600 NE Grand Ave.
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# Metro | *Agenda*

| | |
|---|---|
| Meeting: | SW Corridor Plan Steering Committee |
| Date: | January 11, 2016 |
| Time: | 9:00 a.m. to 11:00 a.m. |
| Place: | Beaverton City Council Chambers, The Beaverton Building, 12725 SW Millikan Way |
| Purpose: | Decisions on alignment options in Tigard, downtown Tualatin terminus option, and a technical modification. Staff reports on mode and PCC connection options. |

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9:00 a.m. Welcome and introductions — Co-chair Dirksen

**ACTION ITEM**

9:10 a.m. Consideration of the Steering Committee meeting summary from October 12, 2015 ACTION REQUESTED — Co-chair Dirksen

**PUBLIC COMMENT**

9:15 a.m. Public Comment — Co-Chair Dirksen
*Opportunity for citizens to provide short testimony and/or submit written comments to inform the Steering Committee decisions.*

**DISCUSSION ITEMS**

9:30 a.m. Upcoming materials and calendar overview — Chris Ford, Metro
*Review of upcoming reports, meetings, and decisions, including recent adjustments.*

9:35 a.m. Engagement update — Noelle Dobson, Metro
*Summary of public input on staff recommendations, and overview of mode input strategy.*
***Discussion: Any questions about public input?***

9:45 a.m. Project staff recommendations regarding alignment and terminus options — Matt Bihn, Metro and Dave Unsworth, TriMet
*Overview of project staff's recommendations on alignment options in downtown Tigard and terminus options, and proposed HCT alignment modification.*
***Discussion: Any concerns with removing the Loop options and downtown Tualatin terminus from further consideration? Any questions or issues regarding the alignment options advancing for further study or the technical modification? Any direction for staff in refining alignment options in downtown Tigard?***

**ACTION ITEM**

10:00 a.m. Consideration of which terminus and alignment options to study further and proposed HCT alignment modifications — Co-Chair Stacey

ACTION REQUESTED *Steering committee discussion and action on whether to continue further study of the HCT alignments in question, the downtown Tualatin terminus option and the technical modification, based on the draft staff recommendations.*

**DISCUSSION ITEMS**

10:20 a.m. Mode evaluation — Matt Bihn, Metro

*Summary of mode evaluation findings, comparing BRT and light rail.*
***Discussion: Any questions regarding the methodology and findings?***

10:40 a.m. PCC connection options update — Dave Unsworth, TriMet

*Summary of alternative connection options evaluated and findings on feasibility.*
***Discussion: Any questions regarding how these connections would work, costs to construct and operate?***

11:00 a.m. Adjourn

**Materials for 1/11/2016 meeting:**

- 10/12/2015 meeting summary
- Updated SWCP Calendar
- Staff Recommendations for December 2015 decisions [postponed to January 2016]
- Letters to the Southwest Corridor Steering Committee related to terminus decision
- Southwest Corridor High Capacity Transit Mode Comparison document
- Mode FAQ document
- PCC Sylvania Enhanced Connection Options technical memo

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Metro | *Meeting Summary*

**Southwest Corridor Plan Steering Committee**
**Monday, October 12, 2015**
**9:00a.m. to 11:00a.m.**
**Tigard Public Library,**
**Community Room**

Committee Members Present

| | |
|---|---|
| Craig Dirksen, Co-chair | Metro Council |
| Bob Stacey, Co-chair | Metro Council |
| John Cook | City of Tigard |
| Steve Novick | City of Portland |
| Krisanna Clark | City of Sherwood |
| Al Reu | City of King City |
| Rian Windsheimer | ODOT |
| Neil McFarlane | TriMet |
| Lou Ogden | City of Tualatin |
| Denny Doyle | City of Beaverton |
| Roy Rogers | Washington County |
| Gery Schirado | City of Durham |

Metro Staff

Malu Wilkinson, Brian Harper, Chris Ford, Noelle Dobson, Matt Bihn, Yuliya Kharitonova, Michaela Skiles, Noah Siegel

## 1.0 Welcome and introductions

Co-chair Craig Dirksen called the meeting to order at 9:04 am and welcomed the committee members and guests to the meeting. Committee members and guests proceeded to introduce themselves. Co-chair Dirksen reminded the committee that in today's meeting they would be taking action on moving the decision on further study of light rail tunnel to Portland Community College (PCC) – Sylvania campus and travel mode to February 2016. He noted that public comments would be made at the beginning of the meeting. He reminded the audience that public forum would be held in Tigard on October 19, 2015.

## 2.0 Consideration of the Steering Committee meeting summary from September 14, 2015.

Co-chair Dirksen asked the committee for approval of the meeting summary from September 14, 2015. With all in favor, the meeting summary was accepted unanimously.

## 3.0 Public Comment

Ms. Linda Degman, Bond Program director at Portland Community College (PCC) expressed support to move the decisions on further study of light rail tunnel to PCC and travel mode to February 2016. She stressed the importance of direct access to PCC and assured the committee members of the college's commitment to assist in the process. Written statement was provided on behalf of Ms. Sylvia Kelley, Interim President of PCC, and included as part of the meeting record.

Mr. John Charles, president of Cascade Policy Institute, expressed disapproval of the tunnel option to connect to PCC-Sylvania campus. Mr. Charles referred to the findings from the Observed Travel Behavior at PCC-Sylvania Research project and raised a question if additional transit service to connect to PCC-Sylvania campus was needed. Summary of the Observed Travel Behavior at PCC-Sylvania Research project was provided and included as part of the meeting record.

Mr. Paul Thiers, an associate professor of Political Science and Program Leader for the Program in Public Affairs at Washington State University (WSU), strongly endorsed the need for transit improvement to connect to PCC-Sylvania campus. Mr. Thiers referred to the PCC Sylvania Light Rail Connection Option technical memo, dated August 14, 2015, page 10, to support additional transit options.

Mr. Jim Howell, a member of the Association of Oregon Rail and Transit Advocates (AORTA), reminded the committee members of the AORTA's proposal for the SW Corridor Plan. Mr. Howell called attention to several additions, and expressed concern about limited transit capacity in the future and servicing the west side of Portland area. Document was provided and included as part of the meeting record.

Mr. John Gibbon, a member of Southwest Neighborhoods Inc. (SWNI) and Portland Utility Review Board (PURB), proposed to focus on the crossroads along the historic highway section of Barbur Blvd. Mr. Gibbon commented on plans to have Metro staff present at the upcoming neighborhood association meeting.

## 4.0 Proposed changes to Southwest Corridor schedule of decisions

Co-chair Dirksen introduced Mr. Chris Ford, Metro staff, and Mr. Dave Unsworth, TriMet, to present proposal to adjust timing of some upcoming meetings, topics of discussion, and Steering Committee decisions.
Mr. Ford gave a brief summary of main changes, which included:

- Moving decision on further study of light rail tunnel to PCC Sylvania to February 2016
- Moving decision on travel mode to February 2016

Mr. Ford noted change implications, which included postponed release date of the Mode Evaluation Report and adjusted time for public review of the Draft Preferred Package.

Mr. Dave Unsworth expressed support for the proposed adjustments and gave a brief overview of the key reasons for the proposed changes, which included:

- PCC LRT Connection
    - Concern about construction cost
    - NEPA does not allow removal of option for cost reasons alone
    - Time to further develop and analyze alternative connections to campus
    - Staff will compare benefits and impacts of all options, including tunnel
- Travel mode
    - Concerns about Transit Mall for BRT
    - New travel time information

The committee members asked for analysis of alternate transit options besides the tunnel option, and expressed support for delaying the decision on travel mode and further study of light rail tunnel to PCC Sylvania.

Mr. Ford summarized the timeline of the Southwest Corridor Plan Steering Committee, which included:

- December – decisions on Tigard and Tualatin alignments, southern terminus
- January – no meeting
- February – decisions on mode and PCC light rail tunnel
- March – no meeting
- April – consider public input on recommendations, approve Final Preferred Package

**5.0 Consideration of whether to adopt proposed changes to calendar**

**MOTION:** Co-chair Stacey moved, seconded by Mayor Denny Doyle, to adopt proposed changes to the Southwest Corridor schedule of decisions. The changes are to move decisions on further study of light rail tunnel to PCC Sylvania and travel mode to February 2016.

The committee members expressed support for proposed changes and noted the need to further study travel mode and PCC-Sylvania connection options. Concerns were raised on providing enough time for neighborhood associations to deliberate and comment on the decisions at the next steering committee meeting. In addition, the committee members noted the importance of ridership capacity and cost-benefit analysis.

**ACTION:** Without further comments, the motion was approved unanimously.

**6.0 Defining a successful connection to PCC Sylvania**

Co-chair Stacey introduced Mr. Chris Ford, Metro staff, to give an overview of possible concepts to define a successful connection to PCC-Sylvania. Mr. Ford elaborated on how to define such connection and presented concepts to consider, which included:

- Meets project's Purpose and Need
- Catalyzes growth and investment in educational opportunities
- Provides connection to students/staff from all directions - north, east, south and west
- Improves on current transit travel time, frequency, and reliability

- Serves campus and surrounding neighborhoods
- Strive for one seat ride or simplified transfer (timed, cross platform, etc.) to key destinations

The committee members stressed the importance of providing direct high capacity transit service to PCC-Sylvania, serving its expanding population, reducing parking space, and effectively defining the benefits of connecting to an important destination. Concerns were made on how some concepts would be measured, determining what would matter to the public, and if the cost information would be provided.

**7.0 Consideration of which goals to adopt related to PCC Sylvania**

Co-chair Stacey asked the committee for approval of the proposed concepts to consider when defining a successful connection to PCC-Sylvania. Hearing no objections, the above mentioned concepts were accepted unanimously.

**8.0 HCT terminus considerations**

Co-chair Stacey introduced Mr. Chris Ford, Metro staff, to give an overview of terminus considerations and options. Mr. Ford presented on the upcoming steering committee decision on High Capacity Transit (HCT) terminus, which included:

- Factors to consider in selecting a terminus
- Overview of the forthcoming terminus options memo
- Potential terminus locations
- Preliminary findings

Mayor Lou Ogden inquired why the downtown Tualatin terminus option was still under consideration if it is beyond the project's funding capacity. Ms. Malu Wilkinson responded that, per National Environmental Policy Act (NEPA), an option cannot be removed based on the cost alone, there must be other reasons not to study it further.

The committee members deliberated on downtown Tualatin as a terminus and its viability, the region's funding capacity, and the best time to remove the option from further consideration. Additional inquiries were made to explore the potential for future extension of an HCT line and analysis of terminus locations by mode advantages and disadvantages. The committee members suggested considering travel mode and terminus locations together, but upon further deliberation agreed a December decision for downtown Tualatin would provide more certainty for citizens and property owners.

**MOTION:** Co-chair Stacey made a motion for the Steering Committee to indicate that they did not consider downtown Tualatin as a viable option for a HCT terminus, and asked staff to provide a proposal for Steering Committee consideration in December.

**ACTION:** Without any objections, the motion passed.

**9.0 Tualatin key issues and Central Barbur technical modifications**

Co-chair Stacey introduced Mr. Chris Ford, Metro staff, to present on Tualatin key issues and Central Barbur technical modifications. Mr. Ford gave a brief overview of tradeoffs between alignment options between Bridgeport Village and downtown Tualatin, and purpose and content of the forthcoming technical modifications memo.

The committee members expressed concerns over the cost and complexity of the technical modifications, and stressed the importance of understanding tradeoffs of each option to avoid elimination of the preferred alternative.

## 10.0 Adjourn

There being no further business, Co-chair Stacey adjourned the meeting at 11:00 am.

Attachments to the Record:

| Item | Type | Document Date | Description | Document Number |
|---|---|---|---|---|
| 1 | Agenda | 10/12/15 | Meeting agenda | 101215SWCSC-01 |
| 2 | Summary | 09/14/15 | 09/14/15 meeting summary | 101215SWCSC-02 |
| 3 | Document | 09/11/15 | PCC Sylvania Connection: Status of Further Investigation | 101215SWCSC-03 |
| 4 | Document | 10/05/15 | SW Corridor Plan Timeline | 101215SWCSC-04 |

# Upcoming Southwest Corridor Plan Schedule
as of 1/4/16

| | Meeting Date | Decisions | Staff Reports |
|---|---|---|---|
| **January** | Jan 11 | Tigard alignments<br><br>Terminus | *By 1/29:*<br>Staff Recommendations |
| **February** | Feb 29 | Mode<br><br>PCC LRT tunnel | |
| **March** | *Public Review of Draft Preferred Package* | | *By 3/11:*<br>Draft Preferred Package |
| **April** | *Public Review of Draft Preferred Package*<br><br>*Evening Steering Committee Mtg* | | *By 4/8:*<br>Staff Recommendations |
| **May** | May 9 | Final Preferred Package | |

Southwest Corridor Plan

# Staff Recommendations for December 2015 Decisions

November 13, 2015

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GREAT PLACES SW Corridor

Portland • Sherwood • Tigard • Tualatin
Beaverton • Durham • King City
Washington County • ODOT • TriMet • Metro

# Overview

The Southwest Corridor Plan is a package of transit, roadway, bicycle and pedestrian solutions that can help reduce congestion, improve circulation and enhance quality of life in this corridor. The Southwest Corridor Plan defines investments to help realize the local land use visions adopted by each community in the area. These visions include the City of Portland's *Barbur Concept Plan*, the *Tigard High Capacity Transit Land Use Plan*, *Linking Tualatin* and the *Sherwood Town Center Plan*. A major component of the Southwest Corridor Plan is the analysis and evaluation of both Bus Rapid Transit (BRT) and Light Rail Transit (LRT) travel modes for several potential route alignments to link Central Portland, Southwest Portland, Tigard and Tualatin.

The Plan is being developed by a group of partners including agencies involved in funding, constructing and operating the transportation investments chosen and the jurisdictions in the project area. A steering committee consisting of elected leaders and appointees from these partners is leading the planning process. Past decisions of the Southwest Corridor Steering Committee include:

- In 2013, the committee recommended a Shared Investment Strategy that prioritizes key investments in transit, roadways, active transportation, parks, trails and natural areas to support the local land use visions.
- In 2014, the committee recommended a narrowed set of high capacity transit design options being considered and directed staff to develop a Preferred Package of transportation investments to support community land use goals.
- In July 2015, the committee recommended removal of tunnel alignments under Marquam Hill and Hillsdale from further consideration, continued study of a BRT direct connection to PCC Sylvania, and the adoption of several technical modifications to transit alignments.

On December 14, 2015, the Southwest Corridor Plan Steering Committee will consider whether several high capacity transit (HCT) alignments under consideration in Portland, Tigard, and Tualatin will continue to be studied as part of the project. Southwest Corridor project partner staff has developed the recommendations in this document to inform the steering committee and aid its deliberations and decision making. Staff formed these recommendations based upon direction from the committee, technical analysis and consideration of input from community groups and the general public.

## Staff Recommendation Summary

Staff proposes the following recommendations for steering committee consideration:

- Remove the Commercial Loop and Downtown Loop alignment options in Tigard from further consideration and look for ways to improve alignment connections within downtown Tigard.
- Remove the adjacent to I-5 segment north of SW 13th Avenue in Portland from further consideration.
- Remove the downtown Tualatin terminus option from further consideration, with an emphasis on strong local bus connections from Sherwood and downtown Tualatin to the HCT line.

