data are for the Yellow Line MAX only. For systemwide information, please refer to the "Capital and Operating Finance Plan, Columbia River Crossing Project." This document shows that TriMet would operate 659 buses and 151 light rail cars systemwide in the multimodal Build Alternative.

B The square footage estimate for Ruby Junction building is allocated based on the number of light rail vehicles (LRVs) for the project. With 19 LRVs for CRC at 747 square feet per LRV, the total would be 14,193 square feet.

The bicycle and pedestrian capital improvements that would occur under the multimodal Build Alternative would be the same as under the multimodal Baseline Alternative.

4.1.2.1 Bus

C-TRAN» Under the multimodal Build Alternative, there would be no additional C-TRAN bus-based capital facilities, compared to the multimodal Baseline Alternative. In fact, with the multimodal Build Alternative, C-TRAN would need two fewer standard buses and no articulated buses (compared to 36 articulated vehicles needed under the multimodal Baseline Alternative). The changes in fleet vehicle requirements under the LPA would be due to the truncation of several lines in downtown Vancouver, which would no longer extend to downtown Portland, the Expo Station or Hayden Island as they would continue to do in the multimodal No Build and Baseline alternatives due to the elimination of Line #105S, which would operate between downtown Vancouver and downtown Portland under the multimodal No Build and the multimodal Baseline alternatives, but is replaced by light rail service in the multimodal Build Alternative.

TriMet» The same bus capital improvements would be made to the TriMet bus system under the multimodal Build Alternative as under the multimodal Baseline Alternative. Please see the Transit Networks spreadsheet in Appendix A of the *2011 New Starts Definition of Alternatives* for more details.

4.1.2.2 Light Rail

Compared to the multimodal Baseline Alternative, the multimodal Build Alternative would include the following additional light rail capital improvements:

- 2.9-mile extension of LRT tracks from the existing Expo Center Station in Portland to Clark Park-and-Ride in Vancouver with the rail guideway adjacent to the new southbound I-5 Bridge on Hayden Island, a one-way couplet in downtown Vancouver, and a two-way center running configuration on 17th Avenue
- Five additional light rail stations at: Clark; Mill (southbound platform on Washington between 15th and 16th Streets, northbound platform on Broadway between 15th and 16th Streets); 9th Street (on both Washington and Broadway between 9th St. and Evergreen Blvd.); 5th Street (on Washington between 5th and 6th Streets); and at Hayden Island (adjacent to I-5)
- 19 additional light rail vehicles
- Replacement of bridge joints on the Steel Bridge to improve light rail travel times into downtown Portland
- Light rail maintenance facility improvements at TriMet Ruby Junction Maintenance Yard

Multimodal Build Alternative Transit Network Map



4.1.3 OPERATIONAL CHARACTERISTICS

This section provides a description of the operational characteristics of C-TRAN's and TriMet's transit systems in the CRC project area under the multimodal Build Alternative. Figure 4-1 shows a map of the transit network for the BIA.

Table 4-3 summarizes the annual systemwide vehicle hours for bus and light rail that would be operated by TriMet and C-TRAN in 2030 under the multimodal Build Alternative. The number of platform hours decreases by approximately 57,500 for C-TRAN reflecting the reduction in bus service across the I-5 bridge in this alternative.

TABLE 4-3

Summary of Multimodal Build Alternative Transit System Operational Characteristics

Transit Characteristic		TriMet ^a	C-TRAN
Annual Platform Hours	Fixed Route Buses (systemwide)	349,500	291,600
	Light Rail	74,167	N/A

A Under all alternatives, TriMet's bus revenue hours would be the same because TriMet's bus networks are the same under all alternatives. TriMet bus data are for North Portland buses only; LRT data are for the Yellow Line MAX only. For systemwide information, please refer to the "Capital and Operating Finance Plan, Columbia River Crossing Project." This document shows that TriMet would operate with 2,146,000 annual platform hours for buses and 338,850 platform hours for light rail systemwide in the multimodal Build Alternative.

The *2011 New Starts Definition of Alternatives* also includes an attachment showing detailed line listings for all transit lines in the region, with headways, route distance and travel time, and peak vehicle requirements. This section provides an overview of key service characteristics. Please check the detailed line listings for information about other lines.

4.1.3.1 Bus

C-TRAN» The routing and operational characteristics of the C-TRAN bus network under the multimodal Build Alternative would be the same as under the multimodal Baseline Alternative, except for the following changes due to the extension of light rail facilities and operations from the existing Expo Center Station to Clark Park-and-Ride in Vancouver:

- Lines #105S (peak only service between downtown Portland and downtown Vancouver) and #44T (peak only service between Clark Park-and-Ride and the Delta Park/Vanport MAX station) would be eliminated, because they would provide redundant service to the new Yellow Line LRT extension.
- Line #105 (all day service between the Salmon Creek Park-and-Ride and downtown Vancouver) would be truncated to operate only between the Salmon Creek Park-and-Ride and downtown Vancouver, because the segment between downtown Vancouver and downtown Portland would duplicate Yellow Line LRT service. This line would operate 40-ft standard buses, rather than 60-ft articulated buses because demand would not require the larger vehicles.
- Lines #4, #41, #44, and #47 (service between Vancouver and the Delta Park/Vanport Station) would be truncated in downtown Vancouver instead of Delta Park/Vanport, because they would no longer need to cross the Columbia River to provide connections to the Yellow Line LRT service. These lines would also operate 40-ft standard buses.

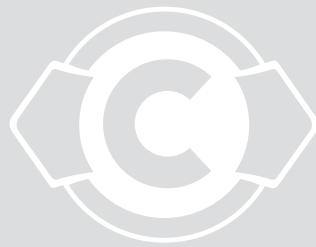
TriMet» The routing and operational characteristics of the TriMet bus network under the multimodal Build Alternative would be identical to the multimodal Baseline Alternative.

TriMet fixed-route bus service in North Portland, including six lines plus the lines 6, 8, and 16 (total nine), were analyzed for the level of demand per TriMet's operating policies and financial plan in the multimodal Baseline Alternative. Modeling results show that the demand for these lines does not exceed capacity in the multimodal Baseline Alternative, and therefore service is held constant with the multimodal Build Alternative.

4.1.3.2 Light Rail

Under the multimodal Build Alternative, the Yellow Line would be extended 2.9 miles from the existing Expo Center Station to near Clark College in Vancouver. Yellow Line frequencies would be adjusted to meet demand. Headways would be 8-minutes during the peak periods and 15-minutes during the off-peak periods, compared to 12-minutes during the peak period and 15minutes during off-peak periods for the multimodal Baseline and No Build alternatives (same as existing conditions).

When tested at 12-minute headways, travel demand model results indicated that demand for the Yellow Line was well above capacity, requiring at least 9-minute headways. Improving the headways also increased demand for the Yellow Line, thus the final headway required to meet the demand was 8-minutes.



Appendix B
Fourth Plain Transit Improvement Project
Draft Alternatives Analysis Report



Acronyms and Abbreviations

AA	Alternatives Analysis
APE	Area of Potential Effects
BAT	Business Access/Transit Lane
BRT	Bus Rapid Transit
CAC	Corridor Advisory Committee
CCCRI	Clark County Cultural Resources Inventory
CPTED	Crime Prevention Through Environmental Design
CRC	Columbia River Crossing
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
GHG	Greenhouse Gas
GIS	Geographic Information System
GPS	Global Positioning System
HCT	High-Capacity Transit
LOS	Level-of-Service
LPA	Locally-Preferred Alternative
LRT	Light Rail Transit
MAX	Metropolitan Area Express
MTP	Metropolitan Transportation Plan
NAC	Noise Abatement Criteria
NRHP	National Register of Historic Places
PMT	Project Management Team
RTC	Southwest Washington Regional Transportation Council
SHPO	State Historic Preservation Office
SR	State Route
STARS	Sustainable Transportation Analysis and Rating System
TAZ	Transportation Analysis Zone
TCRP	Transit Cooperative Research Program
TIP	Fourth Plain Transit Improvement Project
TOD	Transit-Oriented Development
TSM	Transportation System Management
USDOT	United States Department of Transportation
VA	United States Department of Veterans Affairs
VHA	Vancouver Housing Authority
VMT	Vehicle Miles Traveled
WSDOT	Washington State Department of Transportation

1. INTRODUCTION

Over the past 15 years, high-capacity transit (HCT) in Clark County has been evaluated and studied several times. High-capacity transit is any transit that increases passenger capacity over that of a standard bus line through use of larger vehicles, higher frequencies, or higher speed service. Early studies of HCT in Clark County were related to extending light rail transit (LRT) or some other form of HCT from Portland into Vancouver. In 2009, the Southwest Washington Regional Transportation Council (RTC) prepared the Clark County HCT System Study, which focused primarily on options for HCT that could serve intra-Clark County travel. This study led to the identification of bus rapid transit (BRT) as the preferred HCT mode and the selection of four priority HCT corridors. Fourth Plain Boulevard was designated as the highest-priority corridor for BRT implementation. During the HCT study's timeframe, partnering agencies began to prepare and adopt transit supportive plans and policies in anticipation of HCT implementation along promising corridors.

This document presents the Fourth Plain Transit Improvement Project (TIP) Alternatives Analysis (AA). This AA follows on the previous work, describes the previous assessment of HCT modes and alignments and presents an evaluation of a range of alternatives and options for implementing BRT on the Fourth Plain corridor. This AA report includes:

- the alternatives analysis process
- the decision-making process
- previous studies
- the Purpose and Need Statement
- goals, objectives, and evaluation criteria of the project
- a description of the alternatives considered
- evaluation with respect to the goals and objectives established for the project.

The AA report has been prepared consistent with the Federal Transit Administration's (FTA) *Updated Interim Guidance on Small Starts*¹ and *Procedures and Technical Methods for Transit Project Planning*.² Section 3 of FTA's interim guidance describes the AA requirements for both a Small Starts project and a Very Small Starts project. At this stage in the study process, C-TRAN is remaining flexible regarding whether the preferred transit improvement in the corridor would be classified as a Small Starts or a Very Small Starts project. The AA process used for the Fourth Plain TIP meets the requirements for either a Small Starts or a Very Small Starts project.

1 http://www.fta.dot.gov/planning/newstarts/planning_environment_9055.html

2 http://www.fta.dot.gov/planning/newstarts/planning_environment_2396.html

1.1 Planning Context

PRIOR STUDIES

The Fourth Plain TIP follows system planning work that identified a priority corridor and a preferred high-capacity mode. The Clark County High Capacity Transit (HCT) System Study³ resulted in planned transit improvements that were adopted in the C-TRAN 20-Year Transit Development Plan⁴. These two documents are briefly summarized below.

In addition, the City of Vancouver published the Fourth Plain Corridor Subarea Plan in 2007⁵. This study identified strategies to preserve established small businesses and enhance the corridor as a place to do business by improving the streetscape, pedestrian environment, bicycle safety and focusing transit improvements on a series of “Pulse Points” at areas with development potential.

HCT System Study

The purpose of the Clark County HCT System Study was to identify a high-capacity transit system that would provide efficient and high-quality transit service connecting county residents with key destinations. The Clark County HCT System Study considered a range of transit corridors and transit modes that could serve the county and identified the Fourth Plain corridor as a priority for development.

C-TRAN 20-Year Transit Development Plan

The C-TRAN 20-Year Transit Development Plan provides the framework for Clark County to meet the long-term transportation needs of the community. The plan was adopted in June 2010 and includes the findings and conclusions from a multi-year planning process and extensive public outreach. The C-TRAN 20-Year Transit Development Plan endorsed the findings of the Clark County HCT System Study and identified Bus Rapid Transit (BRT) as the preferred HCT mode and the Fourth Plain corridor as the priority HCT corridor in the county.

Metropolitan Transportation Plan

The Clark County Metropolitan Transportation Plan (MTP)⁶ is the long-range, regional transportation plan. The horizon year for the MTP is 2035. The MTP is the collective regional strategy for development of a transportation system to serve person trips as well as freight movement. In December 2010, the RTC Board adopted the Clark County HCT Study and the C-TRAN 20-Year Transit Development Plan, amending the MTP to include Fourth Plain as the priority HCT corridor and BRT as the preferred HCT mode in the regional plan.

.....
3 <http://www.rtc.wa.gov/hct/>

4 http://www.c-tran.com/assets/20_Year_Plan/C-TRAN_20_Year_Plan-Adopted_June_8__2010.pdf

5 http://www.cityofvancouver.us/upload/images/planning/4thplain/fourth_plain_subareaplan.pdf

6 <http://www.rtc.wa.gov/programs/mtp>

1.2 Study Area

Fourth Plain Boulevard is a major east-west arterial in Clark County. It connects downtown Vancouver with Westfield Vancouver Mall and rapidly growing areas in eastern Clark County. The project area is bounded by NE 162nd Avenue to the east and the Delta Park/Vanport Transit Center, Portland, Oregon, to the south and west. The project area was defined so that it would include all areas where physical or operational changes could occur under any of the project alternatives or options.

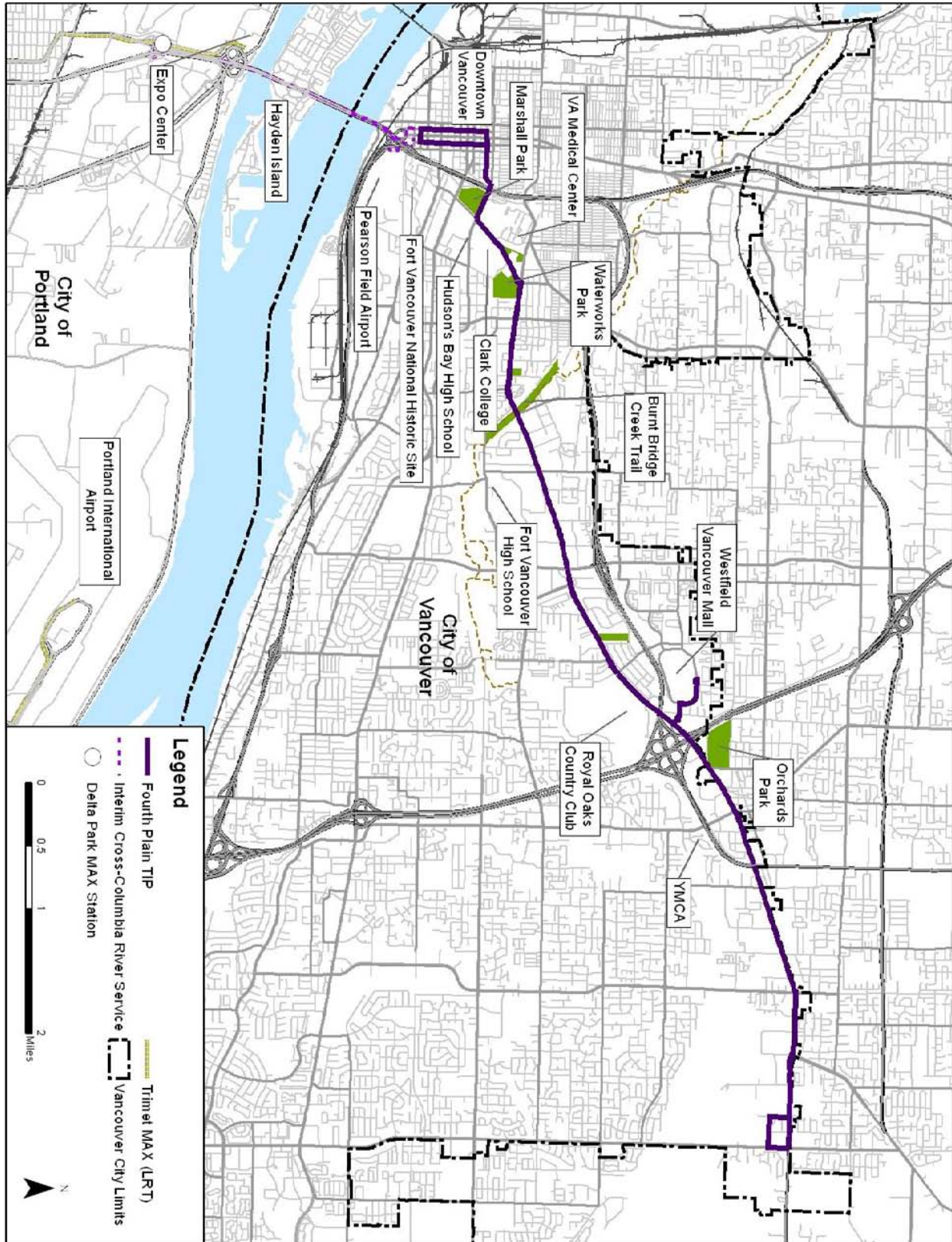
The project alignment is defined as the east-west travel lanes along Fourth Plain Boulevard from NE 162nd Avenue to Fort Vancouver Way. The alignment would then travel along Fort Vancouver Way to McLoughlin Boulevard and would follow McLoughlin Boulevard and Broadway or Washington Street into downtown Vancouver.

The Columbia River Crossing (CRC) project is planned to be constructed by 2019. The CRC project is planned to include an extension of TriMet's Yellow line light rail (LRT) from the Portland Expo Center across the river to the Central Park-and-Ride, just west of Clark College. Once this LRT extension is built, the Fourth Plain TIP would operate on the LRT trackway and share stations with the light rail line in downtown Vancouver.

The Fourth Plain TIP's improvements are planned to be in place by 2014 or 2015, prior to the light rail extension into Vancouver. Until the CRC LRT is constructed, the Fourth Plain TIP's alignment would operate temporarily between downtown Vancouver and Fort Vancouver Way via Broadway and Washington streets and potentially via McLoughlin Boulevard or another interim route. See Figure 1-1 for a map of the project alignment.

Existing transportation conditions in the corridor are described in Chapter 2 Purpose and Need and Chapter 4 Transportation Analysis.

FIGURE 1-1
Fourth Plain Transit Improvement Project (TIP) Alignment



1.3 Alternatives Analysis Process

The Fourth Plain TIP AA was developed by C-TRAN working in collaboration with RTC and the City of Vancouver, while also coordinating with the Washington State Department of Transportation (WSDOT), Clark County, and the Columbia River Crossing Project. C-TRAN and their partners were supported by an extensive public process that engaged the various communities of interest within the project corridor.

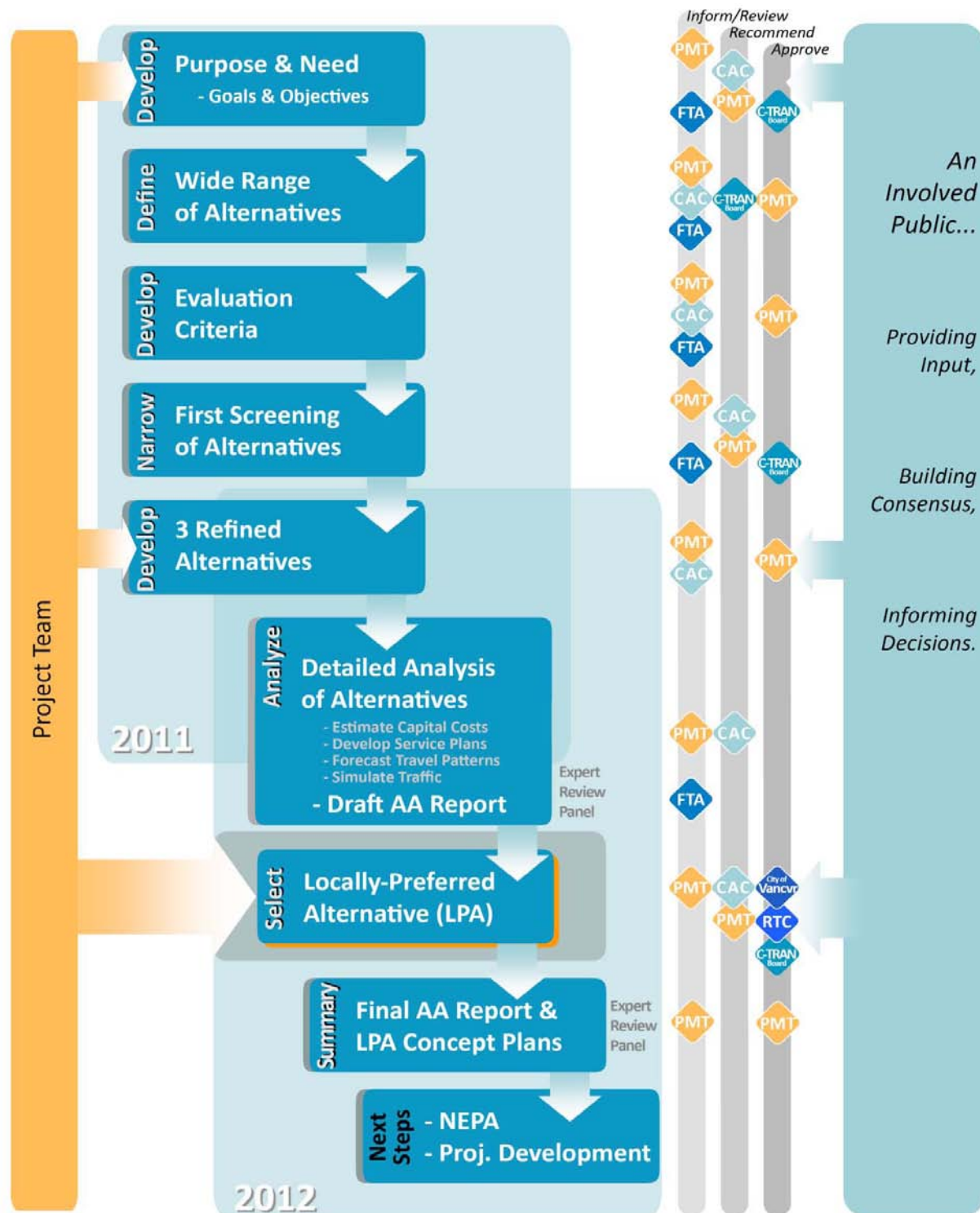
The AA process used for the Fourth Plain TIP was recommended by FTA. A flow-chart showing the AA process is included as Figure 1-2. The following describes the major steps that were included in the Fourth Plain TIP AA process:

- **Alternatives Previously Considered»** This is a report that documents the results of previous studies and policy decisions regarding HCT in the Fourth Plain corridor. It includes a summary of the steps taken to evaluate a range of alternatives for transit modes and corridors, develop a system plan for Clark County, and narrow to a preferred mode and corridor.
- **Purpose and Need»** This document describes the purpose for pursuing the project as well as the problems in the corridor that should be addressed in order to ensure the long-term vitality of the Fourth Plain Boulevard corridor. The Purpose and Need was prepared consistent with what is required for a National Environmental Policy Act (NEPA) Purpose and Need Statement. The Purpose and Need can be found in Section 2 of Appendix B.
- **Goals and Objectives»** The project goals and objectives for the Fourth Plain TIP are based on the Purpose and Need, but provide greater specificity regarding the desired outcomes for the project.
- **Wide Range of Alternatives»** This defines the set of alternatives that could address the transit needs for the Fourth Plain corridor. The wide range of alternatives was a product of the Clark County HCT study process that was used to evaluate the alternatives previously considered, as well as ongoing ideas and suggestions from the public and from local agencies and officials.
- **Alternatives Development»** This describes the initial, planning-level evaluation conducted on the wide range of alternatives. The wide range of alternatives was evaluated against the Purpose and Need as well as Goals and Objectives of the project. Any alternatives that did not meet the project's Purpose and Need and Goals and Objectives were eliminated. The result of this process was the set of Most Promising Alternative Concepts. The set of Most Promising Alternative Concepts was developed and refined further by working with the project team, the community, and corridor stakeholders to develop detailed descriptions of the small set of promising alternatives. The alternatives development process and results are described in Section 3.1 of Appendix B.
- **Evaluation of Promising Alternatives»** This is the detailed evaluation of the small set of promising alternatives described in Section 3.2 of Appendix B. An environmental analysis, transportation analysis, and conceptual design and cost analysis were all conducted for each promising alternative in order to evaluate the alternatives against the goals, objectives, and evaluation measures of the project. Conceptual designs have been prepared in sufficient detail to conduct analysis and make choices among them, but do not yet represent actual plans.

- **Selection of the Locally Preferred Alternative»** The selection of the Locally Preferred Alternative (LPA) will be based on the evaluation described above and will be consistent with the decision-making process described in Section 1.4 of Appendix B. The LPA will be developed in further detail.

FIGURE 1-2

Fourth Plain Alternatives Analysis (AA) Process



1.4 Decision-Making Process and Public Involvement

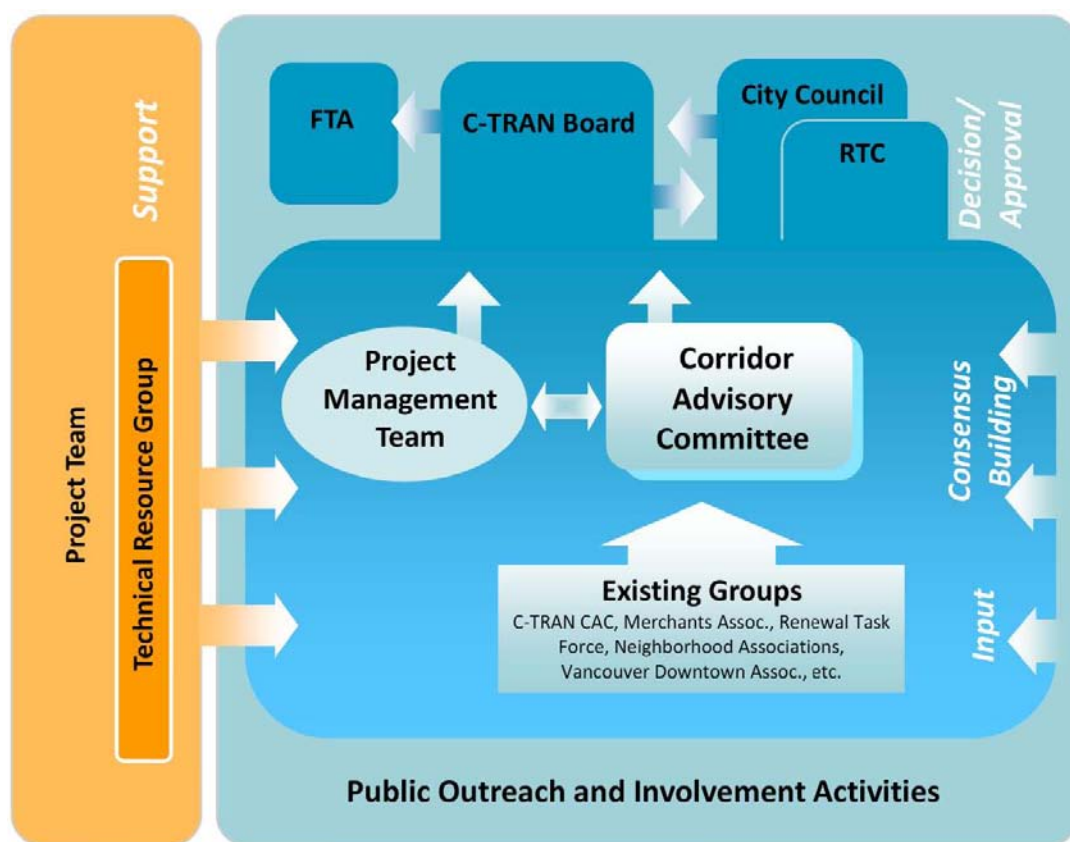
GROUPS AND COMMITTEES

The decision-making process for the Fourth Plain TIP has been a collaborative effort between several groups and committees with an interest in the project.

The C-TRAN Board of Directors is the decision-making body that selects and approves the LPA. The Vancouver City Council and the RTC Board will review and approve the LPA prior to it going to the C-TRAN Board for final adoption. After the C-TRAN Board adopts the LPA, it will be transmitted to the RTC Board for amendment of the MTP. Figure 1-3 displays the decision-making process and the technical and advisory committees that support the process.

FIGURE 1-3

Decision-Making Process



The project committee structure that was designed to complete the technical analysis and support the decision-making process is described below:

- **Project Management Team (PMT)**» This group provided management and oversight for all aspects of the project. The PMT is comprised of representatives from RTC, the City of Vancouver and C-TRAN. Key members of the consultant team participated in the semi-monthly and monthly PMT meetings.

- **Corridor Advisory Committee (CAC)**» This committee included members of area neighborhoods, the Fourth Plain Merchants Association, Fourth Plain Renewal Task Force, bus riders, business owners, the disabled community, schools, community service agencies, bike and pedestrian interests and others. The committee met regularly and was a major source for community input and provided feedback to the PMT and elected officials on key issues and recommendations on the milestone decisions.
- **Technical Resource Group**» This was an ad hoc group of technical specialists who were called upon to provide analysis and support on an as-needed basis.
- **Existing Corridor Groups**» These groups included the established network of neighborhood and business groups in the corridor. The project team attended regularly scheduled meetings of these groups in order to provide updates on the study progress.

PUBLIC INVOLVEMENT AND COMMUNITY OUTREACH

Public involvement and community outreach was an important aspect of the decision-making process. The purpose of the public involvement and community outreach tasks is to proactively engage a diverse cross-section of the community along the corridor, including residents, businesses, schools, commuters and transit users, community leaders and the broad general public. A Community Outreach Plan was prepared and implemented that included a variety of tools used to inform and engage the community along the Fourth Plain TIP corridor. The CAC, described above, was an effective way for the community to provide consensus-based advice regarding the project. Additional tools include:

- **Project website and Facebook page**» C-TRAN established a project website and Facebook page early in the process. These sites became the central location for project information and served as a resource for the public to obtain project updates and provide feedback. A schedule of CAC meetings and meeting materials is maintained on the website and Facebook page.
- **Web surveys**» Three online surveys were conducted to gather the public's perspective and feedback regarding project issues such as project values and concerns, the range of possible transit alternatives, various design options, and the most viable alternatives. The first survey was conducted from August 22 through September 4, 2011, and the second from October 17 through October 23, 2011, and a third survey from April 12 through 22, 2012. The purpose of the first survey was to generate feedback about issues and values that would inform the project's Goals and Objectives and collect input regarding the various bus transit options to be considered as part of the wide range of alternatives. The purpose of the second survey was to generate feedback about the public's preferences for the various lane configuration concepts. The purpose of the third and final survey was to gather community input regarding the lane configurations and routing alternatives on Fourth Plain and Fort Vancouver Way as well as the eastern terminus. The feedback collected is intended to inform the selection of the Locally Preferred Alternative. Full versions of the survey questionnaires can be found in the appendix.
- **Information materials**» Materials included a BRT Planning Guide which included educational information regarding how BRT systems work, and a design visualization presentation video that graphically demonstrated how

BRT stations and lane configurations would operate along the corridor. These materials were available on-line and at public meetings. Additionally, the project goals and objectives were translated into Russian, Vietnamese, Korean, and Spanish for distribution to businesses along the corridor through the Fourth Plain Merchants Association.

- **Informational kiosks at key locations»** A traveling display that included a project overview, renderings of the project area, and potential lane configurations was placed in areas highly trafficked by pedestrians. Kiosk locations and dates were as follows:
 - » October 19 through October 25, 2011—Clark College
 - » October 19 through October 25, 2011—Clark County Health Department
 - » November 9 through November 21, 2011—Clark College Town Plaza
 - » November 9 through November 21, 2011—Clark County Health Department
- **C-TRAN Table»** C-TRAN hosted an information table on the transit platform at Westfield Vancouver Mall on August 29, 2011. Over 50 people stopped by the table for questions and discussion regarding the project.
- **Design Workshops»** C-TRAN held two public design workshops on November 16 and November 19, 2011. The purpose of these events was to gather community input to inform the development of BRT design alternatives and a Transportation System Management (TSM) alternative. Approximately 30 people total attended at least one workshop, in addition to staff from C-TRAN, the consultant team and local media.
- **Tabling at community events»** Project team members staffed informational displays at popular community venues in order to engage residents who typically would not attend public meetings. Approximately 200 people attended these events. Dates and locations were as follows:
 - » October 17, 2011—Clark College Town Plaza location
 - » October 18, 2011 - Clark College Main Campus (Gaiser Hall)
 - » October 19, 2011 - Clark County Public Health Department
 - » October 20, 2011 - Fort Vancouver Regional Library
- **Public meetings»** Two open houses on August 22 and August 31, 2011 were held to provide project information to the public and answer questions. Approximately 16 people attended both meetings. The purpose of these events was to introduce the Fourth Plain Transit Improvement project, present the transit-related issues noted to date and identify others which may need to be addressed, develop a common understanding of the project purpose and need, and to solicit public input that informs the project goals and objectives and the wide range of alternatives. Two additional open houses were held on April 14 and April 18, 2012 to provide information on the technical analysis of the most promising alternatives and to solicit opinions from the public on preferences for the alternatives.
- **Door-to-door outreach to businesses»** C-TRAN staff walked the Fourth Plain section of the corridor and met one-on-one with businesses fronting the corridor. This outreach was conducted in winter and spring of 2011 and provided the businesses with a preview of the study and an invitation to participate in the process.
- **Door-to-door outreach to multi-cultural communities»** C-TRAN staff, along with an interpreter, conducted

door-to-door outreach of Spanish-speaking businesses on the corridor in the spring of 2011. Twenty-one businesses were contacted. Additionally, the project team partnered with Vancouver School District (Fort Vancouver and Hudson's Bay high schools) to recruit youth to serve as interns, assisting with door-to-door education and outreach along the corridor. This outreach effort took place from April 16 to April 20, 2012. Over 100 businesses were contacted, including several Spanish-speaking businesses and sixteen apartment complexes.

- **Community briefings»** The project team conducted project briefings to identified groups and organizations with an interest in the project. Thirty-nine briefings have been held or are scheduled between February 16, 2011 and May 24, 2012.
- **Project notifications»** E-mail notifications at key project milestones were sent to approximately 350 individuals or organizations who expressed interest in the project. One postcard mailing was conducted on January 19, 2012 to over 800 property owners along the corridor, notifying them of the project and providing a link to the project website. A second mailing was distributed to over 6,000 corridor residents and businesses on April 11, 2012.
- **Press releases»** C-TRAN distributed two press releases: one on August 15, 2011 for the project kick-off, and the second on October 19, 2011 for the fourth CAC meeting.
- **News media»** The Columbian Newspaper has published seven articles to date on various project topics. Additionally, the Oregonian and some local opinion blogs have written about the project.

1.5 Decision Points and Report Organization

The Fourth Plain TIP includes numerous mode, alignment and operational choices. The fundamental decision is the choice among the No Build, Transportation System Management (TSM), or BRT alternatives.

Additional choices for the BRT alternative relate to the lane configurations and eastern terminus. The technical analysis that compares and informs these choices make up the bulk of this report and are referred to throughout the report as the Full Analysis Choices (see Figure 1-4). The term "Full Analysis Choice" is used because these decision points utilize the full range of technical analysis tools including travel demand model forecasting, traffic analysis, and detailed environmental evaluation. These alternatives are described in detail in Section 3 of Appendix B. The following lists the Full Analysis Choices:

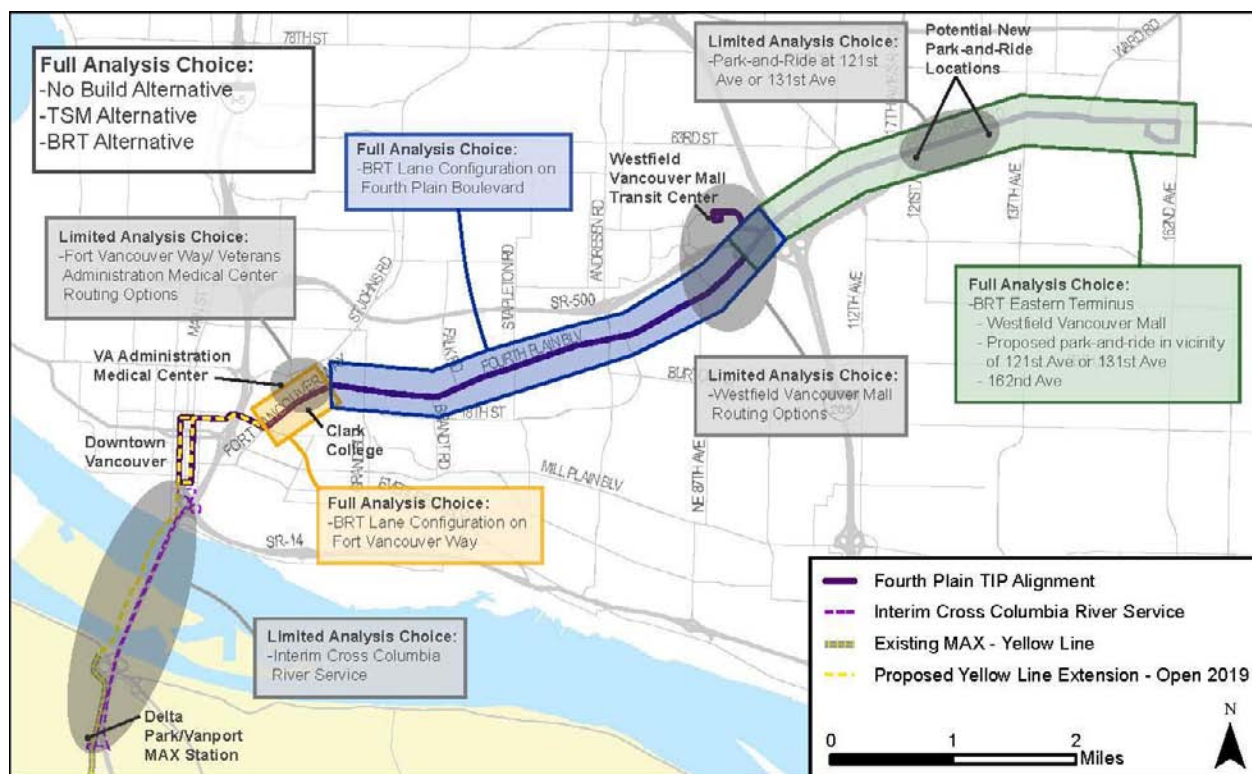
- No Build Alternative
- TSM Alternative
- BRT Alternative
 - » Lane Configurations on Fort Vancouver Way
 - » Lane Configurations on Fourth Plain Boulevard
 - » Eastern Terminus

Beyond these decision points that depend on travel forecasting and modeling are several additional decision points regarding details on what the BRT alternative would look like and how it would operate. These are generally indepen-

dent choices from the Full Analysis Choices and would be interchangeable with any of the BRT lane configuration and terminus options defined as part of the Full Analysis Choices. Referred to in this report as the Limited Analysis Choices (also shown in Figure 1-4), these decision points are described separately from the Full Analysis Choices and relied on less detailed technical analysis. The following lists the Limited Analysis Choices:

- Westfield Vancouver Mall Transit Center Routing Options
- Fort Vancouver Way/Veterans Administration Medical Center Routing Options
- Interim Cross Columbia River Service Options
- Park-and-Ride at 121st Avenue or 131st Avenue

FIGURE 1-4
Fourth Plain TIP Decision Points



The organization of this report is set up to first describe and analyze the Full Analysis Choices, which represent the more fundamental decision points, and then describe the analysis results of the Limited Analysis Choices. The report is organized as follows:

- **CHAPTER 1» Introduction**

- **CHAPTER 2» Purpose and Need:** This chapter describes the decision making framework defined for this alternatives analysis, including the Purpose and Need statement, the Goals and Objectives, and the Evaluation Criteria.

- **CHAPTER 3» Alternatives Considered:** This chapter describes the initial screening of alternatives against the Purpose and Need and Goals and Objectives down to a range of promising alternatives that were analyzed in detail as the Full Analysis Choices. A detailed description of the No Build, TSM, and BRT alternatives, including both the Full Analysis Choices and the Limited Analysis Choices is included in Section 2.2.

- **CHAPTER 4» Transportation Analysis:** This chapter describes the findings of the traffic and transit analyses, focusing on the Full Analysis Choices.

- **CHAPTER 5» Conceptual Design and Cost:** This chapter describes the capital and operating costs based on the Full Analysis Choices.

- **CHAPTER 6» Evaluation—Full Analysis Choices:** This chapter describes the ratings of each alternative against the Goals and Objectives defined in Chapter 3 and summarizes the key findings of the analyses described in Chapters five through seven.

- **CHAPTER 7» Evaluation—Limited Analysis Choices:** This chapter describes the analyses that were performed on each of the Limited Analysis Choices and describes the key findings and conclusions.

- **CHAPTER 8» Preliminary Locally Preferred Alternative**

2. PURPOSE AND NEED

The Purpose and Need Statement sets the stage for consideration of the alternatives. It has three parts: The Purpose, the Need, and Goals and Objectives. The Purpose defines the transportation problem to be solved. The Need provides data to support the problem statement (Purpose). The Goals and Objectives describe other issues that need to be resolved as part of a successful solution to the problem.

The Purpose and Need Statement and the Goals and Objectives for the Fourth Plain Transit Improvement Project were based on an analysis of existing conditions in the Fourth Plain corridor. The analysis of corridor transit service clearly indicated problems of increasing transit travel time, poor reliability of service, overcrowding of buses at certain times, and the need for improved east-west transit connections. Corridor issues included concerns regarding safety and security and the need for corridor revitalization. Land use issues included the need to better serve current and future growth of the eastern portion of the urban area.

The development of the Purpose and Need and Goals and Objectives included a high level of public involvement, including contributions from the Fourth Plain Merchants Association, the Corridor Advisory Committee, and the general public through community meetings and open houses. The Purpose and need Statement was approved by the C-TRAN Board of Directors on September 13, 2011.

2.1 Purpose and Need

The purpose of the Fourth Plain Transit Improvement Project is to cost-effectively increase transit ridership as well as enhance transit's comfort, convenience and image by reducing transit travel time, improving trip reliability, and increasing transit capacity to meet current and long-term transit travel demand, while also enhancing the safety and security of the corridor. The project will support the City of Vancouver's Fourth Plain corridor revitalization efforts and be consistent with the Clark County HCT System Plan as well as other local land use and transportation plans. The need for the project results from:

- **Capacity issues as a result of very high corridor ridership»** Some buses are at standing-room-only conditions between 9:00 AM and 4:00 PM weekdays, and the problem will worsen as ridership increases. There are currently more than 6,000 average weekday boardings on Fourth Plain corridor bus routes; and corridor ridership accounts for approximately one-third of all boardings on the C-TRAN system. Population and employment in the Fourth Plain Study Area are projected to grow by 30 to 40 percent between now and 2035, and downtown Vancouver is expected to grow similarly as well, resulting in projections forecasting a 50 percent ridership increase by 2030, which will significantly exceed transit capacity in the corridor.
- **Poor reliability of the current service»** Routinely, between 30 and 40 percent of buses on the corridor are running at least five minutes late and with the forecast increases in ridership and traffic, service reliability will worsen.
- **Continuing increases in corridor transit delays and travel time»** Transit travel times from Westfield Vancou-

ver Mall to downtown Vancouver have increased from approximately 30 minutes in 1992 to almost 45 minutes in 2011 as a result of higher ridership, more riders using wheelchairs, and delays from traffic congestion and traffic signals. This increase in transit travel time has occurred despite C-TRAN's efforts in reducing transit stops and shortening of the route. This slowing of the service adversely impacts the quality of service and increases transit operating expense. Without efforts to address the causes of delay, forecasts call for transit travel time between Westfield Vancouver Mall and downtown Vancouver to continue to increase.