# Public input

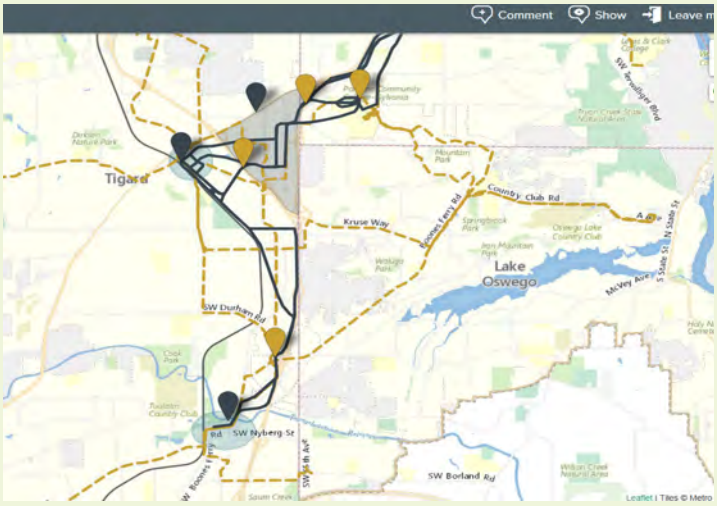
Throughout the last several months we've engaged with stakeholders in the Tigard and Tualatin areas and throughout the corridor in a variety of ways: in-person and online forums, informal discussions and survey feedback. Two online public comment periods in July and October/November generated hundreds of responses that lift up what people care about and questions they have about the choices facing the Tigard and Tualatin communities. Our current online comment period remains open until November 20th, updated public input results will be delivered to the Southwest Corridor Steering Committee members prior to their December 14th meeting.

## Key findings

- Overall support for HCT in general; slight preference for light rail
- Reliable, fast travel times are important
- Concern about removing auto lanes for transit capacity
- Support for protecting neighborhoods; concern about potential property impacts
- Support for new bike/pedestrian/car crossings over OR-217
- Support for strategies that relieve congestion by providing viable alternatives to driving
- High priority to support transit and pedestrian access for seniors and low-income communities
- Support for direct service between Tigard and Tualatin
- Questions about how HCT will interact with WES
- Questions about how a project can connect to and support important destinations not on the HCT alignment, including Sherwood, Beaverton, Wilsonville, Kruse Way, King City

**Thanks to these local groups and many individuals for sharing their input!**

Tigard Downtown Alliance
Tigard City Center Advisory Committee
Tigard Youth Advisory Committee
Tualatin Youth Advisory Committee
Tigard Liberal Drinkers
Concerned Citizens for Social Justice
Residents at Greenburg Oaks apartments
Youth Source Supa Fresh Farm
Shoppers at Tualatin and Tigard farmers markets
Participants at October 19 Tigard Community Forum
Visitors to Southwest Corridor online map tool




## Southwest Corridor Map Tool

In May 2015 the project team launched an online map tool where users can click on various points thoughout the corridor to learn more and provide feedback about HCT options being considered. During an 18-day comment period in May there were more than 3,700 visitors to the map tool; to date during this October/November comment period there have been more than 825 visitors. Most of the feedback about the Tigard and Tualatin areas has been in the form of open-ended comments. Fewer respondents have answered the embedded survey questions specifically about the alignment and terminus choices in these communities. We want to continue to better understand how our online map tool can be a useful resource for project stakeholders and an opportunity to provide feedback. Please let us know what you think and how we can continue to improve the map tool.

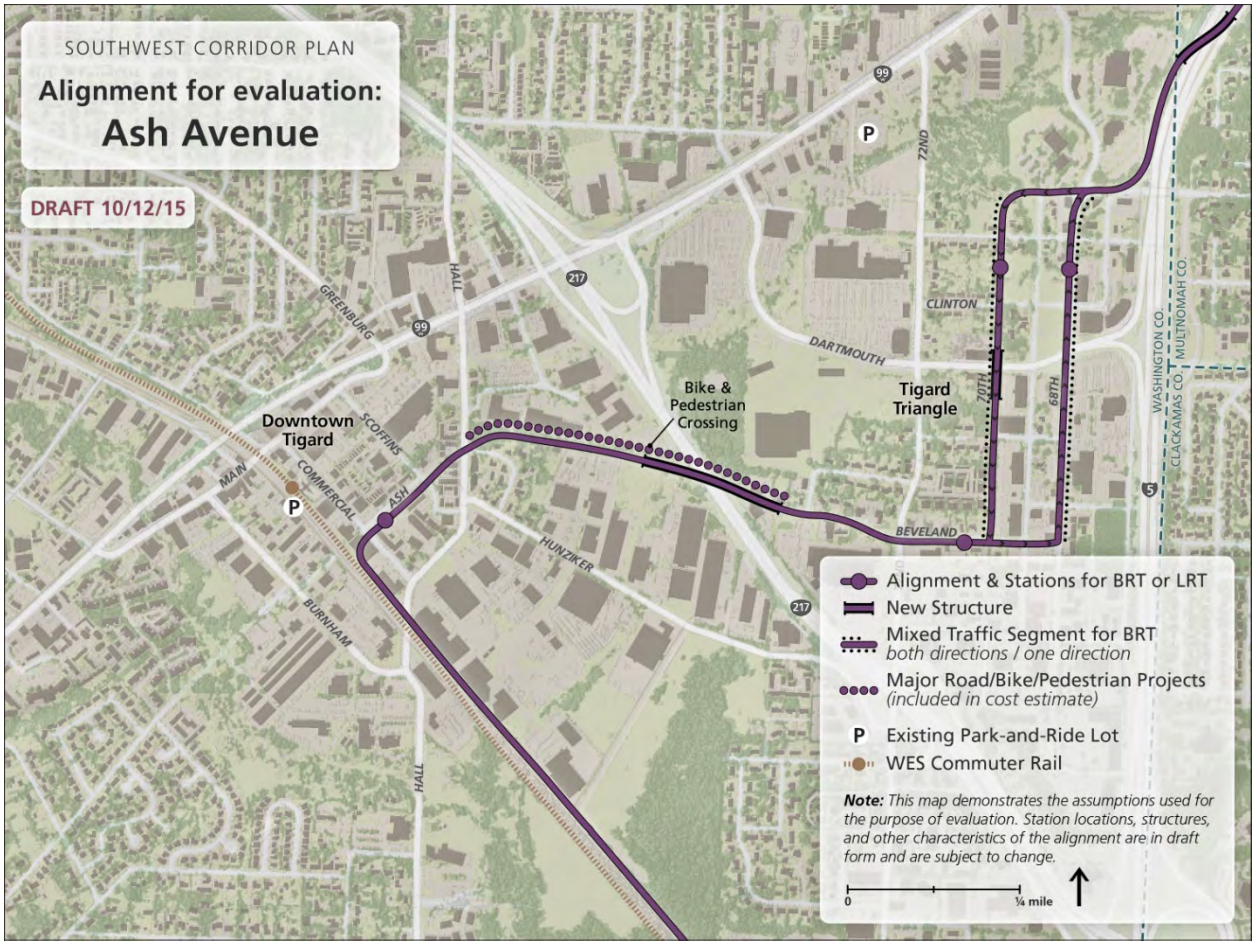
# Alignments under Consideration

The decisions in December 2015 will address HCT alignment options in downtown Tigard, along Central Barbur in Portland, and terminus options.

## Downtown Tigard

The committee is considering whether to continue the study of the following alignments:

### *Ash Avenue via Beveland Street crossing (BRT or LRT)*

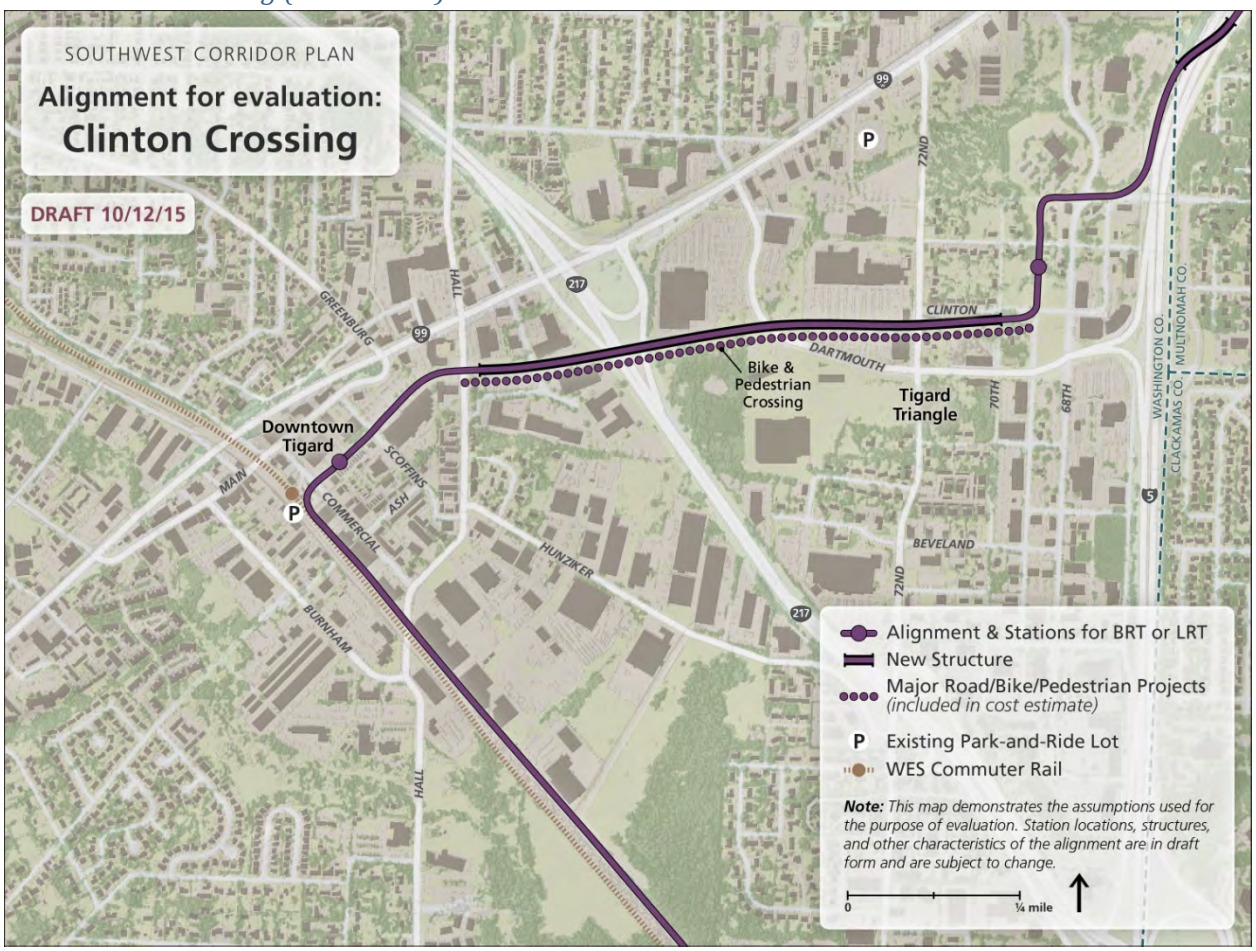



- This option would include two stations in the Tigard Triangle, in the northern and southern ends of the area, and a station near the Tigard Transit Center on Ash Avenue between Scoffins and Commercial streets. This alignment would not include a station in the vicinity of Hunziker and Wall streets ("Hunziker station").
- The alignment would cross OR-217 on a new bridge extending westward from Beveland Street, passing behind the industrial properties fronting Hunziker and crossing Hall Boulevard at Knoll Drive. This new bridge could accommodate cars, but auto traffic may be better served by a second new bridge connecting Beveland to Hunziker near its intersection with Wall. Bikes and pedestrians could be served by one or both bridges.
- From Hall Boulevard, the alignment would run along Ash Avenue, cross Commercial, and then turn southeast to parallel the WES tracks heading toward Tualatin.

*Branch Service via Beveland Street crossing (BRT or LRT)*

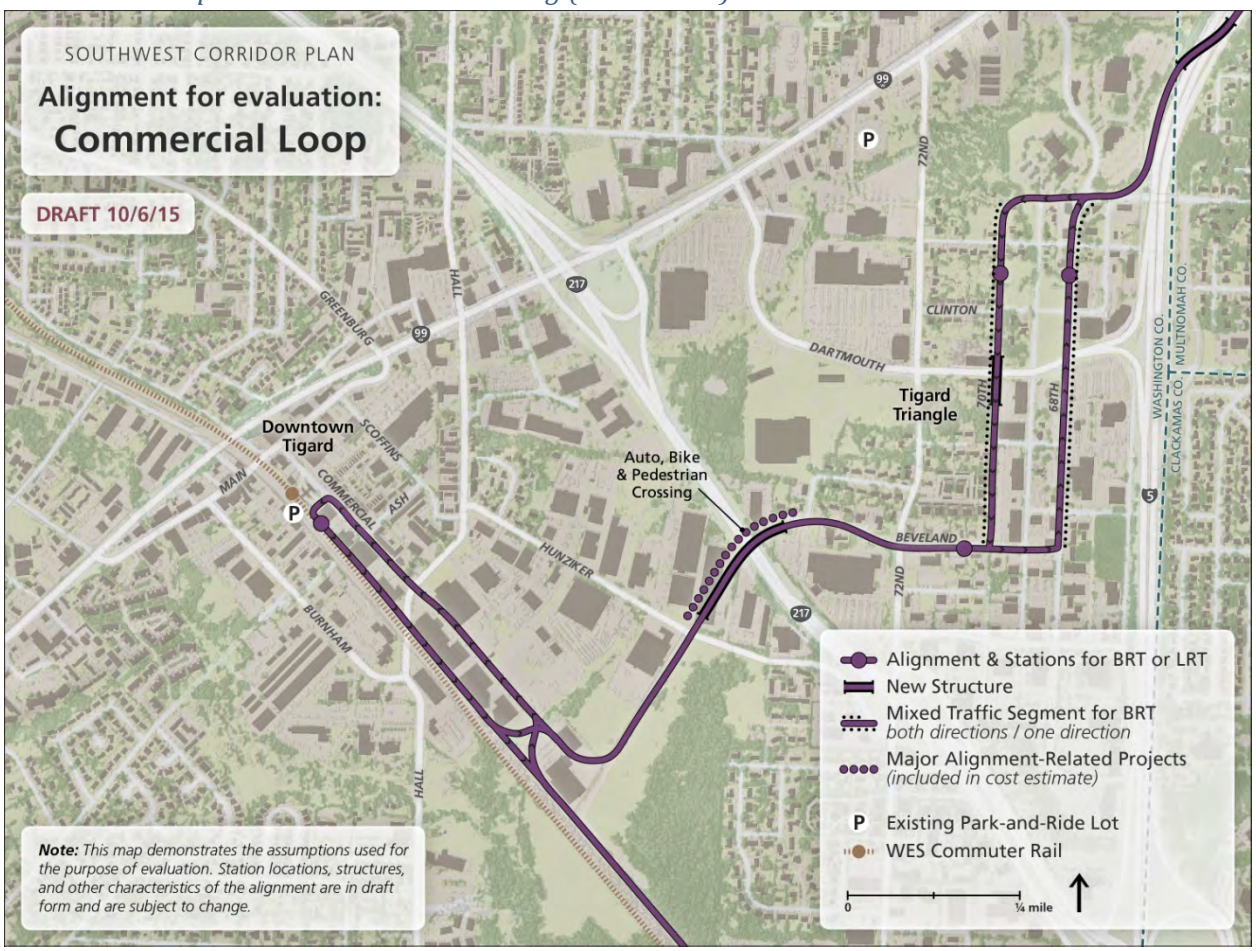

- This option would include two stations in the Tigard Triangle, in the northern and southern ends of the area, and a station near the Tigard Transit Center. It would include a Hunziker station, at which HCT service would split with every other train heading toward the Tigard Transit Center or points south. A park and ride could be sited at the Hunziker station.
- The alignment would cross OR-217 on a new bridge, curving from Beveland to Wall, which would be fully multi-modal, accommodating transit, cars, bikes and pedestrians.
- This HCT alignment would split directions for travel where Wall intersects the WES alignment. The Tigard Branch would parallel the WES alignment on the east side of the existing tracks, crossing Hall to connect to the Tigard Transit Station. The Tualatin Branch would parallel the WES tracks to the east of the existing tracks, heading south toward Tualatin.