- **Increasing need for east/west travel and transit connectivity»** Travel patterns over the past 10 years indicate a substantial amount of east-west travel within Clark County including along the Fourth Plain corridor. Growth at both ends of the Fourth Plain corridor as well as a planned light rail connection from Portland into downtown Vancouver creates a need for an improved east/west transit connection.
- **Corridor safety and security concerns»** The Fourth Plain corridor between I-5 and NE 117th Avenue (SR 500/503) has been designated a Traffic Safety Corridor by the Washington State Traffic Safety Commission (in conjunction with the Washington State Department of Transportation) due to its above-average crash rate (compared to similar roadways in Washington State). Transit users and the general traveling public also experience safety concerns accessing, walking along, and crossing Fourth Plain Boulevard as pedestrians, on bicycles, or using mobility devices. In addition, transit patron safety and security continue to be major concerns for C-TRAN, corridor residents and businesses.
- **Mobility constraints to job creation and retention, and economic growth»** A recent survey conducted of Fourth Plain transit riders indicates that over 40 percent are transit dependent, and that almost half of the transit riders are destined to businesses and establishments along the corridor. Transit delays, trip unpredictability, and bus overcrowding impair transit's ability to carry people to jobs and business appointments, as well as for work and non-work activities, within the Fourth Plain corridor, constraining the ability of the Fourth Plain subarea to sustain jobs and achieve economic growth.

2.2 Goals, Objectives, and Evaluation Criteria

Project Goals and Objectives are desirable outcomes of the project beyond the minimum requirements addressed in the Purpose and Need statement described above in Section 2.1. The Project Goals and Objectives were determined through a series of meetings, open houses and workshops attended by the Fourth Plain Merchants Association, local neighborhood leaders and the CAC. The CAC and PMT considered this community input along with the results of online surveys in recommending goals and objectives that addressed community concerns and aspirations.

In addition, the project utilized elements from the Sustainable Transportation Analysis & Rating System (STARS). STARS is a project of the North American Sustainable Transportation Council that is intended to "help transportation professionals, elected officials, and citizens improve a transportation project's short-term and long-term performance." STARS recommends evaluating the full lifecycle of transportation plans and projects, identifying innovative options and improving decision-making. The STARS approach was considered in identifying evaluation criteria that addressed

the project's adopted goals and objectives.

The adopted goals and objectives guided the selection of screening criteria and evaluation measures that were used to develop and refine the wide range of alternatives into a small set of promising alternatives. The project has six goals. Under each goal, objectives and evaluation criteria have been established to provide a framework for performing a detailed evaluation of each alternative. The project goals, objectives and evaluation criteria are shown in Table 2-1.

Many of the evaluation criteria rely on PM peak traffic and transit travel times. While some delay to transit on Fourth Plain Boulevard occurs during the high transit ridership times in the midday, delay due to traffic congestion predominantly occurs during both the morning and evening commute times. The traffic analysis in this report is based on the PM peak period. The PM peak period was used because the PM peak period includes a wider range of trip types than the AM peak and it, typically provides the worst case analysis for traffic congestion and delays. During subsequent study phases, AM peak period traffic will be evaluated as needed to capture potential traffic and transit operational issues.

TABLE 2-1 • Project Goals, Objectives and Evaluation Criteria

Goal	Objective	Evaluation Criteria
Goal 1 Improve corridor transit service	1a. Improve transit service reliability (on-time performance)	1a.i. Variation in PM peak in-vehicle transit travel time
	1b. Improve access to and from transit for pedestrians and bicyclists	1b.i. Length of new or improved sidewalk in stop/station areas
		1b.ii. Length of new bike lanes or other bicycle treatments instop/station areas
	1c. Increase transit ridership	1c.i. Average weekday boardings on Fourth Plain routes (4, 44, TSM, or BRT)
		1c.ii. New transit trips on C-TRAN
	1d. Reduce transit travel time to help make transit a viable alternative travel choice	1d.i. PM peak hour in-vehicle transit travel time (east-bound)
	1e. Enhance the comfort and convenience of transit	1e.i. Includes station amenities, vehicle branding, off-board fare collection, and level boarding
Goal 2 Create a cost-effective, long-term transit solution	1f. Ensure good transit connections to other routes and destinations	1f.i. Quality of access to the regional transit system
	2a. Develop a cost-effective project	2a.i. Project life cycle cost per boarding ride
		2b.i. Capital cost
		2b.ii. Ability to qualify for FTA funding
		2b.iii. Cost to local taxpayer
		2b.iv. Dollars retained in local economy
		2b.v. Potential to attract public/private partnerships
	2c. Develop a project that can minimize increases in transit operating and maintenance costs	2c.i. Annual operating and maintenance cost
Goal 3 Meet current and future corridor travel demand	3a. Accommodate future growth in travel by increasing transit's share of trips	3a.i. Transit mode share in the study area
	3b. Maintain reliable motor vehicle operations for the projected traffic flow through the Fourth Plain corridor	3b.i. PM peak hour auto/truck travel times
		3b.ii. Variation in corridor PM peak auto/truck travel time
		3b.iii. Number of intersections below LOS D
	3c. Increase transit capacity to meet projected ridership demand in the corridor	3c.i. Person capacity of transit at specified points along route
		3c.ii. Total person capacity (auto and transit) at specified points along corridor
	3d. Improve transit service to key community facilities (educational, medical, recreational, etc.)	3d.i. Changes to corridor transit service (including walk access) for key community facilities
	3e. Maintain or enhance bicycle safety and operations through the Fourth Plain corridor	3e.i. Quality of bicycle operating environment along BRT route

Goal 4 Enhance the safety and security of the corridor	4a. Improve the safety of pedestrians accessing and crossing Fourth Plain Boulevard	4a.i. Number of new marked pedestrian crossings (signalized or unsignalized)
		4a.ii. Quality of marked pedestrian crossings
	4b. Address safety issues at intersections with high crash rates	4b.i. Number of locations with high motor vehicle crash rates improved
		4b.ii. Number of locations with high bike or pedestrian crash rates improved
	4c. Enhance the security of transit users, residents and business patrons at and near stops and stations	4c.i. Extent and character of stop/station improvements
Goal 5. Support economic vitality and corridor revitalization efforts	5a. Maintain motor vehicle and non-motorized access for corridor businesses	5a.i. Number of left turns eliminated (driveways or streets)
		5a.ii. Number of parking spaces removed from businesses
		5a.iii. Number of vehicles diverted off of corridor
		5a.iv. Person demand (peak hour peak direction auto and transit) at specified points along corridor
	5b. Enhance the appearance of the corridor and increase the awareness and visibility of existing businesses	5bcde.i. Level of opportunity for streetscape improvements, wayfinding, and design elements that reinforce the community's identity and increase awareness of the business district
	5c. Stimulate opportunities for development adjacent to transit stations, consistent with the City of Vancouver's Fourth Plain Subarea Plan	
	5d. Support diversity in the size and type of businesses along Fourth Plain Boulevard	5bcde.ii. Stop or station locations reinforce "Pulse Points" identified in Fourth Plain Corridor Subarea Plan
	5e. Transit investments should recognize the corridor's role as the City's International Corridor	5bcde.iii. Amount of vacant and underutilized land at stop or station and within 1/4 mile
	5f. Implement applicable transit-related elements of the City's Subarea Plan	5f.i. Extent to which transit enhancements specified in the Fourth Plain Subarea Plan are included
Goal 6 Support a healthy and livable community	6a. Avoid or minimize negative impacts to businesses, residents and households, historic resources, parks, trails and other public recreation areas	6a.i. Acres of property acquired from businesses
		6a.ii. Acres of property acquired from residences
		6a.iii. Acres of property acquired from historic resources
		6a.iv. Acres of property acquired from parks, trails, or other public recreation areas
	6b. Avoid or minimize adverse impacts to the natural environment	6b.i. Acres of net new impervious surface
	6c. Ensure that corridor transit improvements benefit all segments of the community including transit dependents, disabled, youth, elderly, ethnic minorities, low income, etc.	6c.i. Number of low-income housing properties owned by the Vancouver Housing Authority within 1/2 mile of a stop or station
		6c.ii. Number of social service providers within 1/2 mile of a stop or station
	6d. Develop sustainable transit enhancements that improve air quality, reduce greenhouse gas emissions, and reduce energy use	6d.i. Future year corridor VMT
		6d.ii. Average future year auto speed
		6d.iii. Fuel consumption corridor-wide
		6d.iv. Greenhouse gas emissions corridor-wide
	6e. Encourage pedestrian and bicycle mobility in the corridor and to transit	6e.i. Ability to improve health by encouraging pedestrian and bicycle mobility

3. ALTERNATIVES CONSIDERED

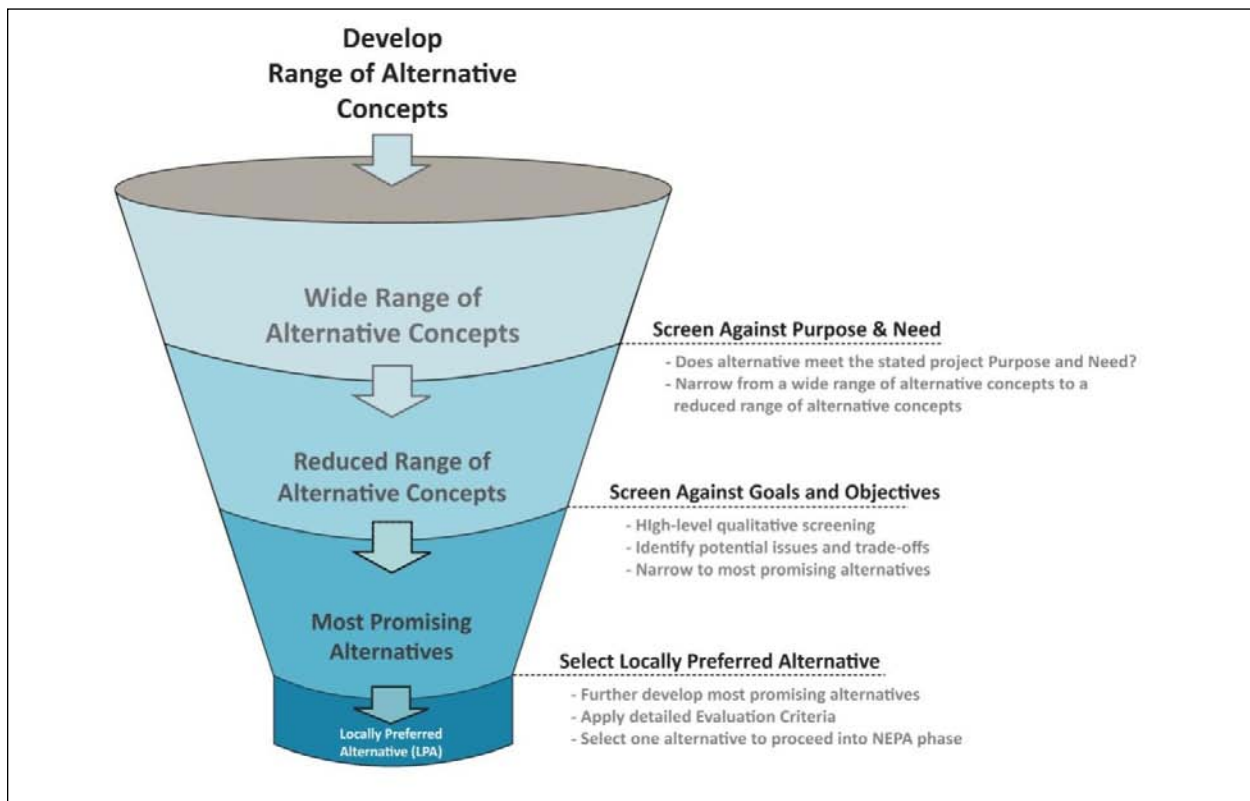
3.1 Alternatives Development

SUMMARY OF SCREENING PROCESS

The evaluation and narrowing of alternatives for the Fourth Plain TIP was accomplished through an iterative screening process. An initial wide range of alternative concepts was evaluated through two screening processes. This resulted in the identification of the most promising alternative concepts, which are evaluated in this AA Report. The process used to narrow the project alternatives is shown in Figure 3-1 below.

FIGURE 3-1

Alternatives Narrowing Process



The key steps in the screening process are summarized below and covered in more detail in the subsequent narrative.

- **Develop a Wide Range of Alternative Concepts»** At this step, ideas were solicited on possible solutions to address the project's Purpose and Need. All ideas for transit improvements were encouraged and considered.
- **Purpose and Need Screening»** The wide range of alternative concepts was evaluated against the project's Purpose and Need. Possible concepts that did not address the project Purpose and Need were eliminated from further consideration. Recommendations on the Purpose and Need screening were made by the CAC and approved by the PMT.

- **Goals and Objectives Screening»** The list of potential concepts that survived the Purpose and Need screening were evaluated against the project's Goals and Objectives. The concepts that were deemed to best meet the project Goals and Objectives were termed the Most Promising Alternative Concepts. The Most Promising Alternative Concepts were carried forward to a more detailed analysis and are the focus of this AA Report. Recommendations on the Goals and Objectives screening were made by the Corridor Advisory Committee and the Project Management Team which included public input from the various public education and outreach activities described in Section 1.4. These recommendations were approved by the C-TRAN Board of Directors on November 8, 2011.

The No Build Alternative and the Transportation Systems Management (TSM) Alternative were not subject to the two rounds of screening. Those two alternatives are required to be analyzed by Federal Transit Administration guidelines and were “automatically” carried forward to the Most Promising Alternative Concepts level and are evaluated in this report.

WIDE RANGE OF ALTERNATIVES

The identification of possible improvements for the Fourth Plain corridor included solicitation of ideas from the public, from C-TRAN and other public agencies, and from local elected and appointed officials. Opportunities to contribute ideas were provided through public events, including community meetings, open houses and tables in public venues, the project CAC, on the project's website, and in meetings with local elected officials. Section 1.4 provides more information on public outreach activities.

The process yielded many potential ideas to improve C-TRAN transit service in the Fourth Plain corridor. Although this project builds upon the Clark County HCT System Study, which identified BRT as the preferred high-capacity transit mode and the Fourth Plain corridor as the initial BRT corridor, ideas for other modes and other corridors were put forward and included among the wide range of alternative concepts. Every idea that was suggested as part of this process was evaluated in the Purpose and Need screening.

The development of the wide range of alternatives also included the identification of possible BRT arterial lane configurations for the project. Seven possible lane configurations were identified and are shown in Figure 3-2.

BRT Lane Configurations

- A) Mixed Traffic Curbside»** This lane configuration would be most like conventional bus service. BRT service would operate in the general purpose curbside travel lane and make stops at curbside stations. Left and right turn accesses would be maintained under this configuration.
- B) Mixed Traffic Left Lane»** This lane configuration would operate BRT service in the general purpose left travel lane and would make stops at median stations. The median stations would be served by signalized pedestrian crossings. Left and right turn accesses would be generally maintained under this configuration, except that left-turn access would be restricted at the location of the median stations. The bus would pull completely out of the travel lane and not block traffic while stopped at a BRT station. Street widening would be necessary at station locations to accommodate the station and bus bay.
- C) Business Access Transit Lane—Converted»** This configuration would involve converting the right travel lane to a Business Access Transit (BAT) lane that would be shared by BRT buses and right-turning vehicles. Stations would be located curbside and through-traffic would be limited to the left travel lane. Left and right turn accesses would generally be maintained under this configuration.
- D) Business Access Transit Lane—Added»** This configuration would add a BAT lane as a third lane in each direction and would use curbside stations. Through traffic would continue to have two lanes in each direction. Left and right turn accesses are generally maintained under this configuration. This BRT lane configuration would require the widening of the right-of-way to accommodate the two additional lanes.
- E) Single Center Running Lane»** This configuration would involve converting the center two-way left-turn lane to a bi-directional transit lane. BRT buses operating in both directions would share the lane. Passing opportunities would occur at median stations, and BRT access to the single lane sections would be controlled by a block signaling system. Stations would be in the median. Left turn access to driveways and some streets would be restricted with this option.
- F) Double Center Running Lanes—Added»** This configuration would involve replacing the center two-way left turn lane with two BRT lanes operating in each direction. Stations would be in the median and left turn access to driveways and some streets would be restricted with this option. This BRT lane configuration would require the widening of the right-of-way to accommodate the additional lane.

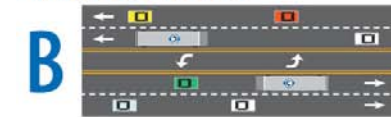
FIGURE 3-2

Lane Configurations

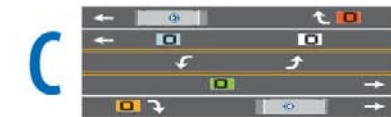
Mixed traffic – curbside



Mixed traffic – left lane



BAT lane – converted



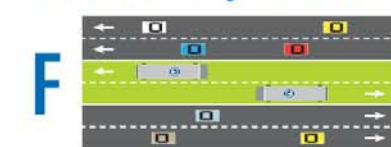
BAT lane – added



Single center running lane



Double center running lane – added



Double center running lane – converted



- **G) Double Center Running Lanes—Converted»** This configuration would involve converting the left travel lanes in each direction to BRT lanes in each direction. Stations would be in the median and left turn access to driveways and some streets would be restricted with this option.

BRT Service Plan Options

The options for BRT service were:

- replace existing service; or
- supplement local bus service

Station Spacing Options

- maintain the current stop spacing used for the Route 4 (an average of approximately 1/4 mile or less);
- station spacing at an average of approximately every 1/4 to 1/3 mile; or
- station spacing at an average of approximately every 1/2 mile or more.

PURPOSE AND NEED SCREENING

Criteria

In order to be considered for further evaluation, suggested Alternative Concepts were, at minimum, required to support and address the project's Purpose and Need. The seven BRT lane configurations, two BRT service options, and three station spacing options described above were evaluated against the project's Purpose and Need. Alternative Concepts that did not meet the minimum requirements of the Purpose and Need were eliminated from further consideration. In addition to the lane configurations, service plan, and stop spacing, the Purpose and Need screening considered many other ideas for transit improvements to the corridor.

Screening Results

BRT Lane Configurations» Five of the seven BRT lane configurations were carried forward as a result of the Purpose and Need screening. Two options were eliminated from further consideration as primary lane concepts during this screening process: D. Business Access Transit Lane—Added; and F. Double Center Running Lanes—Added. These two lane configurations were eliminated for not meeting the cost-effectiveness element of the Purpose statement because they would require extensive expansion of the Fourth Plain Boulevard right-of-way. The right of way expansion was estimated to result in project costs well in excess of \$75 million, which is the amount included in the C-TRAN 2030 Transit Development Plan's capital budget and considered the project's maximum budget.

BRT Service Plan and Station Spacing» The option to replace existing service was the only BRT service plan option found to meet the project's Purpose statement. The option to supplement local service was eliminated as part of the Purpose and Need screening step because it would not meet the cost-effectiveness element of the Purpose statement. Operating BRT service in addition to local service would significantly increase C-TRAN operating cost, and was deter-

mined to be inconsistent with the project Purpose.

Station Spacing Options» The option to place station spacing at approximately 1/4 to 1/3 mile on average (closer together in locations of higher intensity land use, such as downtown, and further apart in locations of low intensity land use) was the only station spacing option that was found to meet the project Purpose and Need, and therefore the only option carried forward to the next screening stage. The option of using current stop spacing was eliminated because it would not achieve the travel time savings element of the Purpose statement. Conventional bus stop spacing of less than a 1/4 mile would result in more frequent stops and longer total dwell times that would make it difficult for the BRT service to significantly reduce travel times. The option of spacing stops 1/2 mile or further apart was eliminated because it would not meet the rider convenience element of the Purpose statement, due to potentially long walking distances which would especially impact the high percentage of Title VI disadvantaged populations along the corridor by reducing access, including minorities, low income, and people with disabilities. Since the BRT service would replace existing service on the corridor, walking distance to stations that are spaced 1/2 mile apart would include the walk distance to the corridor and up to a 1/4 mile walk along the corridor to the nearest station.

Table 3-1 summarizes the results of the Purpose and Need screening for the BRT lane configuration, service plan, and station spacing options.

TABLE 3-1

Purpose and Need Screening Results

BRT Alternative Lane Configurations	Findings	Retained for Further Analysis
A. Mixed Traffic—Curb Side	• Consistent with Purpose and Need Statement. • Appropriate for further consideration for extended segments of the corridor. • Will need to screen design applications against the Goals and Objectives.	Yes
B. Mixed Traffic—Left Lane	• Consistent with Purpose and Need Statement. • Appropriate for further consideration for extended segments of the corridor. • Will need to screen design applications against the Goals and Objectives.	Yes
C. BAT Lane—Converted	• Consistent with Purpose and Need Statement. • Potentially applicable for extended segments of the corridor. • Traffic Analysis will determine whether this allows satisfactory traffic flow.	Yes
D. BAT Lane—Added	• Would exceed project budget due to extensive right-of-way needs. • Not Consistent with cost-effectiveness criterion of Purpose and Need statement.	No
E. Single Bi-Directional Center Lane	• Consistent with Purpose and Need Statement. • Appropriate for further consideration for extended segments of the corridor. • Will need to screen design applications against the Goals and Objectives.	Yes
F. Double Center Running Lane—Added	• Would exceed project budget due to extensive right-of-way needs. • Not Consistent with cost-effectiveness criterion of Purpose and Need statement.	No
G. Double Center Running Lane—Converted	• Consistent with Purpose and Need Statement. • Potentially applicable for extended segments of the corridor. • Traffic Analysis will determine whether this allows satisfactory traffic flow.	Yes
BRT Alternative Service Plan and Stop Spacing	Findings	Retained for Further Analysis
BRT Combined with Maintaining Limited Local Bus Service	• Estimated to increase corridor operating costs by up to 30%. • Not Consistent with cost-effectiveness criterion of Purpose and Need statement.	No
BRT Replaces Existing Bus Service and Maintains Existing Route 4 Stop Spacing	• Frequent stops not consistent with the travel time reduction requirement of the Purpose and Need statement.	No
Average Stop Spacing Every 1/4 to 1/3 Mile	• Enables shorter transit travel time while remaining convenient and accessible. • Retains flexibility to adjust stop spacing, either closer than 1/4 mile or wider than 1/3 mile, based on adjacent land uses and rider needs (including safety and security considerations).	Yes
Average Stop Spacing Every 1/2 Mile or More	• Does not meet the convenience criterion of the Purpose and Need statement.	No

GOALS AND OBJECTIVES SCREENING

Criteria

The Goals and Objectives screening phase was a high-level, qualitative process that evaluated the five alternative concepts that remained after the Purpose and Need Screening. These alternative concepts were evaluated against the project Goals and Objectives. This screening-level review only evaluated the primary configuration of BRT operation for the portion of the corridor between downtown Vancouver and Westfield Vancouver Mall (including both Fourth Plain Boulevard and Fort Vancouver Way). The five alternative BRT configurations evaluated by the Goals and Objectives screening were:

- A)** Mixed Traffic—Curb Side
- B)** Mixed Traffic—Left Lane
- C)** BAT Lane—Converted
- D)** Single Bi-Directional Center Lane
- E)** Double Center Running Lane—Converted

Each of these alternative concepts was considered as a primary style of operation that would apply to a majority of the corridor. For example, Alternative G. Double Center Running Lane—Converted would include an exclusive median BRT running way for most of the corridor, including on Fort Vancouver Way from McLoughlin to Fourth Plain Boulevard and on Fourth Plain Boulevard from Fort Vancouver Way to Westfield Vancouver Mall.

The goals and objectives screening process only evaluated the performance of the alternative concepts as the primary style of operation. BRT configurations that were not deemed appropriate as a primary design option could still be applied in limited sections where appropriate, which would be determined during the concept design phase.

In the goals and objectives screening, each alternative concept was scored on each objective using a scale of zero to three, with three signifying good performance, one signifying poor performance, and zero signifying a critical failure (such as traffic operations that do not meet established standards). The criteria and scoring used to evaluate the alternative concepts for each project goal are summarized in Table 3-2 below.

TABLE 3-2

Goals and Objectives Screening Criteria

Goal	Ranking Criteria	Score
1: Improve Corridor Transit Service	Maximum improvement to travel time and reliability	3
	Moderate improvement to travel time and reliability	2
	Does not improve travel time or reliability	1
2: Create a Cost-Effective, Long-Term Transit Solution	Would minimize construction and maintenance costs	3
	Would have higher construction and maintenance costs, but would maximize improvements to transit travel time reliability through exclusive operation	2
	Would not improve ridership or transit travel time reliability	1
3: Meet Current and Future Corridor Travel Demand	Would maximize improvement to transit mode share due to exclusive transit lanes and not impact traffic operations	3
	Would improve transit mode share and not impact traffic operations	2
	Would improve transit mode share, but have a moderate impact on traffic operations	1
	Would improve transit mode share, but have a high impact on traffic operations	0
4: Enhance the Safety and Security of the Corridor	Would improve pedestrian amenities in station areas, limit left turn movements, and improve overall safety and security	3
	Would improve pedestrian amenities in station areas and overall safety and security	2
	Would not improve pedestrian amenities in station areas or overall safety and security	1
5: Support Economic Vitality and Corridor Revitalization Efforts	Would provide opportunity for streetscape improvements that improve corridor appearance, reinforce the Subarea Plan, recognize the corridor's international character, and maintain all auto access to businesses	3
	Would provide opportunity for streetscape improvements that improve corridor appearance, reinforce the Subarea Plan, and recognize the corridor's international character, but would restrict auto access to businesses	2
	Would not provide opportunity for streetscape improvements that improve corridor appearance, reinforce the Subarea Plan, or recognize the corridor's international character	1
6: Support a Healthy and Livable Community	Would minimize right-of-way impacts and maintain all auto access to businesses	3
	Would have limited right-of-way impacts in station areas, but would maintain all auto access to businesses	2
	Would have limited right-of-way impacts in station areas and would restrict auto access to businesses	1

Screening Results

The goals and objectives screening process eliminated Alternative Concept E. Single Center Running Lane and Alternative Concept G. Double Center Running Lane—Converted from further consideration on Fourth Plain Boulevard due to access and traffic concerns. However, those two options continued to be considered as primary lane configurations for Fort Vancouver Way. Table 3-3 summarizes the rankings for each alternative based on the goals and objectives screening process.

TABLE 3-3
Goals and Objectives Screening—Ranking Results

Alternative Concept	Goal 1	Goal 2	Goal 3	Goal 4	Goal 5	Goal 6	Total
A. Mixed Traffic—Curb Side	2	3	2	2	3	3	15
B. Mixed Traffic—Left Lane	2	3	2	2	3	2	14
C. BAT Lane—Converted	3	3	1	2	3	3	15
E. Single Bi-Directional Center Lane	2	2	3	3	2	1	13
G. Double Center Running Lane—Converted	3	2	0	3	2	1	11

The following conclusions were drawn from the goals and objectives screening process:

- Exclusive lanes for the entire length of the corridor would maximize benefits to transit travel time and reliability, and result in maximum improvements in comfort and convenience, increasing transit's share of trips, and increasing transit capacity. Shared lanes such as BAT lanes provide a moderate level of transit travel time and reliability benefit. Mixed traffic as the primary style of operation combined with BRT-type stop and station improvements would result in more modest benefits to these objectives. (Objectives 1a., 1d., 1e., 3a., and 3c.)
- Building exclusive lanes for the entire length of the corridor would be the most expensive both in terms of capital costs as well as the cost to maintain the BRT facility. However, the exclusive lane concepts would have the ability to maximize benefits in ridership and travel time savings. Alternative C. BAT Lane—Converted would have lower construction and maintenance costs than either of the median exclusive guideway alternative concepts (E and G). (Objectives 2a. and 2c.)
- Reducing general-purpose lanes to one through lane in each direction for the entire length of the corridor would result in the failure of several intersections and the Fourth Plain Boulevard corridor between these intersections to meet traffic performance standards. This is a critical shortcoming of Alternative G. Double Center Running Lane—Converted and, to a lesser extent, Alternative C. BAT Lane—Converted. (Objective 3b.)
- All alternative concepts would improve safety of pedestrians accessing and crossing Fourth Plain Boulevard in station areas. Reducing the number of general purpose travel lanes for the entire length of the corridor, as with Alternative C. BAT Lane—Converted and Alternative G. Double Center Running Lane—Converted, would maximize safety benefits for pedestrians crossing Fourth Plain Boulevard because they would reduce the number of general-purpose traffic lanes to cross. (Objectives 4a.)

- BRT operating in the median or left lane with stations located in the median would provide a benefit to pedestrian safety by providing the opportunity for median refuge islands. (Objective 4a.)
- Exclusive lanes in the median, as with Alternative E. Single Bi-Directional Center Lane and Alternative G. Double Center Running Lane—Converted, would require restrictions to left turns into and out of businesses and unsignalized side streets, allowing them only at signalized intersections for the length of the corridor. The other alternative concepts would maintain existing left turn movements. (Objectives 5a. and 6a.)

SUMMARY OF PRELIMINARY SCREENING RESULTS

The purpose and need screening and goals and objectives screening narrowed the wide range of seven alternatives down to a smaller set of three promising BRT lane configurations for Fourth Plain Boulevard:

- A)** Mixed Traffic—Curbside
- B)** Mixed Traffic—Left Lane
- C)** BAT Lane—Converted

On Fort Vancouver Way, those three promising lane configurations were advanced along with two other BRT lane configuration options:

- E)** Single Center Running Lane
- G)** Double Center Running Lane—Converted

These five remaining alternative concepts were further developed into the BRT Alternatives and Options that are described in further detail in Section 3.2. Figure 3-3 below summarizes the results from the purpose and need and goals and objectives screening processes.

FIGURE 3-3

Summary of Screening Results

BRT LANE OPTIONS All options shown are available for location-specific application.				Potential primary BRT concept for:	
	Lane Type	Lane Location	Station Location	Fourth Plain?	Ft. Vancouver Way?
A Mixed traffic – curbside 	Mixed traffic	Curbside	Curbside	Yes	Yes
B Mixed traffic – left lane 	Mixed traffic	Left lane	Median	Yes	Yes
C BAT lane – converted 	Semi-exclusive (shared with turning vehicles)	Curbside	Curbside	Yes	Yes
D BAT lane – added 	Semi-exclusive (shared with turning vehicles)	Curbside	Curbside	No	No
E Single center running lane 	Exclusive transit	Center	Median	This concept could apply to locations or segments of the corridor based on design study	Yes
F Double center running lane – added 	Exclusive transit	Center	Median	No	No
G Double center running lane – converted 	Exclusive transit	Center	Median	No	Yes

3.2 Description of Alternatives

In order to make choices among alternatives, each alternative needs to be defined to a level of detail sufficient to conduct an alternatives analysis. Assumptions need to be made for purposes of analysis. This section describes the alternatives that were analyzed during this AA process. The alternatives described here represent potential conceptual plans sufficient for analysis, but do not necessarily precisely represent actual plans. Actual decisions among alternatives will be discussed in Chapter 8, Locally Preferred Alternative.

The alternatives have been developed for a 2035 forecast year and are consistent with the Clark County Metropolitan Transportation Plan and C-TRAN's 20-Year Plan.

The existing transit service in the corridor is primarily provided by three C-TRAN routes:

- Route 4 Fourth Plain
- Route 44 Fourth Plain Limited
- Route 72 Orchards

Other routes travel along Fourth Plain for portions of their trips, but would not be subject to possible replacement with TSM or BRT alternatives.

A detailed description of these existing bus routes and other features of the corridor transit service are included in Chapter 4 Transportation Analysis. In addition to the existing service and the long-range, 2035 plans, an opening year network (2014) will be developed during the next phase of the study.

This AA Report analyzes three alternatives: the No Build Alternative, the Transportation System Management (TSM) Alternative, and the BRT Alternative and Options. These alternatives are described in detail below.

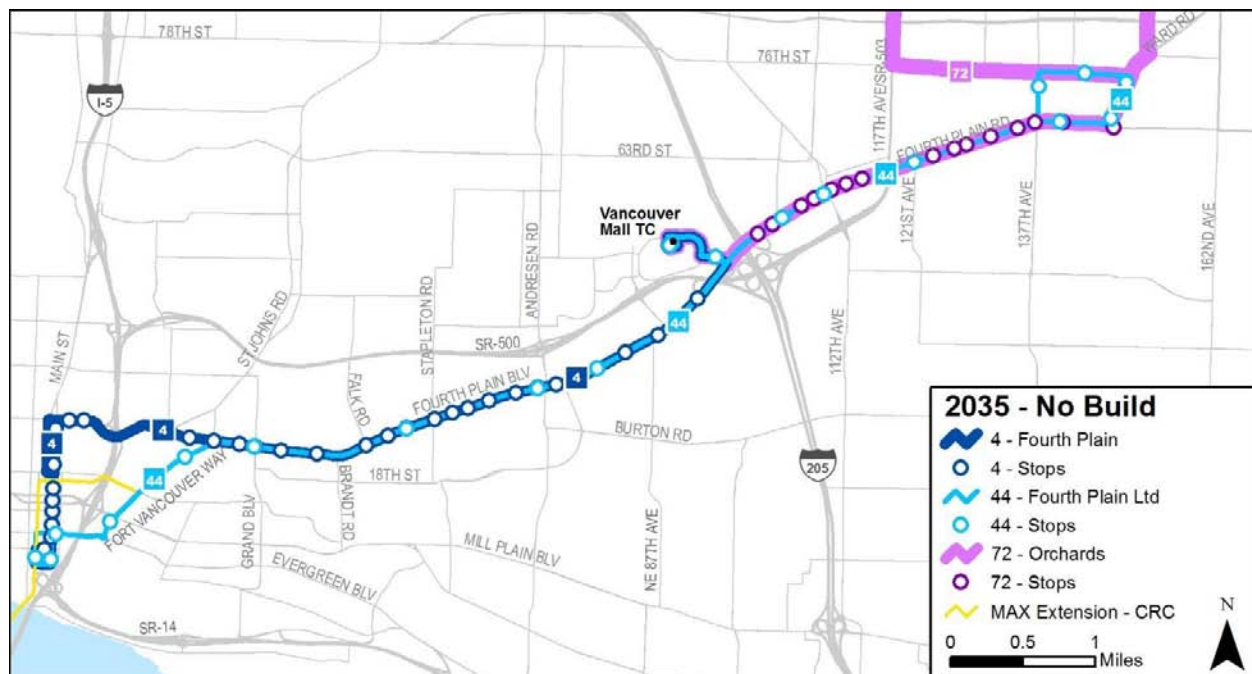
2035 NO BUILD ALTERNATIVE

The 2035 No Build Alternative (see Figure 3-4) includes the same general Fourth Plain Boulevard transit route structure as exists today, but with adjustments due to the completion of the light rail transit (LRT) extension from the Portland Expo Center to the Central Park-and-Ride (just west of Clark College) as part of the Columbia River Crossing (CRC) project.

C-TRAN Route 4 currently travels between Delta Park in north Portland and Westfield Vancouver Mall, serving Hayden Island, downtown Vancouver, Uptown Village, and Fourth Plain Boulevard. Route 44 Limited currently operates only during peak hours and travels between Delta Park and Ward Road, serving downtown Vancouver, Clark College, Fourth Plain Boulevard, Westfield Vancouver Mall, and Sifton. Because it is a limited route, it does not serve all stops along Fourth Plain Boulevard.

Under the 2035 No Build Alternative, Route 4 would no longer travel across the Columbia River. Instead, it would terminate in downtown Vancouver where the riders who wish to cross the river would transfer to the MAX Yellow Line LRT in downtown Vancouver. From downtown Vancouver, Route 4 buses would follow the existing Route 4 routing, which travels north on Broadway Street and then east on Fourth Plain Boulevard. Buses would turn north onto Vancouver Mall Drive and follow Vancouver Mall Drive and Vancouver Mall Loop to the Vancouver Mall Transit Center, where the route would terminate.

FIGURE 3-4
2035 No Build Alternative



In 2035, Route 4 would continue to operate as it operates today, at 15-minute frequencies all day on weekdays. Stop spacing would also remain the same as it is today, with average stop spacing of approximately 800 feet to one-quarter mile outside of downtown Vancouver. In downtown Vancouver, stops are located approximately two blocks apart.

Route 44 Limited, under the 2035 No Build Alternative, would also terminate in downtown Vancouver. The remainder of the route would maintain its current routing. Buses would travel east from downtown Vancouver on Evergreen Boulevard and then north on Fort Vancouver Way where they would travel past Clark College. They would turn east on Fourth Plain Boulevard and travel to Vancouver Mall Drive. Here the route would turn north to serve the Vancouver Mall Transit Center via the same route as Route 4. After serving the transit center, Route 44 Limited buses would travel along the same route back to Fourth Plain Boulevard and continue east to 137th Avenue. At 137th Avenue, buses would turn north and serve the Sifton neighborhood. They would then turn east on 76th Street, then turn south onto Ward Road to return to Fourth Plain Road, and turn west on Fourth Plain Road to return westbound.

In 2035, Route 44 Limited would continue to operate as it does today, operating at 30-minute frequencies only during weekday morning and evening peak periods. It would continue to operate as a limited-stop service, with stops spaced approximately one-half to one mile apart.

In addition to these existing corridor routes, C-TRAN's long-range plans¹ include a new route, Route 48, that would travel between Westfield Vancouver Mall and Fisher's Landing Transit Center via Fourth Plain Road and 162nd/164th Avenue. This route would operate at 30-minute frequencies all day on weekdays. The AA assumed that this route would exist in the 2035 analysis year.

1 http://www.c-tran.com/assets/20_Year_Plan/C-TRAN_20_Year_Plan-Adopted_June_8__2010.pdf

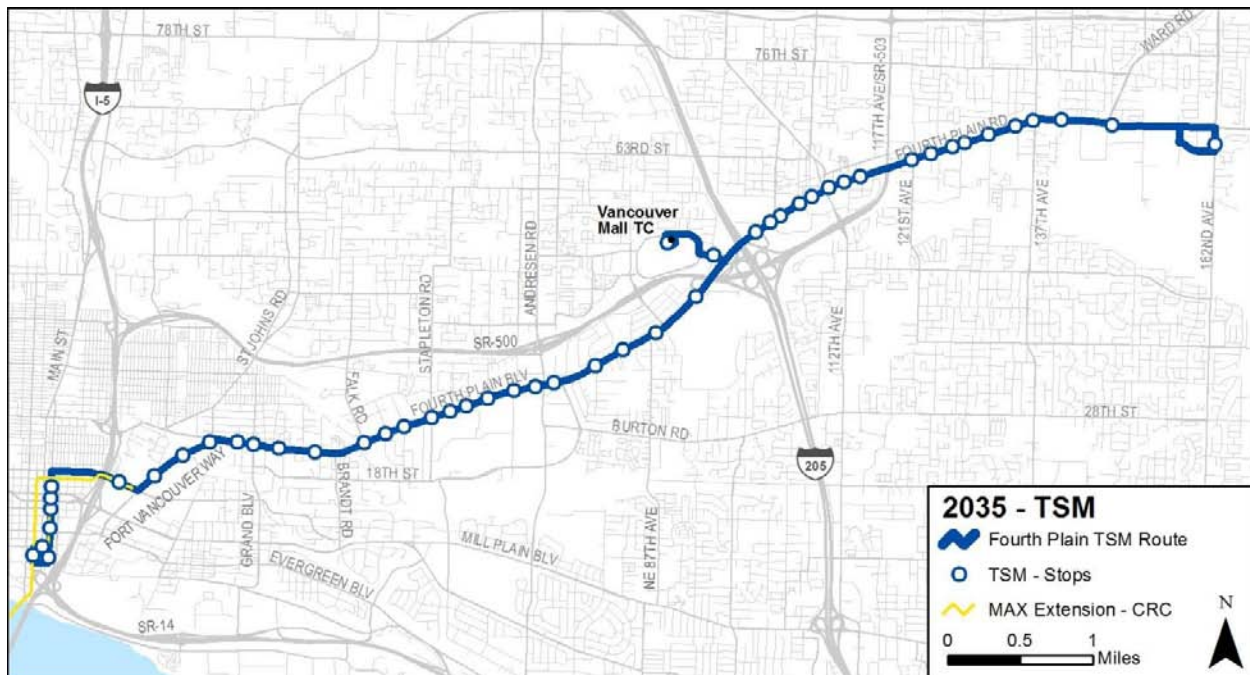
TSM ALTERNATIVE

The TSM Alternative (see Figure 3-5) is intended to be a low capital cost, non-BRT alternative that enhances transit service within the project corridor. The TSM Alternative is defined as follows:

- A new route that would replace Route 4 and 44 Limited. The TSM Route would follow the same route as BRT to 162nd Avenue (the BRT route is described below);
- Same service frequency as BRT (10 minutes peak and 15 minutes off-peak);
- Uses existing stop locations, with enhancements such as lighting and low-capital design improvements to enhance rider safety and security; and
- Includes transit signal priority at all signalized intersections between Fort Vancouver Way at McLoughlin Boulevard and Fourth Plain Boulevard at 162nd Avenue.