*Clinton Street Crossing (BRT or LRT)*



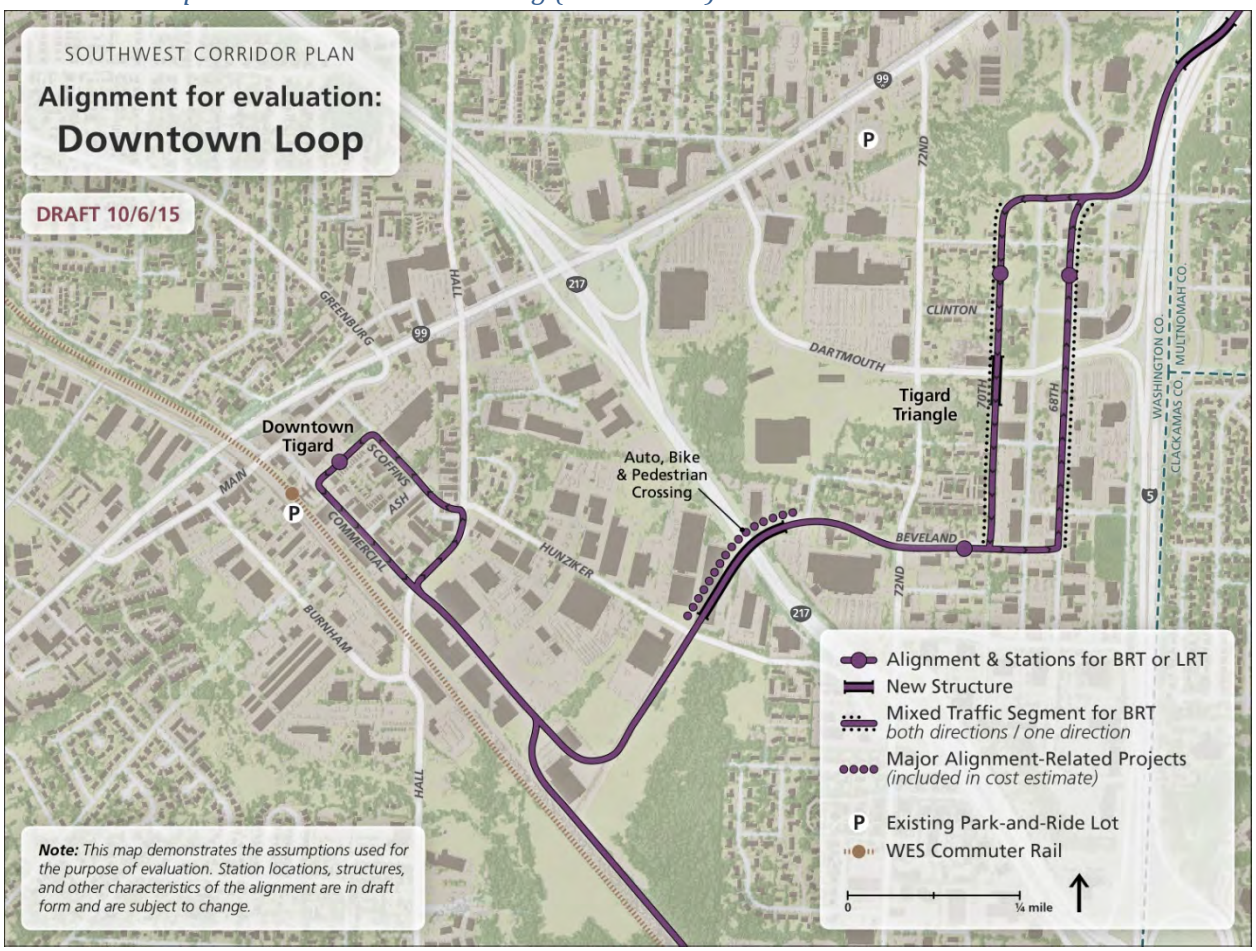

- This option would include one station in the Tigard Triangle, in the northern end of the area, and a station near the Tigard Transit Center.
- The alignment would cross OR-217 on a new 3/4-mile elevated structure extending from 70th Avenue and Clinton Street to Hall. The bridge could accommodate bikes and pedestrians but not cars.
- At Hall, the alignment would transition to center running in a new street connecting Hall to Commercial. The alignment would then turn southeast to parallel the WES tracks heading toward Tualatin.

*Commercial Loop via Beveland Street crossing (BRT or LRT)*




- This option would include two stations in the Tigard Triangle, in the northern and southern ends of the area, and a station near the Tigard Transit Center. It could include a Hunziker station as well. A park and ride could be sited at the Hunziker station.
- The alignment would cross OR-217 on a new bridge, curving from Beveland to Wall, which would be fully multi-modal, accommodating transit, cars, bikes and pedestrians.
- HCT would access downtown Tigard via an extension of Commercial, running in a one-way counter-clockwise loop along first Commercial, turning sharply left (southwest) near the existing Tigard Transit Center and returning south along the WES tracks.

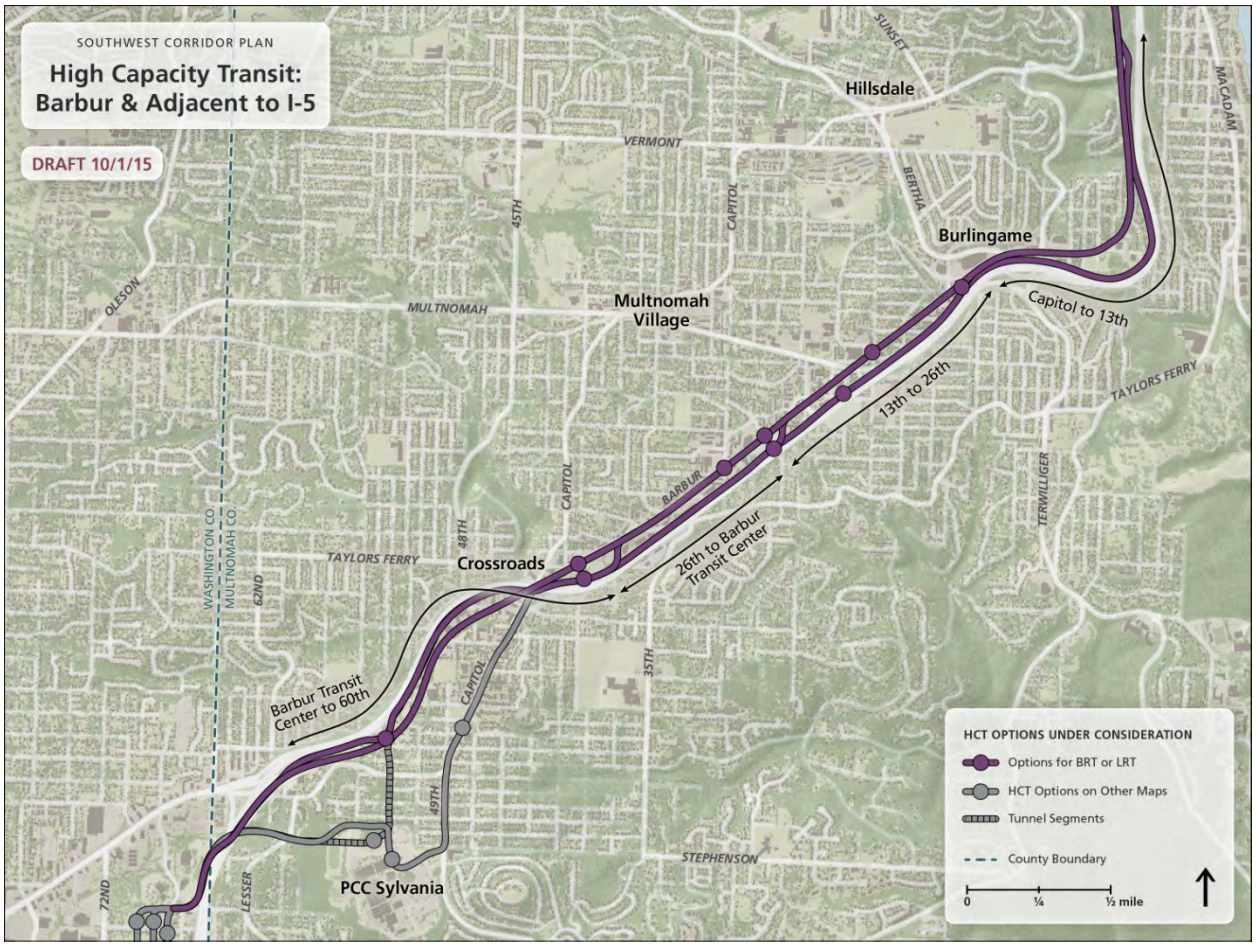
*Downtown Loop via Beveland Street crossing (BRT or LRT)*




- This option would include two stations in the Tigard Triangle, in the northern and southern ends of the area, and a station near the Tigard Transit Center. It could include a Hunziker station as well. A park and ride could be sited at the Hunziker station.
- The alignment would cross OR-217 on a new bridge, curving from Beveland to Wall, which would be fully multi-modal, accommodating transit, cars, bikes and pedestrians.
- HCT would access downtown Tigard via an extension of Commercial then run in a one-way counter-clockwise loop (in two-way streets) along Hall, then Scoffins and a new road south of Main, returning south on Commercial.

## Central Barbur

The Barbur and adjacent to I-5 alignment options have been separated into the following four segments.




### *Capitol Highway to 13th Avenue*

For a Barbur alignment in this segment, HCT could be either center-running or on a structure adjacent to SW Barbur Boulevard. For an adjacent to I-5 alignment in this segment, HCT would depart from Barbur just north of SW Capitol Highway in "The Woods," and run along the northwest side of I-5 to SW 13th Avenue, near the Burlingame Fred Meyers. No stations are currently under consideration in this segment.

### *13th Avenue to 26th Way*

For a Barbur alignment in this segment, HCT would be center-running. For an adjacent to I-5 alignment in this segment, HCT could either continue running adjacent to I-5 from Capitol Highway (if it runs adjacent to I-5 in the Capitol to 13th segment) or depart from Barbur at 13th Avenue and then run along the northwest side of I-5 to SW 26th Way. Two stations are currently under consideration in this segment, around SW 13th and SW 19th avenues for a Barbur alignment, and SW 13th and SW Spring Garden Street for an adjacent to I-5 alignment.

### *26th Way to Barbur Transit Center*

For a Barbur alignment in this segment, HCT would be center-running. For an adjacent to I-5 alignment in this segment, HCT would either continue running adjacent to I-5 (if it runs adjacent to I-5 in the 13th to 26th segment), or depart from Barbur at 26th Way and then run along the northwest side of I-5 to the Barbur Transit Center. To the south, HCT could cross over the Crossroads intersection (Barbur/Capitol/I-5) and continue running adjacent to I-5, drop into the center of Barbur from a structure over Crossroads, or turn south onto Capitol Highway to serve the PCC Sylvania campus directly with BRT. In addition to Barbur Transit Center, a station could be located either at SW 26th or SW 30th Avenue.

### *Barbur Transit Center to 60th Avenue*

For a Barbur alignment in this segment, HCT would be center-running. For an adjacent to I-5 alignment in this segment, HCT would either continue running adjacent to I-5 (if it runs adjacent to I-5 in the 26th to Barbur TC segment), or depart from Barbur just north of the Barbur Transit Center and then run along the southeast side of I-5 until SW 60th Avenue, where it would turn southwest to cross over I-5 into the Tigard Triangle. Two stations are currently under consideration in this segment, at Barbur Transit Center and around SW 53rd Avenue.

## Terminus

There are currently two terminus options under consideration:

### *Downtown Tualatin*

This terminal station is the southernmost terminus option currently under consideration. The location would be on the north side of Boones Ferry Road, south of the Tualatin River and directly adjacent to the Tualatin central retail district.

### *Bridgeport Village*

This terminal station would be located in the existing park-and ride lots between Lower Boones Ferry Road/72$^{nd}$ Avenue and I-5, on either side of Bridgeport Road. The alignment crosses over Lower Boones Ferry, with a station sited on top of two multi-story parking garages linked by a vehicular connection, which would replace the existing surface parking lots. Alternatively, an at-grade station could be located on the northern parking lot to remove the need for an HCT bridge structure over Lower Boones Ferry, with the two parking structures linked by a pedestrian connection.

# Staff Recommendations – Downtown Tigard

## Should the Ash Avenue alignment continue to be part of the project?

**Recommendation:** Continue further study and refinement of the Ash Avenue alignment option.

This alignment option would provide the second highest projected ridership of the Tigard options, a more direct route between the Tigard Triangle and downtown Tigard than the Branch Service and Loop options, strong redevelopment opportunities in downtown Tigard, and would provide two stations in the Tigard Triangle, as desired by the City of Tigard.

However, this alignment would result in more residential property impacts compared to other options as well as wetlands and park impacts. In addition, the location of the transit bridge over OR-217 is not conducive to accommodating autos and a separate auto bridge may not be eligible for federal News Starts funds. The downtown Tigard station on this alignment would also not be immediately adjacent to the existing WES/Tigard Transit Center station.

Staff finds that the above information, as reported in the *Tigard Key Issues Memo*, provides adequate reasons to include the Ash Avenue alignment for further study. On balance, the Ash Avenue alignment would provide some desirable benefits and perform relatively better than other options, but contains some notable disadvantages. To address these disadvantages, staff recommends studying whether:

- The Ash Avenue alignment can be adjusted to reduce impacts to wetlands, parks and residences.
- Alignment modifications near Hall, Ash and Commercial could minimize property impacts.
- The Tigard Transit Center could be modified to improve connections to the downtown HCT station location.
- Cars could be better accommodated on the proposed OR-217 transit bridge with adjustments in alignment or design.
- The Federal Transit Administration (FTA) would consider providing New Starts funding for a separate auto bridge over OR-217 if it would reduce environmental impacts and costs compared to a single, multi-modal bridge.

## Should the Branch Service alignment continue to be part of the project?

**Recommendation:** Continue further study of the Branch Service alignment option.

This alignment option would provide the fastest travel times between Bridgeport Village and points north of Tigard, and would result in the fewest residential property impacts in downtown Tigard. It would provide two stations in Tigard Triangle as desired by the City of Tigard, and the OR-217 bridge would accommodate cars. The Hunziker station would provide the opportunity for a new park and ride near downtown Tigard; the Ash Avenue and Clinton Crossing alignments do not include this option.

However, this alignment would result in higher operating costs—due to peak level service from the Hunziker station northward at all times—and require a transfer for HCT trips between downtown Tigard and Bridgeport Village. This option would also have reduced peak hour service south of the Hunziker

station, with service only every 15 minutes at all times at the Tigard Transit Center and Bridgeport Village.

Staff finds that the above information, as reported in the *Tigard Key Issues Memo*, provides adequate reasons to include the Branch Service alignment for further study. On balance, the Branch Service would provide many desirable benefits with reduced environmental and property impacts, although with aspects of service which may be challenging to TriMet and system users. To address these disadvantages, staff recommends studying alternative operational options on this alignment, which would reduce costs.

## Should the Clinton Crossing alignment continue to be part of the project?

**Recommendation:** Continue further study of the Clinton Crossing alignment option.

This alignment option would provide the most direct route between downtown Tigard and points north, resulting in the shortest travel times to downtown Portland. This option would also have the fewest property impacts in downtown Tigard and the Tigard Triangle.

However, this alignment would only include one station in the Tigard Triangle and would require a long, tall and visible structure to cross OR-217. In addition, this bridge would not accommodate autos, and a separate auto bridge may not be eligible for federal matching funds. This alignment may also result in wetlands impacts.

Staff finds that the above information, as reported in the *Tigard Key Issues Memo*, provides adequate reasons to include the Clinton Crossing alignment for further study. On balance, the Clinton Crossing alignment would provide some desirable benefits and perform relatively better than other options, but contains some notable disadvantages. To address these disadvantages, staff recommends studying:

- Potential design approaches for the OR-217 crossing that would have reduced visual impacts.
- Whether the FTA would consider providing New Starts matching funds for a separate auto bridge over OR-217 if it would reduce environmental impacts and costs compared to a single, multi-modal bridge.

## Should the Commercial Loop alignment continue to be part of the project?

**Recommendation:** Remove the Commercial Loop alignment from further study.

This alignment option would provide two stations in the Tigard Triangle, as desired by the City of Tigard, and the OR-217 bridge would accommodate cars. A Hunziker station, if included, would provide the opportunity for a new park and ride near downtown Tigard.

However, this alignment would result in slow travel times and subsequent reductions in ridership resulting from the loop route. It would also limit access to businesses in downtown Tigard and require reconstruction of the Tigard Transit Center. Finally, the sharp curve at the northern end of the loop might be difficult for light rail vehicles and would likely result in squealing wheels; it could also be problematic for articulated BRT vehicles.

Staff finds that the above information, as reported in the *Tigard Key Issues Memo*, provides adequate reasons to remove the Commercial Loop alignment for further study. On balance, the Commercial Loop would provide few additional benefits beyond other alignment options and would have reduced performance and questions of logistical feasibility.

## Should the Downtown Loop alignment continue to be part of the project?

**Recommendation:** Remove the Downtown Loop alignment from further study.

This alignment option would provide two stations in the Tigard Triangle, as desired by the City of Tigard, and the OR-217 bridge would accommodate cars. A Hunziker station, if included, would provide the opportunity for a new park and ride near downtown Tigard.

However, this alignment would result in slow travel times and subsequent reductions in ridership resulting from the loop route. It would also limit access to businesses in downtown Tigard, restrict auto turns, and require reconstruction of the Tigard Transit Center. This alignment also has a large physical footprint and could thereby limit redevelopment opportunities.

Staff finds that the above information, as reported in the *Tigard Key Issues Memo*, provides adequate reasons to remove the Downtown Loop alignment for further study. On balance, the Downtown Loop would provide few additional benefits beyond other alignment options and would constrain travel into and through downtown Tigard and future development greater than under other alignments.

## Further Refinement

Staff recommends that further investigation of both existing and potential alignment options to serve downtown Tigard and the Tigard Triangle be undertaken as part of the Southwest Corridor project. In particular, staff recommends refining the alignments in order to provide as many of these characteristics as possible:

- Connection to the Tigard Transit Center and WES
- Two stations in the Tigard Triangle
- Improved connections between the Tigard Triangle and downtown Tigard across OR-217 for all modes: transit, bikes, pedestrians, and autos
- Reduced operating costs for a branch service
- Reduced impacts to wetlands and residences

# Staff Recommendation – Central Barbur

In October 2015, project staff released a technical modifications memo related to high capacity transit (HCT) alignment options in the area along Barbur Boulevard and I-5 between South Portland and the Portland/Tigard city limits. Staff focused on station locations, capital cost, travel time and reliability, intersection performance for autos, property impacts, park impacts and engineering complexity.

As a result of this technical work, staff proposed one modification to the list of Central Barbur alignment segments options under consideration: to remove from further study the segment of the adjacent to I-5 alignment north of 13th Avenue.

This segment provides little to no benefit over the Barbur alignment in terms of transit performance while resulting in higher construction cost, impacts and risk. The main advantage of running adjacent to I-5 in this segment would be avoiding the traffic bottleneck at Terwilliger Boulevard. However, a structure over this intersection could also be incorporated in the Barbur Boulevard alignment, likely at a lower cost than being adjacent to I-5 in this segment.

The Barbur alignment in the segment north of 13th Avenue could be either center-running or on a structure adjacent to the roadway.

Project staff recommends further study of the adjacent to I-5 segments south of 13th Avenue. These alignments and those within Barbur Boulevard will require more detailed analysis that will be performed as part of the Draft Environment Impact Statement (DEIS).

# Staff Recommendation – Terminus

In November 2015, concurrent with this document, project staff released a *Terminus Options Memo* to aid the steering committee in deciding which terminus options are most promising and should advance into the DEIS for further analysis. The memo focused on key factors for which data exists or which are inherently qualitative: logistics, existing/future transit connections, accessibility, ridership, cost effectiveness, total cost, HCT performance, freeway congestion, potential for future HCT expansion, relationship with project goals, and viable alternatives.

Based on this analysis, staff found that the downtown Tualatin station location is notably less promising than Bridgeport Village as a terminus location, although it may serve as a good station on a future HCT extension. As a result, staff recommends removing downtown Tualatin from further consideration as a terminus option.

# Next Steps

Project staff will share feedback regarding these recommendations and report any adjustments for steering committee consideration one week prior to the December 14, 2015 meeting. A final report documenting the steering committee actions will be produced after the December meeting.

- In December 2015, staff will produce a report evaluating the mode options for the Southwest Corridor Plan.
- In January 2016, staff will report on its progress analyzing alternative connections options to the PCC Sylvania campus and issue its recommendations on mode and a light rail tunnel alignment to PCC Sylvania.
- In February 2016, the committee will deliberate on mode and a light rail tunnel to PCC Sylvania, and discuss funding strategy for bicycle, pedestrian and roadway projects in the Shared Investment Strategy and land use and development strategies. These decisions will constitute the draft Preferred Package for the Southwest Corridor Plan.
- In April or May 2016, after public review and input, the steering committee will adopt a final Preferred Package.

November 17, 2015

Metro Councilor Craig Dirksen
Metro Councilor Bob Stacey
Southwest Corridor Plan Steering Committee
Metro
600 NE Grand Ave.
Portland, OR 97232

*Sent via email c/o Chris Ford, Project Manager (Chris.Ford@oregonmetro.gov)*

RE: **Southern Terminus of Southwest Corridor High-Capacity Transit Service**

Dear Co-Chairs Dirksen and Stacey and Members of the Committee:

The City of Wilsonville supports the selection of Bridgeport Village as the location of the southern terminus of a future high-capacity transit service in the Southwest Corridor as outlined in the "Staff Recommendations for December 2015 Decisions," dated November 13, 2015.

As you may know, Wilsonville's South Metro Area Regional Transit (SMART) system provides bus service to the park-and-ride lot just south of Bridgeport Village, with continuing service on to Barbur Boulevard. We are part of the transportation solution for travelers along the I-5 and 99W corridors and we expect to continue to play a growing part there in the future. Note that SMART currently stops at the Tualatin park-and-ride 52 times/day (weekdays).

If HCT improvements are made with a southern terminus at Bridgeport Village, SMART will be able to increase its fixed-route service between the south metro area and the selected HCT since service north of Bridgeport Village will no longer be required from SMART. This would greatly enhance Wilsonville's transit connections to Portland and Salem, improving mobility for residents and workers throughout the entire region.

Another consideration concerns the rapid growth of the entire south metro area and the need for increased transportation investments. Whether it might be at Bridgeport Village and/or Wilsonville, some part of this area is certain to warrant designation as a Regional Center in the future, if not today. Having an HCT connection will facilitate the growth and development of that Regional Center, which will also qualify for additional federal funding opportunities.

We have been told that the Steering Committee may opt for designating Tigard as the southern terminus of any future HCT service in the area. While that would no doubt save money in the short-term, it would be a disservice to the 45,000-plus residents and 45,000 workers in Tualatin and Wilsonville, many of whom are commuters.

Thank you for your time and consideration of these comments.

Sincerely,

Tim Knapp

Tim Knapp, Mayor

cc: Washington County Coordinating Committee; Wilsonville City Council

David Edelman
3980 NW North Rd.
Portland, OR 97229



Bob Stacey
600 NE Grand Ave.
Portland, OR 97232-2736

December 2, 2015

Dear Mr. Stacey:

I've been very glad to read that Metro is planning a new transit line to the southwest area of the Portland region. I love to use our local buses and trains to get around without a car, and think we have one of the best public transit systems in the country. However, I disagree with the staff recommendation that Bridgeport Village, not Downtown Tualatin, be the terminus of the proposed corridor. I believe there are several reasons why Downtown Tualatin deserves detailed study as the end of the line, and hope that the steering committee will vote to keep it as an option for the draft environmental impact statement.

According to the Terminus Options Memo, some factors were not considered when evaluating the proposed terminus, including "local community" or "redevelopment potential". While it is true that these are inherently qualitative measurements, that doesn't mean they should be excluded from the decision. I believe that having a station near Tualatin Commons, which is already home to plenty of transit-oriented development and pedestrian- and bike-friendly infrastructure, would further encourage investment in the area.

On the other hand, Bridgeport Village is filled with parking lots and is bounded by Interstate 5 on one side. This makes it difficult to access it by any mode other than bus or car. We need to enable active transportation like cycling and walking, not discourage it. And all those parking lots aren't likely to become vibrant homes and shops any time soon.

Additionally, how will residents get to places like the Tualatin Library and the community park without a downtown Tualatin station? Bridgeport Village is a destination for shoppers and workers, but it doesn't have access to the same community amenities. For people without a car, it's invaluable to be able to travel to places other than just work and home.

With all the benefits of a terminus in Downtown Tualatin in mind, I urge you to maintain it as an option for future consideration. Though funding may be a issue, perhaps the station could be funded by value capture on new development near in Downtown Tualatin. Thank you for your time, and I appreciate your role working to plan our region's transportation future.

Sincerely,

David Edelman

GREAT PLACES
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Beaverton • Durham • King City
Washington County • ODOT • TriMet • Metro

# Southwest Corridor High Capacity Transit Mode Comparison



The goal of this document is to present detailed technical information on a wide range of considerations for bus rapid transit (BRT) and light rail transit (LRT) travel modes. This document does not provide a recommendation or weigh the factors against each other. The information included in this memo will be synthesized and referenced within a staff recommendation report, to be released by the end of January 2016.

In late February 2016, the Southwest Corridor Steering Committee is scheduled to decide whether bus rapid transit or light rail is the preferred high capacity transit mode for further study. The preferred transit mode will be incorporated into a draft 'Preferred Package' of investments for the Southwest Corridor for further public review. The Preferred Package will be finalized at the May 2016 steering committee meeting.

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503-797-1756

## HOW TO NAVIGATE THIS DOCUMENT ELECTRONICALLY

Many of the considerations at play in the decision between bus rapid transit and light rail are inextricably linked. To help you understand these relationships, this document includes several interactive features to make it easier to navigate.

Keep an eye out for these elements to help you explore the information in a "choose your own adventure" style:

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**ridership, p. 26**

*Links to related information in the sidebar and body text:*

service frequency, p. 31

*Links in the summary tables:*

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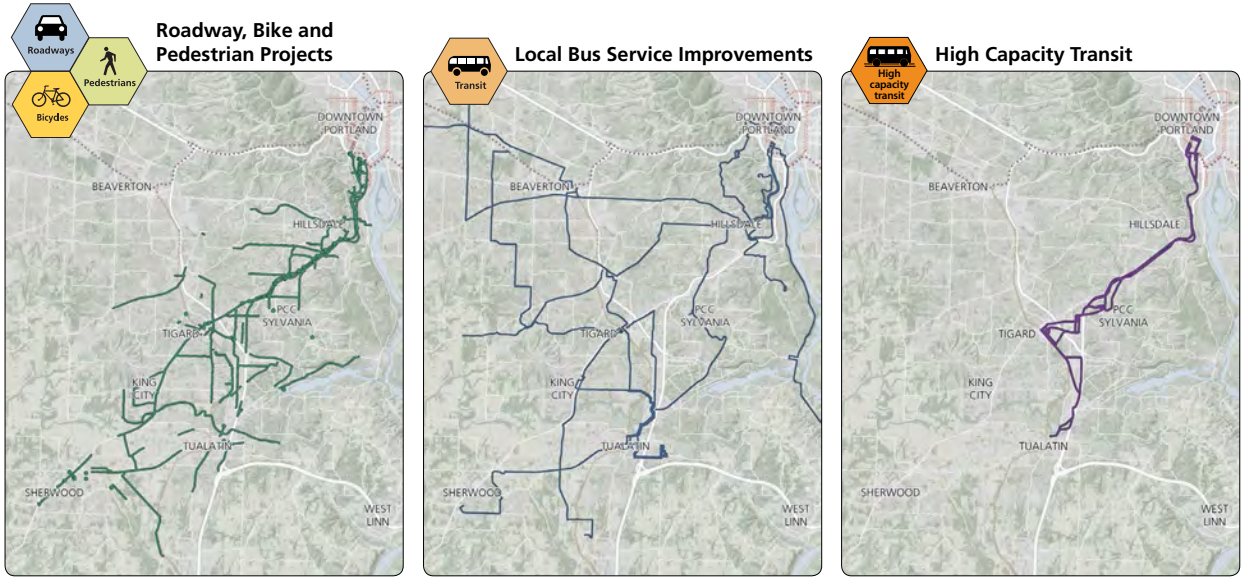
The Southwest Corridor Plan is a collaborative effort between project partners Portland, Sherwood, Tigard, Tualatin, Beaverton, Durham, King City, Washington County, ODOT, TriMet and Metro. It is a comprehensive approach to achieving community visions through integrated land use and transportation planning. The Plan is rooted in the adopted local land use plans of the corridor communities, including the Barbur Concept Plan, the Tigard High Capacity Transit Land Use Plan, Linking Tualatin and the Sherwood Town Center Plan. In support of these community visions, the Southwest Corridor Plan Steering Committee has recommended a Shared Investment Strategy that includes key investments in transit, roadways, active transportation, parks, trails and natural areas.




### *Roadway, bike and pedestrian projects*

Project partners have identified a list of priority projects to improve safety and connectivity throughout the corridor. Staff are working to identify potential funding strategies for these projects.

### *Local bus service improvements*

Through the Southwest Service Enhancement Plan, TriMet has evaluated the existing bus routes throughout the Southwest Corridor and recommended an array of improvements, including service upgrades, route changes and new routes. These improvements will be phased in as funding allows, starting with the new Line 97 between Sherwood and Tualatin opening in summer 2016.