FIGURE 3-5

TSM Alternative

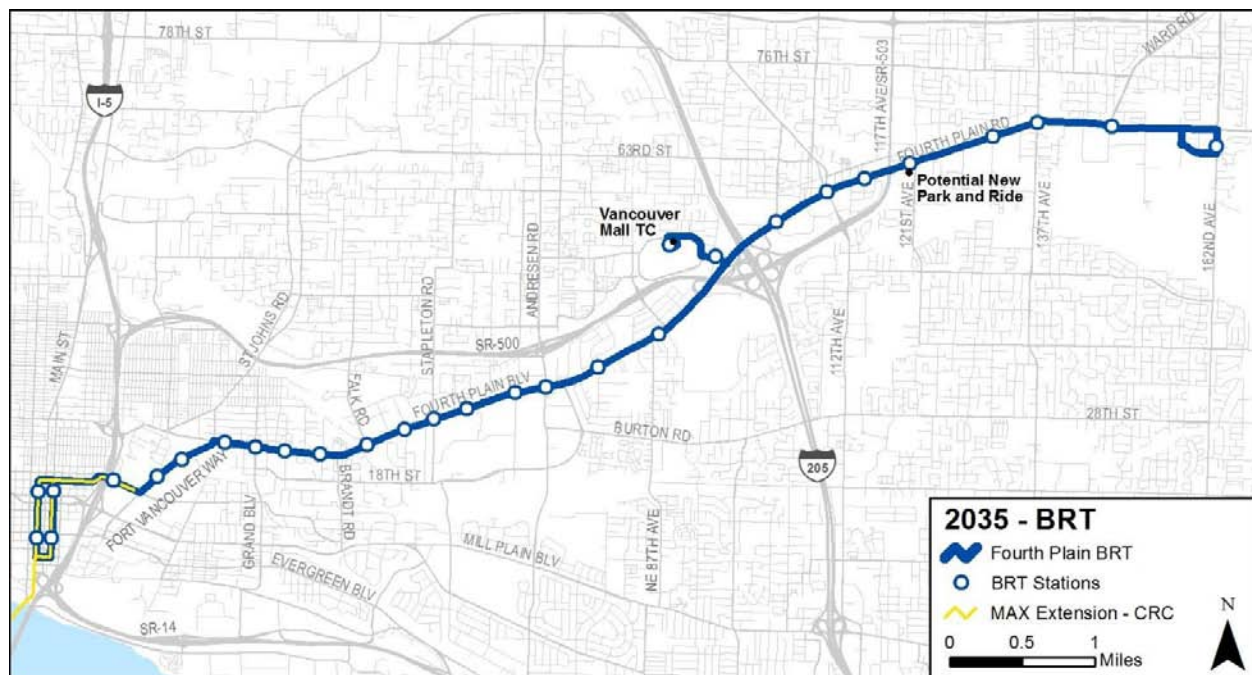


BRT ALTERNATIVE AND OPTIONS

The BRT Alternative (see Figure 3-6) would include a new route on Fourth Plain Boulevard that would replace both Route 4 and Route 44 Limited. From 7th and Washington Streets in downtown Vancouver, the BRT route would share the MAX Yellow Line LRT guideway that would be constructed as part of the CRC project between 7th Street and McLoughlin Boulevard/17th Street. In that section, BRT buses would also share the same station platforms. BRT buses would transition out of the LRT guideway on McLoughlin Boulevard east of I-5 (adjacent to the CRC Project Central Park-and-Ride facility). BRT buses would continue east on McLoughlin Boulevard, and turn north onto Fort Vancouver Way.

At Fourth Plain Boulevard, BRT buses would turn east on Fourth Plain Boulevard and continue to Vancouver Mall Drive, where they would turn north to serve the Westfield Vancouver Mall Transit Center via Vancouver Mall Drive and Vancouver Mall Loop. After leaving the transit center, BRT buses would travel along Vancouver Mall Loop and Vancouver Mall Drive back to Fourth Plain Boulevard. Then, depending on the eastern terminus option, buses would either continue east on Fourth Plain Boulevard or return to Fourth Plain Boulevard westbound.

FIGURE 3-6
BRT Alternative



BRT SEGMENT, TERMINUS AND ROUTING OPTIONS

The BRT Alternative is described according to its lane configuration (see Figure 3-7), routing and operational characteristics. The BRT Alternative would include either median stations or curbside stations depending on the lane configuration option described. The stations would typically include 60-foot long platforms with near-level boarding and fare machines. In the following BRT description, the curbside BRT stations would include platforms on either side of the street. Despite the separation, these paired station platforms are referred to as a single “station.” Median BRT stations, in some instances, would include a single platform shared by BRT traveling in both directions; these stations are also referred to as a single station.

The AA included seven distinct decision points that defined the major elements of the BRT Alternative. As described in Chapter One, three of the decision points were based on a full analysis and four of the decision points were based on a more limited analysis.

The full analysis choices represent the fundamental building blocks of a BRT Alternative (lane configuration, operations,

stations and terminus), while the limited analysis choices represent specific alignment or interim operations choices that are dependent on a few key factors. One fundamental difference between these decision points was the use of transportation model data. The alternatives defined for the full analysis choices were analyzed using regional model data regarding travel demand, transit ridership and travel time and detailed traffic analysis. The factors relating to the limited analysis choices are more localized and less dependent on the overall performance of the full BRT route.

Full Analysis Choices:

- Fort Vancouver Way Lane Configuration Options
- Fourth Plain Boulevard Lane Configuration Options
- Eastern Terminus Options

Limited Analysis Choices:

- Westfield Vancouver Mall Transit Center Routing Options
- Fort Vancouver Way/Veterans Administration Medical Center Routing Options
- Interim Cross Columbia River Service Options
- Park-and-Ride at 121st Avenue or 131st Avenue

Full Analysis Choices

For the full analysis choices, a set of consistent assumptions was developed in order to make comparisons among different lane configuration options and eastern terminus options. In several cases, assumptions were made for analysis purposes regarding a decision that would be made under the Limited Analysis Choices described above. For example, the exact location of a potential park-and-ride lot on Fourth Plain Road somewhere between 121st Avenue and 137th Avenue is discussed in detail under the Limited Analysis Choices section. However, for the Full Analysis Choices, which included travel demand modeling, a single location had to be assumed for the park-and-ride. The exact location would not affect the model results.

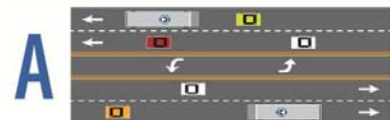
The following assumptions were included for analysis of the Full Analysis Choices:

- All lane configuration options were compared assuming an eastern terminus at 162nd Avenue.
- All BRT options would utilize the existing routing to access Westfield Vancouver Mall and the existing transit center location. Other routing options and station location options at Westfield Vancouver Mall are described below under Westfield Vancouver Mall Routing Options.
- Eastern terminus options were compared assuming mixed traffic curbside operation on Fort Vancouver Way and Fourth Plain Boulevard.

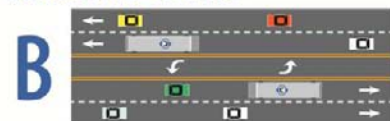
FIGURE 3-7

Lane Configuration

Mixed traffic – curbside



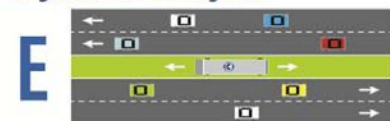
Mixed traffic – left lane



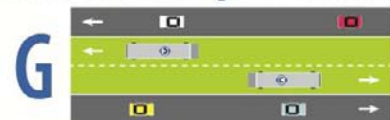
BAT lane – converted



Single center running lane



Double center running lane – converted



- Eastern terminus options at 121st Avenue and 162nd Avenue would include a new park-and-ride constructed in the vicinity of 121st Avenue or 131st Avenue. For purposes of consistent analysis, this park-and-ride was assumed to be located at 121st Avenue and is referred to in this report as the 121st Avenue Park-and-Ride. However, similar conclusions can be drawn for both park-and-ride locations.
- Two express routes (Routes 118 and 190) that are included in the 2035 No Build transit network would be rerouted to serve the new park-and-ride. (Route 118 is a future route that would replace the current 177, which serves the Evergreen Transit Center).
- Eastern terminus at Westfield Vancouver Mall would not include the new park-and-ride or the associated route changes.

Fort Vancouver Way Lane Configuration Options» The CAC, PMT, and C-TRAN Board of Directors narrowed the potential range of lane configurations for Fort Vancouver Way based on the project's Purpose and Need and Goals and Objectives. The lane configurations on Fort Vancouver Way² evaluated during the AA included (see Figure 3-7):

- A)** Mixed Traffic Curbside
- B)** Mixed Traffic Left Lane
- C)** BAT Lane Converted
- E)** Single Center Running Lane
- G)** Double Center Running Lane Converted

Each Fort Vancouver Way lane configuration option was analyzed with a consistent set of representative assumptions included in the other portions of the corridor (mixed traffic curbside on Fourth Plain Boulevard, an eastern terminus at 162nd Avenue, and Westfield Vancouver Mall access via Vancouver Mall Drive). Each lane configuration option included one shared LRT/BRT station on McLoughlin Boulevard and the following two station locations on Fort Vancouver Way between McLoughlin Boulevard and Fourth Plain Boulevard:

- One station located north of McLoughlin Boulevard, adjacent to the O'Connell Sports Center on the Clark College campus and the sports fields on the west side of Fort Vancouver Way.
- One station located immediately north of the main Clark College crosswalk adjacent to Gaiser Hall.

The following describes each of the lane configuration options for Fort Vancouver Way.

A. Mixed Traffic Curbside» On Fort Vancouver Way between McLoughlin Boulevard and Fourth Plain Boulevard, BRT buses would operate in mixed traffic in the right lane with curbside stations. Buses would stop in the traffic lane to serve the two stations in the Fort Vancouver Way segment. The existing 4-foot bike lanes that run continuously between McLoughlin Boulevard and Fourth Plain Boulevard would remain. Stations would include curb extensions and result in the removal of some parking spaces.

.....
 2 Note that the letters D. and F. are not included. These routing options were eliminated during the preliminary screening process described in Section 2.1.

B. Mixed Traffic Left Lane» Under this lane configuration option, BRT buses would operate in mixed traffic in the left lane on Fort Vancouver Way between McLoughlin Boulevard and Fourth Plain Boulevard. Stations would include a single, median station platform shared by buses operating in both directions. Buses would pull out of the traffic lane into a short bus-only lane (bus pullout) to serve these stations. Buses would shift from the left lane to the right lane after the last station on Fort Vancouver Way (in both directions) in order to make a right turn at either McLoughlin Boulevard or Fourth Plain Boulevard. A continuous bike lane with a minimum width of five feet would be retained on both sides of Fort Vancouver Way between McLoughlin Boulevard and Fourth Plain Boulevard. In the vicinity of the stations, traffic lanes would be shifted to accommodate the stations and bus pullouts, which would result in the removal of some on-street parking spaces.

C. BAT Lane Converted» This lane configuration option would be similar to A. Mixed Traffic Curbside on Fort Vancouver Way. However, rather than traveling in mixed traffic, BRT buses would operate in a semi-exclusive right lane, which would be converted into a BAT lane. In the BAT lane, BRT buses would share the right-lane with right-turning general purpose traffic. General purpose traffic using the right lane would use the lane to turn right into driveways or at cross streets, but could not use the lane to continue straight at intersections. BRT buses, on the other hand, would be able to use the right lane as a continuous travel lane. Through traffic for non-BRT vehicles would be limited to the left lane. Other elements of this lane configuration option, including the station design and bike lanes, would be identical to A. Mixed Traffic Curbside.

E. Single Center Running Lane» This lane configuration option would include sections of single bi-directional BRT running way located in the median of Fort Vancouver Way between McLoughlin Boulevard and Fourth Plain Boulevard. Stations would be located in the median. With this lane configuration option, the station north of McLoughlin Boulevard would be located approximately 200 feet north of the station location included in the other options.

Buses would operate in a single bi-directional lane for most of the segment along Fort Vancouver Way. The exceptions would be at the stations and at the ends of the segment. At the stations, northbound and southbound buses would each have their own lane on the right side of the station platform. From McLoughlin Boulevard eastbound BRT buses would turn north directly into a one-way median exclusive BRT lane that would continue to the southernmost station on Fort Vancouver Way. Southbound BRT buses would enter a mixed traffic lane after leaving the southernmost station on Fort Vancouver Way, shift to the right lane, and then turn right onto McLoughlin Boulevard. Northbound BRT buses would exit the bi-directional running way approximately 300 feet south of Fourth Plain Boulevard and shift to the right lane to make the right turn onto Fourth Plain Boulevard.

Depending on how BRT buses are scheduled, a bus using the bi-directional lane could traverse the entire length of Fort Vancouver Way without encountering a bus in the opposite direction. If scheduling required a passing to occur in this segment, a block signaling system would direct a bus to wait at the station platform until the bus in the opposite direction arrived at the same station.

G. Double Center Running Lane Converted» This lane configuration option would convert the left lane in both the north and south directions to an exclusive BRT lane on Fort Vancouver Way between McLoughlin Boulevard and Fourth Plain Boulevard. Stations would include a single median platform serving both directions. Buses would leave the exclusive running way approximately 300 feet prior to making a right turn at either end of the segment, similar to E. Single Center Running Lane.

Fourth Plain Boulevard Lane Configuration Options

The CAC, PMT, and C-TRAN Board narrowed the potential range of lane configurations for Fourth Plain Boulevard based on the project's Purpose and Need and Goals and Objectives. The lane configurations on Fourth Plain Boulevard evaluated during the AA included (from Figure 3-7):

- A)** Mixed Traffic Curbside
- B)** Mixed Traffic Left Lane
- C)** BAT Lane Converted

Each Fourth Plain Boulevard lane configuration option was analyzed with a consistent set of representative assumptions for station locations, pedestrian and bicycle amenities. The Limited Analysis Options, including routing decisions for Fort Vancouver way and the Westfield Vancouver Mall Transit Center, include different sets of station locations where they vary from the assumed corridor alignment. Each of the Fourth Plain Boulevard lane configuration options include stations located at or near the following intersections (on Fourth Plain Boulevard unless otherwise noted):

- Fort Vancouver Way
- A location between Grand Boulevard and Fairmount
- A location between Norris Road and Neals Lane
- Wilson Avenue (Mixed Traffic Curbside and BAT Lane only) or near Brandt Road (Mixed Traffic Left Lane only)
- Falk Road
- General Anderson Avenue
- Stapleton Road
- East of 57th Avenue
- 65th Avenue
- Andresen Road
- 78th Avenue
- 86th Avenue/Thurston Way
- On Vancouver Mall Drive at 94th Ave
- At the existing Vancouver Mall Transit Center
- 102nd Avenue
- Gher Road
- 114th Avenue
- 121st Avenue

- 131st Avenue
- 137th Avenue
- Ward Road/147th Avenue
- On 162nd Avenue southbound, south of Fourth Plain Road

The following describes each of the lane configuration options for Fourth Plain Boulevard between Fort Vancouver Way and Andresen Road. East of Andresen Road, BRT would be common among all the lane configuration options.

A. Mixed Traffic Curbside» Under A. Mixed Traffic Curbside on Fourth Plain Boulevard, BRT buses would operate in mixed traffic in the right lane with curbside stations. In most cases, buses would stop in the traffic lane to serve these stations. The following describes features of A. Mixed Traffic Curbside on Fourth Plain Boulevard, beginning at Fort Vancouver Way and proceeding to the east to Andresen Road.

A station platform would be located east of Fort Vancouver Way. The eastbound platform would be located on the curbside. The westbound station would be located in the median in order to facilitate the left turn to Fort Vancouver Way southbound. Westbound buses would shift from the right lane to the left lane prior to reaching this station. There would be a median bus pullout adjacent to the station platform to allow buses to pull out of the traffic lane. After leaving this station, buses would continue into the left turn lane to turn south onto Fort Vancouver Way. There would be a new pedestrian crossing located at the Fort Vancouver Way Station.

East of the station, BRT buses would travel in mixed traffic in the right lane and all stations would be curbside. A queue jump lane could be included at General Anderson Avenue and a new pedestrian crossing and refuge island would be included at the 57th Avenue station. BRT operations east of Andresen Road are described below under Lane Configuration Common to All Options.

B. Mixed Traffic Left Lane» B. Mixed Traffic Left Lane on Fourth Plain would include operation in mixed traffic in the left lane with median stations from Fort Vancouver Way to NE 65th Avenue. Between NE 65th Avenue and Andresen Road, this option would transition to curbside operation. From Andresen Road to the east, this option would be identical to A. Mixed Traffic Curbside with BRT buses operating in the right lane with curbside stations as described above. Station locations west of Andresen Road would serve the same general markets but would vary slightly in location from A. Mixed Traffic Curbside.

The following describes the features of B. Mixed Traffic Left Lane on Fourth Plain, beginning at Fort Vancouver Way and proceeding east to Andresen Road. Generally, the median stations would require additional right-of-way, compared to A. Mixed Traffic Curbside, in order to accommodate station platforms in the median, as well as bus pullouts adjacent to the platforms.

The Fort Vancouver Way station platforms would be in the same locations as A. Mixed Traffic Curbside, with the eastbound platform located on the curbside and the westbound platform located in the median with a bus pullout and a new pedestrian crossing.

East of the Fort Vancouver Way station, buses would operate in the left lane in mixed traffic. Stations would be located in the median and would include space for buses to pull out of the traffic lane to serve the stations.

The next station to the east would be located at Fairmount Avenue, one block east of Grand Boulevard. This station would be located at an existing, marked pedestrian crossing. This option would include changes to this pedestrian crossing, with the station platforms acting as a pedestrian refuge island. Turning movements to or from Fairmount Avenue would be restricted to right turns only.

The next station, at Neals Lane, would be located approximately one block west of Wilson Avenue. This station would also be located at an existing pedestrian crosswalk, would act as a pedestrian refuge island, and would restrict turns at driveways in the immediate vicinity to right-in/right-out only.

The station at Brandt Road, where there would not be a station under A. Mixed Traffic Curbside, would be located at an existing signal. This station would include a retaining wall adjacent to the sidewalk on the north side of Fourth Plain Boulevard to accommodate widening and would restrict one driveway to right-in/right-out movements.

The Falk Road station would have a shared station platform, with both eastbound and westbound boardings accommodated on the same platform. The 57th Avenue station would include a new pedestrian crossing, with the station platform acting as a pedestrian refuge island.

Stations at General Anderson Avenue, Stapleton Road, and 65th Avenue, would all be located at existing signals and existing pedestrian crossings. The station platforms would act as pedestrian refuge islands. The station at 65th Avenue would have a bus pullout in both directions to accommodate longer dwell times associated with C-TRAN driver reliefs that could occur at that location.

East of 65th Avenue, buses would shift from left lane operation to right lane operation. Operations east of Andresen Road are described below in Lane Configuration Common to All Fourth Plain Options.

C. BAT Lane Converted» C. BAT Lane Converted on Fourth Plain Boulevard would be similar to A. Mixed Traffic Curbside on Fourth Plain. Rather than traveling in mixed traffic, the right lane would be converted into a BAT lane between Fort Vancouver Way and Andresen Road. In the BAT lane, BRT buses would operate semi-exclusively in the right lane and would share the right lane with right-turning general purpose traffic. Through traffic would be limited to the left lane. Other elements of this option, including station locations and design and bike lanes, would be identical to A. Mixed Traffic Curbside. Operations east of Andresen Road are described below in Lane Configuration Common to All Fourth Plain Options.

Lane Configuration Common to All Options

East of Andresen Road, all stations would be curbside and BRT buses would travel in mixed traffic in the right lane. Queue jump lanes could be included at Andresen Road and SR 503/117th Avenue. Stations at 65th Avenue and Andresen Road would use bus pullouts and not stop in the traffic lane.

At Vancouver Mall Drive, BRT buses would turn left to serve Westfield Vancouver Mall. This is based on the existing routing. Other options are discussed for Westfield Vancouver Mall Routing Options in Section 7.1. Buses would run in the right lane on Vancouver Mall Drive, serving a station at 94th Avenue. Buses would then turn right onto Vancouver Mall Loop and follow it to the Vancouver Mall Transit Center. Buses would turn left into the transit center to serve a platform located similarly to the existing Route 4 and 44 stops. Buses would then utilize an adjacent parking aisle to turn around and head back to Vancouver Mall Loop. Buses would follow Vancouver Mall Loop back to Vancouver Mall Drive, turn left, and follow Vancouver Mall Drive back to Fourth Plain Boulevard, stopping again at 94th Avenue. Buses would then turn left onto Fourth Plain Boulevard and continue to the east (if the BRT terminus is not Westfield Vancouver Mall) or turn right on Fourth Plain Boulevard and head west (if the BRT terminus is Westfield Vancouver Mall). Westbound buses would also turn onto Vancouver Mall Drive from Fourth Plain Boulevard and follow the same routing to the mall transit center and back. A queue bypass lane at SR 500 could be considered as part of the next design phase in order to address a projected traffic delay.

The park-and-ride lot assumed for the full analysis would have approximately 200 spaces and would be located in the vicinity of 121st Avenue. This is an assumption for analysis. The actual location for this park-and-ride could be anywhere between 121st Avenue and 137th Avenue. A full description of the potential park-and-ride location options is included in Section 7.4.

At 162nd Avenue, eastbound BRT buses would turn right onto 162nd Avenue and serve a station located approximately 500 feet south of Fourth Plain Road. This station would include a bus pullout. After leaving this station, buses would turn right on 65th Street, right again on 157th Avenue, and then left onto Fourth Plain Road, returning in the westbound direction.

Eastern Terminus Options

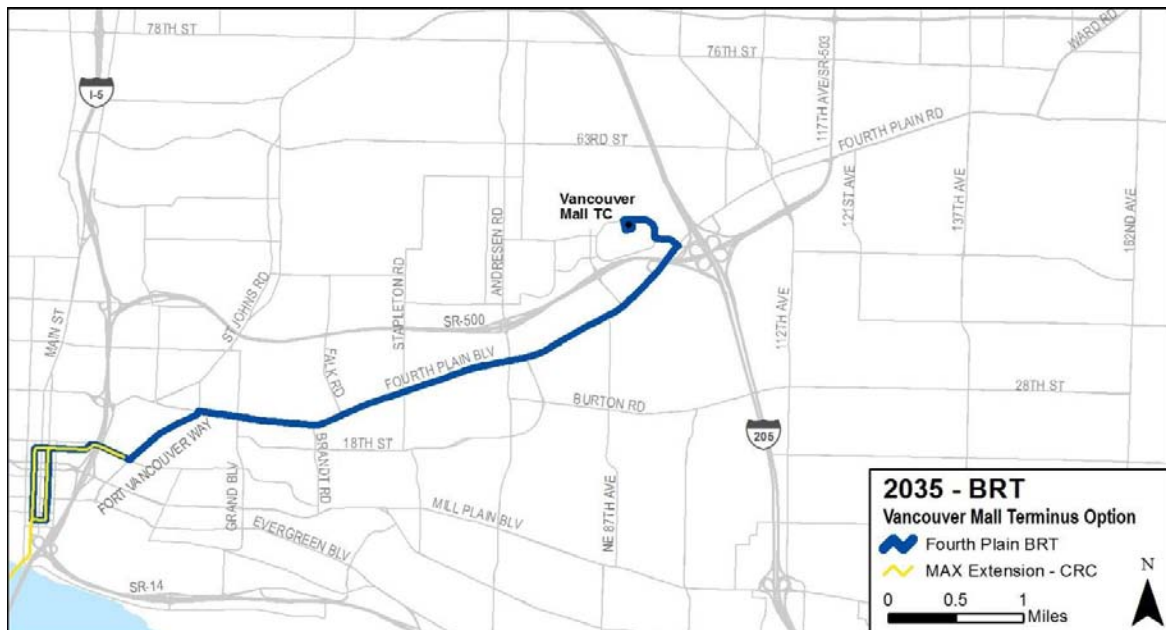
Three eastern terminus options were evaluated during the AA. These include a terminus option at Westfield Vancouver Mall, another at a park-and-ride in the vicinity of 121st Avenue, and another at 162nd Avenue. Each terminus option is being evaluated using data from A. Mixed Traffic Curbside for both Fort Vancouver Way and Fourth Plain Boulevard.

Westfield Vancouver Mall Terminus Option

With the Westfield Vancouver Mall Terminus Option, BRT service would end at the existing Vancouver Mall Transit Center (see Figure 3-8). This terminus option would not include the new park-and-ride in the vicinity of 121st Avenue. Eastbound BRT buses would turn left from Fourth Plain Boulevard onto Vancouver Mall Drive, follow Vancouver Mall Drive and Vancouver Mall Loop to the transit center, turn around, and follow the same route back to Fourth Plain Boulevard. Buses would then turn right onto Fourth Plain Boulevard to return westbound.

FIGURE 3-8

BRT Alternative, Vancouver Mall Terminus Option



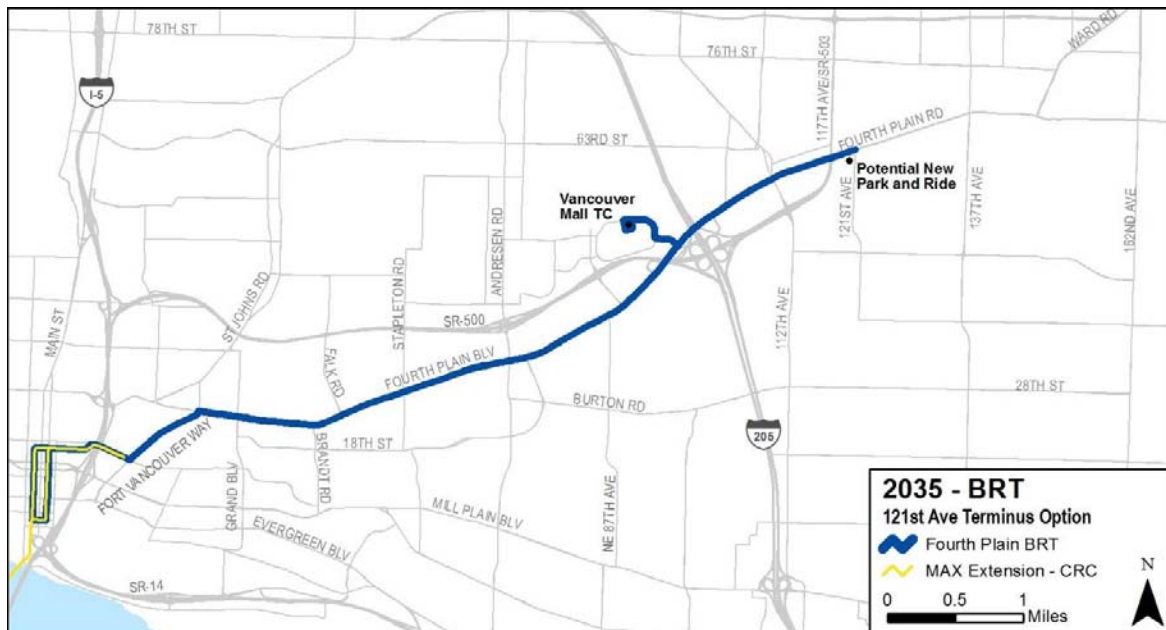
121st Avenue Terminus Option

With the 121st Avenue terminus option (see Figure 3-9), the BRT route would terminate at a park-and-ride lot assumed at 121st Avenue. As described above, the 121st park-and-ride has been assumed for the technical analysis in this AA. No definitive park-and-ride location has been determined and the 121st location provides a reasonable representative park-and-ride site and terminus location to be compared with the other two termini options. The actual location of a park-and-ride in this vicinity could be anywhere between 121st Avenue and 137th Avenue. It may also be determined that there is no need for a park-and-ride at either location. For more detail on the park-and-ride siting analysis, please refer to Section 7.4 of this report.

As a terminus, buses would serve the park-and-ride lot differently than under the 162nd terminus option. Under the 121st Avenue terminus option, eastbound BRT buses would turn into the park-and-ride lot via an access directly off of Fourth Plain Road. BRT buses would serve a station located within the park-and-ride site. BRT buses would then exit the park-and-ride via an access driveway onto 121st Avenue and turn left onto 121st Avenue. They would then turn left onto Fourth Plain Road to continue westbound.

FIGURE 3-9

BRT Alternative, 121st Avenue Terminus Option



162nd Terminus Option

The 162nd Avenue terminus option (see Figure 3-10) would extend BRT service to 162nd Avenue and include operating on a loop via 65th Street and 157th Avenue, as described above under A. Mixed Traffic Curbside. The 162nd Avenue terminus option would include the park-and-ride lot in the vicinity of 121st Avenue.

FIGURE 3-10

BRT Alternative, 162nd Terminus Option



BRT Operational Characteristics

The BRT Alternative would replace both Route 4 and Route 44 Limited. Currently Route 4 operates every 15 minutes on weekdays from 6:30 AM to 10:45 PM (30 minutes during the early morning and late evening) and generally every 17 to 18 minutes on Saturdays and Sundays (less frequent during the early morning and late evening). Route 44 Limited operates only during weekday peak hours with 30-minute service frequency. These routes are assumed to operate at the same frequencies under the 2035 No Build Alternative.

The BRT Alternative would operate at 10 minute frequency between 6:30 AM and 6:30 PM and 15-minute frequency early morning, evening, and weekend daytimes. Late evening service and early morning weekend service would be every 30 minutes. Peak hours are defined for travel demand modeling purposes as 7:00 to 9:00 AM and 4:00 to 6:00 PM.

Under the BRT Alternative, other transit routes would be adjusted to complement the BRT service. Assumptions were made for modeling purposes regarding other route changes that would occur with each 2035 modeling scenario in order to maintain consistency for comparison of alternatives. Adjustments were made to each of the following routes, included in C-TRAN's 2035 transit network, either in routing or frequency:

- Route 25 Fruit Valley/St. Johns: Route adjustment. No change to frequency
- Route 30 Burton: Route adjustment. No change to frequency
- Route 48 Van Mall/Fisher's Landing: Route adjustment, No change to frequency
- Route 72 Orchards: Frequency adjustment. No change to route
- Route 118 Express 18th Street: Route adjustment. No change to frequency
- Route 190 Express Marquam Hill: Route adjustment. No change to frequency

The following tables summarize the operational characteristics of the Fourth Plain routes and other C-TRAN routes that would be adjusted for each full analysis option. Table 3-4 focuses on the segment of the corridor between downtown Vancouver and Westfield Vancouver Mall, currently served by Route 4.

As shown in Table 3-4 and Figure 3-11, under the TSM and BRT alternatives, the new bus route (BRT or TSM) would no longer serve Fourth Plain Boulevard between Fort Vancouver Way and Main Street. Route 25 is proposed to be adjusted to cover this segment of Fourth Plain Boulevard. Also under the TSM and BRT alternatives, Route 44 would no longer travel on Evergreen Boulevard between Fort Vancouver Way and downtown Vancouver. Route 30 is proposed to be adjusted to cover this segment of Route 44 along Evergreen Boulevard.

FIGURE 3-11

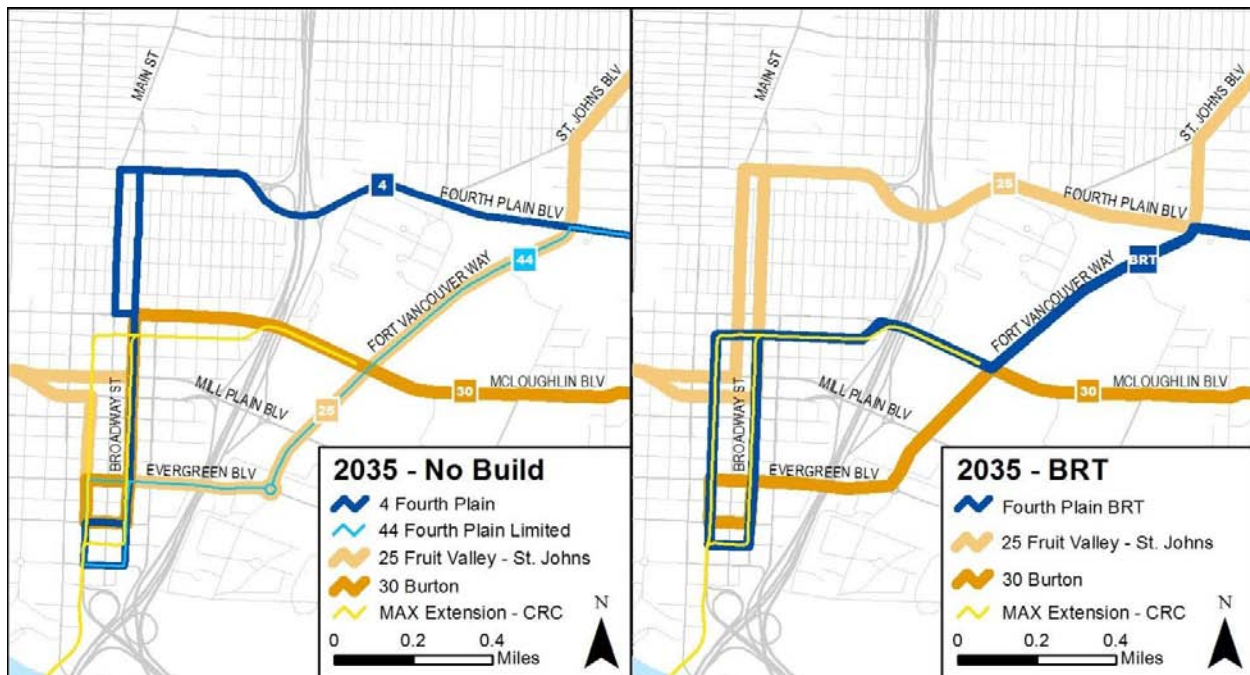
Proposed Transit Operational Changes—Downtown Vancouver to Westfield Vancouver Mall

TABLE 3-4

Transit Operational Changes—Downtown Vancouver to Westfield Vancouver Mall

	2035 No Build Alternative	2035 TSM Alternative	2035 BRT Alternative
Route 4	15 minutes all day	—	—
Route 44 Limited	30 minutes peak only	—	—
TSM Route	—	10 minutes weekday days 15 minutes or 30 min at other times	—
BRT Route	—	—	10 minutes weekday days 15 minutes or 30 min at other times
Route 25 Fruit Valley—St. Johns	Follows Fort Vancouver Way from Fourth Plain to Evergreen and Evergreen west into downtown	Follows Fourth Plain west from Fort Vancouver Way to Main and Main south to downtown	Follows Fourth Plain west from Fort Vancouver Way to Main and Main south to downtown
Route 30 Burton	Follows McLaughlin from Fort Vancouver Way to downtown	Follows Fort Vancouver Way from McLaughlin to Evergreen and Evergreen west into downtown	Follows Fort Vancouver Way from McLaughlin to Evergreen and Evergreen west into downtown

Table 3-5 focuses on changes from Westfield Vancouver Mall to 162nd Avenue, where the eastern terminus options would differ (see Figure 3-12). This segment of Fourth Plain Road is currently served by portions of Route 44 Limited and Route 72. In 2035, a planned Route 48 would run from Westfield Vancouver Mall to Fisher's Landing Transit Center via Fourth Plain Road and 162nd/164th Avenue.

Route 72, which serves portions of Fourth Plain Road east of Westfield Vancouver Mall, would have increased peak period service should the BRT route terminate at either the mall or 121st Avenue. This additional service is intended to compensate for the loss of the peak hour Route 44 service east of Westfield Vancouver Mall that would be eliminated with the implementation of the BRT Alternative.

For this analysis, future Route 48 would be truncated at the eastern terminus of the TSM or BRT route. Therefore, if BRT were to terminate at the Westfield Vancouver Mall, there would be no change to Route 48. Were BRT to extend to 121st Avenue or 162nd Avenue, the eastern terminus of the BRT route would be the western termination point for Route 48.

The other changes in the area of the eastern terminus depend on whether or not the park-and-ride would be constructed near 121st Avenue. As shown in Table 3-5, the 121st Park-and-Ride would be included if BRT extends to 121st Avenue or 162nd Avenue, but not with a BRT terminus at the Westfield Vancouver Mall. In addition, two express routes would be adjusted to serve the new park-and-ride under the 121st and 162nd eastern terminus options.

FIGURE 3-12

Transit Operational Changes—Westfield Vancouver Mall to Eastern Terminus

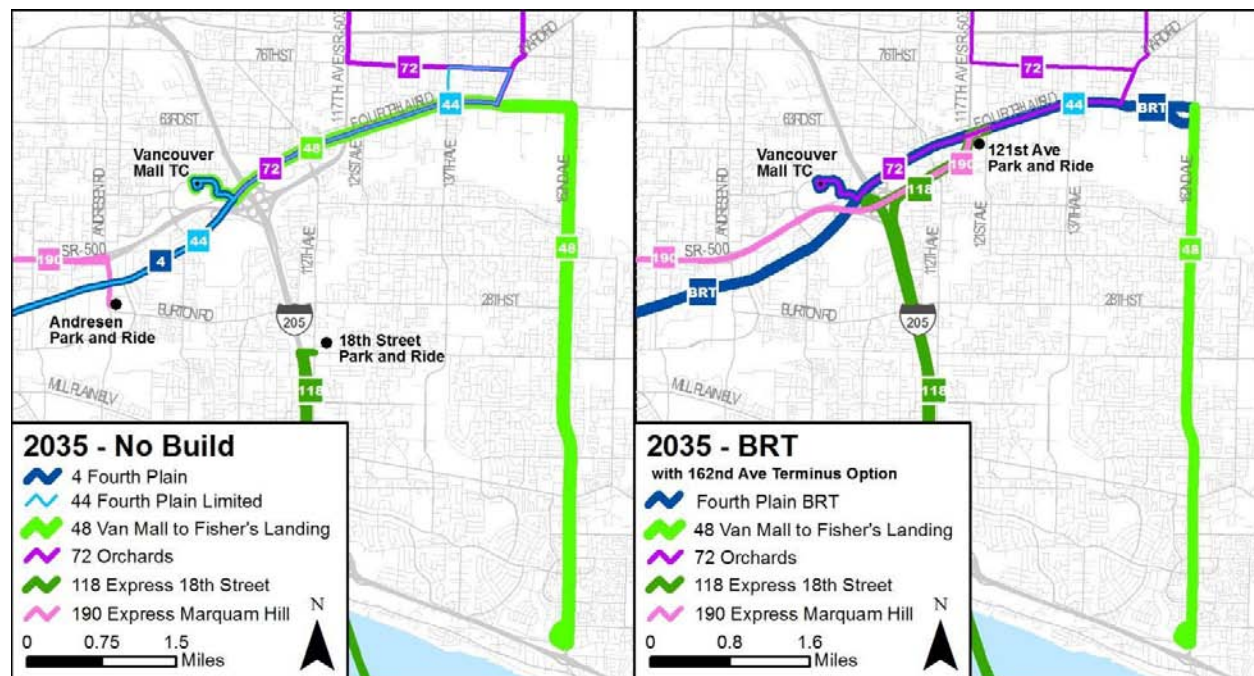


TABLE 3-5

Transit Operational Changes– Westfield Vancouver Mall to Eastern Terminus

	2035 No Build	2035 TSM	2035 BRT		
			to Van Mall	to 121st	to 162nd
Route 44 Limited	30 min. peak only	—	—		
Route 48 Van Mall to Fisher's Landing	New route in 2035 30 min. all day; follows Fourth Plain and 162nd/164th from Van Mall TC to Fisher's Landing TC	Truncated at Fourth Plain and 162nd	No change from No Build	Truncated at 121st P&R	Truncated at Fourth Plain and 162nd
TSM Route	—	10 min. week-day days 15 min. or 30 min at other times	—	—	—
BRT Route	—	—	—	10 min. weekday days 15 min. or 30 min at other times	10 min. weekday days 15 min. or 30 min at other times
Route 72 Orchards	60 min. all day	No change from No Build	30 min. peak 60 min. off-peak	30 min. peak 60 min. off-peak	No change from No Build
New P&R in vicinity of 121st	No	No	No	Yes	Yes
Route 118 18th St P&R Exp	Express route from 18th Street P&R to downtown Portland	No change from No Build	No change from No Build	Adjusted to serve 121st P&R rather than 18th Street P&R	Adjusted to serve 121st P&R rather than 18th Street P&R
Route 190 Marquam Hill Exp	Express route from Andresen P&R to Marquam Hill in Portland	No change from No Build	No change from No Build	Adjusted to serve 121st P&R rather than Andresen P&R	Adjusted to serve 121st P&R rather than Andresen P&R

Limited Analysis Choices

As described above there are four limited analysis choices:

- Westfield Vancouver Mall Transit Center Routing Options
- Fort Vancouver Way/Veterans Administration Medical Center Routing Options
- Interim Cross Columbia River Service Options
- Park-and-Ride at 121st Avenue or 131st Avenue

WESTFIELD VANCOUVER MALL ROUTING OPTIONS

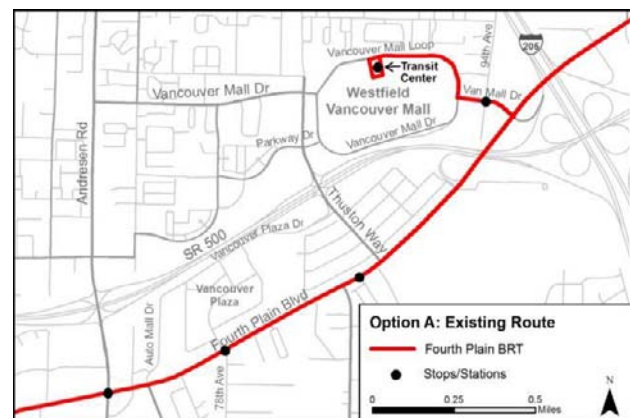
Westfield Vancouver Mall is an important destination for trips along the Fourth Plain Boulevard corridor. In addition to the employment and shopping opportunities at the mall, the Vancouver Mall Transit Center is a major transit center and transfer point for east Vancouver transit users. For the BRT Alternative, optimizing BRT service to Westfield Vancouver Mall and transit center would be an important factor in the potential success of the Fourth Plain TIP.

Five potential Westfield Vancouver Mall routing options were identified by the CAC, PMT, C-TRAN and the project team.

- A) Existing Route
- B) Thurston Way
- C) Eastern Spur
- D) Vancouver Plaza
- E) Endresen Road

Option A: Existing Route

Option A: Existing Route would utilize the same routing as the current Route 4 and Route 44 Limited. BRT buses would remain on Fourth Plain Boulevard between Thurston Way and Vancouver Mall Drive east of Westfield Vancouver Mall. At Vancouver Mall Drive BRT buses would turn northwest and circulate to the Vancouver Mall Transit Center on Vancouver Mall Loop. BRT buses would then turn around and follow the same route out of the mall and back to Fourth Plain Boulevard.



Option B: Thurston

Option B: Thurston would access Westfield Vancouver Mall on the west side via Thurston Way and Vancouver Mall Drive and continue to the transit center on the north side of the mall and continue to the east where the route would exit the mall property on Vancouver Mall Drive connecting back to Fourth Plain Boulevard. A variation of this option would be to utilize Vancouver Mall Drive (the south ring road at the mall) rather than Vancouver Mall Loop (the north ring road) and relocate the transit center to the south side of Westfield Vancouver Mall. This variation is a possible future routing alternative, but is not considered an option at this time since



relocation of the transit center is not being considered with this project.

Option C: Eastern Spur

Option C: Eastern Spur would remain on Fourth Plain Boulevard and utilize the eastern leg of Vancouver Mall Drive to enter the Westfield Vancouver Mall parking lot similar to Option A: Existing Route, but this route would minimize the deviation from Fourth Plain Boulevard by turning around in the southeastern portion of the mall parking lot, in the vicinity of the eastern intersection of Vancouver Mall Drive and Vancouver Mall Loop. This option would serve a new transit stop near the southeast entrance to the Westfield Vancouver Mall (near JC Penney). It would not directly serve the Vancouver Mall Transit Center. A variation of this option would be to relocate the transit center and its functions to this site. This variation is a possible future routing alternative, but is not considered an option at this time since relocation of the transit center is not being considered with this project.



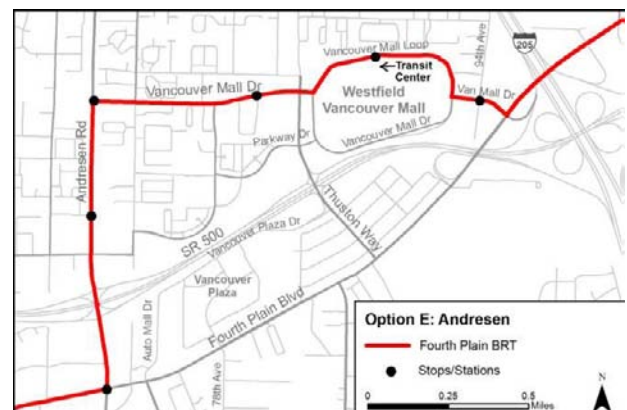
Option D: Vancouver Plaza

Option D: Vancouver Plaza would be similar to Option B: Thurston, but would serve Vancouver Plaza by traveling through the Vancouver Plaza shopping center between Fourth Plain Boulevard and Vancouver Plaza Drive. With this option, a station would be located within the Vancouver Plaza parking lot.



Option E: Andresen

Option E: Andresen would turn north on Andresen Road and travel east on Vancouver Mall Drive from Andresen Road to the Vancouver Mall Transit Center, and then continue east from the transit center along the same alignment as the other options, returning to Fourth Plain Boulevard via Vancouver Mall Drive.



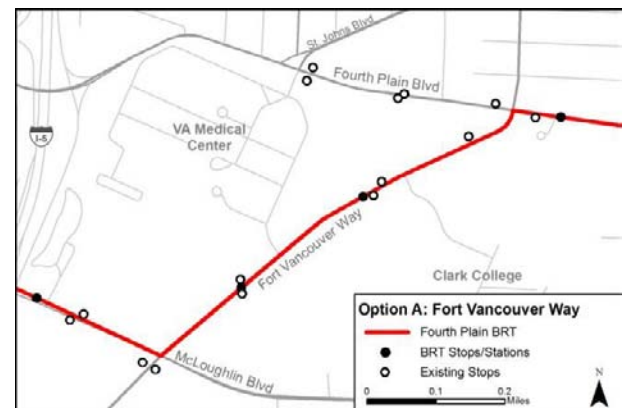
FORT VANCOUVER WAY/VETERANS AFFAIRS MEDICAL CENTER ROUTING OPTIONS

The BRT route travels in proximity to both Clark College and the U.S. Department of Veterans Affairs (VA) Medical Center. Both of these are important transit destinations. Three potential Clark College/VA Medical Center Routing Options have been identified by the CAC, PMT, C-TRAN and the project team:

- A)** Fort Vancouver Way
- B)** VA Medical Center
- C)** New Route East of VA Medical Center

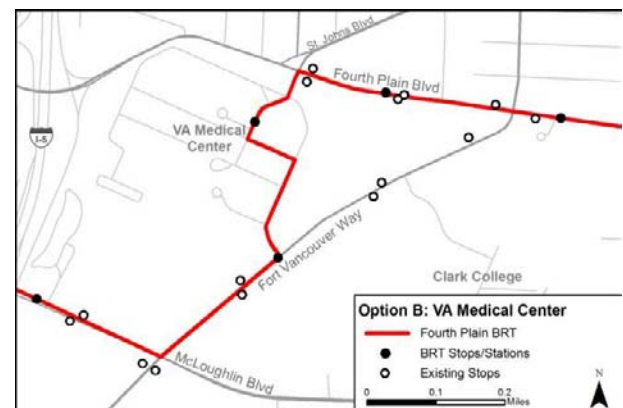
Option A: Fort Vancouver Way

This option would use Fort Vancouver Way for BRT travel between Fourth Plain Boulevard and McLoughlin Boulevard. There would be no deviation into or closer to the VA Medical Center to the west. Two stops would be provided on Fort Vancouver Way, one near the center of Clark College, and the second south of the south entrance to the VA Medical Center. Service into the VA Medical Center would be provided by other routes, with connections between those routes and the BRT route at the south entrance to the VA complex or on Fourth Plain Boulevard, east of Fort Vancouver Way.



Option B: VA Medical Center

Under this option, the BRT route would travel through the VA Medical Center. Traveling westbound on Fourth Plain Boulevard, the BRT service would continue beyond Fort Vancouver Way and turn left into the VA complex. The route would exit at the south end of the complex onto Fort Vancouver Way. The BRT service would use the same route in the opposite direction. Stops would be provided at Fourth Plain Boulevard and S Street, in the VA Medical Center, and on Fort Vancouver Way at the south entrance of the VA Medical Center.



Option C: New Route East of VA Medical Center

This option would use a new connection east of the VA Medical Center for travel between Fourth Plain Boulevard and Fort Vancouver Way. The westbound BRT route would continue on Fourth Plain Boulevard west of Fort Vancouver Way, turning left into the property just east of the VA Medical Center. The route would exit onto Fort Vancouver Way near the main entrance to Clark College. The same route would be used in the opposite direction. Stops would be on Fourth Plain Boulevard west of Fort Vancouver Way, on Fort Vancouver Way near the main entrance to Clark College, and on Fort Vancouver Way south of the entrance to the VA Medical Center.

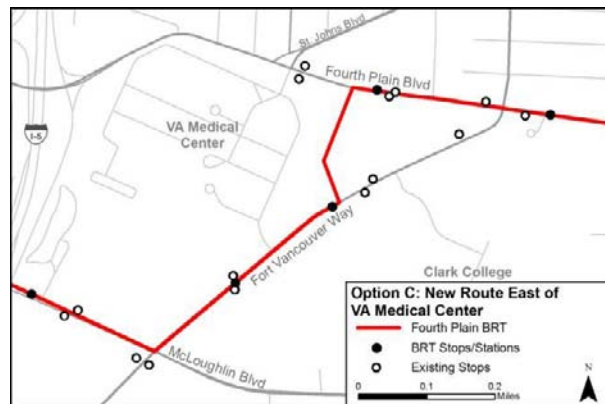


FIGURE 3-13
Interim Crossing Options

INTERIM CROSS COLUMBIA RIVER SERVICE OPTIONS

The light rail component of the CRC Project is anticipated to open in 2019, while the Fourth Plain TIP is planning to open in 2014. During the period between 2014 and the light rail project opening in 2019, the light rail guideway would not be available for BRT use. During this interim period, the BRT Alternative would run parallel to the planned light rail alignment from 7th and Washington Streets via Broadway and Washington Street to McLaughlin Boulevard (note that the planned light rail alignment is on 17th Street rather than McLaughlin west of I-5), then turn north onto Fort Vancouver Way.

Another aspect of the Interim BRT Operation would be the operating plan to connect with the existing MAX service at Delta Park in Portland. There are two options for this interim connection to the Delta Park MAX Station, the BRT Extension Option and the Shuttle Option.

Interim Crossing Option A: BRT Extension Option

Interim Crossing Option A would be an extension of BRT from downtown Vancouver to the Delta Park/Vanport MAX Station, and it would operate in lieu of routes 4, 44, and other C-TRAN routes that currently serve Delta Park (Routes 41 and 47). The alignment would serve Jantzen Beach, Hayden Island and Delta Park/Vanport, similar to existing service



on Route 4. Extending BRT from downtown Vancouver to Delta Park/Vanport would require approximately 15,400 additional platform hours and four additional peak buses. These buses would be branded BRT vehicles.

Interim Crossing Option B: Shuttle Option

Interim Crossing Option B would terminate the Fourth Plain BRT system in downtown Vancouver (at approximately 7th Street and Washington). A new shuttle bus route with frequent cross-river connector service to Jantzen Beach, Hayden Island and Delta Park/Vanport would be provided for cross-river trips. The shuttle would operate less frequently than the BRT Extension described in Option A. Creating a shuttle route between downtown Vancouver and Delta Park/Vanport would require approximately 15,500 platform hours and three peak buses to operate. This shuttle route would use standard buses and not the special BRT-branded buses.

PARK-AND-RIDE AT 121ST OR 131ST

As discussed, as part of the Fourth Plain TIP, C-TRAN is considering the development of a park-and-ride lot located at either 121st Avenue or between 131st and 137th avenues. The park-and-ride site is being considered as either a terminus point for the BRT corridor, or to be served as a mid-route stop if the terminus is east of the park-and-ride sites at 162nd Avenue. Also under consideration is a corridor terminus at Westfield Vancouver Mall, which would stop short of either of these two park-and-ride sites, in which the park-and-ride would not be part of the project.

Should a park-and-ride site be developed at either of these two locations, it could become a transit center within the C-TRAN system. The transit center could replace or supplement the existing transit center at Westfield Vancouver Mall. In addition, the park-and-ride could be used for commuter express routes serving Portland.

FIGURE 3-14

Park-and-Ride Terminus Options



Option A: West of 121st Avenue

As shown in Figure 3-14, Option A is a compilation of six parcels totaling over six acres located on the south side of Fourth Plain Boulevard, west of 121st Avenue. This site is approximately 1.5 miles east of the Fourth Plain Boulevard intersection with Vancouver Mall Drive. These parcels are zoned Community Commercial, which means that park-and-ride lots are a limited use requiring the development to meet specific development criteria.

Option B: East of 131st Avenue

Option B is a compilation of two parcels totaling over 11 acres located on the south side of Fourth Plain Boulevard between 131st and 137th Avenues. This site is approximately 2.2 miles east of the Fourth Plain Boulevard intersection with Vancouver Mall Drive, or 0.7 miles farther east than Option A. These parcels are zoned Light Industrial, which requires a park-and-ride lot to meet specific development criteria, similar to the requirement in a Community Commercial zone.

4. TRANSPORTATION ANALYSIS

The transportation analysis considers impacts on traffic (auto and freight), transit operations, transit ridership, and pedestrian and bicycle safety.

4.1 Traffic

4.1.1 EXISTING AND FUTURE TRAFFIC CONDITIONS

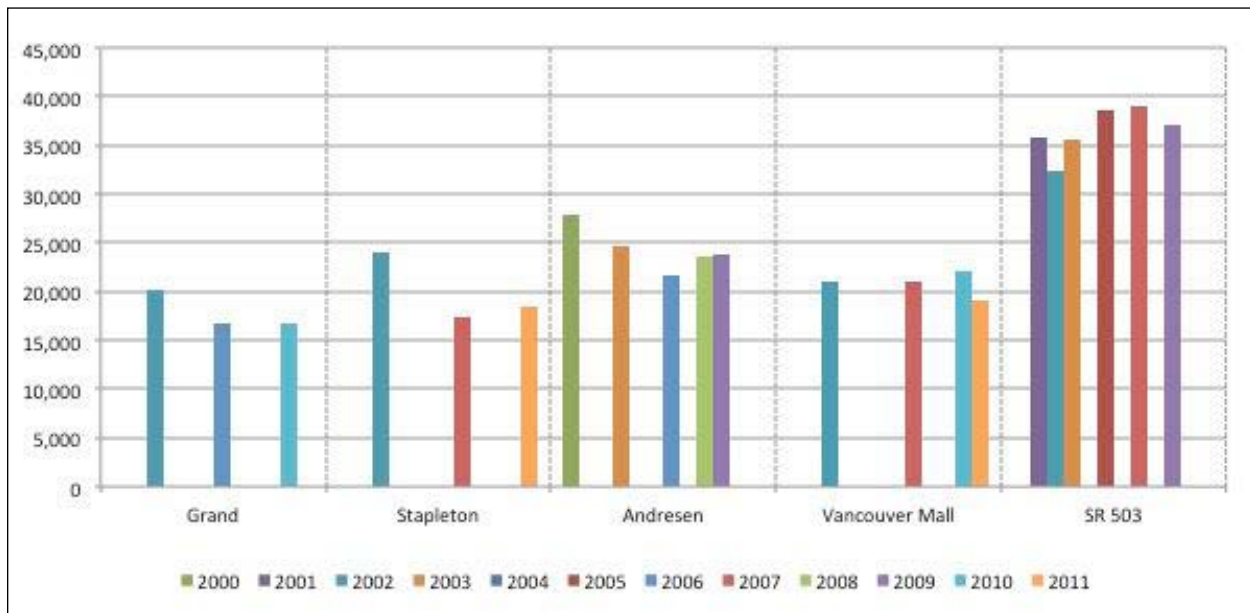
Figure 4-1 shows the major study area corridors and intersections that were included in the baseline traffic analysis. Daily traffic volumes along Fourth Plain Boulevard have remained relatively consistent over the past 10 years east of Andresen Road. Daily counts from Grand Boulevard to Andresen Road indicate a slight decrease in total daily traffic volumes on this segment of Fourth Plain Boulevard. This reduction in traffic volume is due to improvements to the parallel SR 500 and, to some degree, the economic recession that began in 2007. In general, traffic volumes, both daily and PM peak hour, increase further east along Fourth Plain Boulevard, with the highest volume intersections being NE Andresen Road and SR 503, as shown on Figure 4-2.

FIGURE 4-1

Transportation Study Area Corridors and Major Intersections between I-5 and SR 500/SR 503



FIGURE 4-2.
Historic Daily Traffic Volumes along Fourth Plain Boulevard



Travel time data indicates that the average PM peak speed eastbound on Fourth Plain Boulevard in 2011 is 26 miles per hour, while the average speed westbound is 24 miles per hour. Locations with the highest average speeds along Fourth Plain Boulevard are in areas where access management measures (e.g. medians) exist. The lowest speed locations along Fourth Plain Boulevard are near the intersections of SR 500, I-5 ramps, NE Stapleton Road, NE Burton Road, NE Andresen Road and Falk Road. Speeds along Fort Vancouver Way are generally lower compared to Fourth Plain Boulevard ranging from approximately 16 to 19 miles per hour during the PM peak hour.

Intersection operations in 2008 during the PM peak hour have degraded somewhat from those found in the corridor in 1999. The 2008 operations are in the level-of-service (LOS) B, C and D range, with the worst intersection being Fourth Plain Boulevard/SR 500/SR 503 and the Fourth Plain Boulevard/NE Andresen Road intersection both operating at LOS D (as shown in Table 4-1). Previous analysis indicated similar operations during the AM peak hour, with LOS operations in the B to C range with slightly lower volumes compared with the PM peak hour.

TABLE 4-1

Summary of Historic and Current Traffic Operations

Intersection	1999 PM Peak			2008 PM Peak		
	Delay	LOS	V/C	Delay	LOS	V/C
Fourth Plain Boulevard/Ft. Vancouver Way	—	—	—	34.2	C	0.65
Fourth Plain Boulevard/Grand Boulevard	—	—	—	28.5	C	0.66
Fourth Plain Boulevard/Falk Road	—	—	—	17.6	B	0.44
Fourth Plain Boulevard/General Anderson Road	—	—	—	14.5	B	0.43
Fourth Plain Boulevard/NE Stapleton Road	14.7	B	0.61	34.3	C	0.73
Fourth Plain Boulevard/NE 65th Avenue	—	—	—	36.3	D	0.80
Fourth Plain Boulevard/NE Andresen Road	23.7	C	0.82	44.3	D	0.85
Fourth Plain Boulevard/NE Burton Road	14.2	B	0.71	29.1	C	0.63
Fourth Plain Boulevard/Vancouver Mall Drive	16.0	C	0.61	33.3	C	0.74
Fourth Plain Boulevard/NE Covington Road	—	—	—	40.6	D	0.87
Fourth Plain Boulevard/SR 500/SR 503	38.2	D	0.85	46.1	D	0.94

Delay = Average intersection delay

LOS = Level of service

V/C = Volume-to-capacity

— = Data is not available

Freight activity along the corridor ranges from one to four percent range of total volumes at intersections. Freight activity is slightly higher at intersections that access major regional facilities such as I-5 and I-205.

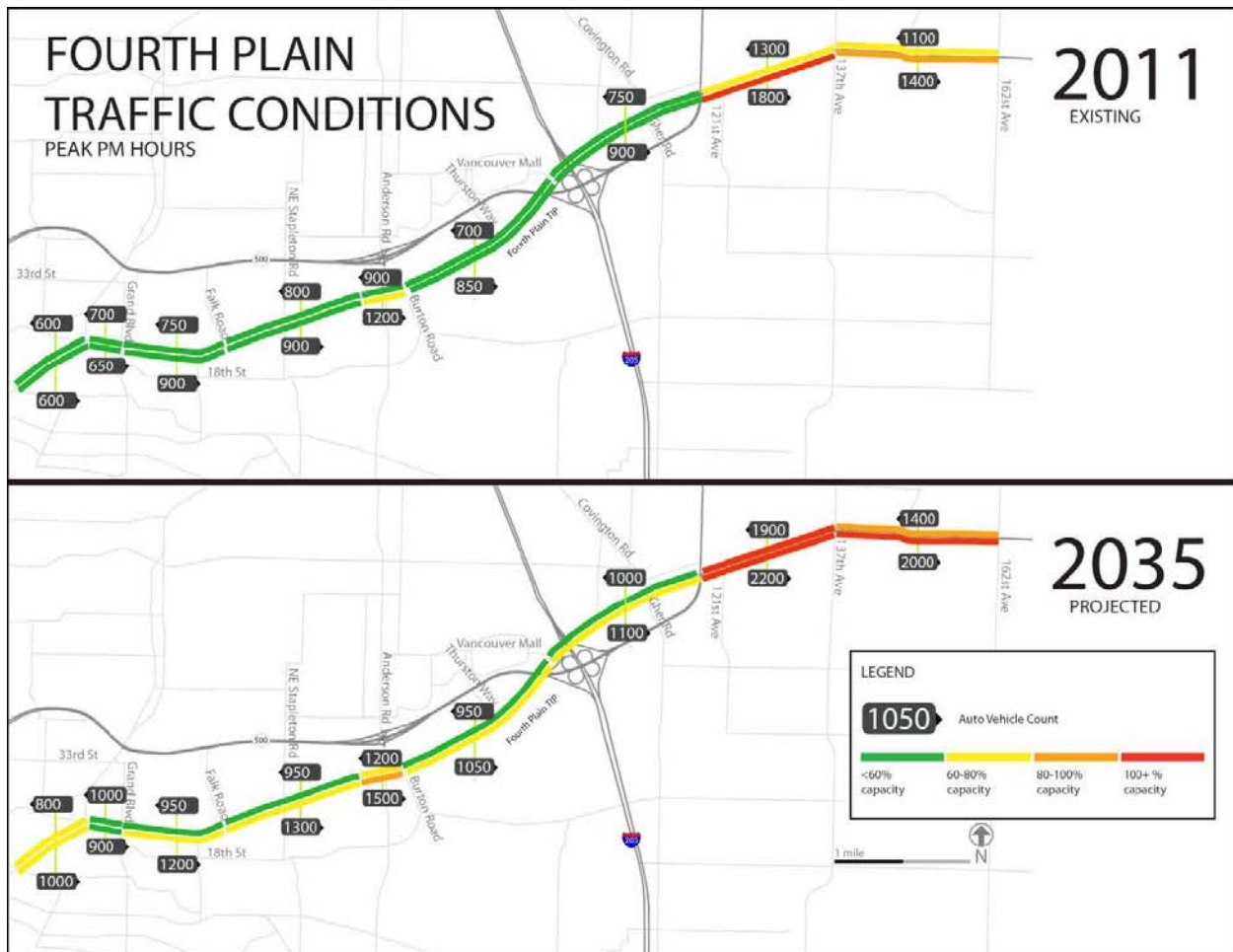
Two of the study area intersections, Fourth Plain Boulevard at SR 500 and Fourth Plain Boulevard at Andresen Road were on the top 20 high-collision locations for Clark County for the years 2007 to 2009. Fourth Plain Boulevard at SR 500 was eighth on the list with 75 collisions over that time period and the intersection of Fourth Plain Boulevard at NE Andresen Road was lower on the list with 32 collisions.

Projected Traffic Growth

Traffic conditions on Fourth Plain Boulevard are projected to worsen over time. Figure 4-3 shows existing traffic volumes (based on 2011 year data) and projected 2035 traffic volumes along the Fourth Plain TIP corridor during PM peak periods.

FIGURE 4-3

Existing and Future Traffic Volumes on Fourth Plain TIP Corridor During PM Peak Hours



Despite recent modest reductions in traffic volumes on Fourth Plain Boulevard and continuing improvements to SR 500 (including interchanges at Saint John's Road and Stapleton Road and the removal of the intersection at Falk Road), population and employment growth between now and 2035 is projected to increase volumes on Fourth Plain Boulevard over the long-term. As shown in Figure 4-3, PM peak hour traffic volumes are projected to grow by approximately 20 to 50 percent in 2035. This would result in more segments of the roadway approaching or exceeding motor vehicle capacity, particularly in the fast growing area east of 117th Avenue/SR 500 and along Fort Vancouver Way.

4.1.2 TRAFFIC EVALUATION METHODS

The following evaluation criteria were used to evaluate the performance for auto and freight travel time and reliability.

- PM peak hour auto/truck travel times
- Number of intersections below LOS D¹
- Total person capacity (auto and transit) at specified points along corridor

Auto and freight operations, travel time, capacity and reliability were evaluated for a forecast year of 2035 using a combination of RTC's regional travel demand model and detailed traffic analysis using VISSIM and Synchro microsimulation models.

- **RTC Regional Travel Demand Model**» RTC developed and maintains a regional, four-step travel demand model that is used for traffic analysis and forecasting for all major transportation projects in Clark County. The RTC model operates with EMME2 software. The regional model uses a 2035 forecast consistent with the travel forecasts used for the Clark County MTP. The model forecasts average weekday travel using motor vehicles and on transit. Transit ridership is forecast based on travel behavior survey data, the quality of the available transit service (frequency and travel time) and the demographic characteristics of the immediate area. The model also produces PM peak hour traffic and transit assignments to streets, highways and bus routes in the county and across the Columbia River to Oregon. Data outputs from the regional model were used as inputs to the microsimulation models, described next.
- **VISSIM**²» VISSIM is a traffic and transit microsimulation model that is used to provide detailed traffic and transit operations analysis. VISSIM is run in multiple repetitions to determine travel times and operational issues for mixing motor vehicles with transit vehicles in a variety of conditions and is particularly valuable in evaluating exclusive lane transit operations. VISSIM typically uses visual simulation as a tool to explain and report on traffic operations. Because VISSIM requires very detailed input data, VISSIM models were prepared for analysis for two of the highest and most complex traffic pattern segments of the corridor:
 - » Fourth Plain Boulevard between Brandt Road and 72nd Avenue
 - » Fort Vancouver Way between McLoughlin Boulevard and Fourth Plain Boulevard.
- **Synchro**³» Synchro is a widely used traffic analysis model that is typically used to evaluate traffic performance of individual intersections. Synchro uses traffic assignment data from the regional travel demand model to prepare an LOS analysis. This analysis can report on how each leg of an intersection performs; the length of queuing on each intersection leg; and the overall delay at an intersection.

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- 1 Level-of-Service (LOS) is an industry standard grading system used in traffic analysis to evaluate the performance of roadway facilities. Facilities such as intersections are ranked on a scale of A through F. LOS D is the intersection performance standard used by the City of Vancouver. LOS D describes traffic situations where speed and freedom to maneuver are restricted and comfort and convenience have declined but traffic flow remains stable. LOS E and F are generally considered congested and would result in undue delay.
- 2 VISSIM is a state-of-the-art traffic simulation model that was originally developed in Germany at Karlsruher Universität in 1979, and is distributed in the United States by PTV America.
- 3 Synchro is a leading traffic analysis software typically used for analyzing intersection performance; it is distributed by Trafficware, Ltd.

PM Peak Hour Travel Times» The regional model provided base transit and motor vehicle travel times based on projected travel demand and available roadway capacity and operations. Projected travel demand is for the PM peak period (4:00 PM to 6:00 PM weekdays) in 2035. The travel times were calibrated so that they reasonably represented projected growth above existing observed traffic and transit conditions. The travel times were then refined further using the VISSIM and Synchro models to provide detailed estimates based on the forecast roadway operations. The VISSIM and Synchro travel times were evaluated to ensure that they provided a realistic representation of possible future travel times based on the defined operating assumptions for each lane configuration option.

Intersection LOS» The traffic operations analysis used the VISSIM and Synchro models to analyze intersection operations related to traffic signal delay, queuing, traffic travel times, and fuel consumption. The analysis was prepared consistent with Highway Capacity Manual⁴ methods for intersection analysis.

Total Person Capacity» Total person throughput (both motor vehicle and transit) capacity was estimated at specific locations (screenlines) along the alignment in order to compare total person capacity (using transit and motor vehicles) through the corridor. Screenlines were defined at the following locations:

- Fort Vancouver Way (at Clark College)
- Fourth Plain Boulevard east of Grand Boulevard
- Fourth Plain Boulevard west of Stapleton Road
- Fourth Plain Boulevard west of 117th Avenue/SR 500

Person throughput capacity is defined as the total number of people that can functionally travel on the corridor in one hour, either on transit or in vehicles. Person capacity at screenlines was evaluated by adding person trips in autos in the peak hour and peak direction to calculated transit person capacity (described under 4.2 Transit Operations).

4.1.3 TRAFFIC EVALUATION FINDINGS

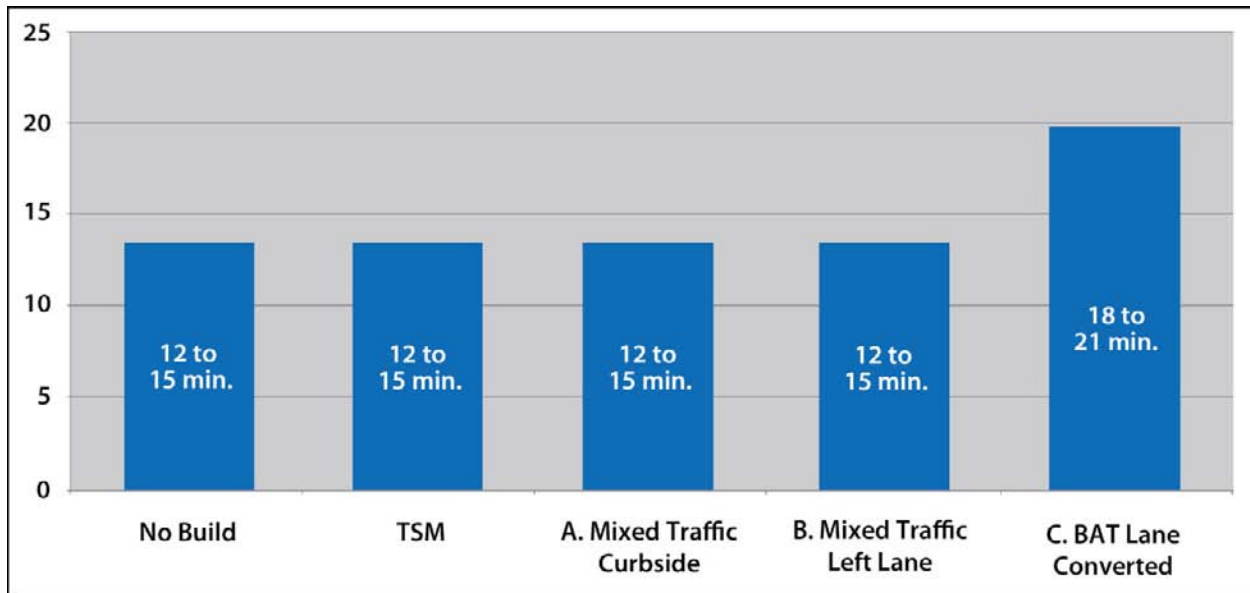
Fourth Plain Lane Configuration Options

PM Peak Hour Motor Vehicle Travel Times» Under the No Build Alternative, it would take approximately 12 to 15 minutes to travel by auto or truck along Fourth Plain Boulevard from Fort Vancouver Way to Vancouver Mall Drive in the PM peak hour in 2035. This trip would take the same travel time under the TSM Alternative, the A. Mixed Traffic Curbside option, and the B. Mixed Traffic Left Lane option. Under C. BAT Lane Converted, the same trip during the PM peak period would increase by approximately 45 percent compared to the No Build Alternative, for a travel time of approximately 18 to 21 minutes. This would be due to reduced roadway capacity for through trips from converting the right lane of Fourth Plain Boulevard to a BAT lane between Fort Vancouver Way and Andresen Road. Figure 4-4 summarizes these findings.

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4 Transportation Research Board. Highway Capacity Manual 2000.

FIGURE 4-4

2035 Auto and Truck Travel Time on Fourth Plain Boulevard, Fort Vancouver Way to Vancouver Mall Drive Eastbound During PM Peak Hour (in minutes)



Intersection LOS» Under the No Build Alternative, TSM Alternative, A. Mixed Traffic Curbside, and B. Mixed Traffic Left Lane there would be nine signalized intersections along Fourth Plain Boulevard from Fort Vancouver Way to 162nd Avenue that would operate at LOS E or LOS F (shown in bold in Table 4-2). These include:

- Fourth Plain Boulevard and Fort Vancouver Way
- Fourth Plain Boulevard and Stapleton Road
- Fourth Plain Boulevard and 65th Avenue
- Fourth Plain Road and Andresen Road
- Fourth Plain Road and 86th Avenue
- Fourth Plain Road and 117th Avenue/SR 500
- Fourth Plain Road and 121st Avenue
- Fourth Plain Road and 131st Avenue
- Fourth Plain Road and 137th Avenue

With C. BAT Lane Converted, there would be three additional signalized intersections that would operate at LOS E or LOS F (shown in shaded cells in Table 4-2):

- Fourth Plain Boulevard and Grand Boulevard
- Fourth Plain Boulevard and Brandt Road
- Fourth Plain Boulevard and Falk Road

TABLE 4-2.

Intersection Level-of-Service (LOS) on Fourth Plain Boulevard

Intersection	2035 No Build	2035 TSM	2035 BRT A. Mixed Traffic Curbside	2035 BRT B. Mixed Traffic Left Lane	2035 BRT C. BAT Lane Converted
Fourth Plain Blvd./Fort Vancouver Way	F	F	F	F	F
Fourth Plain Blvd./Grand Blvd.	D	D	D	D	E
Fourth Plain Blvd./Norris Rd.	A	A	A	A	B
Fourth Plain Blvd./Brandt Rd.	B	B	B	B	E
Fourth Plain Blvd./Falk Rd.	C	C	C	C	E
Fourth Plain Blvd./Wintler Dr.	A	A	A	A	A
Fourth Plain Blvd./Caples Ave.	B	B	B	B	B
Fourth Plain Blvd./General Anderson Rd.	A	A	A	A	B
Fourth Plain Blvd./Stapleton Rd.	E	E	E	E	E
Fourth Plain Blvd./57th Ave.	B	B	B	B	B
Fourth Plain Blvd./62nd Ave.	B	B	B	B	B
Fourth Plain Blvd./65th Ave.	F	F	F	F	F
Fourth Plain Rd./Andresen Rd.	F	F	F	F	F
Fourth Plain Rd./Burton Rd. (Auto Mall Dr.)	D	D	D	D	D
Fourth Plain Rd./78th Ave.	B	B	B	B	B
Fourth Plain Rd./86th Ave.	F	F	F	F	E
Fourth Plain Rd./Thurston Wy.	B	B	B	B	B
Fourth Plain Rd./Spokane Wy. (I-205 SB)	B	B	B	B	B
Fourth Plain Rd./Vancouver Mall Dr.	D	D	D	D	D
Fourth Plain Rd./102nd Ave.	C	C	C	C	C
Fourth Plain Rd./106th Ave. (Coxley Dr.)	B	B	B	B	B
Fourth Plain Rd./Gher Rd. (Covington Rd.)	D	D	D	D	D
Fourth Plain Rd./114th Ave.	C	C	C	C	C
Fourth Plain Rd./117th Ave. (SR 500)	F	F	F	F	F
Fourth Plain Rd./121st Ave.	F	F	F	F	F
Fourth Plain Rd./131st Ave.	F	F	F	F	F
Fourth Plain Rd./137th Ave.	F	F	F	F	F
Fourth Plain Rd./143rd Ave.	A	A	A	A	A
Fourth Plain Rd./Ward Rd.	C	C	C	C	C
Fourth Plain Rd./157th Ave.	B	B	B	B	B
Fourth Plain Rd./162nd Ave.	D	D	D	D	D

Intersections that would not meet LOS standards are shown in bold.

Shaded cells indicate intersections that would be worse than under No Build and would not meet LOS standards.

As shown in the table, there would be no differences among the No Build, TSM, or BRT with A. Mixed Traffic Curbside or B. Mixed Traffic Left Lane alternatives in intersection traffic performance. With the lane restrictions associated with C. BAT Lane Converted, the LOS performance would decline at some intersections between Fort Vancouver Way and Andresen Road, including Grand Boulevard, Brandt Road, and Falk Road, which, at LOS E, would fail to meet city performance standards with this option.

Total Person Capacity» Option C. BAT Lane Converted would have the lowest total person capacity during PM peak conditions in the peak direction. Auto capacity would be diminished because the right lane would be restricted to right-turning vehicles and buses only (Table 4-3) and the transit capacity would be the same as with the other BRT alternatives. The No Build Alternative would have a higher total person capacity than C. BAT Lane Converted, but lower PM peak capacity than A. Mixed Traffic Curbside or B. Mixed Traffic Left Lane, due to increased transit capacity for those two BRT lane configurations.

TABLE 4-3

Total PM Peak Hour, Peak Direction Person Capacity on Fourth Plain Boulevard East of Grand Boulevard

	2035 No Build	2035 TSM	2035 BRT A. Mixed Traffic Curbside	2035 BRT B. Mixed Traffic Left Lane	2035 BRT C. BAT Lane Converted
Auto Person Capacity	1,900	1,900	1,900	1,900	1,430
Transit Person Capacity	280 to 350	280 to 350	580 to 710	580 to 710	580 to 710
Total Person Capacity	2,180 to 2,250	2,180 to 2,250	2,480 to 2,610	2,480 to 2,610	2,010 to 2,140

Fort Vancouver Way Lane Configuration Options

The RTC travel demand model forecasts significant PM peak hour traffic growth on Fort Vancouver Way in 2035. This traffic growth results from several factors, including the added capacity on I-5 across the Columbia River with the CRC project, increased employment in downtown Vancouver, increased congestion on most roadways north and east out of downtown, as well as the 1,800 space Central Park-and-Ride planned as part of the CRC project.

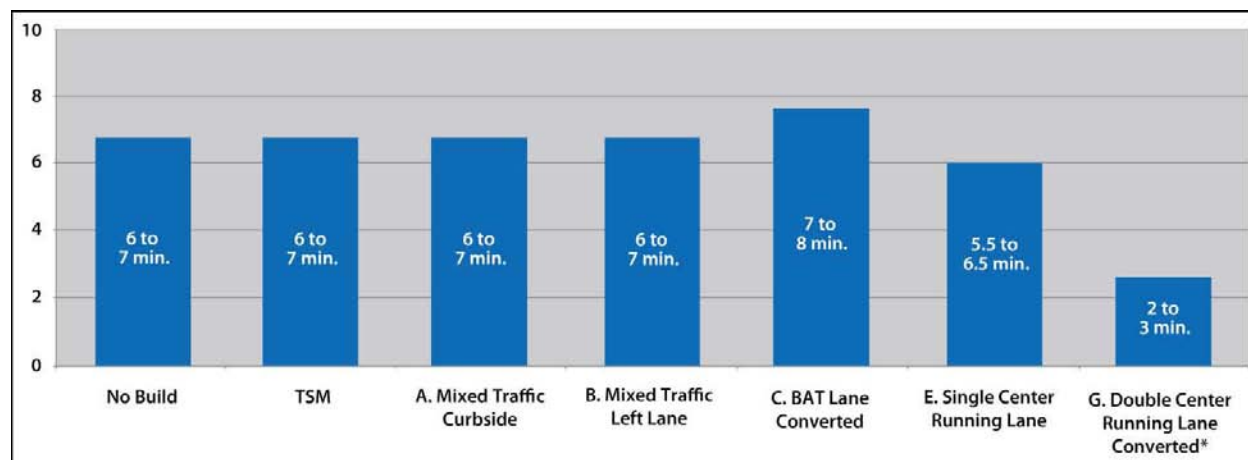
I-5 through central Vancouver is forecast to become increasingly congested during PM peak times, resulting in increased use of alternate routes, such as Fort Vancouver Way, for travel between downtown Vancouver and destinations to the north and east. As shown in Figure 4-3 in Section 4.1.1, PM peak hour volumes on Fort Vancouver Way are projected to grow by approximately 67 percent in the outbound direction by 2035, from 600 to 1,000 vehicles per hour. The traffic growth on Fort Vancouver Way emphasizes its important role in the City of Vancouver's roadway system to provide connections from central Vancouver to Fourth Plain Boulevard, St. Johns Boulevard and SR 500.

PM Peak Hour Motor Vehicle Travel Times» Under the No Build Alternative it would take approximately 6 to 7 minutes to travel by auto or truck on Fort Vancouver Way from McLoughlin Boulevard to Fourth Plain Boulevard during the PM peak hour (see Figure 4-5). Delay that occurs in this segment of Fort Vancouver Way is due in part to high volumes of traffic turning right onto Fourth Plain Boulevard, which results in a long northbound queue approaching the intersection. This travel time would be the same as the No Build Alternative for either the A. Mixed Traffic Curbside or B. Mixed Traffic Left Lane configurations. Travel times would increase by approximately one minute with C. BAT Lane Converted because the right travel lane would be restricted to buses and right-turning traffic in both directions. Travel times with E. Single Center Running Lane would decrease approximately 30 seconds compared to the No Build Alternative.

Under G. Double Center Running Lane Converted, motor vehicle travel time within the same distance would be reduced to between 2 and 3 minutes. With G. Double Center Running Lane Converted, Fort Vancouver Way would be reduced to a single travel lane for motor vehicles in each direction in this area. This situation would result in very long PM peak hour vehicle queues south and west of the intersection of Fort Vancouver Way and McLoughlin Boulevard, resulting in many fewer cars being able to travel through the segment of Fort Vancouver Way north of McLoughlin Boulevard. Although there would be long queues to access Fort Vancouver Way, this smaller number of vehicles would be able to travel through this section unimpeded and a much lower volume of vehicles would arrive at the Fort Vancouver Way and Fourth Plain Boulevard intersection, which would result in much faster motor vehicle travel between McLoughlin Boulevard and Fourth Plain Boulevard. If the travel time analysis were expanded to encompass Fort Vancouver Way south of McLoughlin Boulevard (as well as McLoughlin Boulevard and Mill Plain Boulevard west of Fort Vancouver Way), G. Double Center Running Lane Converted would likely show a significant increase in PM peak motor vehicle travel time compared to the No Build Alternative and the other BRT lane configuration options.

FIGURE 4-5

2035 Auto and Truck Travel Time on Fort Vancouver Way, McLoughlin Boulevard to Fourth Plain Boulevard Northbound During PM Peak Hour (in minutes)



*Because the long traffic queues occurring outside our modeled area, the effect of the queuing south and west of Fort Vancouver Way and McLoughlin Boulevard is not captured in the travel time data reported in Figure 4-5. If that queuing effect was included travel times for G. would be similar to or worse than the other alternatives.

Intersection LOS» In the Fort Vancouver Way segment LOS was analyzed at two intersections, Fort Vancouver Way at McLoughlin Boulevard and Fort Vancouver Way at Fourth Plain Boulevard (see Table 4-4). The intersection of Fort Vancouver Way at McLoughlin Boulevard is forecast to operate at LOS C in 2035 under the No Build Alternative, the TSM Alternative, and all the BRT lane configuration options. The intersection of Fort Vancouver Way at Fourth Plain Boulevard is forecast to operate at LOS F in 2035 under the No Build Alternative, the TSM Alternative, and all the BRT lane configuration options.

TABLE 4-4

Intersection Level-of-Service (LOS) on Fort Vancouver Way

Intersection	2035 No Build	2035 TSM	2035 BRT A. Mixed Traffic Curbside	2035 BRT B. Mixed Traffic Left Lane	2035 BRT C. BAT Lane Con- verted	2035 BRT E. Single Center Run- ning Lane	2035 BRT G. Double Center Running Lane Converted
Fort Vancouver Way/ McLoughlin Blvd.	C	C	C	C	C	C	C
Fort Vancouver Way/ Fourth Plain Blvd.	F	F	F	F	F	F	F

Intersections that would not meet LOS standards are shown in bold.

Total Person Capacity»A. Mixed Traffic Curbside, B. Mixed Traffic Left Lane, and E. Single Center Running Lane would have the highest PM peak hour total person capacity, approximately 20 percent higher than the No Build Alternative (Table 4-5). This is due to an increase in transit capacity under the BRT lane configuration options and maintaining the same motor vehicle capacity as the No Build Alternative.

G. Double Center Running Lane Converted would decrease total person capacity on Fort Vancouver Way due to a reduction in auto capacity. C. BAT Lane Converted would reduce auto capacity, but not as much as under G. Double Center Running Lane Converted. The TSM Alternative would result in an approximately five percent increase in total person capacity on Fort Vancouver Way compared to the No Build Alternative.