### *High capacity transit (HCT)*

Bus rapid transit (BRT) and light rail transit (LRT) alternatives are being considered for several alignments that connect downtown Portland, Southwest Portland, Tigard and Tualatin. The purpose of this document is to explore the advantages and disadvantages of these two HCT modes.

## PROJECT GOALS

The Southwest Corridor Plan Purpose and Need statement, adopted January 2014, includes thirteen project goals:

1. Serve the existing and projected transit demand in the corridor
2. Improve transit service reliability in the corridor
3. Improve transit frequency and travel times
4. Provide options that reduce overall transportation costs
5. Improve multimodal access to a range of housing types and businesses in growing communities
6. Improve potential for housing and commercial development in the corridor and encourage development in centers and transit-oriented development at stations along the corridor
7. Ensure benefits and impacts promote community equity
8. Increase multimodal transportation options and improve mobility in the corridor
9. Complete multimodal transportation networks in the corridor
10. Advance transportation projects that increase active transportation and encourage physical activity
11. Provide transit service that is cost effective to build and operate with limited local resources
12. Advance transportation projects that are sensitive to the environment, improve water and air quality and help reduce carbon emissions
13. Catalyze improvements to natural resources, habitat and parks in the corridor

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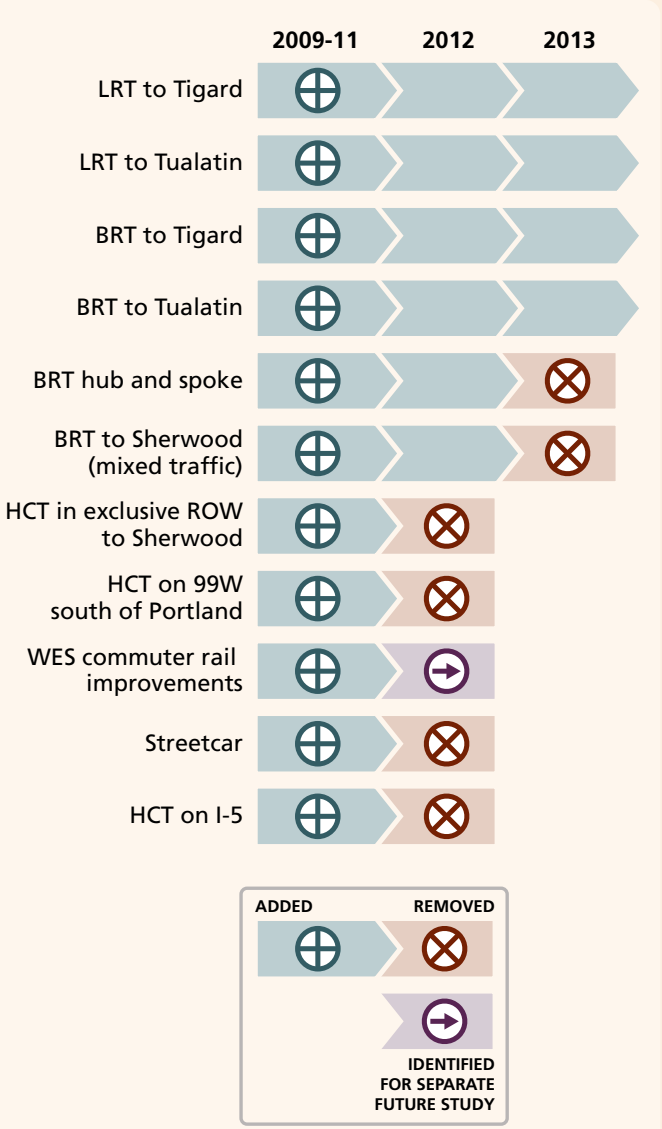
## EARLY NARROWING OF MODE AND ALIGNMENT

In the early stages of the Southwest Corridor project, many HCT modes and alignments were evaluated. The diagram below shows when rapid streetcar and WES commuter rail improvements were removed from consideration for this project, as well as HCT on 99W in Tigard. Since 2013, the project has focused on LRT or BRT to Tigard or Tualatin.




After the steering committee's 2013 Shared Investment Strategy recommendation, a refinement study was initiated to narrow high capacity transit (HCT) options and identify a list of roadway and active transportation projects to support the HCT project. Through this refinement phase, the steering committee has made several narrowing decisions, and further decisions will be made in early 2016.

### *March 2014*

The steering committee removed several options with 'fatal flaws' prior to more detailed analysis leading up to the June 2014 decision, including BRT along the south side of the PCC Sylvania campus and LRT on Hunziker Street in Tigard.

### *June 2014*

The steering committee removed several HCT alignment options and requested additional refinement work from staff on the remaining options. The options removed included a tunnel to Marquam Hill from South Waterfront, a "long tunnel" that served Multnomah Village, BRT in mixed traffic through Hillsdale, and an Upper Boones Ferry option west of Bridgeport Village.

### *July 2015*

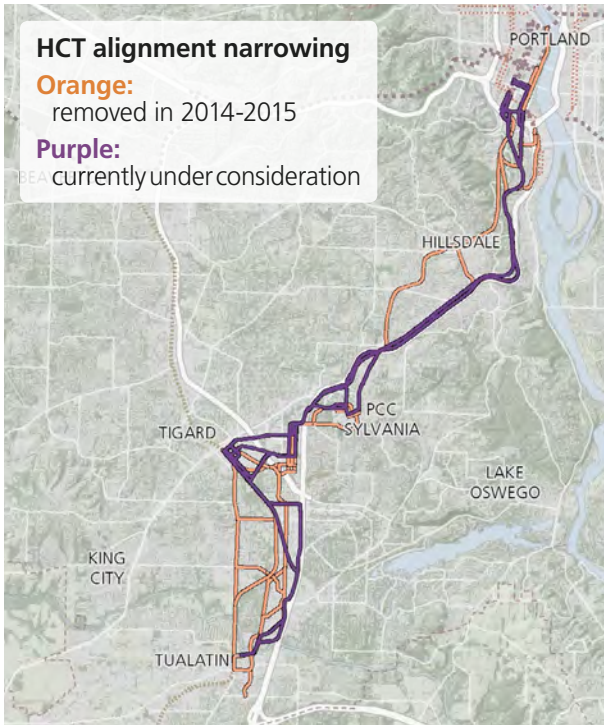
The steering committee removed tunnels to Marquam Hill and Hillsdale and accepted technical modifications to the remaining options.

### *January 2016*

The steering committee is scheduled to consider which HCT alignment and terminus options to study further in Tigard and Tualatin.

### *February 2016*

The steering committee is scheduled to consider whether LRT or BRT is the preferred HCT mode to study further, as well as whether to continue studying an LRT tunnel to PCC Sylvania. This mode will be incorporated into a draft Preferred Package of transportation investments to support community land use goals for further public review.




### *May 2016*

The steering committee is anticipated to recommend a Preferred Package, which will include the recommended HCT project and a funding strategy for priority roadway and active transportation projects.

### *Future analysis*

Once the HCT project and associated road, bike and pedestrian projects are undergoing federal review through the National Environmental Policy Act, staff will assess a wide array of positive and negative impacts and compare to not investing in transportation improvements for the Corridor.

## BUS RAPID TRANSIT


*EmX bus rapid transit in Eugene*

For the purpose of this memo, a bus rapid transit (BRT) line in the Southwest Corridor is assumed to include:

- 11 to 12 mile alignment serving 14 to 15 stations between downtown Portland and Bridgeport Village
- Operations in exclusive transitway for 78 to 85 percent of the alignment
- 60-foot articulated buses that carry up to 86 passengers (fuel/propulsion type to be determined)
- Special BRT system branding
- Advance fare collection with upcoming e-fare system, boarding through all doors and level boarding
- Most stations spaced around ½ to ¾ mile apart
- Improved bike and pedestrian access to stations and along the line
- Service frequency of 15 minutes or better all day
- New and expanded park-and-ride lots

## LIGHT RAIL


*MAX light rail in Portland*

For the purpose of this memo, a light rail (LRT) line in the Southwest Corridor is assumed to include:

- 11 to 12 mile alignment serving 14 to 15 stations between downtown Portland and Bridgeport Village (including existing Lincoln Street station)
- Operations in exclusive transitway for 100 percent of the alignment
- Two-car trains (electric) that carry up to 266 passengers
- Branding consistent with existing MAX system
- Advance fare collection with upcoming e-fare system, boarding through all doors and level boarding
- Most stations spaced around ½ to ¾ mile apart
- Improved bike and pedestrian access to stations and along the line
- Service frequency of 15 minutes or better all day
- New and expanded park-and-ride lots

### HIGH CAPACITY TRANSIT IN THE PORTLAND METRO REGION

Whether BRT or LRT, a Southwest Corridor line would tie into a region-wide high capacity transit network with a history stretching back to the 1980s. In 2016, C-TRAN will open The Vine, the region's first BRT line in Vancouver. The Powell-Division project is anticipated to add another BRT line to the region, and the first for TriMet. A BRT line in the Southwest Corridor would be a bigger investment than The Vine or Powell-Division, with an exclusive busway for most of the line.

**1986** Eastside MAX Blue Line

**1998** Westside MAX Blue Line

**2001** Airport MAX Red Line

**2004** Interstate MAX Yellow Line

**2009** WES Commuter Rail
I-205 MAX Green Line

**2015** MAX Orange Line

**2016** The Vine BRT in Vancouver (C-TRAN)

**~2020** Powell-Division BRT

**~2025** Southwest Corridor BRT or LRT


*TriMet MAX light rail system today*

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# Alignment assumptions

For the purpose of this document, certain assumptions have been made about which alignments to use for ridership projections, travel times and costs. Both modes share the same 'base' alignment, to provide as much of an 'apples-to-apples' comparison as possible. In addition to the base, this document includes the alignment options that serve the PCC Sylvania campus directly because they are considerably different between BRT and LRT and the steering committee is scheduled to consider a decision on the LRT tunnel to PCC at the same time as the mode decision. A memo evaluating several alternative connections to PCC Sylvania is being released concurrently with this document.

***Note**: these alignments are for analysis purposes only and do not indicate a preferred alignment.*

For more information on the performance of the other alignment options not included in the base or PCC alignments, see previously released Key Issues Memos and Evaluation Reports on the project website at www.swcorridorplan.org.

***Base alignment for BRT and LRT:***

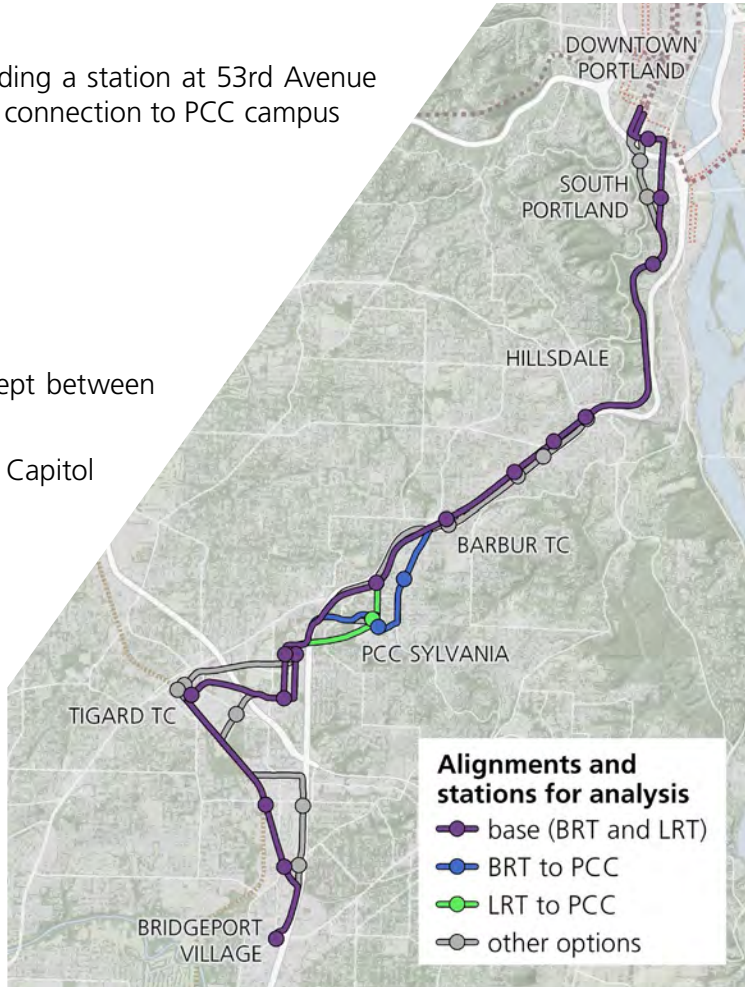
- Naito Parkway in South Portland
- Barbur Boulevard from Naito to 60th Avenue, including a station at 53rd Avenue with a park-and-ride lot and an enhanced walk/bike connection to PCC campus
- 68th/70th Avenue couplet in the Tigard Triangle
- Ash Avenue option in downtown Tigard
- Adjacent to freight rail in Southeast Tigard
- Terminus at Bridgeport Village

***PCC alignment for BRT:*** same as base alignment except between Barbur Transit Center and Tigard Triangle

- Capitol Highway / 49th Avenue with a station near Capitol Hill Library and Holly Farm Park
- Station at "front door" of Sylvania campus
- Connection to Tigard Triangle via new bridge over I-5 from Lesser Road

***PCC alignment for LRT:*** same as base alignment except between 53rd Avenue and Tigard Triangle

- Long bored tunnel from 53rd Avenue to Tigard Triangle (similar costs and travel times for short bored tunnel)
- Station with park-and-ride lot at 53rd Avenue
- Underground station on north side of campus




## HCT TERMINUS & OTHER DECISIONS CURRENTLY UNDER REVIEW

In November 2015, staff recommended removing the downtown Tualatin terminus for consideration at the January 2016 steering committee meeting. In order to provide up-to-date information for a February mode decision, the base and PCC alignments analyzed in this memo assume steering committee agreement with the recommendation and terminate at Bridgeport Village for both BRT and LRT.

The other alignments recommended for removal in the November report, which include the two loop options in downtown Tigard and a portion of the adjacent to I-5 option, are not included in the base alignment and thus are not discussed in this document.

## ASSUMED IMPACTS

HCT would be able to provide fast, reliable travel times by operating mostly in exclusive transit lanes. The transitway itself would require an extra 26 to 28 feet of width, plus more at stations and where upgraded bike lanes and sidewalks are needed. In some areas, vacant land or under-utilized parking would make it easy to find this extra width with few impacts, but in others it may be necessary to convert one or two auto lanes to transit use or widen the roadway and purchase the adjacent properties.

Converting auto lanes to transit use is only under consideration in areas where preliminary traffic analysis indicates that doing so would not negatively impact traffic. Accordingly, two auto lanes would be maintained in each direction along Barbur Boulevard from the Barbur Transit Center to Naito Parkway. South of Tigard, LRT and BRT would be mostly out of roadways altogether.