TABLE 4-5

Total PM Peak Hour, Peak Direction Person Capacity on Fort Vancouver Way at Clark College

	2035 No Build	2035 TSM	2035 BRT A. Mixed Traffic Curbside or B. Mixed Traffic Left Lane	2035 BRT C. BAT Lane Converted	2035 BRT E. Single Center Running Lane	2035 BRT G. Double Center Running Lane- Converted
Auto Person Capacity	1,740	1,740	1,740	1,310	1,740	870
Transit Per- son Capacity	200 to 250	280 to 350	580 to 710	580 to 710	580 to 710	580 to 710
Total Person Capacity	1,940 to 1,990	2,020 to 2,090	2,320 to 2,450	1,880 to 2,010	2,320 to 2,450	1,450 to 1,580

Eastern Terminus Options

PM Peak Hour Motor Vehicle Travel Times» The motor vehicle travel times reported in Figure 4-4 are based on PM peak hour travel on Fourth Plain Boulevard between Fort Vancouver Way and Vancouver Mall Drive. BRT east of the Westfield Vancouver Mall would use the Curbside Mixed Traffic lane configuration and, as a result, the BRT operation would have limited impact on motor vehicle travel times compared with the No Build Alternative (the reduced bus dwell times with BRT would provide a slight reduction in auto travel time).

Intersection LOS» Between the Westfield Vancouver Mall and 162nd Avenue, there are four intersections with Fourth Plain Boulevard that are forecast to operate at LOS E or F under the No Build Alternative or the BRT Alternative (see Table 4-2). These include the intersections with 117th Avenue/SR 500, 121st Avenue, 131st Avenue and 137th Avenue. BRT with a 121st Avenue terminus would be subject to delay at two of these intersections. BRT with a 162nd Avenue terminus would be subject to delay at all four of these intersections.

Total Person Capacity» Person capacity was assessed on Fourth Plain Road west of 117th Avenue/SR 500 (Table 4-6). Unlike at Fourth Plain Boulevard at Grand Boulevard and on Fort Vancouver Way (see Tables 4-3 and 4-5), where the BRT alternative would provide greater passenger capacity than the No Build alternative, at this location the BRT alternative with the Westfield Vancouver Mall terminus would perform the same as the No Build alternative. This is because this location is east of the Westfield Vancouver Mall terminus location and, therefore, would not be served by BRT. As can be seen in Table 4-6, when the BRT is extended to a 121st Avenue or 162nd Avenue terminus, the BRT alternative would result in approximately 18 to 21 percent higher total person capacity at this location than with the No Build Alternative or the Westfield Vancouver Mall terminus, and 15 to 18 percent higher total person capacity than with the TSM Alternative. Between 121st Avenue and 162nd Avenue, the BRT Alternative with a 162nd Avenue terminus would have approximately 18 percent higher total person capacity than with the 121st Avenue terminus.

TABLE 4-6

Total PM Peak Hour, Peak Direction Person Capacity on Fourth Plain Road west of 117th/SR 500

	2035 No Build	2035 TSM 162nd Avenue Terminus)	2035 BRT Van Mall Terminus	2035 BRT 121st Avenue Terminus	2035 BRT 162nd Avenue Terminus
Auto Person Capacity	1,710	1,710	1,710	1,710	1,710
Transit Person Capacity	200 to 250	240 to 300	200 to 250	540 to 660	540 to 660
Total Person Capacity	1,910 to 1,960	1,950 to 2,010	1,910 to 1,960	2,250 to 2,370	2,250 to 2,370

4.2 Transit Operations

4.2.1 EXISTING TRANSIT CONDITIONS

Ridership» There are three primary bus routes that travel along the project corridor. Routes 4, 44, and 72. The current span of service and frequency for the primary routes serving the Fourth Plain corridor are shown in Table 4-7 and Table 4-8.

TABLE 4-7

Fourth Plain Boulevard Corridor—Existing Major Bus Route Span of Service

Route	Weekday Span	Saturday Span	Sunday Span
4 Fourth Plain	4:47 AM–12:42 AM	6:20 AM–12:33 AM	6:19 AM–12:32 AM
44 Fourth Plain Limited	5:07 AM–9:32 AM 2:37 PM–7:30 PM	No service	No service
72 Orchards	5:00 AM–9:47 PM	8:00 AM–8:46 PM	9:00 AM–5:46 PM

TABLE 4-8

Fourth Plain Boulevard Corridor—Existing Major Bus Route Frequency (in minutes)

Route	Weekday Frequency (AM/Mid/PM/Eve/Nt)	Saturday Frequency (AM/Mid/PM/Eve/Nt)	Sunday Frequency (AM/Mid/PM/Eve)
4 Fourth Plain	15/15/15/15/30	35/18/18/18/35	35/18/18/35/35
44 Fourth Plain Limited	30/NS/35/NS/NS	No service	No service
72 Orchards	60/60/60/60/NS	60/60/60/60/NS	NS/60/NS/NS

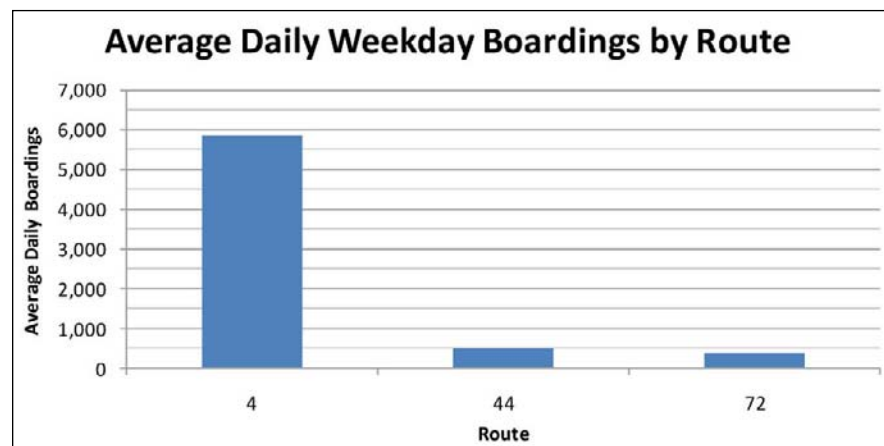
(AM/Mid/PM/Eve/Nt) corresponds to these timeframes (6:00-9:00/9:00-15:00/15:00-18:00/18:00-21:00/21:00-24:00)

NS: no service

Route 4 is C-TRAN's highest ridership route, carrying nearly 6,000 riders on a typical weekday. Route 44, which is Route 4's parallel limited-stop route, carries approximately 500 daily passengers, while route 72 carries just over 350 daily passengers on a typical weekday. The ridership distribution is shown in Figure 4-6.

FIGURE 4-6

Average Daily Weekday Boardings on Fourth Plain Routes



Source: C-TRAN 2011

Existing ridership patterns show that ridership levels drop off dramatically east of the Westfield Vancouver Mall when compared with the remainder of the corridor. The Westfield Vancouver Mall Transit Center is the highest ridership Clark County bus stop on the C-TRAN system (Table 4-9). Routes 4 and 44 have strong ridership at stops along the Fourth Plain Boulevard corridor between Fort Vancouver Way and the Westfield Vancouver Mall and the VA Medical Center and Clark College are also significant transit destinations.

TABLE 4-9.

Highest Average Daily Weekday Ridership Bus Stops on Routes 4 and 44, in order of ridership

Stop	Average Boardings	Average Alightings	Combined Boardings & Alightings
Denver Ave & Victory Blvd (Delta Park MAX)	891	821	1,713
Vancouver Mall Transit Center	544	674	1,219
Main St & W 25th St SB	150	301	451
Jantzen Beach TC & Jantzen Ave WB	107	341	449
E Fourth Plain Blvd & St Johns Blvd	146	182	328
Broadway & E 24th St NB	210	92	301
Broadway & E 13th St SB	158	136	295
E Fourth Plain Blvd & St Johns Blvd	159	133	293
E 4th Plain Blvd & Ft Vancouver Way EB	215	77	292
Broadway & 13th St NB	178	112	289
Broadway & Evergreen Blvd	71	196	267
Washington St & 7th St SB	182	77	259
E 4th Plain Blvd & Ft Vancouver Way WB	96	158	254
Jantzen Beach & TC	164	80	244
Center Ave & Hayden Island Drive NB	199	44	243
4th Plain Blvd & General Anderson EB	71	139	210
E 4th Plain Blvd & Rossiter Lane WB	122	81	203
NE Van Mall Dr & NE 94th Ave EB	186	14	201

Source: C-TRAN 2011

Performance—Scheduled Travel Time» The bus travel times on Fourth Plain Boulevard are highly variable by time of day, due to both traffic conditions and passenger loads. As shown in Table 4-10, run time on Route 4 between downtown Vancouver and Westfield Vancouver Mall can vary by up to seven minutes depending on the time of day. The peak run times are during the afternoon, with the slowest run times from about noon to 5:30 PM. Route 44, which also operates along Fourth Plain Boulevard, has less variability than Route 4 in run time between the morning and afternoon peaks. Route 72 typically has a consistent run time in the Fourth Plain Boulevard corridor between Westfield Vancouver Mall and Ward Road. In the PM peak, additional bus travel time is required, primarily due to more congested traffic conditions in the corridor.

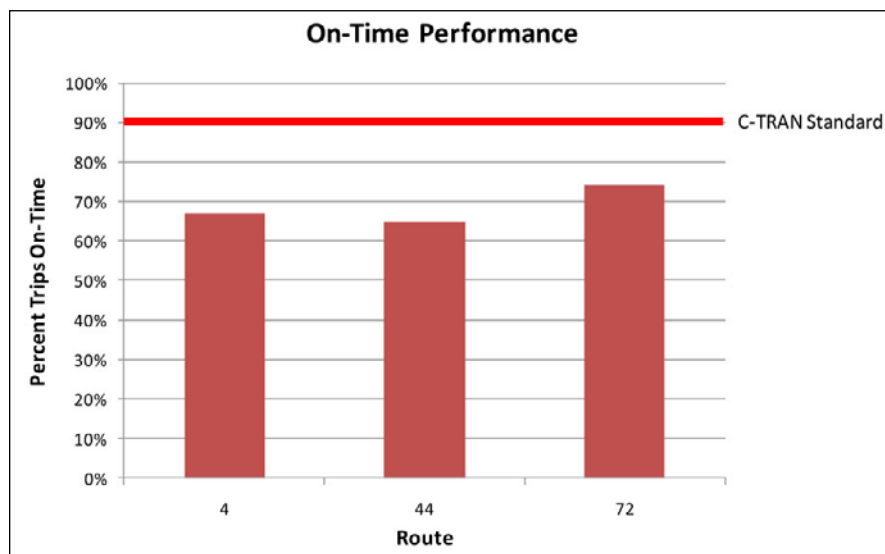
TABLE 4-10

Route 4, 44, and 72—Downtown Vancouver to Westfield Vancouver Mall Scheduled Run Time by Time of Day

Time Period	Route 4		Route 44		Route 72	
	Eastbound	Westbound	Eastbound	Westbound	Eastbound	Westbound
7 AM	27 minutes	24 minutes	19 minutes	21 minutes	11 minutes	20 minutes
Noon	34 minutes	30 minutes	no service	no service	11 minutes	20 minutes
5 PM	34 minutes	32 minutes	20 minutes	21 minutes	13 minutes	22 minutes
7 PM	28 minutes	26 minutes	no service	no service	11 minutes	20 minutes

C-TRAN has a performance standard that calls for 90 percent of trips operating on-time.¹ All three routes operating in the Fourth Plain corridor fall below C-TRAN's on-time performance standard (Figure 4-7). This is likely due to high ridership, a large number of wheelchair boardings, traffic congestion, and the fact that Routes 4 and 44 both cross the Interstate Bridge over the Columbia River, which has unpredictable congestion throughout the day due to bridge lifts and a high frequency of accidents.

FIGURE 4-7

Average Weekday On-Time Performance

Source: On-Time Performance Data are from June 6-10, 2011 AVL data

Operational Issues» Two segments of the corridor have a significant effect on on-time performance: the Columbia River bridge crossing and the routing near the Westfield Vancouver Mall. The I-5 Columbia River bridge is a source of schedule unreliability for both Routes 4 and 44. Any option that has a BRT alignment crossing the Columbia River would have increased schedule variation. On the other hand, the Delta Park MAX station is one of the highest ridership destinations on both Routes 4 and 44.

1 C-TRAN's definition of "on-time" is a bus arrival within five minutes of scheduled arrival times at east timepoint along the route.

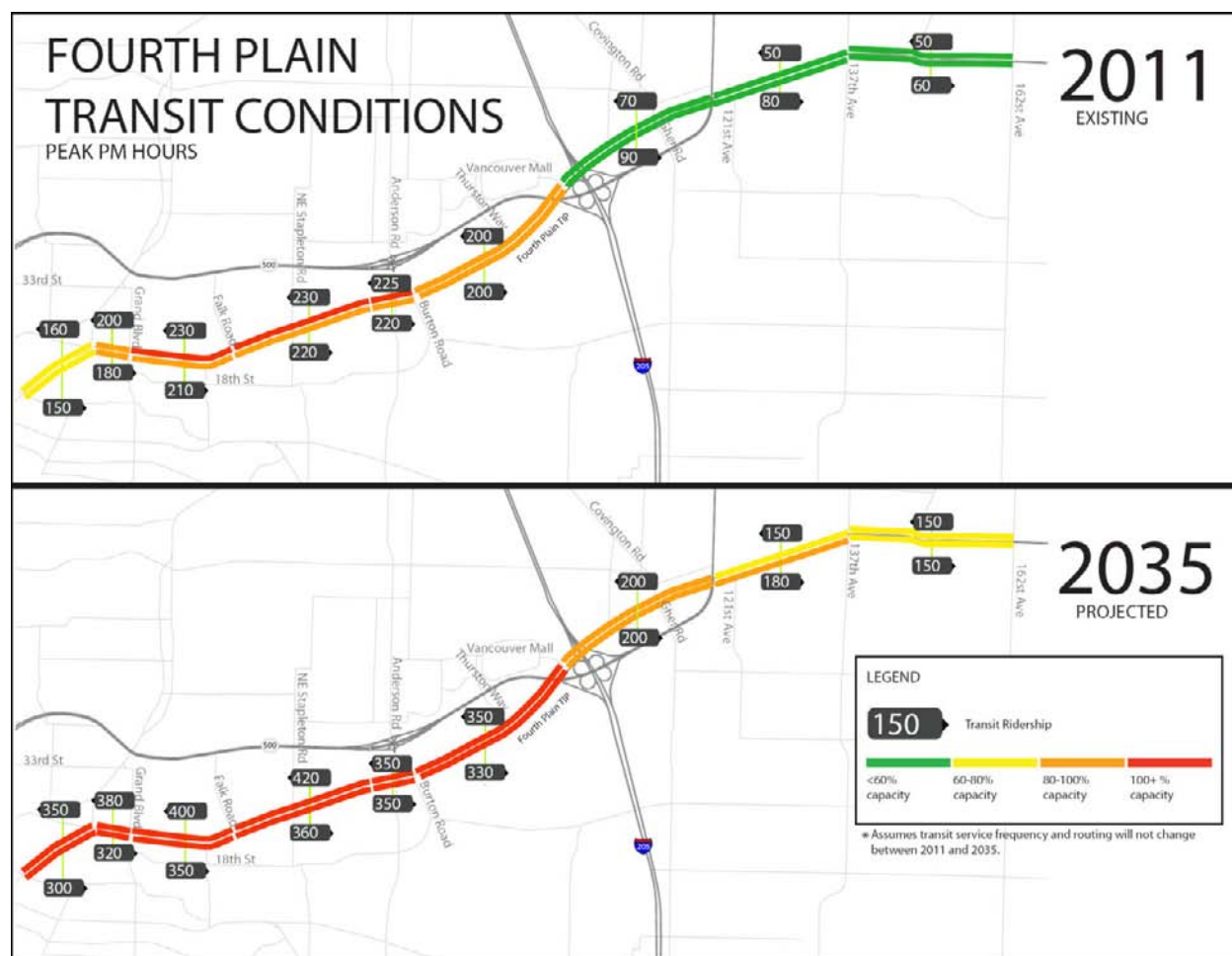
The Westfield Vancouver Mall Transit Center site, which has good proximity to the mall entrance, however, this proximity is offset by long-travel times through the mall parking areas to reach the terminal. This problem is particularly acute during holiday shopping periods, as vehicle traffic searching for parking causes delays to buses entering and exiting the mall property.

The corridor routes, particularly Route 4, experience high dwell times (the time the bus spends at stops and stations) as a result of high ridership and a large number of boardings by people who use wheelchairs and other mobility devices. Delays in the boarding process are created by the on-board fare payment and the need to secure wheelchairs on the bus.

Existing and Future Transit Volumes» Figure 4-8 shows the projected growth in transit ridership in the Fourth Plain Boulevard corridor. Transit demand is approaching or beyond capacity on Fourth Plain Boulevard between Fort Vancouver Way and Vancouver Mall Drive. In 2035, the entire corridor west of Vancouver Mall Drive will be over capacity, on Fort Vancouver Way as well as Fourth Plain Boulevard. The segment of Fourth Plain Road from Vancouver Mall Drive to 117th Avenue/SR 500 will also be approaching capacity in 2035.

FIGURE 4-8

Existing and Projected Transit Ridership on Fourth Plain Corridor During the PM Peak Hour



4.2.2 TRANSIT OPERATIONS EVALUATION METHODS

The following criteria were used to evaluate each alternative's performance on transit travel time and reliability.

- Variation in PM peak in-vehicle transit travel time
- Person capacity of transit at specified points along route
- PM peak hour in-vehicle transit travel time

Transit travel time and reliability were evaluated using a combination of RTC's regional travel demand model and detailed traffic analysis. The regional model provided base transit travel times. These were then refined using the VISSIM and Synchro traffic analyses, including assumptions about dwell times at stops/stations. The transit travel times were verified using C-TRAN's existing travel time data. The following dwell times were assumed at each stop/station in the VISSIM analysis:

- No Build Alternative: 30 seconds
- TSM Alternative : 25 seconds
- BRT Alternative: 15 seconds

The No Build Alternative and TSM Alternative dwell times were based on the existing average dwell times found on the Route 4 buses on Fourth Plain Boulevard. The reduced dwell time assumed for the BRT options was based on the dwell time performance of other similar, recent BRT projects that include level-boarding and off-board fare collection, such as the Swift BRT in Snohomish County, Washington and the EmX in Eugene, Oregon.

PM Peak Hour Transit Travel Time

PM peak travel times were used because the models were based on the PM peak hour and buses would typically experience the most delay due to traffic congestion during this time period. The transit travel times included in this report are in-vehicle transit travel time and do not include time for riders to access buses on Fourth Plain Boulevard. The ridership modeling prepared using the RTC travel demand model does account for access time and provides the basis for the ridership forecasts.

Variation in Travel Time

A series of VISSIM model runs were conducted to estimate the amount of variation in transit travel times. These model runs measured the bus travel times during the model period and saved the range of times, which are reported by standard deviation.

Transit Person Capacity

Transit person capacity was evaluated to compare whether the alternatives would provide adequate capacity for passengers. This assessment was completed by identifying key screenline locations along the alignment and calculating the total transit person capacity during a mid-day period and during the PM peak period for all routes crossing each screenline, based on vehicle size and frequency of service. While frequency of service varies between peak and off-peak

times, Fourth Plain routes are currently busiest during mid-day periods, so both mid-day and PM peak are evaluated here. Vehicle capacities were estimated using C-TRAN's experience and policies on passenger load factors for standard buses and industry standards for BRT as follows:

- Approximately 45 to 55 passenger capacity per standard 40 foot bus
- Approximately 90 to 100 passenger capacity per articulated BRT bus

4.2.3 TRANSIT OPERATIONS EVALUATION FINDINGS

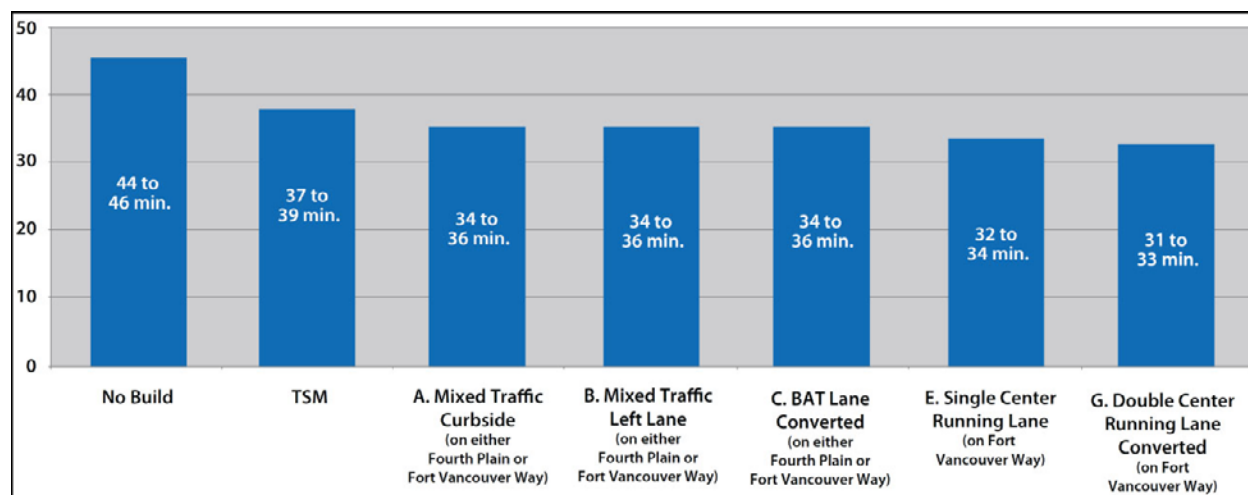
PM Peak Hour Transit Travel Time

Under the No Build Alternative a bus would take approximately 44 to 46 minutes to travel from downtown Vancouver to Westfield Vancouver Mall Transit Center during the PM peak hour. Transit signal priority treatments with the TSM Alternative would reduce travel time to approximately 37 to 39 minutes, a 15 percent improvement. Under the BRT Alternative, transit travel times would be between 31 and 36 minutes, depending on the lane configuration option, a 22 to 29 percent improvement compared with the No Build Alternative. Figure 4-9 shows the 2035 transit travel time results.

Under the No Build Alternative a bus would take approximately 44 to 46 minutes to travel from downtown Vancouver to Westfield Vancouver Mall Transit Center during the PM peak hour. Transit signal priority treatments with the TSM Alternative would reduce travel time to approximately 37 to 39 minutes, a 15 percent improvement. Under the BRT Alternative, transit travel times would be between 31 and 36 minutes, depending on the lane configuration option, a 22 to 29 percent improvement compared with the No Build Alternative. Figure 4-9 shows the 2035 transit travel time results.

FIGURE 4-9

2035 Transit Travel Time Downtown Vancouver to Westfield Vancouver Mall During PM Peak Hour (in minutes)



Fourth Plain Lane Configuration Options» PM peak transit travel times for the lane configurations on Fourth Plain Boulevard are estimated to be approximately 34 to 36 minutes from downtown Vancouver to Westfield Vancouver Mall Transit Center, a time savings of approximately 22 percent compared to the No Build Alternative. A. Mixed Traf-

fic Curbside and B. Mixed Traffic Left Lane would operate in a similar manner in mixed traffic. Option C. BAT Lane Converted would not save time compared with the two mixed traffic options due to conflicts with right turning vehicles.

Fort Vancouver Way Lane Configuration Options» PM peak transit travel times for A. Mixed Traffic Curbside, B. Mixed Traffic Left Lane and C. BAT Lane Converted on Fort Vancouver Way would be similar and all would save at least ten minutes compared with the No Build Alternative. With E. Single Center Running Lane transit would operate approximately two minutes faster than Options A., B. or C. and would save approximately 12 minutes compared with the No Build Alternative. Option G. Double Center Running Lane Converted is forecast to save an additional one to two minutes compared with Option E. Single Center Running Lane, a savings of approximately 29 percent compared to the No Build Alternative.

Eastern Terminus Options» Transit travel times for the Westfield Vancouver Mall Terminus are reported in Figure 4-9. With the 121st Avenue or 162nd Avenue terminus option, transit travel times to 121st and 162nd Avenues would improve compared to the No Build Alternative or the Westfield Vancouver Mall terminus.

Transit Reliability (Variation in Travel Time)

Transit reliability is typically measured by “on-time performance”. Under C-TRAN standards, a bus is considered on-time if it is not early and no more than five minutes late at a route timepoint. While scheduled timepoints can be set to allow for all potential delays, and, thus, would almost always be met, such a situation would greatly increase transit travel times and operating costs. Thus, most transit systems aim for schedules that account for some delay, but not a worse case situation.

The Route 4 has an on-time performance of between 60 and 70 percent, well below the C-TRAN goal of 90 percent. The poor reliability of Route 4, with about one-third of trips running late, has an adverse impact of ridership. The reliability problems of Route 4 result from unpredictable running times affected by:

- High ridership by persons using wheelchairs. Each wheelchair boarding takes between three and five minutes on average, and the current service averages more than one boarding by a person in a wheelchair per trip.
- Use of the system by those who travel with a bicycle, which requires the rider to mount the bicycle on the front of the bus before boarding.
- Long dwell time at stops caused by a high number of riders required to funnel through the front door, pay their fare, and have the fare verified by the bus operator. The need to climb stairs entering or exiting the bus also contributes to long dwell times,
- Delays caused by riders attempting to board and find room on buses with a high number of standees, and
- Traffic congestion caused by traffic signal delays and heavy traffic volumes at major intersections.

The variation in travel time was estimated using the VISSIM transit operations model. This analysis indicated that consistency of travel times and reliability would improve with all BRT lane configuration options by 30 to 40 percent compared with the No Build Alternative. This is due to significantly reduced dwell times from level boarding, off-board

fare collection, and traffic signal priority for BRT buses. Further, a significant reduction in travel time would be experienced due to the elimination of wheelchair and bicycle boarding delays.

Transit person capacity

Under existing conditions, C-TRAN buses on Fourth Plain Boulevard are frequently overcrowded. Crowding would worsen in 2035 with the No Build Alternative. Under the No Build Alternative, the Fourth Plain corridor would have 15-minute service frequency on Route 4 during weekday daytimes and 30-minute service frequency on Route 44 during peak periods. Both routes would use standard 40-foot buses, as are used today. Based on C-TRAN's experience, these carry approximately 45 to 55 passengers (both seated and standing). This capacity is limited to some extent by the characteristics of the current riders. Route 4 has a high number of persons using wheelchairs, averaging more than one wheelchair boarding per trip. Each wheelchair rider takes up three seats as well as potential standing space. In addition, there is a high use of strollers, walkers, and carts by current riders, which also limits bus capacity.

Under the BRT Alternative, buses on Fourth Plain would operate with 10-minute service during weekday daytimes and would use larger vehicles. The BRT vehicles would be 60-foot long articulated buses that carry approximately 90 to 100 passengers (both seated and standing). This capacity is based on estimates from systems that currently use 60-foot BRT buses with doors on both sides. Those buses have relatively few seats (the multiple doors and interior bicycle storage eliminate seats) but relatively large areas for standees.

Fourth Plain Lane Configuration Options» All of the BRT lane configuration options on Fourth Plain Boulevard would result in a similar increase in transit person capacity over the No Build Alternative (Table 4-11). In 2035, with the No Build Alternative, transit on Fourth Plain Boulevard would have the capacity to carry 200 to 250 passengers per hour in the eastbound direction during mid-day, measured just east of Grand Boulevard. With the TSM Alternative, capacity measured at the same location would increase to between 280 and 350 passengers. With the any of the lane configuration options of the BRT Alternative, transit would have the capacity to carry 580 to 710 riders during mid-day, nearly triple the capacity of the No Build Alternative.

During the PM peak hour, under the No Build Alternative, transit would have the capacity to carry approximately 280 to 350 passengers per hour in the eastbound direction, just east of Grand Boulevard. The TSM Alternative would not add any capacity during peak periods. Capacity with the BRT Alternative would be 580 to 710 passengers at this location during the PM peak period, approximately doubling the peak period capacity of the No Build Alternative.

TABLE 4-11

Transit Person Capacity on Fourth Plain Blvd. in the Eastbound Direction East of Grand Blvd.

	2035 No Build	2035 TSM	2035 BRT A. Mixed Traffic Curbside	2035 BRT B. Mixed Traffic Left Lane	2035 BRT C. BAT Lane Converted
Mid-Day	200 to 250	280 to 350	580 to 710	580 to 710	580 to 710
PM Peak Hour	280 to 350	280 to 350	580 to 710	580 to 710	580 to 710

Fort Vancouver Way Lane Configuration Options» All of the BRT lane configuration options on Fort Vancouver Way (Table 4-12) would result in a similar increase in transit person capacity over the No Build Alternative. Under the No Build Alternative, Route 44 would travel on Fort Vancouver Way, while Route 4 would not serve Fort Vancouver Way. The TSM Alternative and BRT Alternative would include new service on Fort Vancouver Way. Measured at Clark College, the BRT Alternative would have the capacity to carry 580 to 710 riders per hour during mid-day and during the PM peak period in the northbound direction. This is approximately triple the 150 to 250 person capacity available at this location with the No Build Alternative. The TSM Alternative would also increase capacity at this location. The TSM Alternative would provide capacity for approximately 40 percent more passengers at Clark College than the No Build Alternative.

TABLE 4-12

Transit Person Capacity on Fort Vancouver Way in the Northbound Direction at Clark College

	2035 No Build	2035 TSM	2035 BRT
Mid-Day	150 to 250	280 to 350	580 to 710
PM Peak Hour	200 to 250	280 to 350	580 to 710

Eastern Terminus Options» East of Westfield Vancouver Mall, transit person capacity was measured just west of 117th Avenue/SR 500. At this location, with the No Build Alternative, transit would have the capacity to carry 120 to 150 passengers per hour in the eastbound direction during mid-day. The TSM Alternative would increase this capacity to between 240 and 300 passengers. The BRT Alternative with an eastern terminus at either 121st Avenue or 162nd Avenue would have the capacity to carry 540 to 660 passengers in the eastbound direction at this location, approximately four times the capacity of the No Build Alternative. The BRT Alternative with an eastern terminus at Westfield Vancouver Mall would have the same capacity measured at 117th Avenue/SR 500 as the No Build Alternative.

During the PM peak period, the eastbound direction transit person capacity at 117th Avenue/SR 500 would increase from a range of 200 to 250 with the No Build Alternative or the Westfield Vancouver Mall terminus option to between 540 and 660 with the 121st Avenue terminus option or the 162nd Avenue terminus option. The TSM Alternative with a terminus at 162nd Avenue would have a transit person capacity of 240 to 300. Table 4-13 shows the transit person capacity for each eastern terminus option measured at 117th Avenue/SR 500.

TABLE 4-13

Transit Person Capacity on Fourth Plain Road in the Eastbound Direction west of 117th/SR 500

	2035 No Build	2035 TSM (162nd Avenue Terminus)	2035 BRT Van Mall Termi- nus	2035 BRT 121st Avenue Terminus	2035 BRT 162nd Avenue Terminus
Mid-Day	120 to 150	240 to 300	120 to 150	540 to 660	540 to 660
PM Peak Hour	200 to 250	240 to 300	200 to 250	540 to 660	540 to 660

4.3 Transit Ridership

The following evaluation criteria were used to evaluate each alternative's performance on transit ridership.

- Average weekday boardings on Fourth Plain Boulevard routes (4, 44, TSM, or BRT)
- Transit mode share (percent traveling on transit) on Fourth Plain Boulevard

4.3.1 TRANSIT RIDERSHIP EVALUATION METHODS

Transit ridership was evaluated with RTC's regional travel demand model using an analysis year of 2035. The model provided the number of passengers projected to board Fourth Plain Boulevard transit routes in 2035 and the share of trips traveling on Fourth Plain Boulevard that would be made on transit.

The model provided average weekday boardings on each of the Fourth Plain Boulevard bus routes in 2035. For the No Build Alternative, this is the average weekday boardings on Routes 4 and 44. For the BRT Alternative and TSM Alternative, this is the average weekday boardings on the BRT or TSM route. The model results were calibrated based on current observed boarding data on Routes 4 and 44. This assessment determined that the RTC model underestimated boardings on the existing Fourth Plain Boulevard routes. In order to account for the model's underestimation of current ridership, an adjustment was made to all boardings on Fourth Plain Boulevard routes for every alternative, including No Build, TSM, and BRT.

In addition to the calibration adjustment that was necessary to match existing counts, an additional adjustment to boardings was included to account for elements of BRT service that regional travel demand models do not typically capture. This adjustment for BRT's unique attributes is generally accepted in the industry and is based on the ridership history of many BRT systems in the U.S. This BRT adjustment methodology is described in the BRT Practitioner's Guide, published by the Transit Cooperative Research Program (TCRP Report 118).²

Transit mode share on Fourth Plain Boulevard was calculated by adding average weekday transit passenger volumes and auto passenger volumes at specific screenline locations. Passengers in autos were calculated by multiplying average weekday auto volumes by an average vehicle occupancy rate (the average number of passengers in each vehicle).

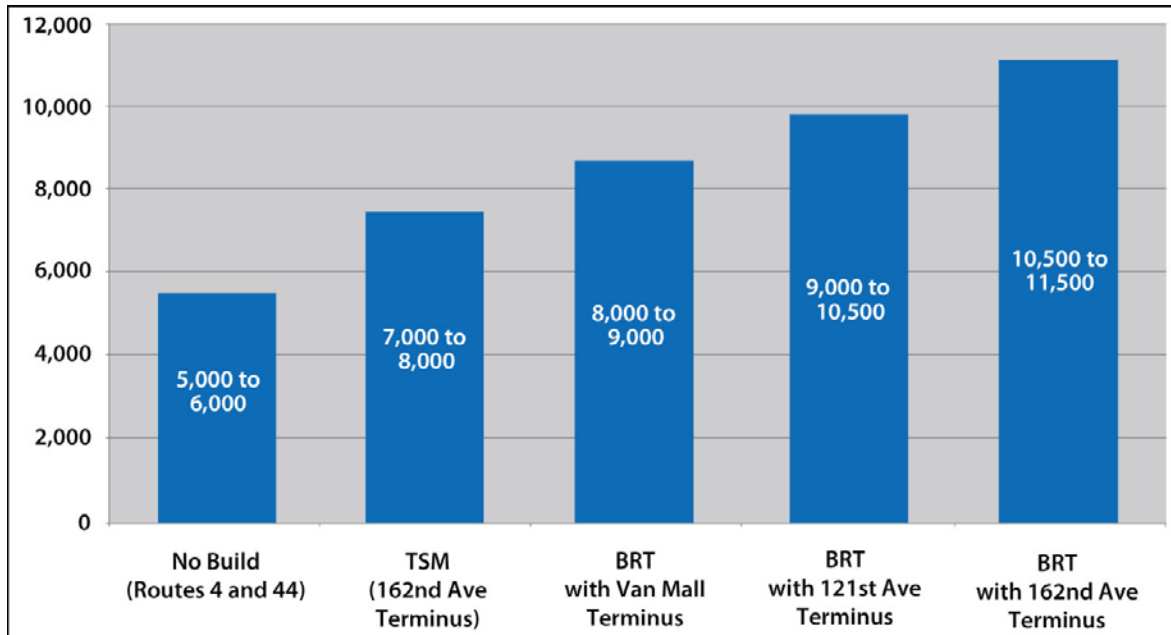
4.3.2 TRANSIT RIDERSHIP EVALUATION FINDINGS

Boardings» Average weekday boardings would be lowest under the No Build Alternative. Route 4 and 44 together would have approximately 5,000 to 6,000 average weekday boardings under the No Build Alternative. The TSM Alternative would result in an approximately 36 percent increase in boardings over the No Build Alternative to approximately 7,000 to 8,000 between downtown Vancouver and 162nd Avenue. Under the BRT Alternative, average weekday boardings would be between 8,000 and 11,500 depending on the eastern terminus, an increase of 60 to 100 percent compared to the No Build Alternative. This is due to reduced travel times, improved reliability, and improved amenities and image under the BRT Alternative. All lane configuration options of the BRT Alternative would have comparable ridership. Figure 4-10 shows the forecast average weekday boardings in 2035.

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2 TCRP 118: Bus Rapid Transit Practitioner's Guide, Chapter 3. Available at <http://www.trb.org/main/blurbs/158960.aspx>

FIGURE 4-10

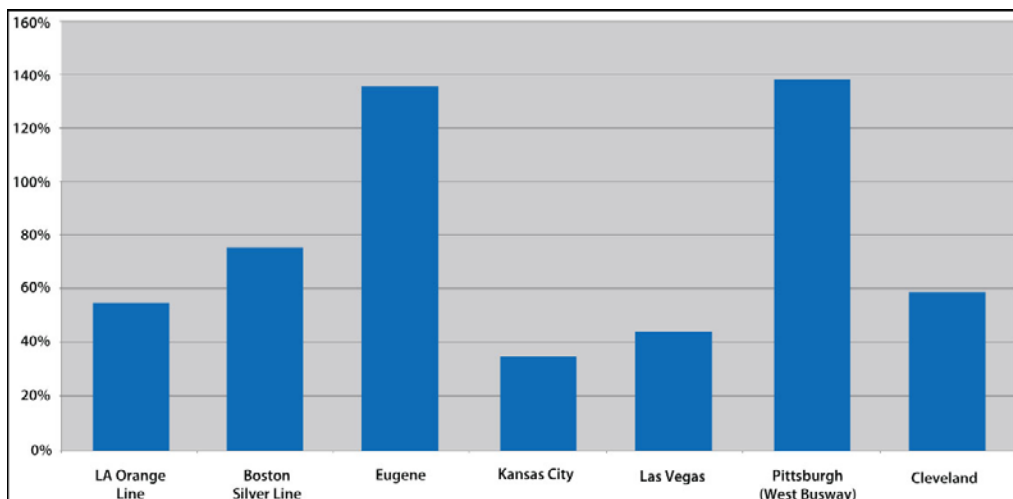
2035 Average Weekday Boardings on Fourth Plain Routes (4, 44, TSM, or BRT)



Reasonableness Check» the projected ridership impact of the BRT service is within the range of experiences of other systems that have implemented BRT. Based on data from the National Bus Rapid Transit Institute, ridership increases as a result of implementing a BRT system range from about 30 percent to well over 100 percent (see Figure 4-11). This data is for ridership within 1 to 3 years of BRT service start, whereas the ridership projections for the Fourth Plain corridor are for Year 2035, 20 years after service implementation.

FIGURE 4-11

Net Corridor Ridership Gains on Other New BRT Lines (percent increase)



Source: National Bus Rapid Transit Institute

Notes:

- Gains shown within 1-3 years of opening. Also: RapidRide A Line (South Puget Sound): +60% in first year.
- Fourth Plain w/ BRT, 20-year projection: +90-110% over no-build

Fourth Plain Lane Configuration Options» The transit travel times and station locations for all Fourth Plain Boulevard lane configuration options would be similar. No significant difference in transit boardings would be expected among the different BRT lane configurations.

Fort Vancouver Way Lane Configuration Options» The transit travel times for the two exclusive transit lane configurations, E. Single Center Running Lane and G. Double Center Running Lane Converted, would be from 1.5 to 4 minutes faster than mixed traffic lane configurations. This improved transit time would attract a modest number of additional transit boardings compared to the mixed traffic lane configurations.

Eastern Terminus Options» By continuing BRT service further east, the 121st Avenue terminus option and the 162nd Avenue terminus option would have additional transit boardings on Fourth Plain Boulevard, as shown in Figure 4-10. These additional boardings would be related both to serving a potential park-and-ride lot and to significantly improving service frequency.

Daily Transit Volumes

Figures 4-12 through 4-16 show the 2035 average weekday volumes of passengers on board Fourth Plain routes in the No Build, TSM, and BRT alternatives. The BRT lane configuration options would not differ in terms of ridership. Differences among the eastern terminus options are shown.

FIGURE 4-12

2035 Passenger Volumes on Routes 4 and 44—No Build Alternative



FIGURE 4-13
2035 Passenger Volumes on the TSM Route—TSM Alternative



FIGURE 4-14
2035 Passenger Volumes on the BRT Route—BRT Alternative with Westfield Vancouver Mall Terminus Option



FIGURE 4-15
2035 Passenger Volumes on the BRT Route—BRT Alternative with 121st Ave. Terminus Option



FIGURE 4-16

2035 Passenger Volumes on the BRT Route—BRT Alternative with 162nd Ave. Terminus Option



As can be seen in Figures 4-12 through 4-16, average weekday passenger volumes on Fourth Plain Boulevard between Fort Vancouver Way and Westfield Vancouver Mall would increase approximately 30 to 40 percent with the TSM Alternative compared to the No Build Alternative. The BRT Alternative, with the 162nd Avenue terminus (the same terminus as the TSM Alternative) would have approximately 50 to 60 percent higher average weekday passenger volumes than the TSM Alternative and more than double the average weekday passenger volumes with the No Build Alternative.

The Westfield Vancouver Mall and 121st Avenue terminus options would each have lower overall passenger volumes than the 162nd Avenue terminus option. However, both would be higher than the No Build Alternative. The Westfield Vancouver Mall option would have approximately 60 to 70 percent higher average weekday passenger volumes on Fourth Plain Boulevard between Fort Vancouver Way and Westfield Vancouver Mall compared to the No Build Alternative. The 121st Avenue terminus option would have about double the passenger volume on this same segment of Fourth Plain Boulevard compared to the No Build Alternative.

Transit Share

The share of total trips made by transit was evaluated by comparing the number of passengers on transit with the number of passengers in autos at selected screenlines on Fourth Plain Boulevard. The percent on transit at each screenline location is shown in Table 4-14.

Under the No Build Alternative, transit's share on Fourth Plain Boulevard would be approximately 14 percent of all daily trips measured west of Grand Boulevard. Under the TSM Alternative, transit's share would increase to approximately 17 percent of all trips at this same location. Under the BRT Alternative, transit's share of trips at Grand Boulevard would increase to between 21 and 24 percent, depending on the eastern terminus. With the BRT options, other locations along the corridor showed a similar increase in transit's share of trips, ranging from 70 percent to 100 percent increases in transit's share of trips compared to the No Build Alternative.

TABLE 4-14

2035 Transit Share of Total Trips on Fourth Plain Boulevard

	2035 No Build	2035 TSM (162nd Avenue Terminus)	2035 BRT Van Mall Terminus	2035 BRT 121st Avenue Terminus	2035 BRT 162nd Avenue Terminus
West of Grand Blvd.	14%	17%	21%	23%	24%
East of Falk Rd.	9%	12%	15%	17%	18%
East of Stapleton Rd.	9%	12%	14%	16%	18%
East of Andresen Rd.	7%	9%	11%	13%	14%

4.4 Bicycle and Pedestrian Safety

The following evaluation criteria were used to evaluate each alternative's performance on bicycle and pedestrian access and safety.

- Length of new or improved sidewalk in stop/station areas
- Length of new bike lanes or other bicycle treatments in stop/station areas
- Quality of bicycle operating environment along BRT route
- Number of new marked pedestrian crossings (signalized or unsignalized)
- Quality of marked pedestrian crossings
- Number of high crash rate locations improved
- Number of locations with high bike or pedestrian crash rates improved
- Extent and character of stop/station improvements

4.4.1 METHODS

Pedestrian and bicycle improvements associated with BRT on Fourth Plain were evaluated both qualitatively and quantitatively, measured in part by the amount of physical improvements that would be included in the project:

- The total length of new or improved sidewalks or bike lanes under each BRT alternative
- Number of new marked crosswalks
- The quality of both the pedestrian and bicycle environment under each alternative

Other safety and security improvements were also included under this category, including turn restrictions associated with the project that would be located in areas with high crash rates and a qualitative evaluation of opportunities for security enhancements based on the amount of infrastructure improvements included in station areas.

Much of the Fourth Plain corridor has high crash rates, based on crash history data for a period from January 2008 to June 2011. This period is the latest data available and was selected in order to provide at least a three-year history. Ten locations along the alignment were identified that currently have crash rates that are more than double the rate for the corridor as a whole (shown in bold in Table 4-15). Each BRT lane configuration option was evaluated for number of

high crash rate locations improved based on whether it included improvements at these locations that would improve auto safety, such as reduction in number of driveways or turn restrictions.

Seven locations were identified where there had been two or more crashes involving pedestrians or bicyclists in the period from January 2008 to June 2011 (shown in bold in Table 4-15). Each BRT Alternative was evaluated for number of locations with high bike or pedestrian crash rates improved based on whether it included improvements at these locations that would improve pedestrian or bicycle safety, such as including a new crosswalk or pedestrian refuge island.

TABLE 4-15

Crash History by Type on Fourth Plain Boulevard between Fort Vancouver Way and 162nd Avenue, January 2008 through June 2011

Fourth Plain Intersection	Total Crashes	Pedestrian/Bicycle Involved
Fort Vancouver Way	18	5
Z St.	4	—
Grand Blvd.	16	2
Fairmount Ave.	7	—
Norris Rd.	5	1
Laurel Pl.	2	1
Neals Ln.	6	1
Wilson Ave.	3	—
Todd Rd/Rossiter Ln.	19	3
Algona Dr.	3	—
Brandt Rd.	4	—
Falk Rd.	10	2
Wintler Dr.	3	—
Caples Ave.	5	—
General Anderson Rd.	17	2
Carlson Rd.	2	1
Stapleton Rd.	15	1
57th Ave.	17	—
62nd Ave.	8	—
65th Ave.	19	3
Andresen Rd.	32	—
72nd Ave.	1	1
Burton Rd. (Auto Mall Dr.)	9	—
Whitman Ave.	1	—
78th Ave.	7	1
Pacific Way	1	—
86th Ave.	3	—
Royal Oaks Dr.	2	—
Thurston Wy.	4	—
Spokane Wy. (I-205 SB)	4	—
Vancouver Mall Dr.	28	2

Fourth Plain Intersection	Total Crashes	Pedestrian/Bicycle Involved
54th St.	2	—
102nd Ave.	4	—
105th Ave.	3	—
106th Ave. (Coxley Dr.)	9	1
108th Ave.	1	—
Gher Rd.	18	—
112th Ave.	9	—
114th Ave.	6	—
117th Ave. (SR 500)	11	—
121st Ave.	24	—
123rd Ave.	5	—
124th Ave.	2	—
127th Ave.	5	—
131st Ave.	11	1
134th Ave.	3	—
137th Ave.	15	—
140th Ave.	3	—
143rd Ave.	2	—
Ward Rd.	4	—
152nd Ave.	1	—
157th Ave.	8	—
162nd Ave.	10	—
TOTAL	431	28
Corridor Average	8	0.5

In addition to these safety elements, the evaluation includes a qualitative assessment of opportunity for security improvements based on station visibility and the extent of station improvements under each alternative.

4.4.2 FINDINGS

Fourth Plain Lane Configuration Options

Pedestrian Facilities» The BRT Alternative would improve sidewalks and pedestrian crossings in station areas. All new or improved sidewalks would be designed to conform to city standards and the Fourth Plain Subarea Plan, which set 10 foot minimums as a guideline for sidewalk widths. B. Mixed Traffic Left Lane would create the most length of improved sidewalk, with approximately 8,500 lineal feet of new or improved sidewalk, compared to 2,200 lineal feet for A. Mixed Traffic Curbside and C. BAT Lane Converted.

All of the lane configuration options under the BRT Alternative would include two new pedestrian crossings on Fourth Plain Boulevard. These would be located east of Fort Vancouver Way and east of 57th Avenue. These could have pedestrian-actuated signals or flashing beacons to improve safety. In addition, the median stations included under B. Mixed Traffic

Left Lane would provide median refuge islands at nine locations for pedestrians crossing Fourth Plain Boulevard.

Bicycle Facilities» All stations would be designed to accommodate space for bike lanes on Fourth Plain Boulevard, though creating bike lanes would not be part of this project. Based on discussions with the City of Vancouver, the project would work to retain existing on-street bicycle facilities and, where possible, provide some additional widening to accommodate future bicycle facilities. Stations for all BRT lane configuration options would accommodate approximately 820 lineal feet of new bike lane.

C. BAT Lane Converted could be perceived as somewhat safer and more attractive for bicyclists than A. Mixed Traffic Curbside because of lower auto volumes in the right travel lane shared with bicyclists.

Crash Reduction» There are frequent crashes of all types along Fourth Plain Boulevard, including turning related crashes, rear-end crashes, side swipes, and crashes involving pedestrians and bicyclists. Improved transit service on Fourth Plain Boulevard would provide only limited opportunities to address these types of crashes. However, the BRT Alternative would provide opportunities to reduce crashes in station areas by improving lighting conditions and improve pedestrian and bicycle safety by enhancing pedestrian crossings and providing space for bicycle lanes. The BRT alternative also provides an opportunity for the city to enhance safety by improving sidewalks, adding bike lanes, and providing other streetscape improvements.

In addition, with the B. Mixed Traffic Left Lane option, median stations would result in several existing driveways being limited to right-in/right-out movements only. Six of the ten locations identified as having high crash rates (double the rate for the corridor as a whole, see Table 4-15), would have some reduction in left turning movements as a result of this change. This could help reduce crashes due to turning movements in these areas. One high crash rate location would also have some left turning restriction under A. Mixed Traffic Curbside or C. BAT Lane Converted. Under the No Build or the TSM Alternative, the current high crash rate along Fourth Plain Boulevard would continue and likely worsen as traffic volumes increase.

Under B. Mixed Traffic Left Lane, the median stations would result in pedestrian and bicycle improvements at six of the seven locations identified as having had two or more pedestrian or bicycle involved crashes during the period January 2008 to June 2011 (see Table 4-15). These improvements would include new pedestrian refuge islands and reduced conflict between buses and bicyclists.

Security Improvements» Improvements to the sidewalks and streetscape that would be associated with the BRT Alternative lane configuration options would provide an opportunity to include new lighting and other design elements to improve security. Because B. Mixed Traffic Left Lane would include improvements over a longer length of Fourth Plain than the other BRT lane configuration options, it would have greater opportunity for new lighting, streetscape, and security improvements.

In addition, the BRT stations will be designed using Crime Prevention Through Environmental Design (CPTED) principles. CPTED is used to create public spaces that enhance safety through their design, by providing for items such as

improved visibility, adequate lighting, and elimination of “hiding spots.” The TSM alternative would include improved lighting at some major stops, but since station improvements and reconstruction would be limited, would not allow for a full CPTED approach.

Fort Vancouver Way Lane Configuration Options

Pedestrian Facilities» All lane configuration options of the BRT Alternative would result in sidewalk improvements in station areas on Fort Vancouver Way. Unlike on Fourth Plain Boulevard, where the median station option would result in more length of sidewalk improvement, on Fort Vancouver Way the median station options (B. Mixed Traffic Left Lane, E. Single Center Running Lane, and G. Double Center Running Lane Converted) would include slightly less improvement to sidewalks than the curbside options. This is because there is no widening required to construct median stations on Fort Vancouver Way.

Under all lane configuration options of the BRT Alternative, there would be two stations located on Fort Vancouver Way. These are generally located at existing stops and crosswalk locations that currently have pedestrian refuge islands in the median.

E. Single Center Running Lane could introduce some confusion for pedestrians crossing Fort Vancouver Way due to the bi-directional operation of BRT buses in the center running lane.

Bicycle Facilities» As with the Fourth Plain Boulevard lane configuration options, BRT on Fort Vancouver Way would be designed to accommodate and maintain existing bike lanes.

Crash Reduction» The intersection of Fort Vancouver Way and Fourth Plain Boulevard was identified as one of the ten locations having high crash rates (double the rate for the corridor as a whole, see Table 4-15). There would be some limited improvements on Fort Vancouver Way and on Fourth Plain Boulevard with the BRT Alternative that could improve safety at the intersection.

Security Improvements» As with Fourth Plain Boulevard, BRT improvements would provide an opportunity for lighting and streetscape improvements on Fort Vancouver Way.

Eastern Terminus

By continuing BRT service further east, the 121st Avenue terminus option and the 162nd Avenue terminus option would include additional stations and associated improvements to sidewalks and streetscape in the station areas. The 121st Avenue terminus option would include four more stations than the Vancouver Mall terminus option. The 162nd Avenue terminus option would include eight more stations than the Vancouver Mall terminus option. Each additional station would provide an additional opportunity for improvements that address pedestrian and bicycle safety as well as lighting and streetscape improvements.

5. CONCEPTUAL DESIGN AND COST

5.1 Design Considerations

The BRT Alternative lane configuration options described in Section 3.2 were designed as relatively simple, conceptual designs that would allow for planning-level evaluation of costs, operations and impacts. The BRT lane configuration designs maintained existing lane widths for BRT operations in mixed traffic or, when existing lanes were repurposed, as exclusive or semi-exclusive BRT lanes. Where lanes were added, in order to accommodate a new bus lane or median station, 11-foot travel lanes were assumed regardless of the existing condition.

Streetscape improvements consistent with the Fourth Plain Subarea Plan were included where widening of the street, new transit stations or new sidewalks were identified. This meant that under B. Mixed Traffic - Left Lane, larger portions of Fourth Plain would be “upgraded” with wider sidewalks and other streetscape enhancements due to more street widening within the proximity of stations than the other lane configuration options. Regardless of the option selected, certain portions of the corridor could be identified for streetscape improvements above and beyond those being considered as part of the proposed BRT project.

Corridor-based infrastructure included traffic signal improvements to provide for signal priority for the BRT vehicles at all signalized intersections. For costing purposes, it was assumed that the signal priority system would be GPS-based, but transponder-based technologies could also be used with similar effectiveness and cost. A fiber-optic data backbone was also assumed for the entire corridor that would allow for a C-TRAN operated data connection at all stations. Primary uses for this connection would be to feed information to the real time signage, provide a data link for ticket vending machines to make non-cash transactions, and provide capability to include CCTV security cameras at each station.

Station locations were identified based on the location of existing bus stops, the number of boardings at existing stops, and input from the public, CAC, and the design team’s judgment. The stations would be located to provide convenient access to signalized crossings of Fourth Plain or near existing crosswalks on Fort Vancouver Way. Final station locations will be determined through additional design refinement after an LPA is selected. The number and location of stations could change through design refinement, although the relative costs and impacts would not be expected to materially affect the selection of the preferred alternative.

All stations were assumed to provide 60 to 70 feet of level boarding platform length in order to accommodate an articulated BRT vehicle with doors on both sides. Station platforms were assumed to be raised to approximately 14 inches to allow for “level” boarding. Station amenities include one ticket vending machine per platform and a station canopy of size and architectural quality similar to those used on the Swift BRT system in Everett, WA and EmX BRT system in Eugene, OR. Real time passenger information signage would also be included as well as an allowance for station furnishings such as bike racks and benches.

Utility services assumed at stations include electrical service for platform lighting and water service to provide an in-

ground hose bib for station cleaning and landscape irrigation, if present. For the concept design evaluation, all stations throughout the project corridor were assumed to have a similar design. During refinement of the LPA, a plan that includes both major and minor stations may be developed. Differentiating between major and minor stations could result in capital cost savings.

5.2 Capital Costs

Methodology

The capital cost estimate for the Fourth Plain TIP was prepared using 2011 dollars by estimating unit costs for each of the FTA Standard Cost Categories (Table 5-1).

TABLE 5-1

FTA Standard Cost Categories for Capital Projects

Category	Description
10	Guideway & Track Elements
20	Stations, Stops, Terminal, Intermodal
30	Support Facilities: Yards, Shops, Admin. Bldgs
40	Sitework & Special Conditions
50	Systems
60	Row, Land, Existing Improvements
70	Vehicles
80	Professional Services
90	Unallocated Contingency
100	Finance Charges

Stations» Typical station sections, concept design sheets and sketches and photos displaying station amenities were used as the basis for determining quantities. Five station types were analyzed:

- Curbside Platform
- Center Platform—Single Side
- Center Platform—Double Side
- Midblock Median
- Farside Split

Sidewalks were assumed to be ten feet wide unless that width would impact an abutting building. In those instances the minimum sidewalk width was assumed to be seven feet. Quantities were estimated for each station type, covering a range of potential construction procedures and station elements. These elements include: demolition and excavation, electrical, paving and concrete, water systems, lighting, shelter, and communications.

For the TSM Alternative, a modest level of stop improvements was assumed. Likely improvements include lighting and additional shelters. TSM stop costs were estimated to be \$10,000 per stop.

Roadway/Running Way» Most project elements were focused directly in station areas, with improvements between stations limited to traffic signal priority, bypass lanes and network communications. No pavement rehabilitation or overlays were included outside of the immediate station areas.

Unit Costs» Unit costs were derived from actual contractor's costs for the two recently completed BRT projects in Eugene, OR, and a recently estimated BRT project in Fresno, CA, as well as Oregon and Washington State Department of Transportation databases.

Contingency» The cost contingency at this early planning stage with conceptual designs ranges from ten percent to 35 percent. The lowest contingency was applied to the best known (least risk) project expenses such as vehicles and professional services. The highest contingencies were applied to the least known and riskiest project expenses such as site work and special conditions.

Inflation» The FTA standard cost category worksheet uses an annual inflation rate of 3.5 percent to estimate the Year of Expenditure (YOE) costs. The project schedule calls for construction in 2014 and revenue service in 2015, and estimated construction costs reflect the annual 3.5 percent inflation rate assuming construction would occur during those years.

Costs Not Included» Certain elements that may or may not be considered part of the project were not included in the capital cost estimate. These include:

- Park-and-Ride Lot
- Maintenance Facility Expansion
- Streetscape Improvements Between Stations
- Relocation of Westfield Vancouver Mall Transit Center

Findings

Table 5-2 shows the estimated capital costs for the No Build Alternative, TSM Alternative and the lane configuration options of the BRT Alternative. All costs are in year of expenditure dollars, which is 2014. There would be no capital costs associated with the No Build Alternative; however, additional buses would need to be purchased to maintain adequate service in 2035.

The TSM Alternative is intended to be a low-capital cost investment, also termed a “better bus” option. It would include a modest level of improvements to stops, including additional shelters and other passenger amenities. In addition, the TSM Alternative includes costs associated with transit signal priority, and additional buses required to achieve the 10-minute service frequency. Total costs are in the \$8 to \$12 million range, with the low end for the Westfield-Vancouver mall terminus, and the upper end for the lengthier route associated with 162nd Avenue terminus.

The BRT Alternative options range in capital cost between \$40–\$49 million for BRT to the Westfield Vancouver Mall

Terminus and \$59–\$72 million for B. Mixed Traffic Left Lane BRT to 162nd Avenue. Since all the BRT Alternative options would qualify for FTA Section 5309 New Starts federal funding, the local portion of the cost for the BRT Alternative Options would range from approximately \$8 million to \$14 million. Any costs associated with the No Build Alternative or the TSM Alternative would need to seek funding from local or state sources or through other federal funding opportunities such as regional Surface Transportation Program formula funds apportioned by the Regional Transportation Council.

TABLE 5-2
Estimated Capital Costs (in Millions—Year of Expenditure \$)

Focus	Option ¹	Capital Cost (\$ YOY)	Capital Costs Funded Locally ³
No Build Alternative⁴		\$0	\$0
TSM Alternative	A. Westfield Vancouver Mall Terminus	\$6–\$7	\$6–\$7
	B. 121st Avenue Park-and-Ride Terminus	\$7–\$8	\$7–\$8
	C. 162nd Avenue Terminus	\$8–\$9	\$8–\$9
Fort Vancouver Way Focus²	A. Mixed Traffic Curbside	\$53–\$65	\$11–\$13
	B. Mixed Traffic Left Lane	\$51–\$63	\$10–\$13
	C. BAT Lane Converted	\$53–\$65	\$11–\$13
	E. Single Center Running Lane	\$54–\$66	\$11–\$13
	G. Double Center Running Lane Converted	\$53–\$65	\$11–\$13
Fourth Plain Focus²	A. Mixed Traffic Curbside	\$53–\$65	\$11–\$13
	B. Mixed Traffic Left Lane	\$59–\$72	\$12–\$14
	C. BAT Lane Converted	\$53–\$65	\$11–\$13
Terminus	A. Westfield Vancouver Mall Terminus	\$40–\$49	\$8–\$10
	B. 121st Avenue Park-and-Ride Terminus	\$46–\$56	\$9–\$11
	C. 162nd Avenue Terminus	\$53–\$65	\$11–\$13

1 Options include two temporary stations (four platforms) in downtown Vancouver.

2 Mixed Traffic Left Lane and BAT Lane Converted extend to Andresen Road. Between Andresen and Vancouver Mall Drive the options concepts include curbside stations.

3 Federal funds through the FTA Small Starts or Very Small Starts Program will be sought to help fund the Build Alternative. It is estimated that FTA will cover 80 percent of the project cost. The TSM Alternative would not be eligible for FTA Small Starts or Very Small Starts funding.

4 The No Build Alternative would have to purchase 2 or 3 new buses to maintain adequate service under the 2035 conditions. Each standard 40-foot buses would cost between \$400,000 and \$500,000.

5.3 Operating and Maintenance Costs

Methodology

Operating and maintenance costs were estimated by converting the forecast transit travel times to annual platform hours and adding in other non-service costs. The following assumptions were used to estimate daily and annual operating and maintenance costs:

- Used PM peak hour transit travel times from transportation modeling.
- Assumed the same relationship as on the existing Route 4 between PM peak hour times and the AM peak hour and midday and evening transit travel times.
- Used 2011 cost per hour for C-TRAN bus service; with an additional \$7 per hour for the BRT alternatives to reflect higher fuel, operating and maintenance costs associated with use of articulated vehicles.
- Assumed layover would be 15 percent of round trip runtime, consistent with C-TRAN's current scheduling and operations planning practices.
- Included the following in the BRT costs: station cleaning and maintenance costs, fare collection maintenance costs, fare enforcement and ticket machine maintenance. These costs were estimated based on existing BRT systems in Oregon and Washington.
- Estimated BRT savings for reduced operator relief costs and for reduced tripping and falling accidents with level-boarding.
- Assumed that span of service for TSM and BRT would be similar to the existing Route 4 span of service (5:00 AM to 12:30 AM).
- Assumed a reduced dwell time for BRT due to eliminating wheelchair lifts with level boarding and the reduced number of stops.
- Assumed additional fare revenue, using C-TRAN average fare per boarding, for additional ridership projected for the TSM and BRT Alternatives.

TABLE 5-3

Estimated Operating and Maintenance Costs for Vancouver Mall Terminus (in 2011 \$)

	No Build	Van Mall Terminus			
	Total No Build	TSM	BRT A. Mixed Traffic– Curbside	BRT B. Mixed Traffic– Left Lane	BRT C. BAT Lane– Converted
Peak Bus Requirement	11	9	9	9	9
Annual Platform Hours	51,937	48,548	46,558	47,701	46,558
Cost per Hour	\$105	\$105	\$112	\$112	\$112
Annual Service Cost	\$5,453,000	\$5,097,500	\$5,214,500	\$5,342,500	\$5,214,500
Non-Service TSM/BRT Costs	\$0	\$170,500	\$439,000	\$373,500	\$439,000
BRT Cost Savings	\$0	\$0	(\$72,000)	(\$72,000)	(\$72,000)
Additional Fare Revenue	\$0	(\$83,000)	(\$640,000)	(\$640,000)	(\$640,000)
TOTAL NET COST	\$5,453,000	\$5,185,000	\$4,941,500	\$5,004,000	\$4,941,500
Change from No Build		(\$269,000)	(\$511,500)	(\$449,000)	(\$511,500)

Findings

Table 5-3 shows the annual operating and maintenance costs comparing the TSM and BRT with the No Build Alternative. The BRT Alternative would have fewer annual platform hours than the TSM or No Build Alternative due to faster round trip travel times for buses resulting from reduced dwell times. The three BRT Alternative options would have similar operating and maintenance costs.

TABLE 5-4

Estimated Operating and Maintenance Costs for Terminus Options (in 2011 \$)

	No Build	TSM			BRT		
		Van Mall Terminus	121st Terminus	162nd Terminus	Van Mall Terminus	121st Ave Terminus	162nd Terminus
Peak Bus Requirement	11	9	12	14	9	11	13
Annual Platform Hours	51,937	48,548	63,606	74,610	46,558	58,271	68,353
Cost per Hour	\$105	\$105	\$105	\$105	\$112	\$112	\$112
Annual Service Cost	\$5,453,000	\$5,097,500	\$6,679,000	\$7,834,000	\$5,214,500	\$6,526,000	\$7,655,500
Non-Service TSM/BRT Costs	\$0	\$170,500	\$190,000	\$211,000	\$439,000	\$525,000	\$703,500
BRT Cost Savings	\$0	\$0	\$0	\$0	(\$72,000)	(\$72,000)	(\$72,000)
Additional Fare Revenue	\$0	(\$83,000)	(\$267,000)	(\$408,000)	(\$640,000)	(\$913,500)	(\$1,122,000)
TOTAL NET COST	\$5,453,000	\$5,185,000	\$6,602,000	\$7,637,000	\$4,941,500	\$6,065,500	\$7,165,000
Change from No Build	n/a	(\$269,000)	\$1,149,000	\$2,184,000	(\$511,500)	\$612,500	\$1,712,000

Table 5-4 compares the annual operating and maintenance costs for the No Build Alternative, TSM Alternative (with three termini shown) and the BRT Alternative's three terminus options (Westfield Vancouver Mall, 121st Avenue and 162nd Avenue). The terminus operating and maintenance costs for the BRT Alternative options were estimated based on A. Mixed Traffic - Curbside on Fort Vancouver Way and Fourth Plain Boulevard. These costs assume that 10-minute weekday daytime service would operate between downtown Vancouver and each terminus. Additional fare revenue would increase based on the length of the project as well as from the TSM Alternative to the BRT Alternative. This additional fare revenue offsets the operations and maintenance costs associated with the build alternatives. As shown, compared to the No Build Alternative, both the TSM—Van Mall Terminus and the BRT Alternative—Van Mall Terminus would experience a savings in operations and maintenance costs, where the BRT Alternative would save an additional \$243,000 over the TSM Alternative's savings. Where the BRT Alternative—121st Avenue Terminus would save less money over the No Build Alternative compared to the TSM Alternative—121st Avenue Terminus, the BRT Alternative—162nd Avenue Terminus would save more operations and maintenance costs compared to the TSM Alternative—162nd Avenue Terminus.

6. EVALUATION—FULL ANALYSIS CHOICES

This chapter summarizes the key differences among the BRT lane configuration options and eastern terminus options and evaluates how well each would meet the project goals. The relative performance of the BRT Alternative compared to the No Build and TSM Alternatives will be described in Chapter 8, Preliminary Locally Preferred Alternative.

The project team provided relative scores for each BRT Alternative option based on the analysis results. These scores were adjusted based on input from the CAC and PMT. The scores included five ranking levels ranging from Poor to Very Good. The scores are provided below for each goal. Figure 6-1 shows a symbol legend for each table.

FIGURE 6-1

Evaluation Scoring Symbol Legend

	Very Good
	Good
	Moderate
	Moderate to Poor
	Poor

6.1 Fort Vancouver Way Lane Configuration Options

Goal 1: Improve Corridor Transit Service

Figure 6-2 shows the relative scoring on each of the Goal 1 objectives for the Fort Vancouver Way lane configuration options. The key findings are:

- All five Fort Vancouver Way lane configurations would perform similarly on Goal 1, with scores ranging from good to very good.
- E. Single Center Running Lane and G. Double Center Running Lane Converted would provide additional transit travel time benefits over the other options due to exclusive transit operations.

FIGURE 6-2

Goal 1 Evaluation Results for Fort Vancouver Way BRT Lane Configuration Options

Goal 1: Improve corridor transit service		A. Mixed Traffic Curbside	B. Mixed Traffic Left Lane	C. BAT Lane Converted	E. Single Center Running Lane	G. Double Center Running Lane Converted
a.	Improve transit service reliability (on-time performance)					
b.	Improve access to and from transit for pedestrians and bicyclists					
c.	Increase transit ridership					
d.	Reduce transit travel time to help make transit a viable alternative travel choice					
e.	Enhance the comfort and convenience of transit					
f.	Ensure good transit connections to other routes and destinations					

Goal 2: Create a Cost-Effective, Long-Term Transit Solution

Figure 6-3 shows the relative scoring on each of the Goal 2 objectives for the Fort Vancouver Way lane configuration options. The key findings are:

- All five lane configuration options would perform similarly on Goal 2.

FIGURE 6-3

Goal 2 Evaluation Results for Fort Vancouver Way BRT Lane Configuration Options

Goal 2: Create a cost-effective, long-term transit solution	A. Mixed Traffic Curbside	B. Mixed Traffic Left Lane	C. BAT Lane Converted	E. Single Center Running Lane	G. Double Center Running Lane Converted
a. Develop a cost-effective project	■	■	■	■	■
b. Identify an affordable, fundable project that identifies a range of funding opportunities (including federal, state and/or public/private partnerships) and minimizes the burden on local taxpayers and users	■	■	■	■	■
c. Develop a project that can minimize increases in transit operating and maintenance costs (Van Mall terminus)	■	■	■	■	■

Goal 3: Meet Current and Future Corridor Travel Demand

Figure 6-4 shows the relative scoring on each of the Goal 3 objectives for the Fort Vancouver Way lane configuration options. The key findings are:

- C. BAT Lane Converted and G. Double Center Running Lane Converted would result in extensive queuing of vehicles travelling on Fort Vancouver Way due to decreased auto and truck capacity.
- A. Mixed Traffic Curbside, B. Mixed Traffic Left Lane, and E. Single Center Running Lane would all maintain the same auto capacity as No Build.
- B. Mixed Traffic Left Lane, E. Single Center Running Lane, and G. Double Center Running Lane Converted would slightly improve bicycle safety and operations on Fourth Plain Boulevard due to the removal of conflicts between buses and bicyclists from buses stopping on the curb side.
- C. BAT Lane Converted would also slightly improve bicycle safety and operations on Fort Vancouver Way due to the reduction in auto traffic volumes in the lane adjacent to bicyclists.

FIGURE 6-4

Goal 3 Evaluation Results for Fort Vancouver Way BRT Lane Configuration Options

Goal 3: Meet current and future corridor travel demand	A. Mixed Traffic Curbside	B. Mixed Traffic Left Lane	C. BAT Lane Converted	E. Single Center Running Lane	G. Double Center Running Lane Converted
a. Accommodate future growth in travel by increasing transit's share of trips	■	■	■	■	■
b. Maintain reliable motor vehicle operations for the projected traffic flow through the Fourth Plain corridor	■	■	◆	■	◆
c. Increase transit capacity to meet projected ridership demand in the corridor	■	■	■	■	■
d. Improve transit service to key community facilities (educational, medical, recreational, etc.)	■	■	■	■	■
e. Maintain or enhance bicycle safety and operations through the Fourth Plain corridor	■	■	■	■	■

Goal 4: Enhance the Safety and Security of the Corridor

Figure 6-5 shows the relative scoring on each of the Goal 4 objectives for the Fort Vancouver Way lane configuration options. The key findings are:

- E. Single Center Running Lane could result in a decrease in safety for pedestrians crossing Fort Vancouver Way due to removal of the center median and BRT buses travelling in both directions in the single center running lane.
- G. Double Center Running Lane Converted would result in the highest improvement in safety for pedestrians crossing Fort Vancouver Way due to a reduction in the number of lanes to cross.
- All five lane configurations would otherwise perform similarly on Goal 4.

FIGURE 6-5

Goal 4 Evaluation Results for Fort Vancouver Way BRT Lane Configuration Options

Goal 4: Enhance the safety and security of the corridor		A. Mixed Traffic Curbside	B. Mixed Traffic Left Lane	C. BAT Lane Converted	E. Single Center Running Lane	G. Double Center Running Lane Converted
a.	Improve the safety of pedestrians accessing and crossing Fort Vancouver Way					
b.	Address safety issues at intersections with high crash rates					
c.	Enhance the security of transit users, residents and business patrons at and near stops and stations					

Goal 5: Support Economic Vitality and Corridor Revitalization Efforts

Figure 6-6 shows the relative scoring on each of the Goal 5 objectives for the Fort Vancouver Way lane configuration options. The key findings are:

- C. BAT Lane Converted and G. Double Center Running Lane Converted would result in diversion of traffic away from Fort Vancouver Way due to a reduction in auto and truck capacity on Fort Vancouver Way under these options.
- C. BAT Lane Converted and G. Double Center Running Lane Converted would not attract enough additional people to this part of the corridor to offset the traffic diverted from the corridor.
- B. Mixed Traffic Left Lane and E. Single Center Running Lane would result in higher impacts than any of the other options in terms of maintaining motor vehicle access due to more parking spaces removed.

FIGURE 6-6

Goal 5 Evaluation Results for Fort Vancouver Way BRT Lane Configuration Options

Goal 5: Support economic vitality and corridor revitalization efforts		A. Mixed Traffic Curbside	B. Mixed Traffic Left Lane	C. BAT Lane Converted	E. Single Center Running Lane	G. Double Center Running Lane Converted
a.	Maintain motor vehicle and non-motorized access					
	–Impacts	■	■	■	■	■
	–Minimizes diversion of traffic away from corridor	■	■	◆	■	◆
	–Attracts new person trips to the corridor	■	■	◆	■	◆
b.	Enhance the appearance of the corridor and increase the awareness and visibility of existing businesses	■	■	■	■	■
c.	Stimulate opportunities for development adjacent to transit stations, consistent with the City of Vancouver's Fourth Plain Subarea Plan					
d.	Support diversity in the size and type of businesses along Fourth Plain Boulevard					
e.	Transit investments should recognize the corridor's role as the City's International Corridor					
f.	Implement applicable transit-related elements of the City's Subarea Plan	■	■	■	■	■

Goal 6: Support a Healthy and Livable Community

Figure 6-7 shows the relative scoring on each of the Goal 6 objectives for the Fort Vancouver Way lane configuration options. The key findings are:

- All five lane configurations would perform similarly on Goal 6.

FIGURE 6-7

Goal 6 Evaluation Results for Fort Vancouver Way BRT Lane Configuration Options

Goal 6: Support a healthy and livable community		A. Mixed Traffic Curbside	B. Mixed Traffic Left Lane	C. BAT Lane Converted	E. Single Center Running Lane	G. Double Center Running Lane Converted
a.	Avoid or minimize negative impacts to businesses, residents and households, historic resources, parks, trails and other public recreation areas	■	■	■	■	■
b.	Avoid or minimize adverse impacts to the natural environment	■	■	■	■	■
c.	Ensure that corridor transit improvements benefit all segments of the community including transit dependents, disabled, youth, elderly, ethnic minorities, low income, etc.	■	■	■	■	■
d.	Develop sustainable transit enhancements that improve air quality, reduce greenhouse gas emissions, and reduce energy use	■	■	■	■	■
e.	Enhance the comfort and convenience of transit	■	■	■	■	■

6.2 Fourth Plain Lane Configuration Options

Goal 1: Improve Corridor Transit Service

Figure 6-8 shows the relative scoring on each of the Goal 1 objectives for the Fourth Plain lane configuration options.

The key findings are:

- All three lane configurations would perform similarly on most objectives under Goal 1.
- B. Mixed Traffic Left Lane would perform slightly better than the other options regarding improved transit access for pedestrians and bicyclists due to greater extent of sidewalk reconstruction in station areas than under the other options.

FIGURE 6-8

Goal 1 Evaluation Results for Fourth Plain BRT Lane Configuration Options

Goal 1: Improve corridor transit service		A. Mixed Traffic Curbside	B. Mixed Traffic Left Lane	C. BAT Lane Converted
a.	Improve transit service reliability (on-time performance)			
b.	Improve access to and from transit for pedestrians and bicyclists			
c.	Increase transit ridership			
d.	Reduce transit travel time to help make transit a viable alternative travel choice			
e.	Enhance the comfort and convenience of transit			
f.	Ensure good transit connections to other routes and destinations			

Goal 2: Create a Cost-Effective, Long-Term Transit Solution

Figure 6-9 shows the relative scoring on each of the Goal 2 objectives for the Fourth Plain lane configuration options.

The key findings are:

- All three lane configurations would perform similarly on Goal 2.

FIGURE 6-9

Goal 2 Evaluation Results for Fourth Plain BRT Lane Configuration Options

Goal 2: Create a cost-effective, long-term transit solution		A. Mixed Traffic Curbside	B. Mixed Traffic Left Lane	C. BAT Lane Converted
a.	Develop a cost-effective project			
b.	Identify an affordable, fundable project that identifies a range of funding opportunities (including federal, state and/or public/private partnerships) and minimizes the burden on local taxpayers and users			
c.	Develop a project that can minimize increases in transit operating and maintenance costs (Van Mall terminus)			

Goal 3: Meet Current and Future Corridor Travel Demand

Figure 6-10 shows the relative scoring on each of the Goal 3 objectives for the Fourth Plain lane configuration options.

The key findings are:

- C. BAT Lane Converted would impact auto and freight traffic flow on Fourth Plain Boulevard due to the conversion of one lane in each direction to a BAT lane.

- B. Mixed Traffic Left Lane would slightly improve bicycle safety and operations on Fourth Plain due to the removal of conflicts between buses and bicyclists from buses stopping on the curb side.
- C. BAT Lane Converted would also slightly improve bicycle safety and operations on Fourth Plain due to the reduction in auto traffic volumes in the lane adjacent to bicyclists.

FIGURE 6-10

Goal 3 Evaluation Results for Fourth Plain BRT Lane Configuration Options

Goal 3: Meet current and future corridor travel demand		A. Mixed Traffic Curbside	B. Mixed Traffic Left Lane	C. BAT Lane Converted
a.	Accommodate future growth in travel by increasing transit's share of trip			
b.	Maintain reliable motor vehicle operations for the projected traffic flow through the Fourth Plain corridor			
c.	Increase transit capacity to meet projected ridership demand in the corridor			
d.	Improve transit service to key community facilities (educational, medical, recreational, etc.)			
e.	Maintain or enhance bicycle safety and operations through the Fourth Plain corridor			

Goal 4: Enhance the Safety and Security of the Corridor

Figure 6-11 shows the relative scoring on each of the Goal 4 objectives for the Fourth Plain lane configuration options. The key findings are:

- All three lane configurations would perform similarly on Goal 4.

FIGURE 6-11

Goal 4 Evaluation Results for Fourth Plain BRT Lane Configuration Options

Goal 4: Enhance the safety and security of the corridor		A. Mixed Traffic Curbside	B. Mixed Traffic Left Lane	C. BAT Lane Converted
a.	Improve the safety of pedestrians accessing and crossing Fourth Plain Boulevard			
b.	Address safety issues at intersections with high crash rates			
c.	Enhance the security of transit users, residents and business patrons at and near stops and stations			

Goal 5: Support Economic Vitality and Corridor Revitalization Efforts

Figure 6-12 shows the relative scoring on each of the Goal 5 objectives for the Fourth Plain lane configuration options. The key findings are:

- C. BAT Lane Converted would result in diversion of traffic away from Fourth Plain Boulevard due to the conversion of one lane in each direction to a BAT lane.
- C. BAT Lane Converted would not attract enough additional people to the corridor (via increased transit use) to offset the traffic diverted from the corridor.
- B. Mixed Traffic Left Lane would result in slightly higher impacts than the curbside options in terms of maintaining motor vehicle access to corridor businesses due to slightly more left turn restrictions and parking spaces removed.

FIGURE 6-12

Goal 5 Evaluation Results for Fourth Plain BRT Lane Configuration Options

Goal 5: Support economic vitality and corridor revitalization efforts		A. Mixed Traffic Curbside	B. Mixed Traffic Left Lane	C. BAT Lane Converted
a.	Maintain motor vehicle and non-motorized access for corridor businesses			
	–Impacts	■	■	■
	–Minimizes diversion of traffic away from corridor	■	■	◆
	–Attracts new person trips to the corridor	■	■	◆
b.	Enhance the appearance of the corridor and increase the awareness and visibility of existing businesses	■	■	■
c.	Stimulate opportunities for development adjacent to transit stations, consistent with the City of Vancouver's Fourth Plain Subarea Plan			
d.	Support diversity in the size and type of businesses along Fourth Plain Boulevard			
e.	Transit investments should recognize the corridor's role as the City's International Corridor			
f.	Implement applicable transit-related elements of the City's Subarea Plan			

Goal 6: Support a Healthy and Livable Community

Figure 6-13 shows the relative scoring on each of the Goal 6 objectives for the Fourth Plain lane configuration options.

The key findings are:

- C. BAT Lane Converted would result more gallons of fuel used and in higher GHG emissions in the corridor due to increased auto and freight traffic delay due to the conversion of one lane in each direction to a BAT lane.
- A. Mixed Traffic Curbside and B. Mixed Traffic Left Lane would decrease gallons of fuel consumed and greenhouse gas emissions in the corridor.
- B. Mixed Traffic Left Lane would result in slightly higher right-of-way impacts than the curbside options due to slightly more street widening required in station areas.

FIGURE 6-13

Goal 6 Evaluation Results for Fourth Plain BRT Lane Configuration Options

Goal 6: Support a healthy and livable community		A. Mixed Traffic Curbside	B. Mixed Traffic Left Lane	C. BAT Lane Converted
a.	Avoid or minimize negative impacts to businesses, residents and households, historic resources, parks, trails and other public recreation areas	■	■	■
b.	Avoid or minimize adverse impacts to the natural environment	■	■	■
c.	Ensure that corridor transit improvements benefit all segments of the community including transit dependents, disabled, youth, elderly, ethnic minorities, low income, etc.	■	■	■
d.	Develop sustainable transit enhancements that improve air quality, reduce greenhouse gas emissions, and reduce energy use	■	■	◆
e.	Encourage pedestrian and bicycle mobility in the corridor and to transit	■	■	■

6.3 Eastern Terminus Options

Goal 1: Improve Corridor Transit Service

Figure 6-14 shows the relative scoring on each of the Goal 1 objectives for the eastern terminus options. The key findings are:

- All three terminus options would perform similarly on most objectives under Goal 1.
- Extending BRT east of Westfield Vancouver Mall to 121st Avenue or 162nd Avenue would result in higher ridership, both in terms of boardings on the BRT route and in terms of total transit trips in Clark County, and result in improved connections to more destinations.

FIGURE 6-14

Goal 1 Evaluation Results for BRT Eastern Terminus Options

Goal 1: Improve corridor transit service		Vancouver Mall	121st Ave	162nd Ave
a.	Improve transit service reliability (on-time performance)	■	■	■
b.	Improve access to and from transit for pedestrians and bicyclists	■	■	■
c.	Increase transit ridership	■	■	■
d.	Reduce transit travel time to help make transit a viable alternative travel choice	■	■	■
e.	Enhance the comfort and convenience of transit	■	■	■
f.	Ensure good transit connections to other routes and destinations	■	■	■

Goal 2: Create a Cost-Effective, Long-Term Transit Solution

Figure 6-15 shows the relative scoring on each of the Goal 2 objectives for the eastern terminus options. The key findings are:

- Extending BRT east of Westfield Vancouver Mall to 121st Avenue or 162nd Avenue would result in higher capital costs, though by a relatively small increment that would not warrant a different score in the evaluation.
- Extending BRT east of Westfield Vancouver Mall would result in higher operating costs.
- Extending BRT east of Westfield Vancouver Mall would result in a lower total project lifecycle cost per boarding ride because the higher boardings that would result from extending further east would offset the higher capital and operating costs.

FIGURE 6-15

Goal 2 Evaluation Results for BRT Eastern Terminus Options

Goal 2: Create a cost-effective, long-term transit solution		Vancouver Mall	121st Ave	162nd Ave
a.	Develop a cost-effective project	■	■	■
b.	Identify an affordable, fundable project that identifies a range of funding opportunities (including federal, state and/or public/private partnerships) and minimizes the burden on local taxpayers and users	■	■	■
c.	Develop a project that can minimize increases in transit operating and maintenance costs (Van Mall terminus)	■	■	■

Goal 3: Meet Current and Future Corridor Travel Demand

Figure 6-16 shows the relative scoring on each of the Goal 3 objectives for the eastern terminus options. The key findings are:

- All three terminus options would perform similarly on Goal 3.

FIGURE 6-16

Goal 3 Evaluation Results for BRT Eastern Terminus Options

Goal 3: Meet current and future corridor travel demand		Vancouver Mall	121st Ave	162nd Ave
a.	Accommodate future growth in travel by increasing transit's share of trips			
b.	Maintain reliable motor vehicle operations for the projected traffic flow through the Fourth Plain corridor			
c.	Increase transit capacity to meet projected ridership demand in the corridor			
d.	Improve transit service to key community facilities (educational, medical, recreational, etc.)			
e.	Maintain or enhance bicycle safety and operations through the Fourth Plain corridor			

Goal 4: Enhance the Safety and Security of the Corridor

Figure 6-17 shows the relative scoring on each of the Goal 4 objectives for the eastern terminus options. The key findings are:

- All three terminus options would perform similarly on Goal 4.