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# Summary table: project goals



| | | bus rapid transit (BRT) | | light rail (LRT) | |
|---|---|---|---|---|---|
| | | **base*** | **PCC*** | **base*** | **PCC*** |
| **land use** | **land use and development, p. 11** | While BRT would include many amenities that attract development, there is insufficient research nationally to quantify the amount of private investment. | | Introduction of LRT has a documented impact on development, attracting private investment to station areas. | |
| | **access to key places, p. 13** | Access to PCC Sylvania via BRT would require a half mile walk or a transfer to another connection. | Would include on-campus BRT station to serve PCC Sylvania. | Access to PCC Sylvania via LRT would require a half mile walk or a transfer to another connection. | Would include underground on-campus LRT station to serve PCC Sylvania. |
| **mobility** | **travel time, p. 16**<br>*2035 PSU to Bridgeport Village* | 38 min peak<br>34 min off-peak | 42 min peak<br>37 min off-peak | 31 min peak<br>30 min off-peak | 32 min peak<br>31 min off-peak |
| | **reliability, p. 17** | Generally less reliable, especially during peak periods, due to mixed traffic segments and limited signal priority. Less likely to be disrupted in extreme circumstances, such as unusually hot weather. | | Generally more reliable, due to 100% exclusive transitway and signal priority. More likely to be disrupted by unusually hot weather, blocked tracks and other extreme circumstances. | |
| | **rider experience, p. 18** | Both modes would include enhanced station amenities, level boarding, and boarding through all doors. LRT would provide a smoother ride. | | | |
| | **capacity for current & future demand, p. 19** | BRT would have limited capacity to serve rush hour ridership growth beyond 2035 because of its smaller vehicle size. | | LRT could increase service frequencies to serve future rush hour ridership growth beyond 2035. | |
| | **road, bike & pedestrian projects, p. 20** | Both modes would include road, bike and pedestrian improvements along the length of the alignment and to provide access to stations. | | | |
| | **local bus service, p. 21** | For both BRT and LRT, local bus service would be optimized to improve connections to key locations and transit stations. | | | |
| **community** | **public opinion, p. 23** | In a December 2015 survey, 25 percent of 600 respondents moderately or strongly favored BRT for the Southwest Corridor. | | In a December 2015 survey, 61 percent of 600 respondents moderately or strongly favored LRT for the Southwest Corridor. | |
| | **equity, p. 24** | Both BRT and LRT would increase access to many educational opportunities and job centers throughout the corridor for a range of demographic groups, including those with higher than average rates of poverty, English as a second language, seniors and youth. | | | |
| **cost-effectiveness** | **ridership, p. 26**<br>*2035 average daily new system transit trips and line riders* | 9,800 new transit trips<br>28,500 line riders | 9,900 new transit trips<br>28,300 line riders | 12,800 new transit trips<br>39,700 line riders | 15,500 new transit trips<br>42,500 line riders |
| | **capital cost, p. 27**<br>*current estimate in 2014$, w/o finance & escalation* | $1.0 billion | $1.0 billion | $1.8 billion | $2.1 billion |
| | **operating and maintenance costs, p. 28**<br>*current estimate based on 2035 ridership* | $2.32 per rider | $2.24 per rider | $1.59 per rider | $1.48 per rider |

*see *Alignment assumptions, p.7, for more information on the base and PCC alignments*

# Summary table: logistics



| | | bus rapid transit (BRT) | | light rail (LRT) | |
|---|---|---|---|---|---|
| | | **base*** | **PCC*** | **base*** | **PCC*** |
| **operations** | **vehicle capacity, p. 30** | 86 passengers per vehicle | | 266 passengers per vehicle | |
| | **service frequency, p. 31**<br>*2035 PSU to Tigard*<br>*(see p. 29 for frequencies south of Tigard)* | 3.0 min peak<br>*(demand for 2.9 min)*<br>12 min off-peak | 3.3 min peak<br>12 min off-peak | 6.7 min peak<br>15 min off-peak | |
| | **transit mall capacity, p. 32** | To meet demand, 18 to 20 BRT vehicles would be added to the Transit Mall in each direction during the peak hour in 2035, which could result in bus bunching at stations and at the northern terminus. | | Because a Southwest Corridor LRT line would interline with an existing MAX line, there would be little to no increase in hourly LRT vehicles on the Transit Mall, which would preserve capacity for future system growth. | |
| | **transit signal treatment, p. 34** | Higher service frequencies would limit how often buses would receive signal priority, especially during rush hour. | | Less frequent service would allow LRT vehicles to receive signal priority or preemption through most intersections. | |
| | **interlining, p. 33** | Would not interline with another transit line because there would be no BRT line to connect to from the north end of the Transit Mall. | | Would interline with the MAX yellow or green line. | |
| **finance** | **federal funding, p. 36** | The absence of comparable high-level BRT projects in the United States makes it more difficult to gauge the competitiveness of a Southwest Corridor BRT project for federal funding. | | The Portland region's history of receiving federal New Starts funding for MAX projects, paired with the anticipated strength of a Southwest Corridor LRT line, suggests that LRT could be competitive for federal funding. | |
| | **local funding, p. 37** | While a BRT project would cost less to construct than an LRT project, LRT would outperform BRT in terms of ridership, travel time and capacity for future ridership growth. Due to this difference in both costs and benefits between the two modes, it is difficult to assess the relative feasibility of receiving the necessary local funding. | | | |

*see *Alignment assumptions, p.7, for more information on the base and PCC alignments*

land use and development, p. 11

access to key places, p. 13

**RELATED PROJECT GOALS**

- Improve potential for housing and commercial development in the corridor and encourage development in centers and transit-oriented development at stations along the corridor
- Improve multimodal access to a range of housing types and businesses in growing communities

**Why does land use matter?**

The Southwest Corridor Plan is rooted in the adopted local land use plans of the corridor communities, including the Barbur Concept Plan, the Tigard High Capacity Transit Land Use Plan, Linking Tualatin and the Sherwood Town Center Plan. The project could support these land use visions by encouraging private investment in residential and commercial development along the HCT alignment. In addition to land use and development goals, each city identified and prioritized key places throughout the corridor to connect to the high capacity transit alignment, including Marquam Hill, Crossroads (Barbur Transit Center), downtown Tigard and Bridgeport Village.

**Key questions:**

- How well would BRT and LRT support the land use visions of the corridor communities? How much private investment would BRT or LRT encourage along the HCT alignment?
- What differences are there between the key places that BRT or LRT would serve? How would access to PCC Sylvania differ between BRT and LRT?

**Key findings:**

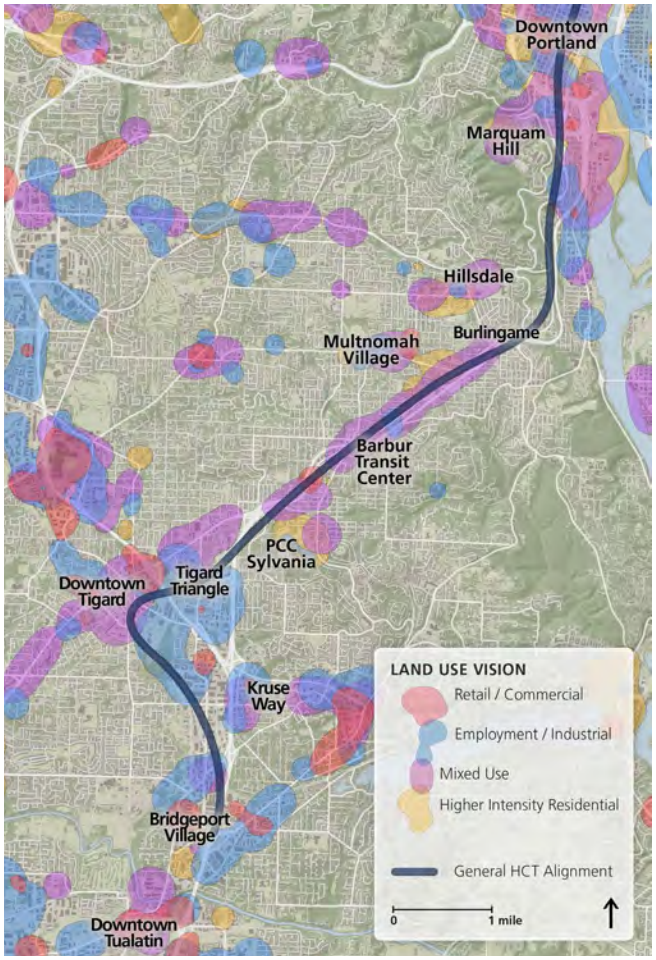
- Both BRT and LRT would serve many of the areas prioritized for future development in the corridor land use vision.
- Introduction of LRT has a documented impact on development, attracting private investment to station areas. While BRT includes many of the same amenities as LRT and streetcar that attract development, there is insufficient research nationally to quantify the amount of private investment.
- Both modes would directly or indirectly improve transit access to several 'essential' key places throughout the corridor, including Marquam Hill, the Tigard Triangle and Bridgeport Village.
- BRT and LRT would have stations in similar locations, with the exception of the PCC Sylvania area. BRT could serve the Sylvania campus directly at little additional capital cost, while LRT would require a tunnel in order to provide direct service to the campus. Several concepts are under consideration for improving access to the campus with HCT on Barbur (base alignment), including a bus hub on campus, an aerial tram to a station at Barbur/53rd and a special branded bus that could share the HCT transitway in certain areas to bypass traffic.

**How well would BRT and LRT support the land use visions of the corridor communities?**

To create the Southwest Corridor Plan, representatives of cities and counties throughout the corridor looked to local land use plans and policies to identify areas where the communities wanted to focus new development. The resulting 'land use vision' compiled and coordinated these plans. The map on the right illustrates these land use goals for the corridor, highlighting areas where communities envision retail, commercial, employment, industrial, mixed use and higher intensity residential development.

As a result of this land use focused process, the HCT alignments have been designed to improve access to the places in the corridor that have been prioritized for future development. Locations identified for future development in the land use vision that could be served by the HCT line include Marquam Hill (with a bike/pedestrian connection), the historic segment of Barbur Boulevard, the PCC Sylvania area, downtown Tigard, the Tigard Triangle and Bridgeport Village.

In addition to the HCT line under consideration, project partners have identified many priority roadway, bike and pedestrian projects that would improve access to the key destinations in the corridor and further support the land use vision. These projects would improve access not only along the HCT line and to its stations, but also in other areas not directly served by HCT, such as Sherwood and King City. See road, bike & pedestrian projects, p. 20, for more information on these projects.





**RELATED CONSIDERATIONS**

- access to key places, p. 13
- equity, p. 24

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**How much private investment would BRT or LRT encourage along the HCT alignment?**

In an attempt to quantify the effects of HCT on potential future development outcomes, Metro commissioned Johnson Economics to run a predictive development model for the corridor. The results of that work are summarized here.

Existing literature is extensive on the effects of LRT on development, with years of statistically relevant data that point to a clear value premium associated with this particular transit investment. Consequently, the LRT outputs from the model show impacts on development in the corridor that align with national trends and are grounded by local experience. The following table summarizes the assumed average value premiums for properties within the impact radius, for both a low range and a high range estimate:

| | | LRT value premium (base) | |
|---|---|---|---|
| **use type** | **impact radius** | low range | high range |
| ownership residential | 1/4 mile | 4.0% | 6.0% |
| rental residential | 1/4 mile | 5.6% | 8.4% |
| office | 1/8 mile | 9.6% | 14.4% |
| retail | 1/8 mile | 8.0% | 12.0% |

The table below summarizes the predictive increase in development activity that could happen over 20 years as a result of an LRT investment in the Southwest Corridor. The model estimates that the value premiums associated with LRT would effectively increase development outcomes along the corridor by approximately 13 to 15 percent overall.

| | increased development with LRT over 20 years (base) | | | |
|---|---|---|---|---|
| | construction investment | residential units | commercial space | change in real market value |
| low range | $574 million | 5,100 | 23,100 | $836 million |
| high range | $642 million | 5,600 | 75,400 | $930 million |

The land development impacts of BRT have not been extensively studied. Since there are few BRT lines in the United States with a design similar to that of the proposed Southwest Corridor BRT, there is a lack of viable data to establish value premiums for the model. However, the BRT envisioned for the Southwest Corridor would include many of the design elements of light rail and streetcar projects that are known to encourage private investment, including stations with shelters, benches, and real-time arrival information, a permanent alignment largely in exclusive right-of-way, branding, and high projected ridership. Based on the quality of the BRT line under consideration, it can be assumed that it would induce some level of development, but there is insufficient data to quantify an amount.

**RELATED CONSIDERATIONS**


- access to key places, p. 13
- equity, p. 24


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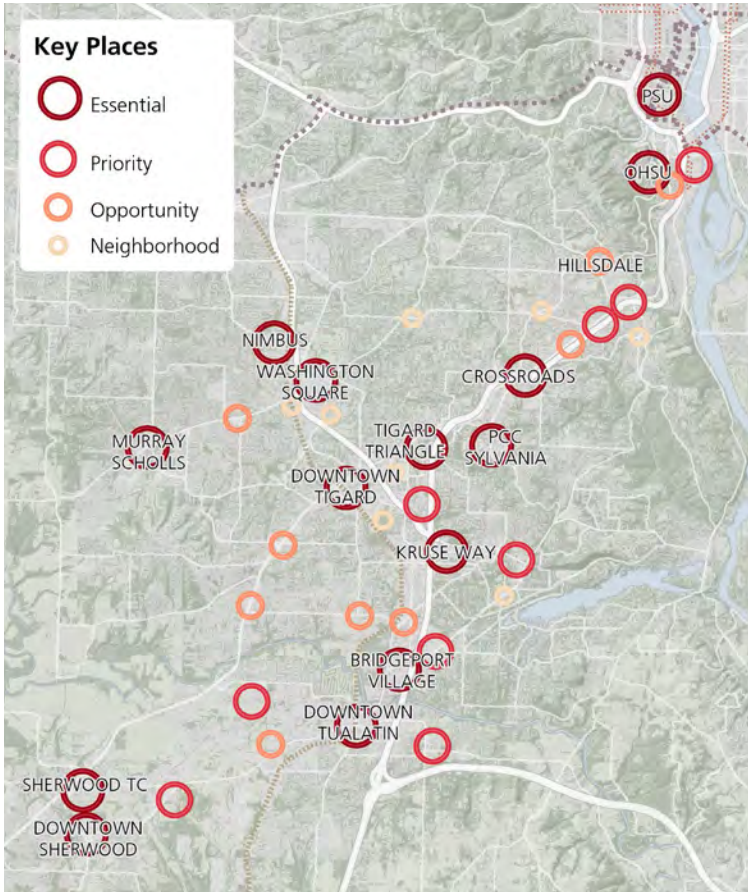
**What differences are there between the key places that BRT or LRT would serve?**

Early on in the Southwest Corridor Plan, project partners identified and prioritized key places to directly or indirectly connect to an HCT line. Both the BRT and LRT alignments provide access to several of the 'essential' key places, including Marquam Hill (OHSU and the Veterans Hospital), Crossroads (Barbur Transit Center), the Tigard Triangle, downtown Tigard and Bridgeport Village. Several other essential places would be connected to either BRT or LRT indirectly with local bus lines, such as Sherwood, downtown Tualatin and Washington Square. The Portland Community College (PCC) Sylvania campus is the only essential place where there is a notable difference in the options available for routing BRT or LRT directly to the campus.




***Marquam Hill***

Marquam Hill, which is home to both the Oregon Health Sciences University (OHSU) and the Veterans Affairs Medical Center (VA), would require a special connection for HCT access due to the steep grades separating the area from Barbur Boulevard. Several LRT tunnel options with an underground Marquam Hill station have been studied, but were removed from consideration by the steering committee in 2014 and 2015 because the high costs and impacts of tunneling were not justified by the projected gains in travel time and ridership. Current cost estimates assume some form of mechanized connection near Gibbs Street for pedestrians and bicyclists to access OHSU and the VA from an HCT station on either Barbur or Naito Parkway.

***Sherwood***

High capacity transit to Sherwood in exclusive ROW was removed from consideration by the steering committee in 2012, and BRT to Sherwood in mixed traffic was removed in 2013 (see page 5 for a timeline of HCT project narrowing). Since then project partners have continued to identify ways of improving access to Sherwood, in particular along Tualatin-Sherwood Road, which is an important employment area. TriMet's Southwest Service Enhancement Plan recommended a new bus line on Tualatin-Sherwood Road, which will be opening as the Line 97 in July 2016 and would connect to the HCT line at Bridgeport Village (see local bus service, p. 21). The list of roadway, bike and pedestrian projects prioritized for the corridor also includes a project to widen Tualatin-Sherwood Road to two lanes in each direction with bike lanes and sidewalks (see road, bike & pedestrian projects, p. 20).

**RELATED CONSIDERATIONS**


- land use and development, p. 11
- travel time, p. 16
- public opinion, p. 23
- equity, p. 24
- ridership, p. 26
- capital cost, p. 27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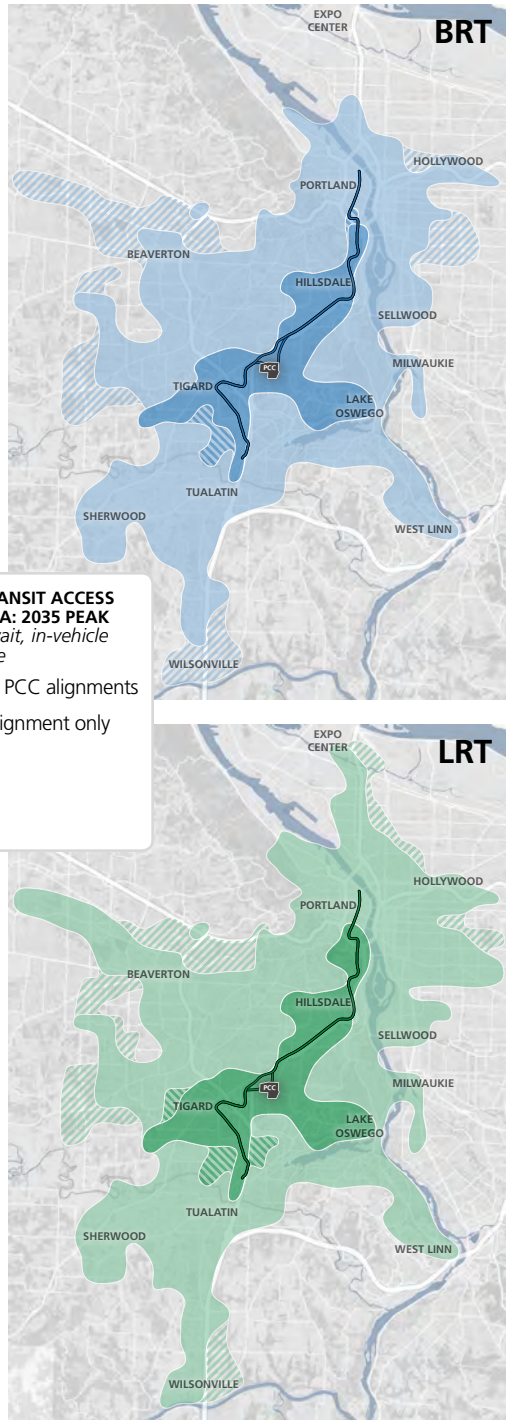
Sylvania has the largest enrollment of the four PCC campuses. In the fall 2015 term, the campus had 14,200 students, or a full-time equivalent of 3,100. Yet due to its location in a residential area on a hill, the Sylvania campus is challenging to serve with transit. While some students, teachers and staff ride the line 78 and 44 buses or use the hourly PCC shuttles today, a majority drive alone.

As part of the City of Portland's Comprehensive Plan update (in progress), PCC Sylvania is recommended to receive the "Institutional Zone" designation on the Comprehensive Plan Map. High capacity transit service to the PCC Sylvania campus would support this new designation and subsequent classification as a Campus Institutional Zone on the City's zoning map. Application of the Campus Institutional Zone to the Sylvania campus would enable additional transit-supportive campus development, including new educational facilities and potentially student housing.




### How would access to PCC Sylvania differ between BRT and LRT?

BRT could serve the Sylvania campus directly via Capitol Highway and a new bridge over I-5, at little additional capital cost compared to the base BRT alignment. Although the PCC alignment would be slower than the base, the two would have similar ridership due to the on-campus station and an additional station on Capitol Highway (see ridership, p. 26).

For LRT, providing an on-campus station would require a tunnel because the grades dropping from the campus down to the Tigard Triangle would be too steep for trains. Because the tunnel would only add an extra minute of travel time, it would attract more line riders than the base LRT alignment (see ridership, p. 26).

Project staff have studied several other approaches to improving access to PCC in conjunction with an HCT alignment on Barbur. The base alignment in this memo assumes an enhanced walk and bike connection from a station at Barbur and 53rd Avenue for the purpose of modeling and cost estimates. The other concepts under consideration, which could be combined, include a bus hub on campus, an aerial tram or a special branded bus that could run on the light rail transitway to bypass traffic. For more information, see the technical memo 'PCC Sylvania Enhanced Light Rail Connection Options' on the project website at www.swcorridorplan.org.

**RELATED CONSIDERATIONS**


- land use and development, p. 11
- travel time, p. 16
- public opinion, p. 23
- equity, p. 24
- ridership, p. 26
- capital cost, p. 27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travel time, p. 16

reliability, p. 17

rider experience, p. 18

capacity for current & future demand, p. 19

road, bike & pedestrian projects, p. 20

local bus service, p. 21

**RELATED PROJECT GOALS**

- Serve the existing and projected transit demand in the corridor
- Improve transit service reliability in the corridor
- Improve transit frequency and travel times
- Provide options that reduce overall transportation costs
- Improve multimodal access to a range of housing types and businesses in growing communities
- Increase multimodal transportation options and improve mobility in the corridor
- Complete multimodal transportation networks in the corridor
- Advance transportation projects that increase active transportation and encourage physical activity

## Why does mobility matter?

Many of the project goals focus on improving mobility throughout the corridor by providing a range of safe, fast, reliable and accessible options for getting around. Mobility encompasses not only the improvements that HCT would provide, but also roadway, bike and pedestrian projects and local bus service changes that could be implemented along with HCT. Because the corridor and region are growing, it is also important to assess whether each mode will provide the capacity to serve future transit demand.

## Key questions:

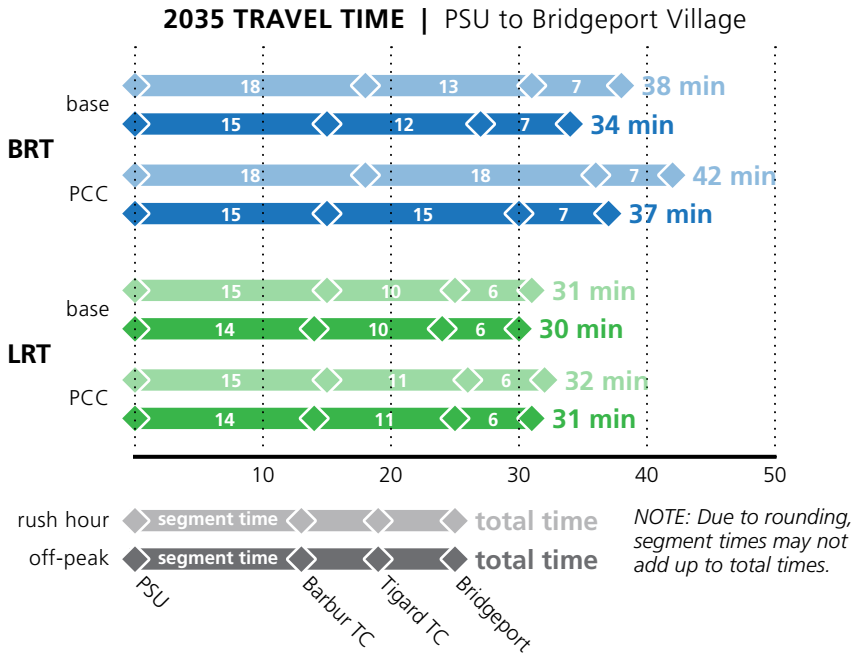
- How would travel time compare between BRT and LRT? Why would BRT be slower than LRT?
- How would reliability compare between BRT and LRT?
- How would the rider experience differ from standard buses and between BRT and LRT?
- Would each mode serve the projected ridership demand both today and into the future?
- What road, bike and pedestrian projects are included in the Southwest Corridor Plan? Would either mode allow for more roadway, bike and pedestrian projects in the corridor?
- What local bus service changes are proposed for the corridor? What differences would there be between BRT and LRT in terms of local bus service?

## Key findings:

- For the base alignment, LRT would usually be around 4 minutes faster than BRT, but 7 minutes faster during rush hour. Direct HCT service to PCC Sylvania campus would add 1 minute for LRT and 3 to 4 minutes for BRT.
- LRT would be more reliable day-to-day, but BRT would be less likely to be disrupted in extreme circumstances such as unusually hot weather or obstacles blocking the transitway.
- Both modes would include enhanced station amenities compared to local bus stops, level boarding and boarding through all doors, but LRT would provide a smoother ride.
- BRT would have limited capacity to serve rush hour ridership growth beyond 2035 because of its smaller vehicle size. LRT could increase service frequencies to double its peak capacity beyond 2035.
- Both BRT and LRT would include bike and pedestrian improvements along the alignment and to provide access to stations.
- For either mode, local bus service would be adjusted with HCT to optimize service and allocate operating hours efficiently and equitably throughout the corridor. The lower per-rider operating cost of LRT may help allow for more of the local bus improvements identified in the Service Enhancement Plan.

**How would travel time compare between BRT and LRT?**

The chart on the right shows the estimated peak (rush hour) and off-peak travel times for the base and PCC alignments for each mode in 2035. For the base alignment, LRT would usually be around 4 minutes faster than BRT, but 7 minutes faster during rush hour. Direct HCT service to PCC Sylvania would add 1 minute for LRT and 3 to 4 minutes for BRT.




Travel times would differ between the peak and off-peak periods because of the extra delay time HCT would experience at some signalized intersections during rush hour. Signal delay times have been estimated for both BRT and LRT and are at least partially included in the travel times presented here and the assumptions for the travel demand model. BRT is estimated to experience an average of 6 minutes of delay in the peak and 2 minutes in the off-peak in 2035. For LRT, the range of signal delay is estimated to be 40 seconds to 2 minutes in the peak only. This 40 seconds of peak delay has been incorporated into the travel times and the ridership assumptions. With the full 2 minutes of peak delay at signals, LRT ridership would be slightly lower.

***Why would BRT be slower than LRT?***

BRT would be 4 to 7 minutes faster than LRT for three primary reasons:

- LRT would run exclusively in its own transitway and interact with auto traffic only at intersections, which would allow for reliable travel times. For BRT, these travel times assume 16 percent of the alignment would operate in mixed traffic in order to reduce costs and minimize impacts. (See reliability, p. 17, for a map of where BRT could potentially operate in mixed traffic.) Congestion in the mixed traffic segments could slow down the BRT vehicles and affect reliability.
- There is more operator variability for BRT than for LRT due to the additional need to guide the BRT vehicles from side to side in a dedicated transitway, as well as interactions with other vehicles while in mixed traffic.
- Particularly during the peak periods, the higher service frequency of BRT would result in extra delay time at signals because not all vehicles could receive signal priority (see transit signal treatment, p. 34).

**RELATED CONSIDERATIONS**

- access to key places, p. 13
- reliability, p. 17
- rider experience, p. 18
- public opinion, p. 23
- service frequency, p. 31
- transit signal treatment, p. 34

return to the table of contents, p. 3

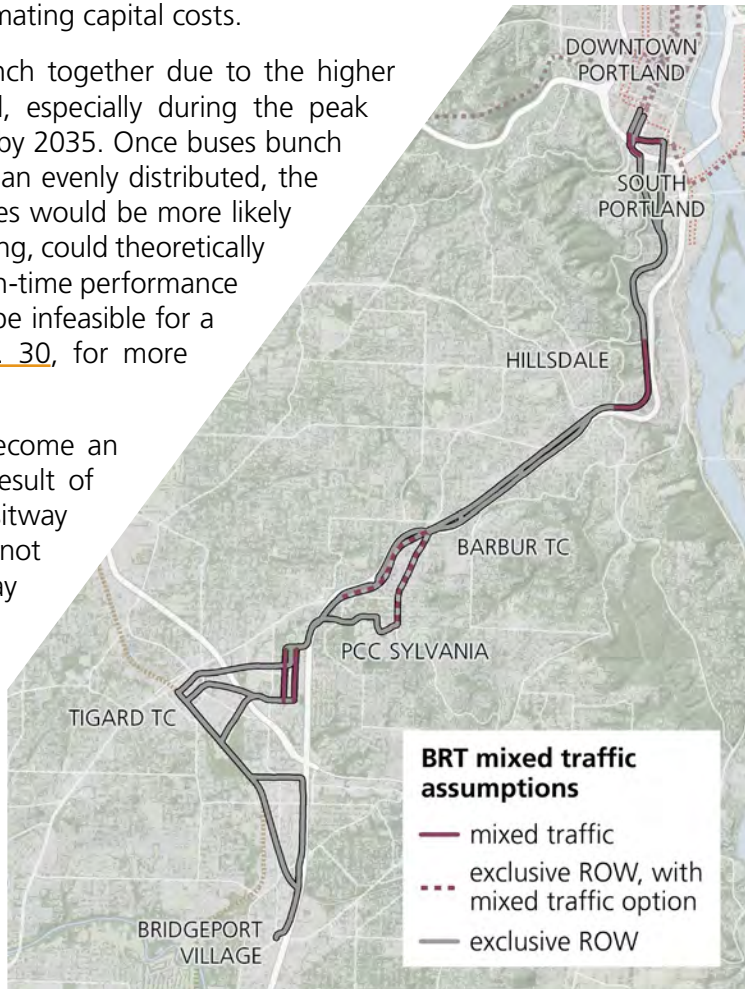
**How would reliability compare between BRT and LRT?**

Based on modal characteristics and preliminary design, general assumptions can be made about reliability for BRT and LRT in the Southwest Corridor, both in terms of day-to-day performance and extreme circumstances.

In terms of day-to-day reliability, meaning both on-time performance and variation in travel times, LRT would likely outperform BRT on average because it would receive signal priority more often than BRT due to the ability of trains to hold more people than buses, resulting in more time between trains (see transit signal treatment, p. 34). Additionally, LRT would operate only in exclusive transitways while BRT would include portions in mixed traffic to reduce costs and property impacts. The current assumption is that about 2 miles (16 percent) of the BRT alignment would run in mixed traffic, or up to about 3 miles (24 to 27 percent) if mixed traffic options along Barbur Boulevard or Capitol Highway near PCC Sylvania are included. Within these mixed traffic areas BRT may be unable to bypass congestion. See the map below for the mixed traffic segments currently assumed for the purpose of modeling ridership and travel times and estimating capital costs.

Additionally, BRT vehicles would be more likely to bunch together due to the higher service frequency required to meet ridership demand, especially during the peak hours, when vehicles may need to run 3 minutes apart by 2035. Once buses bunch together, arriving at stations at the same time rather than evenly distributed, the wait time between bus arrivals would increase and buses would be more likely to run off schedule. (Note that bus bunching, or platooning, could theoretically be implemented intentionally as a means of improving on-time performance while sacrificing scheduled frequency, but would likely be infeasible for a Southwest Corridor BRT line). See vehicle capacity, p. 30, for more information.)