FIGURE 6-17

Goal 4 Evaluation Results for BRT Eastern Terminus Options

Goal 4: Enhance the safety and security of the corridor		Vancouver Mall	121st Ave	162nd Ave
a.	Improve the safety of pedestrians accessing and crossing Fourth Plain Boulevard			
b.	Address safety issues at intersections with high crash rates			
c.	Enhance the security of transit users, residents and business patrons at and near stops and stations			

Goal 5: Support Economic Vitality and Corridor Revitalization Efforts

Figure 6-18 shows the relative scoring on each of the Goal 5 objectives for the eastern terminus options. The key findings are:

- All three terminus options would perform similarly on Goal 5.

FIGURE 6-18

Goal 5 Evaluation Results for BRT Eastern Terminus Options

Goal 5: Support economic vitality and corridor revitalization efforts		Vancouver Mall	121st Ave	162nd Ave
a.	Maintain motor vehicle and non-motorized access for corridor businesses			
	–Impacts	■	■	■
	–Minimizes diversion of traffic away from corridor	■	■	■
	–Attracts new person trips to the corridor	■	■	■
b.	Enhance the appearance of the corridor and increase the awareness and visibility of existing businesses	■	■	■
c.	Stimulate opportunities for development adjacent to transit stations, consistent with the City of Vancouver's Fourth Plain Subarea Plan			
d.	Support diversity in the size and type of businesses along Fourth Plain Boulevard			
e.	Transit investments should recognize the corridor's role as the City's International Corridor			
f.	Implement applicable transit-related elements of the City's Subarea Plan	■	■	■

Goal 6: Support a Healthy and Livable Community

Figure 6-19 shows the relative scoring on each of the Goal 6 objectives for the eastern terminus options. The key findings are:

- All three terminus options would perform similarly on most objectives under Goal 6.
- Extending BRT east of Westfield Vancouver Mall would result in a reduction in fuel consumed and GHG emissions in the corridor due to higher transit ridership.

FIGURE 6-19

Goal 6 Evaluation Results for BRT Eastern Terminus Options

Goal 6: Support a healthy and livable community		Vancouver Mall	121st Ave	162nd Ave
a.	Avoid or minimize negative impacts to businesses, residents and households, historic resources, parks, trails and other public recreation areas	■	■	■
b.	Avoid or minimize adverse impacts to the natural environment	■	■	■
c.	Ensure that corridor transit improvements benefit all segments of the community including transit dependents, disabled, youth, elderly, ethnic minorities, low income, etc.	■	■	■
d.	Develop sustainable transit enhancements that improve air quality, reduce greenhouse gas emissions, and reduce energy use	■	■	■
e.	Encourage pedestrian and bicycle mobility in the corridor and to transit	■	■	■

6.4 Summary

FORT VANCOUVER WAY LANE CONFIGURATION

Most of the BRT lane configuration options would perform similarly relative to the project goals and objectives on Fort Vancouver Way. The primary distinguishing factors between the lane configurations on Fort Vancouver Way are related to the median exclusive running options and the BAT lane option. E. Single Center Running Lane and G. Double Center Running Lane Converted would offer greater potential to improve transit travel time and reliability than the mixed traffic options in this short section. C. BAT Lane Converted and G. Double Center Running Lane Converted would reduce auto capacity on Fort Vancouver Way and, therefore, would result in significant queuing and likely diversion of through traffic to other roadways in the area. A key finding for Fort Vancouver Way was that maintaining two general-purpose travel lanes in each direction would be critical to maintain traffic flow. An alternative of removing on-street parking in order to create a BAT lane or exclusive center running lane and maintain two general-purpose travel lanes in each direction was discussed, but this loss of parking was unacceptable to Clark College.

FOURTH PLAIN LANE CONFIGURATION

There are two key differences among the three lane configuration options evaluated for Fourth Plain Boulevard. The most significant finding is that the BAT Lane - Converted option would significantly increase auto and truck travel time, increase fuel consumption and GHG emissions on Fourth Plain Boulevard, would divert traffic away from Fourth Plain Boulevard, and would not significantly improve transit travel time or reliability. Maintaining two general-purpose travel lanes in each direction on Fourth Plain Boulevard would be critical to maintain traffic flow.

The other key finding on Fourth Plain Boulevard is that, due to providing more extensive streetscape improvements, B. Mixed Traffic Left Lane would provide slightly more opportunity for sidewalk, bicycle facility, pedestrian crossing improvements than A. Mixed Traffic Curbside. However, B. Mixed Traffic Left Lane would correspondingly have higher right of way impacts and capital cost than A. Mixed Traffic Curbside. The additional impacts resulting from median stations would include some removal of business parking spaces and some limited left turn access restrictions at a few locations in the corridor

EASTERN TERMINUS

There are trade-offs between the eastern terminus locations. With each alignment increment east from the Westfield Vancouver Mall (121st Avenue or 162nd Avenue), there would be an additional increment of capital cost to construct more stations as well as additional operating and maintenance costs to run more BRT-level service. These additional investments would result in additional boarding rides. However, analysis of 2035 boarding projects indicates that the cost per boarding increases with each increment further east.

7. EVALUATION—LIMITED ANALYSIS CHOICES

7.1 Westfield Vancouver Mall Routing Options

This section compares the five Westfield Vancouver Mall Routing Options. As described in Chapter 3, five potential BRT routing options have been evaluated for connecting to Westfield Vancouver Mall (see Figure 7-1):

- Option A. Existing Route
- Option B. Thurston Way
- Option C. Eastern Spur
- Option D. Vancouver Plaza
- Option E. Andresen Road

These routing options have been evaluated on their ability to serve Westfield Vancouver Mall effectively based on transit travel time, travel market, traffic context, route directness, and institutional barriers.

The five options are described in Chapter 3 Description of Alternatives.

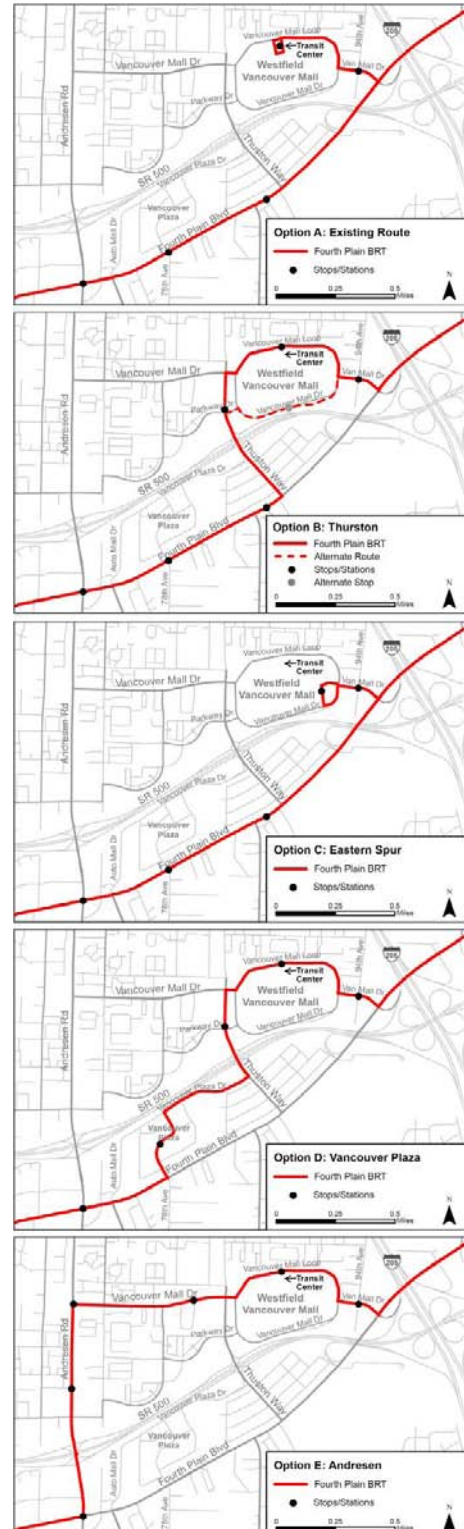
TRAVEL TIME

Travel time runs were conducted by both car and bus. Car travel time runs were conducted during the week of January 9th, 2012 during the afternoon peak hours, between 3:00 and 6:00 PM. In addition, travel time runs were also conducted on the Friday before Christmas (December 23rd, 2011) to provide a comparison of worst case traffic around the Westfield Vancouver Mall and to help understand the effect of holiday traffic on bus operations. Travel times were measured along each route from the intersection of Fourth Plain Boulevard and Andresen Road to the intersection of Fourth Plain Boulevard and Vancouver Mall Drive. The car travel runs did not include the Thurston option variation using the south ring road. Simulated passenger stops were not included in the car runs.

C-TRAN conducted travel time runs by bus on January 31, 2012. The bus travel times were from the intersection of Fourth Plain and Andresen to Vancouver Mall Transit Center. The bus simulated passenger stops.

The results from the two travel time analyses are shown in Table 7-1 below. As can be seen in the table, there is some variation in travel time

FIGURE 7-1
Westfield Vancouver Mall
Routing Options



between the options, though the differences are not great. The car runs were significantly faster, both because they did not include simulated passenger stops and because cars have faster acceleration and generally travel faster than buses.

TABLE 7-1

Test Run Travel Times (in minutes)

	Option A Existing Route	Option B1 Thurston- north	Option B2 Thurston- south	Option C Eastern Spur	Option D Vancouver Plaza	Option E Andresen
Car Travel time	8	7.5	n/a	7	8.5	7
Bus Travel time	12	13	12	10	13	13

na: not available

Option A: Existing Route would require the bus to turn around using the existing transit center. This is a relatively slow maneuver.

Travel time for Option B: Thurston Way would be comparable to Option A. The car test run showed this option being slightly faster, while the bus travel run indicates it would be a bit slower than the existing route. There would be more variability in travel time on this route than Option A: Existing Route due to additional signals and much longer signal cycle lengths. The intersections at Vancouver Plaza Drive, SR 500, Parkway Drive, and Vancouver Mall Drive all handle very large vehicle volumes, particularly the the single-point urban interchange (SPUI) at SR 500, which has a very long signal cycle length. Signal priority applied at these intersections could result in significant transit travel time savings. Utilizing the south ring road (Option B2) rather than the north ring road to access Vancouver Mall could save one minute in travel time per trip per direction.

Travel time for Option C: Eastern Spur, would be one to two minutes faster than the existing route. Despite diverting off of Fourth Plain Boulevard only half as far as Option A: Existing Route, Option C: Eastern Spur would still incur a substantial amount of delay between Fourth Plain Boulevard and the edge of the mall property.

Option D: Vancouver Plaza would add up to 1 minute per trip per direction compared to Option A: Existing Route or Option B: Thurston. This option involves travelling through the parking lot of the shopping center, which includes speed bumps and a high degree of traffic turning movements and other bus travel impediments such as a high number of unsignalized pedestrian crossings.

Option E: Andresen would have approximately the same travel time as Option A: Existing Route. The car travel runs indicated it would be slightly faster, while the bus travel runs indicated it would be slightly slower.

Travel Time Variability» The average travel times discussed here represent a limited sample. Sampled travel times varied widely depending primarily on traffic signal timing. This is due to long signal cycles, some approximately 2 minutes or longer. Option B: Thurston and Option: D: Vancouver Plaza experienced the highest variability in travel time. Option A: Existing Route and Option E: Andresen experienced the least. This is due to more signals and longer cycle lengths on Thurston Way than on Andresen Road or on Fourth Plain Boulevard between Thurston Way and Vancouver Mall Drive. While the longer signal cycle lengths along Thurston Way currently result in long delays, they could represent an opportunity for significant travel time savings if transit signal priority were to be implemented along this stretch of Thurston Way.

Christmas Shopping Season» Car travel time runs were also conducted during the week before Christmas. Generally, travel times during that week were consistent with the discussion above. There is an important exception to this. Delays within the mall property were very high during the week before Christmas. Very long queues formed at the stop-controlled intersection of Vancouver Mall Drive and Vancouver Mall Loop in the outbound direction (leaving the mall). This resulted in additional delays of up to 10 minutes during the Christmas shopping season. The Eastern Spur routing could avoid some of this, but overall, travel times through the mall during the Christmas shopping season would be highly unpredictable.

TRAVEL MARKET

A transportation analysis zone (TAZ) is a unit of geography that contains information on the number of existing and projected households and jobs. Each of the alignment options for serving Westfield Vancouver Mall would provide access to a different set of TAZs and, therefore, to differing ridership markets.

A set of TAZs was identified for each alignment option. A TAZ was included if all or a portion of it would be within a 1/4 mile walk of a BRT stop. If only a portion of a TAZ would be within 1/4 mile of a stop, then approximately that portion of the zone's households and jobs were assumed to have access to the BRT stop. For example, if a TAZ is projected to contain 200 households in 2035 and approximately half of this TAZ is within a 1/4 mile of a stop, then it was estimated that 100 households would have access to the stop.

Using this method, an estimate was prepared of the approximate number of households and jobs that would be served by each routing option. Table 7-2 lists the numbers for each routing option for 2035. These numbers only include the stations from Andresen Road to the east side of Vancouver Mall.

The results of this analysis show that serving the area west of the mall and north of SR 500 would serve a slightly larger market than Option A: Existing Route. Option B: Thurston would serve 6,900 employees in the area from Andresen Road to the east side of the mall in 2035. This is approximately 23 percent more than the 5,600 that would be served by Option A: Existing Route. Slightly more households would be served by Option B: Thurston as well.

Option C: Eastern Spur would serve slightly fewer households and jobs than Option A: Existing Route.

Option D: Vancouver Plaza would be similar to Option B: Thurston, but would serve slightly fewer households and slightly more employees, due to its routing through the shopping center and away from residential areas south of Fourth Plain Boulevard.

Option E: Andresen serves a similar number of employees as Option B: Thurston, but serves significantly more households, due to the location of several large apartment complexes along Andresen Road and Vancouver Mall Drive west of Thurston Way.

TRAFFIC CONTEXT

Option A: Existing route minimizes the number of signals and avoids the most high-volume, less predictable signals on Thurston Way. The stretch of Fourth Plain Boulevard between Thurston Way and Vancouver Mall Drive has relatively few cross streets and few driveways. Buses, therefore, encounter little interference in this area. The greatest delay with Option A: Existing Route would occur between Fourth Plain Boulevard and the edge of the mall property. This stretch includes two signals and a high degree of friction from turning vehicles.

Within the Westfield Vancouver Mall property, travel time is relatively consistent. However, there is a high degree of unpredictability due to queuing during the Christmas shopping season, mentioned above. It should also be noted that there are speed bumps along Vancouver Mall Loop that slow buses down further. In addition, this option requires the BRT service to use the existing Vancouver Mall Transit Center, which, as currently configured, requires travel along a parking aisle to exit the station area. This introduces added delay and safety issues. The other routing options would use a BRT station along the north ring road adjacent to the transit center, and would not be required to circle the transit center.

Option B: Thurston would be subject to the same delays and unpredictability from mall traffic along either the north or south loop roads. The left turn from eastbound Fourth Plain Boulevard to northbound Thurston Way can create delays due to the short left turn pocket, which prevents vehicles from accessing the left turn lane when the queue in the travel lane exceeds the length of the turn pocket. This could be addressed through transit signal priority, which could trigger an extended green light for eastbound Fourth Plain traffic (for both the through and left turn movements) as the BRT bus is approaching that intersection.

Along Thurston Way itself, there is significant opportunity for signal priority to reduce transit travel times. Currently, the long signal cycles and high variability in travel time along this section of Thurston Way, would make it a less desirable route for transit. However, signal priority could potentially save a couple of minutes in this segment and make transit travel times more predictable and reliable. For Option B2, using the south ring road, there is an issue with the bus merge on Thurston Road, across traffic from the westbound off-ramp from SR 500, to reach the east lane to turn right onto the south ring road.

Any of the other routes, except Option C: Eastern Spur, would also be subject to speed bumps and unpredictable travel times within the Westfield Vancouver Mall property. Option C: Eastern Spur would still be subject to some delay and unpredictability associated with general mall traffic.

ROUTE DIRECTNESS

The routing options were measured from Andresen Road and Fourth Plain Boulevard to Vancouver Mall and from Vancouver Mall to Vancouver Mall Drive and Fourth Plain Boulevard. There is very little difference in total lengths among the options. The key difference is in the degree of out-of-direction travel.

Option A: Existing Route travels approximately 2 miles from the intersection of Andresen Road and Fourth Plain Boulevard to Vancouver Mall, and then 0.5 mile back to Vancouver Mall Drive and Fourth Plain Boulevard. Because this route would deviate from Fourth Plain Boulevard at Vancouver Mall Drive, travel 0.5 mile to the mall, and then turn around and retrace its path back to Fourth Plain Boulevard, it could be perceived by riders as particularly time consuming.

Option B: Thurston would avoid the out-of-direction nature of Option A: Existing Route. This option would travel approximately 1.8 miles from the intersection of Andresen Road and Fourth Plain Boulevard to Vancouver Mall, and then 0.5 mile to Vancouver Mall Drive and Fourth Plain Boulevard. This is slightly less travel distance than Option A: Existing Route and does not involve turning around and retracing a portion of the route. The south ring road option is a slightly shorter route than the north ring road, and, thus more direct. It also avoids the out-of-direction nature of Option A: Existing Route. Option B2 using the south ring road would have a slightly shorter travel distance and time.

Option C: Eastern Spur would travel about the same distance as Option B: Thurston. While it reduces the amount of out-of-direction travel compared to Option A: Existing Route, it does not eliminate it. The out-of-direction travel associated with this option could still be perceived by riders as taking longer than it actually does.

Option D: Vancouver Plaza offers little advantage over other options. It would be approximately the same length as Option B: Thurston. Option D: Vancouver Plaza provides slightly more direct service to the Vancouver Plaza shopping center than Option B: Thurston, but would not feel particularly direct to potential riders because the stop would be located somewhere in the shopping center parking lot, far from the doors of the surrounding shops.

Option E: Andresen would be approximately the same length as Option B: Thurston. However, it could feel more indirect to riders because of the long distance spent off of Fourth Plain Boulevard.

INSTITUTIONAL ISSUES

The key institutional issues involve Westfield Vancouver Mall and Vancouver Plaza. Option A: Existing Route would not require any change on Westfield Vancouver Mall property. Option B: Thurston, Option D: Vancouver Plaza, and Option E: Andresen would all require the construction of a new BRT station located on Vancouver Mall Loop adjacent to the existing transit center.

For the south ring road variation of Option B, the transit center would need to be relocated, which would require agreements with the Westfield Vancouver Mall and, possibly, the Washington Department of Transportation (WSDOT). This could affect parking spaces on the south side of the mall. The relocation of the transit center is a possible future option, but is not considered a part of this project

Option C: Eastern Spur would require obtaining agreements from both the Westfield Vancouver Mall and the corporate office for JC Penney, which controls the section of parking lot where the new BRT station would be located with this option. This option could also include relocating the entire transit center in order to facilitate transfers between the BRT line and other routes. This would require significantly more space to accommodate the transfer functions and would likely result in the elimination of some parking spaces in this section of the parking lot. The relocation of the transit center is a possible future option, but is not considered a part of this project

If Option C: Eastern Spur is selected, but the transit center remains at its current location, transfers between the BRT line and other routes would be more complicated, potentially discouraging many riders.

Option D: Vancouver Plaza would be routed through the Vancouver Plaza parking lot. As a result, this routing option would require agreements with the owner of Vancouver Plaza.

CONCLUSIONS AND RECOMMENDATIONS

Option B: Thurston offers the best potential to serve Westfield Vancouver Mall, while minimizing travel time, out-of-direction travel, and avoiding other institutional issues. Despite current travel times comparable to Option A: Existing Route, Option B: Thurston would not travel out-of-direction or retrace a portion of its route, as would both Option A: Existing Route and Option C: Eastern Spur. It offers potential for time savings due to signal priority opportunities at the Fourth Plain Boulevard intersection with Thurston Way as well as along Thurston Way. Option B: Thurston would also serve a slightly larger travel market than Option A: Existing Route by serving a stop on Thurston Way north of SR 500. The south ring road variation of Option B would result in a small additional travel time savings, but would also introduce issues related to relocating the transit station.

Option C: Eastern Spur does not save much time, does not eliminate out-of-direction travel, and introduces a range of potential issues with transfers to other routes and agreements with property owners.

Option D: Vancouver Plaza also introduces institutional issues, and provides no benefit in terms of travel time or travel market served. It would serve the Vancouver Plaza shopping center, but it would not serve it well and it would not be worth the extra potential travel time. Previous C-TRAN service through Vancouver Plaza had very poor ridership.

Option E: Andresen has comparable travel time and a good travel market. However, it is potentially beyond the scope of a Fourth Plain Boulevard focused BRT route. It would spend a significant amount of time off of Fourth Plain Boulevard. This would reduce service on the segment of Fourth Plain Boulevard between Andresen Road and Vancouver Mall Drive and it could feel like a significant detour to riders. Comparing existing boardings and alightings, on the bus routes on Andresen Road and Vancouver Mall Drive (routes 32 and 78), indicates that there are currently fewer riders getting on and off in this area than there are on Fourth Plain Boulevard between Andresen Road and the Westfield Vancouver Mall (a weekday average of 290 total ons and offs on routes 32 and 78 in this area versus a weekday average of 350 on routes 4 and 44). However, because Route 4 operates at higher frequency than the 32 or 78 and travels directly to downtown Vancouver, it would be expected to draw higher boardings.

Table 7-2 summarizes the findings for the Westfield Vancouver Mall routing options.

TABLE 7-2

Westfield Vancouver Mall Routing Advantages and Disadvantages

Measures	Option A: Existing Route	Option B: Thurston	Option C: Eastern Spur	Option D: Vancouver Plaza	Option E: Andresen
Travel Time	• Car test run: 8 Minutes • Bus test run: 12 minutes	• Option B1 (North ring road) • Car test run: 7.5 Minutes • Bus test run: 13 minutes • Option B2 (South ring road) • Bus test run: 12 minutes	• Car test run: 7 Minutes • Bus test run: 10 minutes	• Car test run: 8.5 Minutes • Bus test run: 13 minutes	• Car test run: 7 Minutes • Bus test run: 13 minutes
2035 Travel Markets	• Households: 1,500 • Employees: 5,600	• Households: 1,700 • Employees: 6,900	• Households: 1,200 • Employees: 4,300	• Households: 1,200 • Employees: 7,200	• Households: 2,600 • Employees: 6,800
Traffic Issues	• Speed bumps on mall property.	• Higher volume signals with long cycles. • Opportunity for significant savings from signal priority on Thurston. • Speed bumps on mall property.	• Least potential for delay due to signals and mall traffic.	• Speed bumps on mall property. • Speed bumps on Vancouver Plaza Property.	• Speed bumps on mall property.
Route Directness	• Andresen/ Fourth Plain to Van Mall: 2 miles • Van Mall to Van Mall Dr/Fourth Plain: 0.5 miles • Out-of-direction travel.	• Andresen/Fourth Plain to Van Mall: 1.8 miles • Van Mall to Van Mall Dr/Fourth Plain: 0.5 miles • No out-of-direction travel.	• Andresen/ Fourth Plain to Van Mall: 1.8 miles • Van Mall to Van Mall Dr/Fourth Plain: 0.3 miles • Out-of-direction travel.	• Andresen/ Fourth Plain to Van Mall: 1.8 miles • Van Mall to Van Mall Dr/Fourth Plain: 0.5 miles • No out-of-direction travel.	• Andresen/ Fourth Plain to Van Mall: 1.8 miles • Van Mall to Van Mall Dr/Fourth Plain: 0.5 miles • No out-of-direction travel.
Institutional Issues		• For Option B-2, agreement needed with owners of Vancouver Mall and, possibly, WSDOT regarding relocation of the Transit Center.	• Agreement needed with the owners of Vancouver Mall and JC Penney, which owns the lot in the southeast corner of the mall. • Transfer to other routes would be complicated if transit center remains in its current location.	• Agreement needed with the owner of Vancouver Plaza shopping center.	

7.2 Fort Vancouver Way/Veterans Administration Medical Center

Routing Options

Three potential BRT routing options have been evaluated for travel between Fourth Plain Boulevard and McLoughlin Boulevard using Fort Vancouver Way (see Figure 7-2):

- Option A: Fort Vancouver Way
- Option B: VA Medical Center
- Option C: New Route East of VA Medical Center

The routing options differ in the level of transit access they provide to Clark College and the VA Medical Center (and the Clark County Community Health Center), two important rider destinations. The options have been evaluated on their ability to serve these two key destinations, on the impact of the routing options on transit travel time and service hours, and on institutional barriers to implementation.

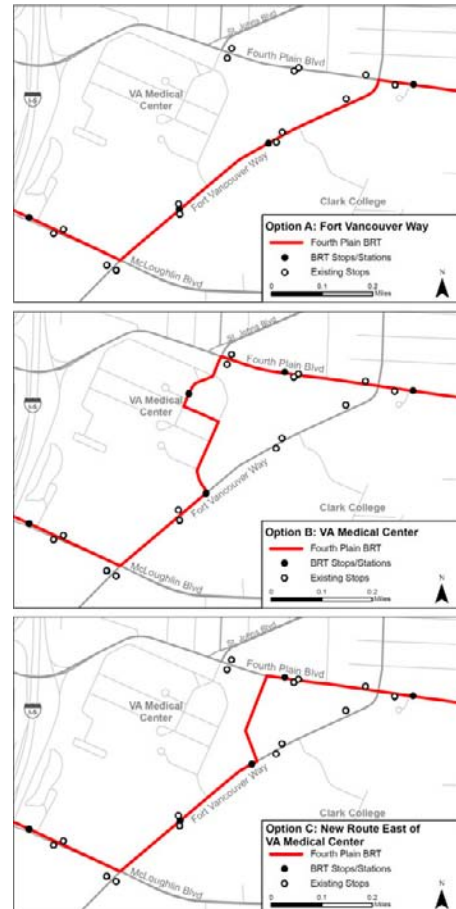
TRAVEL TIME & ANNUAL SERVICE HOURS

Travel times were measured for Options A and B between the intersection of Fourth Plain Boulevard and Fort Vancouver Way and the intersection of McLoughlin Boulevard and Fort Vancouver Way. The travel time data was collected in a car on January 11, 2012. Data was collected for two runs in each direction for Options A and B. Since Option C involves travel on roadways that do not currently exist or are inaccessible, the travel time for that option was estimated based on distances, assumed travel speeds, and time allocated for turns. The travel time for all the options includes an addition of 20 seconds for each transit stop. Since analysis was conducted in a car, the travel times may be quicker than when operated with a bus.

As shown in Table 7-3, Option A using Fort Vancouver Way had the shortest travel time. Including stops, this routing option would take just under three minutes per one-way trip. Option C would be just a little longer, at about 3.5 minutes. Option B, which includes slow and circuitous travel through the VA Medical Center, would have the longest travel time at over five minutes per one-way trip.

Assuming 90 round trips per weekday, 55 round trips per Saturday and 45 round trips per Sunday on the BRT service, there would be approximately 28,000 annual BRT round-trips, or 56,000 one-way BRT trips. Using Option A as a baseline, Option B would require about 2,130 additional service hours and Option C would require about 530 additional service hours.

FIGURE 7-2
**Fort Vancouver Way
Routing Options**



TRAVEL MARKET

A major difference between the options is their ability to serve Clark College and the VA Medical Center, two key destinations in the C-TRAN service area. Options A and C serve Clark College well, with a transit stop close to the major entrance to the college. The estimated walking distance between the transit stop and Cannell Library (selected as representing the heart of the Clark College campus) is about 600 feet for those two options. For Option B, which travels through the VA Medical Center and accesses Fort Vancouver Way south of the main entrance to Clark College, the walking distance between the transit stop and Cannell Library is 500 to 600 feet longer than for Options A and C. By comparison, existing Route 44 service provides access to Clark College comparable to Options A and C. Route 4 currently requires a 2,000-foot walk from the closest stop at Fourth Plain and Fort Vancouver Way to Cannell Library.

The VA Medical Center is another key destination in the area, and Option B clearly provides the best direct BRT access to that location. The distance between the transit stop and the VA Hospital is estimated to be 700 feet for Option B, 1,800 feet for Option C, and 2,200 feet for Option A. For many riders, travel to the VA Medical Center would require a transfer to another route under Options A and C. By comparison, Route 4 currently requires a 1,200-foot walk from the closest stop at Fourth Plain and St. Johns to the VA Hospital. Route 44 currently provides access to the VA that is similar to Option A.

TRAFFIC ISSUES/TRAVEL SAFETY

It is generally better for operations and safety for transit routes, and particularly major routes such as the BRT route, to use major streets for travel and avoid local streets and access roads. In particular, it is best to avoid travel on access roads that are used for parking and on local streets and drives with high pedestrian volumes. Option A would use major streets for all travel. The route through the VA Medical Complex in Option B would use driveways and access roads that are intended for slow speed travel and for access to parking lots. This option would have a higher collision risk than Options A and C. Option C would use, in part, a new roadway that could be designed as BRT-only. However, the southern portion of that route segment would likely use a parking access driveway.

There has been an ongoing issue on Fort Vancouver Way regarding pedestrian crossing safety. There is a heavy volume of Clark College students who cross Fort Vancouver Way walking to or from campus. The routing options under consideration do not, in and of themselves, worsen or improve the problem. Design options for BRT, including lane configurations, signalization, and station design could address this problem. Those design considerations could apply to these routing options.

INSTITUTIONAL ISSUES

Option A, which would not require travel on private roads or through private property, does not have institutional barriers to implementation.

Option B involves travel through the VA Medical Center. The key institutional issue involves site access. Homeland

Security concerns require that the south entrance to the VA Medical Center be closed at 8:00 PM. Thus, a BRT route using Option B would have to use a different route after 8:00 PM, which could create confusion for riders.

Option C would require travel on property that was owned by the National Park Service and carries a restriction that it can only be used as open space and recreation. In addition, the Clark College Foundation has plans for the property that may conflict with the proposed route. Clark College is planning for a Science, Technology, Engineering and Mathematics facility (STEM) that would be impacted if the Option C alignment were shifted to the east to avoid the open space restriction. In addition, Homeland Security controls security and access for the VA facility's perimeter. Discussions with VA staff indicate that Homeland Security concerns for the VA Medical Center eliminate the possibility of an access directly through the fenced east perimeter of the VA complex, which is one was one of the prime motivations for considering this route option.

MITIGATION FOR TRANSIT ACCESS

All three routing options will require some type of transit service west along Fourth Plain Boulevard to downtown Vancouver to replace lost transit access and service due to the BRT routing. It is possible that this "backfill" of service west of the BRT line along Fourth Plain Boulevard, as well as existing service provided by routes 3, 25 and 39, could provide substantial mitigation for lost or modified transit access under each of the routing options. For instance:

- Option A: Routes 3 (45-minute frequencies each direction) and 39 (one-hour frequencies each direction) currently provide transit access through the VA complex and, with no reconfiguring, can provide a transfer connection to the VA complex from a BRT station on Fort Vancouver Way (note that this transfer option currently exists). The combined headway of these two routes is approximately 30-40 minutes. Route 25 could be reconfigured to provide a transfer to the BRT line at Fort Vancouver Way and Fourth Plain with service west along Fourth Plain every 35 minutes in each direction, and with a stop at St. Johns and Fourth Plain, could provide an additional option for VA-bound BRT users. Additionally, VA staff indicated that volunteer shuttles are available to provide pick up and drop off of transit passengers at the BRT station and shuttle them to destinations within the campus.
- Option B: While this option provides the best transit access for VA Medical Center transit users, it increases the transit walk access distance for Clark College-bound transit users. Clark College-bound users could board/alight BRT on Fourth Plain Boulevard and Fort Vancouver Way, and walk to and from the College along Fort Vancouver Way, similar to what Route 4 riders do today.
- Option C: assuming that an opening in the eastern VA Medical Center fence line is not possible to provide walk access between a BRT station and the VA Medical Center campus, transit access mitigation would be similar to that provided under Option A.

CONCLUSIONS AND RECOMMENDATIONS

The analysis points to Option A, with travel on Fort Vancouver Way, as the preferred route. Option A has the fastest travel times, lowest operating cost, and the fewest institutional issues. In addition, Clark College likely generates more ridership than the VA Medical Center, and Option A best serves Clark College. Mitigation, in the form of continued service on routes 3 and 39 into the VA Medical Center, as well as other potential routing connections to service west on Fourth Plain Boulevard, would address the biggest deficiency of this option which is the poor access from the BRT route to the VA complex.

Option B would require an additional 2 minutes of travel time per one-way trip compared to Option A, which translates to an additional 2,130 annual service hours. Option B would also miss the heart of Clark College. Mitigation, in the form of transfers to other routes that travel closer to Clark College, may be possible.

Option C would be a very good alternative if the institutional issues could be resolved, including the ability to have access through the east side of the VA Medical Center complex. However, the institutional barriers for this route option would likely be very difficult to overcome.

TABLE 7-3

Fort Vancouver Way/Veterans Affairs Medical Center Routing Options

Measures	Option A: Fort Vancouver Way	Option B: VA Medical Center Route	Option C: New Route East of VA Medical Center
Segment Length	3,340 feet	4,800 feet	3,960 feet
Time (min.)¹	2:56	5:13	3:30
Additional Annual Service Hours²	—	2,130	530
Walking Distance	- Clark College Cannell Library to nearest station (1 - Fort Vancouver Way north station): 580 ft. - VA Medical Center Hospital to nearest station (2 - Fort Vancouver Way south station): 2,200 ft	- Clark College Cannell Library to nearest station (5 - Fort Vancouver Way station): 1,150 ft - VA Medical Center Hospital to nearest station (4 - VA Medical Center Station): 700 ft	- Clark College Cannell Library to nearest station (6 - Fort Vancouver Way north station): 600 ft - VA Medical Center Hospital to nearest station (3 - Fourth Plain Station): 1,800 ft
Pros	- Easy to understand BRT routing which would not be affected by time-of-day restrictions (see Option B “cons”) - Use of existing right-of-way Excellent service to Clark College - Provides two stations on Fort Vancouver Way near or at existing station locations - Transit access to/from the VA complex can be provided by existing routes with no reconfiguration needed.	- Direct BRT service to VA Medical Center - Provides a station at a high topography point on Fourth Plain Boulevard	- New portion of the alignment would be a dedicated bus lane which would reduce travel conflicts and congestion - Provides a station near the VA Medical Center at a high topography point on Fourth Plain Boulevard - Not affected by time-of-day restrictions (see Option B “cons”) - Good service to Clark College Transit access to/from the VA complex can be provided by existing routes with no reconfiguration needed.
Cons	- No direct BRT service to the VA Medical Center - Does not provide a station at the high topography point on Fourth Plain Boulevard.	- Out of direction travel Nearly doubles Travel time through the Fort Vancouver Way segment compared to Options 1 and 3 - Requires an additional station Provides only one station on Fort Vancouver Way Station on Fort Vancouver Way is relatively far from Clark College - The VA access road gate currently closes at approximately 8:00 PM every night, resulting in the need for a modified BRT route after 8:00 PM.	- Complications due to National Parks Service/TSA security constraints - No direct BRT service to the VA-Medical Center - Requires Congressional action to remove the recreation/open space condition on the NPS/Clark College Foundation property - Any shift in BRT alignment to the east would negatively impact Clark College’s planned STEM facility. - Requires property acquisition Requires an additional station - Out of direction travel

¹ Travel time is for a one-way trip and includes 20 seconds dwell time for each stop.

² Service hours is the additional hours compared to the shortest travel option (Option A) and assumes 56,000 one-way BRT trips per year.

7.3 Interim Cross Columbia River Service Options

Two interim Cross Columbia River Service options (described in Section 3.2 and shown in Figure 7-3) were analyzed for their ability to provide transit service between North Portland and downtown Vancouver prior to the LRT extension north into Vancouver, which is scheduled for 2019. This section details the limited analysis conducted for the two interim cross Columbia River service options, Option A and Option B.

ANNUAL SERVICE HOURS

Travel time assumptions are the key drivers to determine the cost assessments for both interim cross Columbia River service options. Travel times between downtown Vancouver and Delta Park were taken from the existing Route 4 schedule. Travel time data for the BRT line taken from the 2020 20-Year Plan for the downtown Vancouver to Westfield Vancouver Mall alignment. The cost implications of each alternative may differ if a longer BRT alignment is chosen. Although estimated costs are not provided, it is assumed that the more platform hours, the more costly the option. Frequency assumptions for the cross-river service are summarized in Table 7-4.

TABLE 7-4

Travel Frequency for Interim Cross Columbia River Service Options

Frequency	Option A: Extend BRT	Option B: Shuttle Service
Early AM	15	30
AM Peak	10	15
Midday	10	15
PM Peak	10	15
Evening	15	15
Night	30	30
Saturday Day	15	15
Saturday Eve.	30	30
Saturday Night	30	30
Sunday Day	15	30
Sunday Evening	30	30
Sunday Night	30	30

FIGURE 7-3

**Fort Vancouver Way
Routing Options**



Table 7-5 summarizes the existing C-TRAN bus hours spent crossing the bridge, as well as the number of hours required for both Options A and B. Bus requirements include the Fourth Plain TIP corridor, assuming a terminus at Westfield Vancouver Mall.

TABLE 7-5
Hours of Service for Interim CRC Options

	Existing Conditions Routes 4 and 44	Option A: Extend BRT	Option B: Shuttle Service
Hours of Service between Delta Park and Downtown Vancouver	11,90016	15,400	15,500
Conventional bus requirement	11	0	3
BRT bus requirement	0	12	8
TOTAL BUS REQUIREMENT	11	12	11

Costs for Option A were developed using the frequency assumptions described above. They include layover time and deadhead time (time for buses to travel to and from the starting or ending point of the route). Extending BRT from downtown Vancouver to Delta Park/Vanport would require approximately 3,500 additional platform hours than are currently operated across the river by routes 4 and 44. Option A requires twelve specifically branded BRT buses; one more bus than currently operated by routes 4 and 44.

Likewise, costs for Option B were developed using the shuttle frequency assumptions shown above in Table 7-4. Providing a shuttle between downtown Vancouver and Delta Park/Vanport would require approximately 3,600 more platform hours to operate than currently operated by routes 4 and 44. Option B would require eight specifically BRT-branded buses to operate between Westfield Vancouver Mall and downtown Vancouver and three regular buses. This is the same number of buses as are currently being operated by routes 4 and 44.

Please note that Option B's shuttle service requires about the same number of service hours as the BRT extension, despite the fact that it has less frequency and requires fewer peak buses. This is due to additional fixed costs in layover time and deadhead time associated with a separate route.

TRAVEL MARKET

Data from C-TRAN's passenger counting system collected June 5-10, 2011 indicates that there are 775 boardings and 715 alightings (people getting off) from Route 4 at Delta Park Transit Station on an average weekday. This means that more than 30 percent of all trips on Route 4 either start or end at Delta Park. Route 44 has a much larger percentage, nearly 60 percent, of total riders on the route boarding or alighting at the Delta Park station on an average weekday. In addition, nearly 14 percent of all Route 4 riders get on or off the route at the Jantzen Beach transit stops.

An examination of the transfer data found in the *C-Tran Fourth Plain Transit Corridor On-Board Rider Survey, September 2011* showed that more 65 percent of existing Route 4 and Route 44 customers already transfer at least once during their

trip; 18 percent transfer twice. Table 7-6 shows the percentage of route transfers for routes 4 and 44.

TABLE 7-6
Transfers for Routes 4 and 44

Number of Transfers	Percentage of Transfers
0	35%
1	44%
2	18%
3	1%
4	1%
TOTAL	100%

Option B would require riders to transfer to a shuttle bus prior to reaching the Jantzen Beach or the Delta Park Transit Station. Transfers add travel time and trip uncertainty, and deter riders.

Given the fact that currently 65 percent of Route 4 and Route 44 riders already transfer, and the biggest transfer destination is MAX, a large percentage of riders would require another transfer. Eighteen percent of existing riders already transfer twice and this change would increase these transfers to three. Market research has shown that most passengers will not regularly endure the inconvenience and longer travel times of three transfers, and will quit riding.

Not providing seamless access to the Delta Park Transit Station will deter riders from choosing BRT for travel to Portland. Some riders may choose to drive to the Delta Park park-and-ride. Similarly, riders destined for the Jantzen Beach Center will be deterred from this trip due to the required transfer.

TRAFFIC ISSUES

The Interstate Bridge is a major bottleneck on the I-5 corridor. The Bridge is a bottleneck not only during peak hour travel times, but, since the bridge lifts to allow for river vessels to pass below, it can cause mid-day traffic delays that can take hours to recover. Bridge lifts are restricted between 6:30 and 9 AM and 2:30 and 6 PM Monday through Friday and occur about once per day, on average.³

Regardless of which transit service option is chosen, any rider choosing to cross the bridge will be subject to travel unreliability. The two options have different impacts on intra-Clark County travel reliability.

Market research has shown that transit riders are sensitive to route reliability, and unreliable transit service will have a detrimental effect on ridership. The cross-river shuttle route in Option B would be more likely to maintain BRT schedule in Clark County since it would not extend BRT service across the Interstate Bridge. In addition, solutions to address severe schedule delays, such as bridge lifts or accidents, are easier to implement with the shuttle service since it is an

.....
3 <http://www.columbiarivercrossing.org/ProjectInformation/Problem.aspx>

independent route that can be fairly easily adjusted. Further, since the shuttle would use conventional buses instead of BRT buses, there is more flexibility in allocating additional buses to address schedule problems.

CONSTRUCTION IMPACTS

The cross-river service reliability challenges would be exacerbated by the construction of the CRC project along the I-5 corridor, which could start soon after BRT was implemented and last until LRT operates to the Central Park-and-Ride station just west of Clark College in 2019. During construction, the CRC project would cause lane restrictions and detours, both of which are likely to have negative impacts on transit service reliability. Additionally, the phased construction schedule will cause bus stop locations to be moved. Given the fact that BRT stations have raised platforms and enhanced amenities such as fare machines, multiple relocations of stops can be a significant project cost. Adjusting travel time, stops served, and the path available to buses repeatedly as the CRC project progresses will be a challenge to C-TRAN, particularly if the BRT alignment is extended to Delta Park.

Construction impacts are easier to manage with a dedicated shuttle route than by extending the BRT to Delta Park. Repeated changes to travel time, routing, or stop locations with a BRT will likely cause ripple effects through the entire BRT alignment in Clark County. Dedicated shuttle service can adjust routing, adjust recovery times, and add additional service (often called “tripper” buses) without unduly affecting service outside of the CRC corridor. Any change in schedule or unreliability is confined to the CRC corridor between downtown Vancouver and Delta Park.

CAPITAL COST

The shuttle option could use existing facilities at the three Oregon stops and, thus, would have no capital cost.

The BRT extension, in order to adhere to the BRT operation and design standards, would require reconstruction of the passenger stops to provide for level boarding and the installation of ticket vending machines. In addition, the Delta Park stop would need to be lengthened to accommodate an articulated bus. It is estimated that these improvements would cost about \$300,000 for the three Oregon stops. In addition, the stops could have shelters and other amenities that matched the BRT brand and image; this could add another \$100,000 per stop. Thus, the capital cost for BRT improvements at the three Oregon stops is estimated to be between \$300,000 and \$600,000. This cost could be greater if the stops were to be relocated during CRC construction. Since these are likely to be temporary improvements until the LRT line is extended to Vancouver, FTA has indicated that the North Portland capital costs would not be eligible for federal funding as part of the Small Starts project.

It should be noted that the ticket vending machines could be easily relocated and reused if no longer needed by BRT. There is even the possibility that BRT shelters could be removed and reused elsewhere.

CONCLUSIONS

There are two options to temporarily span the gap in service between the Fourth Plain BRT terminus in downtown Vancouver and the Delta Park/Vanport MAX station. Option A is to extend the BRT from downtown Vancouver to Delta Park/Vanport and Option B is to run a shuttle service between those two points. Both options would cost approximately the same to operate. One issue which could affect operating costs is the possibility that the CRC project compensate C-TRAN for the operation of the cross-river connection during the construction of the new bridge. It is not clear at this time whether that would only apply to the shuttle option or whether the compensation could be used for the temporary BRT extension.

There is a clear trade-off between ridership and reliability between the two options. Option A would maximize ridership, but likely subject the BRT route to schedule reliability problems, which has been one of the biggest concerns with the existing Route 4. Option B would introduce a transfer and additional travel time for many riders, which would reduce ridership and dissuade potential users from the service. However, Option B would have operational advantages and allow the BRT route to have a more reliable schedule.

This issue, along with other routing and service questions associated with BRT service prior to the extension of LRT to Vancouver, would be evaluated as part of the initial phase of Project Development that would occur following the selection of the LPA. At that time, it is expected that more would be known regarding the schedule and potential construction impacts of the CRC project. That information, as well as consideration of issues regarding ridership, transfers, and operational issues, will be evaluated in determining the best approach to the interim cross-river service.

TABLE 7-7

Interim Cross Columbia River Service Options Evaluation Summary

Measures	Option A: BRT Extension to Delta Park	Option B: Shuttle between Downtown Vancouver and Delta Park¹
Service Hours	15,400	15,500
Number of Additional Peak Hour Buses	4	3
Percent of BRT Riders who would have an added transfer	0%	30%
Pros	• Provides a one-seat ride for all BRT riders between Vancouver and heavily used stops in north Portland • Maintains existing connections and ridership provided by Route 4 and 44 • Easiest to understand option • Fastest option for passengers • Ensures that the ridership on the BRT will be strong from system initiation	• BRT would have more reliable running times since not involved in congestion associated with the Interstate Bridge • Shuttle service and BRT service frequencies can be determined independently, based in ridership demand. This could reduce overall operating cost • Establishes transfer in downtown Vancouver, as will happen once light rail is extended to Vancouver
Cons	• BRT crosses the Interstate Bridge, a major cause of delay and unreliable service times for all transit routes • Requires C-TRAN to fund substantial yet temporary capital improvements in Oregon as they would not be eligible for FTA Small Starts/Very Small Starts funding	• Most BRT riders travelling to Portland will need to make two transfers (one in Downtown Vancouver, one at Delta Park) • Introducing multiple transfers can reduce ridership • Approximately 44 percent of existing Route 4 riders start or end their trip at Delta Park or Jantzen Beach • Approximately 60 percent of Route 44 riders start or end their trip at Delta Park or Jantzen Beach • With 15-minute frequency on the shuttle, travel between the MAX Station and any BRT station outside of downtown will add an average at least 7.5 minutes in travel time to their trip

¹ Shuttle service is assumed to operate at 15 minute peak and 30 minute off-peak headways.

7.4 Park-and-Ride Terminus Options

This section analyzes the two park-and-ride options, at Option A: 121st Avenue or Option B: 131st Avenue (see Figure 7-4). The sites have been evaluated for their accessibility and traffic safety, service hours/operational cost, property costs, ability to accommodate the desired number of parking spaces and the site's ability to attract joint development opportunities.

SITE ACCESS/TRAFFIC SAFETY

Option A would have direct access to two roadways: Fourth Plain Boulevard and 121st Avenue. The traffic signal at the intersection of Fourth Plain Boulevard and 121st Avenue would provide for signalized left-turn access from the site onto Fourth Plain Boulevard. As a terminus location, buses from the west would enter the site west of 121st Avenue and exit the site by turning left on 121st and left again onto Fourth Plain Boulevard to begin the inbound trip.

FIGURE 7-4

Park-and-Ride Terminus Options



With a 162nd Avenue terminus, the Option A site would be accessed with a stop on Fourth Plain Boulevard on the outbound route, and using 121st Avenue for ingress and egress to the site on the inbound route. There is an option for the inbound (westbound) route to simply stop on the north side of Fourth Plain Boulevard. However, that would require users of the park-and-ride to cross Fourth Plain Boulevard to access the bus, which would significantly discourage use of the park-and-ride.

Option B is a mid-block site without direct access to a major cross street to Fourth Plain Boulevard. This presents challenges in terms of site access, particularly if the park-and-ride lot is also a transit center. It is hazardous for buses to make left turns from or to Fourth Plain Boulevard without a traffic signal. Thus, for this site to operate in a safe manner and to provide convenient access for cars to the park-and-ride lot, a traffic signal would need to be installed to access the site directly, or vehicle access from the site to 131st or 137th Avenue would be needed, either through property purchase or easement.

As a route terminus, buses would pull through the site. With a 162nd Avenue terminus, the Option B site would be accessed with a stop on Fourth Plain Boulevard on the outbound route, and use a signalized access for ingress and egress to the site on the inbound route. There is an option for the inbound (westbound) route to simply stop on the north side of Fourth Plain Boulevard. However, that would require users of the park-and-ride to walk to the nearest signalized intersection and cross Fourth Plain to access the bus, which would significantly discourage use of the park-and-ride.

SERVICE HOURS/OPERATING COSTS

The BRT operating costs for the two park-and-ride sites would be similar with a 162nd Avenue terminus, since the round trip running times would be similar. However, as a terminus, Option A would result in a shorter BRT route, which would require fewer service hours and have less operating cost than Option B. Assuming that the extra 1.4 miles of travel (0.7 miles in each direction) required by Option B would add 10 minutes of round-trip travel time, Option B would add approximately 5,000 service hours per year compared to Option A.

Option A would also be more efficient for express bus park-and-ride routes, since those could reduce travel on Fourth Plain Boulevard to access SR 500 compared to Option B.

PROPERTY COST

According to the Clark County online mapping tool, property records shown an assessed total value for Option A at \$2.14 million; Option B is assessed at \$2.07 million (see attached summary Table 7-8 for source information). Option B may also require purchase of property or an easement to allow access to 131st or 137th avenues, which would add to the site development cost. Other development costs are likely to be similar for the two sites, unless Option B includes a new traffic signal at the site, which would add approximately \$250,000 to site development costs.

PARKING SPACES

C-TRAN has assumed about 200 park-and-ride spaces for the park-and-ride site. Both options can accommodate this number of parking spaces. Option B, with 11 acres, has the flexibility to accommodate the 200 park-and-ride spaces with a significant amount of land remaining for joint development. Option A, with 6 acres, could accommodate the 200 park-and-ride spaces with a limited amount of land remaining for joint development.

JOINT DEVELOPMENT OPPORTUNITY

Although Option A is smaller in size, its location near SR 500 and the Community Commercial zoning designation make it a better candidate for transit-oriented joint development opportunities than Option B. In addition, Option A also has greater street frontage, which is critical in encouraging private development.

The size of Option B would easily lend itself to allowing a property line adjustment and selling off the excess land for other development. However, the limited street frontage and site access and Light Industrial zoning limit opportunities for joint development that support transit.

CONCLUSIONS

Based on this side-by-side comparison, Option A has better site access, would have lower operating cost as a corridor terminus, and has better opportunities for joint development. The major drawback to Option A is that the size of the site would require a decision to be made whether to emphasize park-and-ride use or joint development, since the site

could not accommodate both a 200 space park and ride lot and a significant level of joint development. Table 7-8 summarizes the evaluation of the park-and-ride options.

TABLE 7-8

Park-and-Ride Option Evaluation Summary

	Option A: West of 121st & Fourth Plain	Option B: East of 131st & Fourth Plain
Zoning	Community Commercial	Light Industrial
Park & Ride Allowed Use?	Limited Use ¹	Limited Use ¹
Maximum² Parking Spaces (Estimated)³	425	875
Total Size of all Parcels	262,666 square feet (6.03 acres)	488,743 square feet (11.22 acres)
2011 Assessed Value (Structure & Land)	\$2,141,210	\$2,073,900
Existing Access Driveways	• One (1) from Fourth Plain • One (1) from 121st	• Two (2) from Fourth Plain
Pros	• Good site access via 121st Avenue • Zoning support joint commercial development • Would work well for express commuter buses • Shorter route (than 131st option) reduces total BRT operating costs • More street frontage than 131st site, which adds to joint development viability	• Large site can accommodate both a large park and ride lot and joint development • Less expensive (based on assessed value) than 121st site • Could prepare a property line adjustment and sell excess property for other development
Cons	• Park and rides are a Limited Use within Community Commercial Zone and will be required to meet additional standards for approval; however, it is not permitted outright in any zone • Site size would preclude large park and ride and significant joint development	• Site is ten blocks further than the other parkand ride site which adds to BRT operating cost. Ridership may not warrant extending to 131st • Park and rides are a Limited Use within LightIndustrial Zone and will be required to meet additional standards for approval; however, it is not permitted outright in any zone • Need access to 131st in order to reach signalized left turn access onto Fourth Plain Joint development opportunities limited

1 Must comply with Section 20.430.040.E of the City of Vancouver's Municipal Code.

2 The number of parking spaces reported does not include joint development or open space on the site. Based on the calculation described below, only the lower range number is reported.

3 Parking Space Calculation: Assumes one (1) acre for the transit station area and preservation of 12 to 15 percent of the total remaining land area for on-site stormwater management. A typical parking space is 8-10 feet wide and 18-20 feet deep, totaling 144-200 square feet. Off-street parking requires driveways and access lanes, and so typically requires 300-400 square feet per space, allowing 100-150 spaces per acre. (Source: Victoria Transportation Institute. Parking Management. February 18, 2011.) The 99th Street park-and-ride in Vancouver has about 115 spaces/acre, well within the range reported.

8. PRELIMINARY LOCALLY PREFERRED ALTERNATIVE

NOTE: This Chapter is in draft form and will be completed when the Alternatives Analysis Report is finalized after the LPA adoption process has been completed.

This Chapter provides a description of the Preliminary Locally Preferred Alternative (LPA) for the Fourth Plain Corridor. The Preliminary LPA was endorsed by the Vancouver City Council on May 21, 2012 and preliminarily by the C-TRAN Board of Directors on June 12, 2012. The Preliminary LPA will become the final project LPA when the

C-TRAN Board takes final action which is scheduled for July 10, 2012, and when the Southwest Washington Regional Transportation Council (RTC) votes for its approval and incorporates the LPA into their Metropolitan Transportation Plan and Transportation Improvement Program. This vote is anticipated to occur on August 7, 2012.

8.1 Role of the Locally Preferred Alternative

The Locally Preferred Alternative (LPA) is the community's selection of the transit option that best meets the project's purpose, goals and objectives. It defines the alignment and termini, transit mode, general station locations, and design objectives for the transit project. While the LPA outlines the general corridor configuration, it does not determine a specific design. The design will be determined during the project development phase that follows.

The Federal Transit Administration (FTA) reviews the LPA and the process used to select it for consistency with their Alternatives Analysis (AA) study requirements, including measuring the LPA against a no-build alternative as well as a Transportation System Management (TSM) or "enhanced bus service" alternative. FTA will need to determine the eligibility and rating of the project for potential funding through the Small Starts Program.

Adoption of the LPA allows C-TRAN to seek federal funding for project development and construction, and secure the local matching funds needed for the federal grant. Additionally, environmental study, documentation and approvals required by the National Environmental Policy Act (NEPA) and Washington State Environmental Policy Act (SEPA) will be completed after the LPA is adopted, during the project development phase.

8.2 Summary of Alternatives Considered

The AA process began in the spring of 2011 with a substantial amount of public involvement, including meetings with the Fourth Plain Merchants Association and door-to-door contact with corridor businesses and apartment complexes. Over 60 public meetings have been held since February 2011 to present information and results, and receive public input and comments.

As noted earlier in this AA Report, a wide range of alternatives were considered and evaluated against the project's Purpose and Need Statement; those that were not consistent with the Purpose and Need were eliminated. The remaining alternatives were assessed during the fall of 2011, through a series of community design workshops, committee meetings and C-TRAN Board actions which resulted in the development of four alternatives to be evaluated: No-build, Transporta-

tion System Management, curbside Bus Rapid Transit (BRT) on Fourth Plain and Fort Vancouver Way and median Bus Rapid Transit on Fourth Plain and Fort Vancouver Way. Each of the BRT alternatives includes transit routing options for the areas near the Westfield Vancouver Mall and the Veterans' Administration (VA)/Clark County Community Health Complex. These four alternatives were approved by the C-TRAN Board on November 8, 2011.

The alternatives evaluated included:

- **BRT in mixed traffic on Fourth Plain and Fort Vancouver Way with curbside stations»** BRT buses would operate in the right lane of traffic and stop along the curb-side much like they do now. Also included would be substantial transit stations (see Section 8.6), Transit Signal Priority (TSP), low floor and level boarding stations and vehicles, special branding of service, and frequent service - 10 min peak/15 min off peak for up to 19 hours per weekday;
- **BRT in mixed traffic on Fourth Plain and Fort Vancouver Way with median stations»** Under this alternative BRT buses would travel in the left lane and stations would be located in the center of the street rather than on the curb on Fort Vancouver Way and on Fourth Plain between Fort Vancouver Way and 65th Avenue (they would be curbside elsewhere). Signalized pedestrian crossings would accommodate transit user access to and from each station. All other BRT elements as noted in the BRT Curbside Alternative above would be incorporated into this alternative as well;
- **No-build»** Otherwise known as "No Action", this alternative is required by the federal evaluation and environmental study processes. The No-Build alternative is essentially the existing transportation system in the Fourth Plain study corridor (existing roadway network and transit service), with additional buses and service added over time to maintain the current 15-minute service frequencies on the Fourth Plain corridor. Outside of the study corridor, a transportation network consistent with the Clark County 2035 Metropolitan Transportation Plan would be assumed; and
- **Baseline or Transportation System Management (TSM), otherwise known as "enhanced bus"»** Also required under federal guidelines, the Baseline or TSM alternative consists of transit operational and capacity improvements with the intention of addressing problems identified in the Purpose and Need Statement with low-cost solutions. The TSM Alternative was developed to run along the same alignment, with the same eastern and western termini, as the BRT alternatives. It includes transit signal priority (similar to the BRT alternatives), safety and security enhancements to existing stops and up to three mid-block pedestrian crossings at existing transit stops, as well as additional buses and bus service to result in 10-minute frequencies during much of the day (again, similar to the BRT alternatives).

8.3 Decision-Making Process

A Corridor Advisory Committee (CAC), comprised of business, neighborhood, and other stakeholders in the corridor; as well as an agency Project Management Team, (PMT) comprised of C-TRAN, City of Vancouver, and Regional

Transportation Council (RTC) staff, have provided review, comments, and recommendations during the AA process.

At their May 2, 2012 meeting, the CAC reached consensus to recommend an initial Locally Preferred Alternative. This alternative consisted of BRT in mixed traffic between downtown Vancouver and NE 121st Avenue, with future extension(s) to NE 162nd Avenue, on an alignment following the Columbia River Crossing Light Rail Transit (LRT) route in downtown Vancouver, traveling north on Fort Vancouver Way, and turning east on Fourth Plain Boulevard to its eastern terminus.

The PMT met later in May to review the CAC's recommendation, as well as updated financial information from C-TRAN's Financial Plan work (see Section 8.9 below). Additionally, the PMT discussed opening year rating requirements of the FTA's Small Starts program and concluded that in the short term, the most financially feasible and practical option for the LPA would be to terminate the initial project at Westfield Vancouver Mall, with consideration for future extensions to the vicinity of NE 121st Avenue and/or to NE 162nd Avenue when ridership, growth, economic conditions, and environmental analysis warrant. See Section 8.4 for more information on the LPA.

Since the entire LPA corridor to the eventual eastern terminus at NE 162nd Avenue is within the jurisdiction of the City of Vancouver, the Vancouver City Council was part of the decision-making process on the LPA. Vancouver City Council, after a public hearing, adopted the LPA by resolution on May 21, 2012.

The Regional Transportation Council, as the Metropolitan Planning Organization (MPO) for the Clark County region, is responsible for maintaining the Metropolitan Transportation Plan (MTP). The LPA, by FTA's Small Starts requirements, must be "included within the MPO's long range plan" (the MTP). It is anticipated that the RTC Board will be taking action to endorse the LPA and amend it into the MTP at their August 2012 meeting.

The C-TRAN Board is responsible for approving the LPA as lead agency for the project. The C-TRAN Board gave preliminary approval to the LPA at their June 12, 2012 meeting pending review of the Expert Review Panel report. Final action by the C-TRAN Board is expected at their July 10, 2012 meeting.

8.4 Elements of the Preliminary Locally Preferred Alternative

The foundation of the Preliminary LPA is as follows:

- **Mode**—Bus Rapid Transit (BRT) in primarily mixed traffic.
- **Termini**—The project would extend from downtown Vancouver with an eastern terminus in the vicinity of the Westfield Vancouver Mall Transit Center. Future BRT Corridor extensions should be considered to the vicinity of NE 121st Avenue and/or to NE 162nd Avenue.
- **Alignment**—The alignment would follow the Columbia River Crossing Light Rail Transit (LRT) route in downtown Vancouver, travel north on Fort Vancouver Way, and turn east on Fourth Plain Boulevard to serve the Westfield Vancouver Mall area and Transit Center, with possible future extensions along Fourth Plain Boulevard to as far east as NE 162nd Avenue.

The following sections provide more details about discrete characteristics of the Preliminary LPA alignment, cost, and financing plan. A graphic showing the Preliminary LPA is provided in Figure 8-1.

LANE CONFIGURATIONS AND STATIONS

Downtown Vancouver» In downtown Vancouver, BRT would operate in the LRT guideway. West of Fort Vancouver Way, the BRT service would share stations with LRT on McLoughlin (both directions), Washington Street (two southbound platforms) and Broadway (two northbound platforms).

Fort Vancouver Way» Two lane configuration options are being considered along Fort Vancouver Way. Stations (or pairs of stations for the curbside configuration) would be located near the south entrance of the Veterans Administration Complex and just north of the primary entrance to Clark College.

- **Mixed Traffic Curbside**—BRT would operate in mixed traffic in the curbside lane. Stations would be located curbside.
- **Mixed Traffic Left Lane**—BRT would operate in mixed traffic in the left lane. Stations would be located in the center of the street.

Fourth Plain Boulevard» Two lane configurations are being considered as design options along Fourth Plain Boulevard between Fort Vancouver Way and Thurston Way. Twelve stations (or pairs of stations for the curbside configuration) would be located on Fourth Plain Boulevard between Fort Vancouver Way and Thurston Way, with station spacing averaging 1/4 to 1/3 of a mile.

- **Mixed Traffic Curbside**—BRT would operate in mixed traffic in the curbside lane. Stations would be located curbside. A single median station for westbound travel would be located just east of the Fort Vancouver Way intersection to accommodate a left turn onto Fort Vancouver Way.
- **Mixed Traffic Hybrid**—BRT would operate in mixed traffic in both curbside and left lanes. Left lane operation with median stations would occur between Fort Vancouver Way and 65th Avenue, with the exception of eastbound stations located at Grand Boulevard and Neals Lane, which would be curbside.

Westfield Vancouver Mall Routing» Three routing options remain under consideration for the Westfield Vancouver Mall terminus. They are as follows:

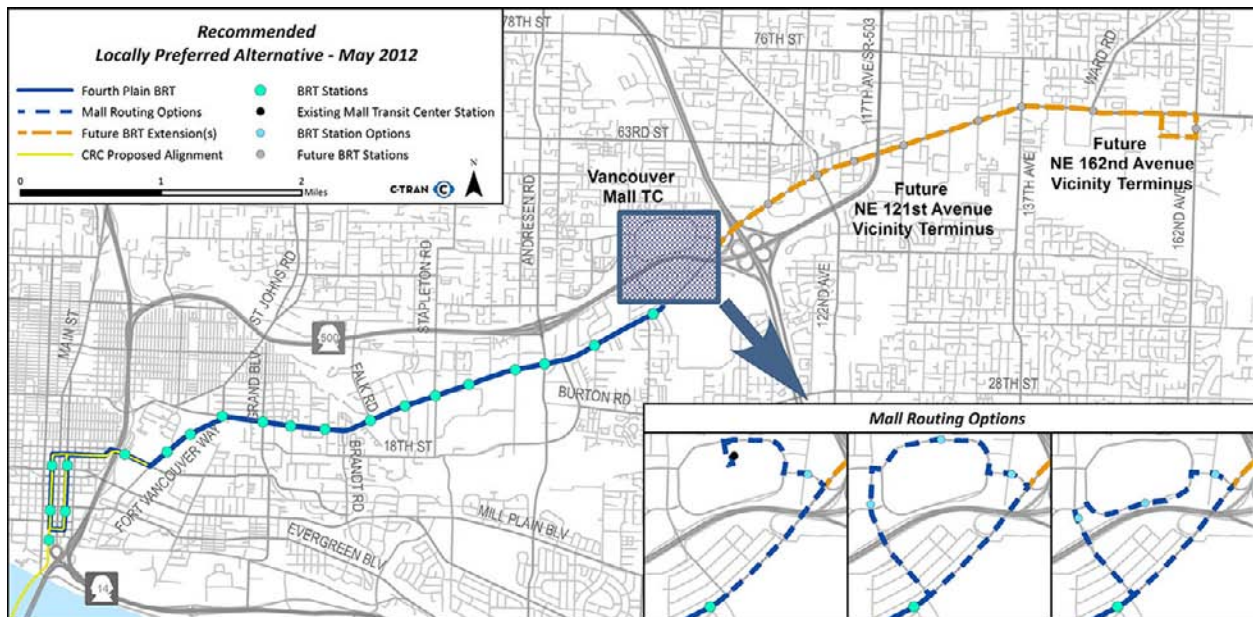
- **Existing Mall Routing Option**—Identical to existing routing, BRT would operate along Fourth Plain Boulevard to NE Vancouver Mall Drive where it would travel northbound to the existing Vancouver Mall Transit Center. It would then return to downtown Vancouver using the reverse routing. BRT stations would be located on NE Vancouver Mall Drive east of the mall, and at the Vancouver Mall Transit Center.
- **Thurston Loop Mall Routing**—From Fourth Plain Boulevard at Thurston Way, BRT would travel northbound on Thurston Way and access the Westfield Vancouver Mall from the west. A BRT station would be located on NE Vancouver Mall Loop, near the existing Vancouver Mall Transit Center. BRT would continue around Vancouver

Mall Loop to NE Vancouver Mall Drive where it would travel westbound on Fourth Plain Boulevard to downtown Vancouver. In addition to the BRT station at the Vancouver Mall Transit Center, BRT stations would be located on Thurston Way west of the mall and on NE Vancouver Mall Drive east of the mall.

- **Thurston South Loop Mall Routing**—From Fourth Plain Boulevard at Thurston Way, BRT would travel northbound on Thurston Way and access NE Vancouver Mall Drive (south ring road). BRT would serve a relocated Vancouver Mall Transit Center along the ring road south of the mall. BRT would continue on NE Vancouver Mall Drive to Fourth Plain Boulevard, where it would travel westbound on Fourth Plain Boulevard to downtown Vancouver. In addition to the BRT station at the Vancouver Mall Transit Center, BRT stations would be located on Thurston Way west of the mall and on NE Vancouver Mall Drive east of the mall.

FIGURE 8-1

Preliminary Locally Preferred Alternative with Routing Options



8.5 Why the LPA was Selected

All alternatives were evaluated against the Purpose and Need Statement (adopted by the C-TRAN Board in September 2011) and Goals and Objectives (recommended by the CAC and approved by the PMT in October 2011). The LPA, including BRT, was selected as the preferred alternative because it, better than any other alternative, met the project's goals and objectives and best addressed the Purpose and Need.

The adopted Purpose Statement is:

“Consistent with the Clark County High Capacity Transit System Study, the purpose of the Fourth Plain Transit Improvement Project is to cost-effectively increase transit ridership as well as enhance transit's comfort, convenience and image by:

- Reducing transit travel time,

- Improving trip reliability, and
- Increasing transit capacity to meet current and long-term transit travel demand, while also enhancing the safety and security of the corridor.

The project will support the City of Vancouver and neighborhood/community-based Fourth Plain corridor revitalization efforts.”

The following summarizes why the LPA was selected based on the Purpose and Need statement.

- **Most cost effective alternative»** by selecting BRT as the preferred transit mode, the LPA is the most cost effective alternative. Operating costs for the corridor will be reduced compared to existing (no-build) conditions and lower than the TSM/Baseline alternative. Operating cost per boarding passenger would be approximately half of existing costs.
- **Increases transit ridership»** the LPA is projected to attract the highest number of new transit riders of any alternative, both in opening year and by 2035. The increase is substantial enough to help constrain growth in, or even reduce, traffic congestion levels along the Fourth Plain corridor.
- **Reduces transit travel time/improves trip reliability»** the LPA is projected to save 8-10 minutes each way between downtown Vancouver and the Mall, better than any other alternative, with transit travel time savings remaining consistent over the long-term. Additionally, the LPA improves trip reliability, more than any other alternative, which is the most valued element of what C-TRAN’s transit riders consider in using transit.
- **Provides long-term transit capacity»** the LPA provides enough transit capacity to accommodate growth in transit demand well beyond the Year 2035. All other alternatives will require additional service to be added to accommodate growth, and will increase operations and maintenance costs.
- **The LPA is the only alternative which supports current corridor revitalization efforts** and is consistent with adopted City, C-TRAN, and regional vision, land use, and transportation plans.

8.6 Physical and Operational Description of the LPA

The physical components of the LPA are consistent with FTA’s Small Starts criteria for BRT and include:

- **Stations»** stations will be either curbside or in the median (see prior section), except in downtown Vancouver where BRT would utilize the CRC’s LRT guideway and stations. A separate BRT loading/unloading area would be designated at each LRT station. Stations would have the following characteristics:
 - » special branding of the LPA/BRT corridor
 - » raised platforms/sidewalks for level boarding
 - » be illuminated at night
 - » include real-time rider information including next-bus arrival information
 - » a ticket vending machine for off-board fare payment, and

» potentially, station art, historical aspects, or streetscape treatments consistent with the City of Vancouver's Fourth Plain Corridor Subarea Plan and Streetscape Study.

- **Transit Signal Priority (TSP)**, which would give BRT vehicles priority at signalized intersections along the corridor, either to extend a green signal or to provide a green signal for BRT buses.
- **Queue jumps or bypasses** at up to three locations at major intersections, which would allow BRT vehicles to have their own signal to either “jump ahead” of or bypass a traffic queue via an additional, dedicated bus lane (no existing through traffic lanes taken) at major intersections.
- **Low-floor buses for level boarding**» final design decisions on the type and design of BRT vehicles would be made during Project Development; however, current assumptions call for 60-foot, articulated BRT buses with on-board bike racks and wheelchair slots designed for “self-parking” by wheelchair users (instead of driver securement).
- **Special branding of service.**
- **Frequent service:**» 10 min peak/15 min off peak for up to 19 hours per weekday.
- **Supporting Transit Service**» the LPA offers operations and service savings that can be redeployed to other routes; this analysis has shown that BRT can be operated along the corridor with fewer buses than what C-TRAN is currently operating on the corridor. Some of these buses could be shifted to intersecting routes or to backfill service west on Fourth Plain to replace the removal of Route 4 service. Examples include a reconfiguration of Route 72 east of the Mall to provide more frequent service and potentially extend the service coverage to as far east as NE 162nd Avenue, and a realignment of Route 25 to provide service on Fourth Plain west of Fort Vancouver Way into downtown Vancouver and Fruit Valley.

Additionally, the LPA includes upgrades to C-TRAN's existing Maintenance and Operations facility to accommodate a new fleet of specialized BRT vehicles. Also included are revisions to the Vancouver Mall Transit Center, with the following options under consideration:

- Revisions to the existing bus platform to accommodate articulated BRT vehicles with level boarding; or
- Relocation of the Transit Center to a site on the south side and ring road of the Mall, which would include all bus and BRT operations and rider amenities that currently exist at the Mall Transit Center.

There are no park-and-rides included in the LPA. If the Fourth Plain corridor BRT service is extended to one of the other eastern termini in the future, a potential new park-and-ride could be included in the Orchards area.

8.7 Interim Options for Crossing the Columbia River

It is expected that if the LPA were to be implemented along the Fourth Plain Corridor, it would be open and operating several years prior to completion of the CRC's LRT project. Through initial direction from the FTA, C-TRAN was to consider the Record of Decision for the Columbia River Crossing project, including its LPA which includes extending Light Rail Transit (LRT) into Downtown Vancouver, as a base component of every alternative being evaluated by the

Fourth Plain Transit Improvement Project. Additionally, FTA gave direction that because any corridor transit component between downtown Vancouver and north Portland (to be served by the CRC LRT project) is interim in nature, they will not consider cross-Columbia River and north Portland service and capital improvements as part of the Fourth Plain Transit Improvement Project and LPA.

Because C-TRAN currently provides service along the Fourth Plain corridor (Routes 4 and 44) across the Columbia River to Jantzen Beach, Hayden Island and Delta Park/MAX, two interim options are being considered to continue providing service to North Portland, one of which will be selected during Project Development:

- A short-term extension of BRT serving Jantzen Beach, Hayden Island and Delta Park/Vanport, similar to today's service; or
- Terminating the Fourth Plain BRT system in downtown Vancouver (at approximately 7th Street, Washington Street and Broadway), and providing a temporary shuttle with a frequent cross-river connector service to Jantzen Beach, Hayden Island and Delta Park/MAX.

8.8 Capital Costs

Chapter 5 of the Alternatives Analysis Report provides information on the methodology used to estimate capital costs as well as cost estimates for the various alternatives considered in the study. The capital cost estimates use the Standard Cost Categories (SCC) system required by the Federal Transit Administration (FTA) for projects that intend to apply for FTA New Starts or Small Starts funding. The SCC format breaks costs into 10 categories. However, rather than use the SCC format, the capital costs for the Preliminary LPA provided in this memorandum are summarized by functional element for ease of understanding.

The cost range for the Preliminary LPA is \$40 to \$55 million dollars as shown in Figure 8-2. This fairly wide range of cost is attributable to two primary factors:

FIGURE 8-2

Preliminary Locally Preferred Alternative Capital Cost Estimate



- There are several design options carried forward into the Project Development phase which, depending on the option selected, can have a significant impact on project cost. For example, the decision whether to use a curbside lane configuration or one that includes left lane bus operation with median stations can have an estimated \$4 to \$5 million difference in project cost. Another example is the routing options in the vicinity of the Westfield Vancouver Mall which, depending on the routing option selected, would require a remodeling of the existing station or a complete relocation of the transit center.
- The project is currently estimated to be at a five percent design level. Some elements, such as the maintenance facility remodel, have had virtually no design work, with the cost estimate based on experience with similar projects. A range of costs is more appropriate for this level of conceptual design.

The C-TRAN Financial Plan (discussed in the following section) assumes an estimated project capital cost of \$55 million, which is the upper end of the Preliminary LPA cost range. This estimate is used both to be conservative in project financing projections and to be able to accommodate project design options that have higher costs.

PRELIMINARY LPA CAPITAL COST ELEMENTS

- **Station Area, Signals & Safety Improvements:** This category includes all costs associated with station construction (platform, shelter, and station amenities), roadway changes, right-of-way acquisition, signal systems, and pedestrian improvements. The lower end of this range would assume use of curbside lanes and curbside stations, while the upper end of the range is associated with use of the “hybrid” lane configuration which includes some median stations.
- **Transit Center:** Depending on the routing option selected, the Vancouver Mall Transit Center would either be remodeled to accommodate BRT or be relocated to the south side of the mall. The lower end of the cost range is for a station remodel; the higher end is for a relocation of the transit center.
- **Maintenance Facility:** It is expected that BRT would use articulated buses. Since C-TRAN currently does not use vehicles in excess of 40 feet in length, the maintenance facility will need to be remodeled to be able to accommodate the 60-foot vehicles. This cost element is for remodel and expansion of the current maintenance facility.
- **BRT Vehicles:** A preliminary schedule for the Preliminary LPA based on transit travel time modeling assumes that seven buses will be needed to operate the 10-minute BRT service. Since BRT uses a dedicated fleet and other C-TRAN buses cannot be used as spares, it is assumed that three spares are needed to maintain service. The upper end of the range assumes eight buses in service (with three spares), in case the transit travel times are a little longer than currently projected.
- **Design, Permits & Administration:** This category includes project design and engineering, construction administration, project management costs, permits, and other similar project costs.

8.9 C-TRAN High Capacity Transit 2012 Financial Plan

As part of the Revised Code of Washington (RCW) 81.104 *High Capacity Transit System Plan and Expert Review Panel* process, a detailed financial study was undertaken of the Columbia River Crossing Light Rail Extension project, the Fourth Plain Transit Improvement Project's Preliminary LPA, and C-TRAN's system as a whole for the period from 2013 to 2035. This financial analysis addressed current C-TRAN Board of Directors policies, revenue expectations, maintaining current service levels with some enhancements, as well as maintaining adequate capital program and operating reserves. This resulted in the *C-TRAN High Capacity Transit Financial Plan*.

Unlike the Fourth Plain AA process, which evaluated alternatives based on constant (Year 2011) dollars, the Financial Plan was a more economic- and financial-based assessment and used Year-of-Expenditure (YOE) dollars for systemwide capital and operations and maintenance (O&M) costs.

The Financial Plan developed three long-term economic scenarios: optimistic, pessimistic, and realistic. These scenarios were presented to the Expert Review Panel in May 2012 for their review and comment. Included in the three economic scenarios in the YOE analysis were cost inflation, construction cost indexing, population (and thus ridership) growth assumptions, as well as revenue assumptions based on historical trends.

Regarding BRT and the Preliminary LPA, also included were revenue projections including a proposed 0.1% sales tax increase for High Capacity Transit under RCW 81.104, varying farebox recovery ratios, and varying FTA shares of a Small Starts project for the Preliminary LPA, ranging from 50% for the pessimistic scenario up to 80% for the optimistic scenario.

The Financial Plan concluded that under any of the scenarios:

- The Preliminary LPA would result in a net decrease in C-TRAN's system O&M costs with measurable savings;
- The Preliminary LPA would reduce the Fourth Plain corridor's share of systemwide O&M costs from 9% to 8% in the 2015 Opening Year;
- **C-TRAN would have the financial capacity to operate and maintain the Preliminary LPA over the life of the Financial Plan;**
- Based on policy decisions regarding other C-TRAN capital projects, **C-TRAN would have the financial capacity to match federal capital project funds (FTA Small Starts assumed) under any of the federal funding share scenarios.**

See the *C-TRAN High Capacity Transit Financial Plan* for more detailed information on the financial assumptions and analysis.

8.10 Year 2015 Opening Year Corridor Transit Ridership

NOTE: Year 2035 ridership estimates for the LPA can be found in Chapter 4, Section 4.3, for the BRT alternatives with the Westfield Vancouver Mall terminus.

Ridership forecast modeling for the Small Starts' Opening Year (2015) ridership forecasting process will not begin until after the Preliminary LPA is adopted and direction from the C-TRAN Board is given to prepare a Small Starts funding application. Therefore, opening year ridership forecasts to support the Financial Plan were developed using a trend-based and growth-outlook-based model. This model extrapolated current ridership (2011) out to year 2015, opening year.

Earlier in the AA process, FTA notified C-TRAN that the portion of the Fourth Plain Corridor transit service that provides service across the Columbia River into north Portland was not to be included in the Fourth Plain Transit Improvement Project. This direction is based on having a Record of Decision for the Columbia River Crossing project, which includes an LRT component which is anticipated to be open in the year 2019. This results in a short interim period (5 years) where whatever capital or service improvements made as part of the Fourth Plain project would be removed when LRT is built. Thus, this analysis will focus on the corridor within the Preliminary LPA termini of downtown Vancouver to Westfield Vancouver Mall for both No-Build and the Preliminary LPA and will not include cross-Columbia River transit trips.

For 2015 opening year, based on a survey of several other BRT projects of similar scale and in comparable locations, BRT on Fourth Plain Boulevard is projected to experience anywhere from a 30 to 50% increase in ridership over the No-Build alternative in its opening year. As indicated in Chapter 4, the 2035 ridership forecasts project that BRT would attract 60% more riders than the No-Build alternative. For the conservative Financial Plan analysis, a 30% increase is assumed for 2015 Opening Year.

Land use growth assumptions for 2015 opening year were based on 2010 existing conditions as well as a recently-developed year 2022 forecast approved by the RTC Board in early 2012. Opening year (2015) population growth, which was assumed to also be reflected in corridor transit ridership growth, was estimated to be approximately 1.7-1.8 percent per year from 2011 to 2015. Resultant 2015 Opening Year ridership projections are detailed in Table 8-1.

TABLE 8-1
Existing and Opening Year (2015) Ridership Estimates

Year	Total Annual Systemwide Boardings	Cross-River Trips	Annual Boardings, Downtown to Mall
2011 Existing (Routes 4 and 44, no BRT)	1,955,000	391,000	1,564,000
2015 No-Build	2,117,000	424,000	1,693,000
2015 Preliminary LPA			2,201,000

8.11 Operations and Maintenance Costs

Two separate methods were used to estimate Operations and Maintenance (O&M) costs of the Preliminary LPA with a comparison to the No-Build alternative. The first is outlined earlier in Section 7.3 and uses 2011 dollars to estimate year 2035 O&M costs for each alternative; it is focused on the Fourth Plain Boulevard corridor and the Preliminary LPA. The second, for the Financial Plan, was expressed in YOE dollars, conducted for C-TRAN's entire system (including the Preliminary LPA) and included more rigorous and conservative O&M cost and financial analysis. Both methods estimated BRT O&M costs with similar assumptions (see Section 5.3 as well as the Financial Plan document).

Year 2015 opening year analysis contained in this report assumes that cross-river service will either consist of a frequent shuttle between downtown Vancouver, Jantzen Beach and Delta Park/MAX LRT, or would extend BRT service across the river but outside of the Preliminary LPA's termini. Either of these options is to be entirely funded by C-TRAN. Separate capital and O&M cost assumptions for this "interim" period are incorporated into C-TRAN's system costs as part of the Financial Plan.

Operating hours for 2015 opening year were estimated using existing service (No-Build), and applying travel time and dwell time reductions based on research to estimate BRT annual service hours. Travel time reductions are compared to the No-Build alternative, and were estimated by researching travel time savings realized with similar transit and BRT treatments elsewhere in the United States for the Preliminary LPA's major components, including implementing Transit Signal Priority (TSP) along the Fourth Plain Boulevard route (not available in the No-Build Alternative), level boarding and wheelchair-user self-securement, off-board fare collection, on-board bicycle parking, and BRT buses having multiple doors for boarding and alighting. Year 2035 service hours and ridership were developed during the AA (see Chapter 4).

Table 8-2 summarizes O&M costs. O&M costs labeled as "net O&M costs", are calculated by subtracting fare revenue from O&M costs for each alternative, for both 2015 opening year as well as Year 2035, using the Realistic economic scenario from the Financial Plan. These are in YOE and should not be confused with the Year 2035 analysis described earlier in the AA report which uses 2011 constant dollars and determined using a different O&M cost methodology.

TABLE 8-2

Estimated Operations & Maintenance Costs, 2015 & 2035 (YOE)

Category	Opening Year 2015	AA Long-Term Planning Year 2035
Operating Cost Rates Per Service Hour		
No-Build (Fixed Route)	\$115.76	\$232.00
Preliminary LPA	\$135.13	\$257.46
Service (Operating) Hours		
No-Build	36,534	50,201
Preliminary LPA	27,234	42,089
Annual Operating Costs		
No-Build	\$4,229,000	\$11,647,000
Preliminary LPA	\$3,680,000	\$10,836,000
Farebox Recovery Ratio		
No-Build	24%	29%
Preliminary LPA	33%	33%
Annual Farebox Revenue		
No-Build	\$1,009,000	\$3,424,000
Preliminary LPA	\$1,214,000	\$3,574,000
Net Operations and Maintenance Costs		
No-Build	\$3,220,000	\$8,223,000
Preliminary LPA	\$2,466,000	\$7,262,000
ANNUAL DIFFERENCE, BRT COMPARED TO NO-BUILD	\$(754,000)	\$(961,000)

As a reasonableness check, the results of the two O&M cost methods and resultant O&M costs were compared. This was done by converting Year 2035 YOE O&M costs from the Financial Plan (using the Plan's interest rate assumptions) to Year 2011 dollars, and comparing the results with the AA's Year 2035 O&M cost methodology which is already in Year 2011 dollars (see Table 7-3 earlier in this report). The analysis concluded that both methods resulted in estimated O&M savings with the Preliminary LPA that were within 2.2 percent of each other and thus, validates the O&M assessment for the Preliminary LPA.

Total projected O&M expenditures for the 2015-2035 period for each of the alternatives is shown in Table 8-3 below. This is based on cost analysis undertaken during the Financial Plan effort.

TABLE 8-3

Estimated Gross & Net O&M Expenditures, 2015 - 2035

Alternative	Total O&M Costs 2015-2035	Total Fare Revenue 2015-2035	Net O&M Costs 2015-2035
No-Build (Routes 4/44)	\$154,928,000	\$43,252,000	\$111,676,000
Preliminary LPA	\$141,341,000	\$46,625,000	\$94,716,000
Savings/additional revenue with Preliminary LPA	\$13,587,000	\$3,373,000	\$16,960,000

Figure 8-3 compares No-Build (Routes 4/44) and the Preliminary LPA projected “net” O&M costs in five-year increments between 2015 and 2035.

FIGURE 8-3

Net O&M Costs of the Preliminary LPA vs. No Build, 2015 - 2035