In extreme circumstances, the flexibility of BRT can become an asset. While a light rail train could be delayed as a result of blocked tracks, BRT vehicles could depart from the transitway to avoid an obstacle. Additionally, BRT vehicles would not be hindered by unusually hot weather, which can delay LRT by restricting maximum travel speeds. Both modes could be delayed as a result of power outages to traffic signals, though LRT would require substitute shuttle buses if the power supply to the train was lost.




**RELATED CONSIDERATIONS**

- travel time, p. 16
- rider experience, p. 18
- public opinion, p. 23
- service frequency, p. 31
- transit signal treatment, p. 34

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**How would the rider experience differ from standard buses and between BRT and LRT?**

BRT in the Southwest Corridor would be relatively similar to LRT in terms of station amenities and the boarding process. At stations, both modes would have shelters, benches and real-time arrival information. Both modes would provide level boarding using raised stations and low-floor vehicles, which improves accessibility and speeds up boarding times. BRT and LRT would both use advance payment with TriMet's upcoming electronic fare system, which also speeds up boarding times and allows people to board at any door.

BRT could include bike storage either within the vehicles, as seen on existing MAX trains, or on the front of the vehicles, like a standard TriMet bus. Bike storage on the front of the BRT vehicles would increase delay time at stations compared to what is currently assumed in the travel times and modeling results.

For both BRT and LRT, the exclusive transitway can improve the rider experience by providing a more prominent view of where the HCT line runs. Mixed-traffic sections of the BRT alignment may not provide as strong of a visual cue of where the route is going.

While modern BRT vehicles provide a comparable level of amenities to light rail, they are often challenged to provide an equal ride quality. Since trains run on tracks rather than pavement and turning movements are more gradual and less frequent, LRT vehicles typically deliver a smoother ride than buses, thus making it easier to read or work on board. Additionally, articulated BRT buses, which allow for more passengers than the standard TriMet buses, include a trailer that tends to sway, causing more vertical and horizontal movement for riders in the back.

**RELATED CONSIDERATIONS**


- travel time, p. 16
- reliability, p. 17
- public opinion, p. 23
- ridership, p. 26
- service frequency, p. 31
- interlining, p. 33


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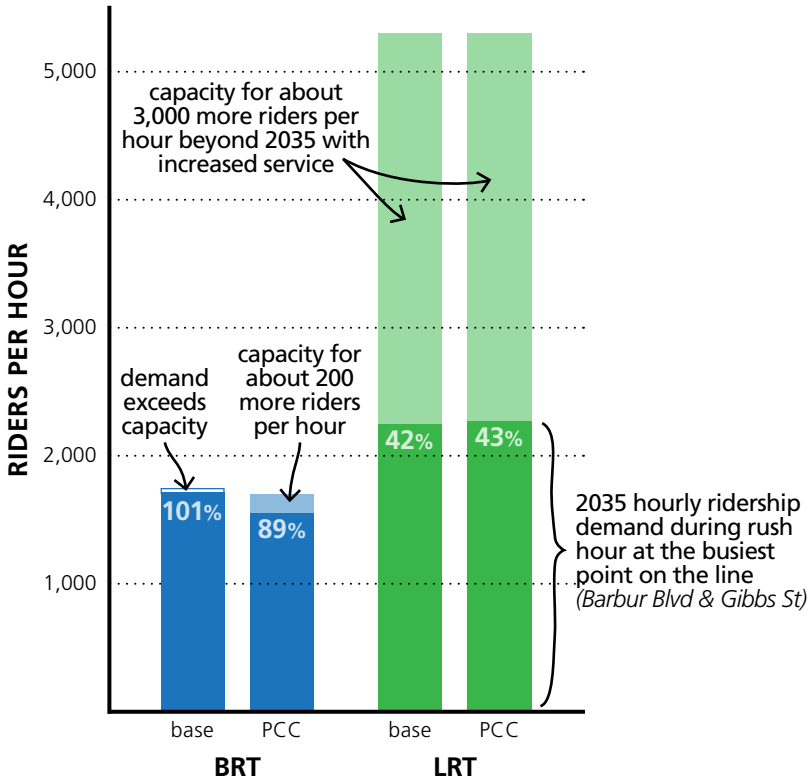
**Would each mode serve the projected ridership demand both today and into the future?**

Long-term ridership capacity for BRT and LRT would be constrained by the maximum service frequency that the Transit Mall in downtown Portland would allow. An analysis of Transit Mall operations found that either BRT or LRT could operate at a frequency of up to 3 minutes without significant issues on the Transit Mall. (See service frequency, p. 31, and transit mall capacity, p. 32, for more information.) For BRT, this 3 minute frequency restriction would result in overcrowding during weekday rush hours sooner because of the smaller vehicle size.

At 86 passengers per bus, the maximum hourly passenger capacity of BRT would be around 1,720. Ridership projections estimate a rush hour demand of approximately 1,540 to 1,740 passengers per hour at the busiest point on the line by 2035. The PCC alignment for BRT would have lower demand at the busiest point along the line, Barbur and Gibbs Street, because fewer people would take trips from south of PCC to north of Barbur/Gibbs as a result of the slower travel times compared to the base alignment. Ridership to the Sylvania campus would be higher with direct access, but many of these people would come from south and west of the campus and thus wouldn't contribute to the crowding at Barbur and Gibbs. Beyond 2035, there would be no additional rush hour capacity for the base alignment, but the PCC alignment would have room for around 180 additional riders per hour. In other words, 89 to 100 percent of the maximum rush hour capacity would be utilized by 2035 with BRT.

Light rail, with a vehicle capacity of 266 passengers, could accommodate a maximum of 5,320 riders per hour. Ridership projections estimate a rush hour demand of around 2,300 passengers per hour at the busiest point in 2035. Beyond 2035, the line could eventually serve over 3,000 more riders per hour by increasing the service frequency to up to 3 minutes. In other words, in 2035, the LRT line would be utilizing less than half of its long-term maximum rush hour capacity, allowing for significant growth in ridership for the future as the region grows.

(Note that service frequencies of 3 minutes could result in more signal delay than the 40 seconds to 2 minutes currently assumed for LRT with 6.7 minute headways during rush hour in 2035. See travel time, p. 16, for more information.)




**RELATED CONSIDERATIONS**

- ridership, p. 26
- vehicle capacity, p. 30
- service frequency, p. 31
- transit mall capacity, p. 32

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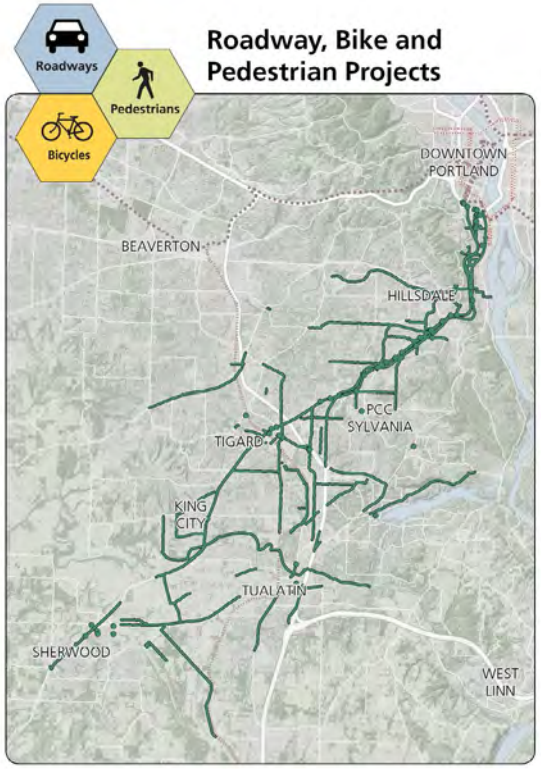
**What road, bike and pedestrian projects are included in the Southwest Corridor Plan?**

The current capital cost estimates already include approximately $75 million in road, bike and pedestrian projects that overlap with the HCT alignments, such as bringing bike lanes and sidewalks along Barbur Boulevard up to current standards and adding a new crossing over OR-217 for transit, bikes, pedestrians and potentially autos. Many other projects have been identified to improve access to HCT stations, and would also be eligible for federal transit funding, but haven't yet been incorporated into the HCT capital costs.

Project partners have also prioritized a list of projects that would improve access to key places and support the land use vision throughout the Southwest Corridor communities. This broader list includes projects such as widening Tualatin-Sherwood Road to improve connectivity along an important industrial employment corridor.

The map on the right shows all of the roadway, bike and pedestrian projects that have been prioritized for the Corridor, including the projects along the HCT alignment, the station-supportive projects and the broader land use supportive projects.




**Would either mode allow for more roadway, bike and pedestrian projects in the corridor?**

There is currently no assumption that either mode would allow for more roadway, bike and pedestrian projects than the other. Because the funding strategy for either mode has not yet been developed, it is too early to tell what implications the difference in project capital cost between BRT and LRT would have on the capacity to fund other projects around the corridor or the region.

**RELATED CONSIDERATIONS**

- equity, p. 24
- capital cost, p. 27
- local funding, p. 37

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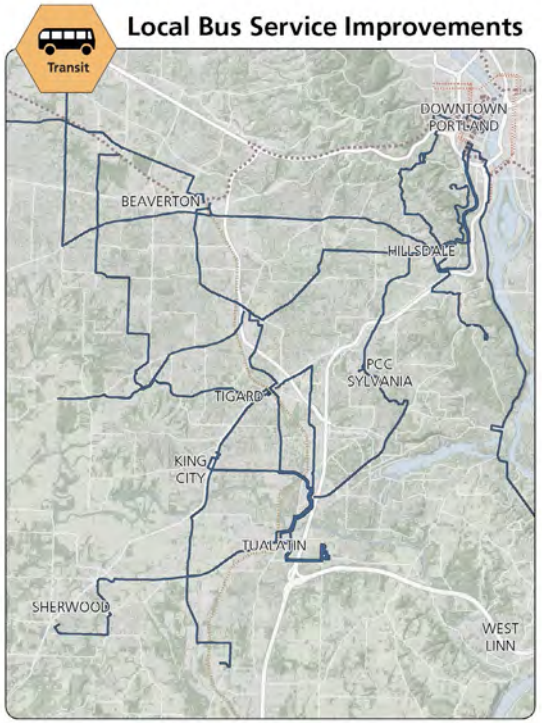
**What local bus service changes are proposed for the corridor?**

Alongside the Southwest Corridor HCT planning process, TriMet has developed the Southwest Service Enhancement Plan (SWSEP) to identify priorities for improving local bus service throughout the Southwest part of the region. The map on the right highlights the frequency upgrades and new bus lines that are proposed in the SWSEP. The new line 97 on Tualatin-Sherwood Road, which is expected to begin service in summer 2016, will provide an important connection between Sherwood and Tualatin, and eventually to a potential HCT terminus at Bridgeport Village. The remaining changes will be implemented over many years as necessary funding becomes available.




The Southwest Corridor HCT line would help allow for many of the proposed SWSEP improvements because it would attract new transit ridership in the corridor and could carry many riders more efficiently than local bus service does today. As a result, HCT could free up operating hours for new bus lines and service improvements in the under-served areas of the corridor.

Later in the HCT planning process, the proposed changes in the SWSEP would be revisited to account for the HCT line. Certain lines could be reduced in frequency, shortened, or rerouted in order to optimize service and allocate operating hours efficiently and equitably throughout the corridor.

**What differences would there be between BRT and LRT in terms of local bus service?**

While LRT would cost about the same as BRT to operate in total, LRT would attract more riders, resulting in a lower operating cost per rider than BRT (see operating and maintenance costs, p. 28). This higher cost efficiency might allow for more local bus service improvements across the corridor with LRT than with BRT.

Additionally, there may be opportunities to allow local buses to use the light rail transitway in certain areas to bypass congestion. BRT wouldn't be able to accommodate buses on the transitway because of the high service frequencies (see service frequency, p. 31). For more information on some potential shared transitway scenarios, see the technical memo 'PCC Sylvania Enhanced Light Rail Connection Options' on the project website at www.swcorridorplan.org.

**RELATED CONSIDERATIONS**

- operating and maintenance costs, p. 28
- transit mall capacity, p. 32

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public opinion, p. 23

equity, p. 24

**Why does community matter?**

Decision makers consider technical and operational issues along with the public interest and support when determining the best mode for a corridor. Transportation models indicate that more riders would choose to ride light rail than bus rapid transit, but this should be considered along with input from the public. Ultimately the success of an HCT project relies on transit riders using the line since it meets their daily needs and supports desires for their communities.

**Key questions:**

- What is known about public preferences for BRT or LRT?
- What differences are there between BRT and LRT in terms of equity?

**Key findings:**

- To date, a majority of survey respondents moderately or strongly prefer LRT over BRT.
- The public has requested additional information regarding the trade-offs and details of both LRT and BRT, including more information on how either mode would impact traffic, cost-benefit analysis, how either mode may impact redevelopment opportunities and housing affordability, and how existing bus service would be impacted.
- Both BRT and LRT would increase access to many educational opportunities and job centers throughout the corridor for a range of demographic groups, including those with higher than average rates of poverty, English as a second language, seniors and youth.
- Based on current designs, both modes would improve bike and pedestrian facilities along the length of the HCT line.

**RELATED PROJECT GOALS**

- Provide options that reduce overall transportation costs
- Improve multimodal access to a range of housing types and businesses in growing communities
- Ensure benefits and impacts promote community equity

**What is known about public preferences for BRT or LRT?**

To date, project partners have collected public input on a preferred mode for the Southwest Corridor through open-ended questionnaires, online surveys, and in-person dialogue. Closed-ended survey responses in May, June, October and November 2015 point to important factors and outcomes that the public wants decision makers to consider for the project, including:

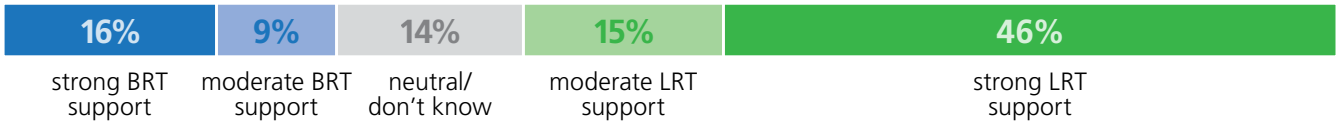
- reliable, fast travel times
- high ridership numbers that will result in fewer cars on the road
- access to employment and education centers

Open-ended survey questions and in-person discussions have provided a sense of how the public views the trade-offs between the mode options, and what further information people need in order to form an opinion about their preference. A sampling of comments include:

- Some respondents perceive BRT to be less noisy, more flexible and less expensive
- Some respondents feel that LRT is worth the upfront additional expense in order to have a system that will serve ridership long into the future
- Some respondents feel that LRT will be a more attractive option for the most riders
- Some respondents want more detail about how BRT would function in the corridor, including the location of transit stops and where BRT may run in mixed traffic
- Some respondents want more information on the costs and benefits of each option
- Some respondents want more information about how either mode option would impact existing local bus service
- Some respondents want more information about how each mode option would impact redevelopment potential for new retail, housing and employment in the area

In a December 2015 online survey, people were asked to indicate their preference between BRT and LRT for a Southwest Corridor HCT line. Respondents favored LRT over BRT at over a two to one ratio (61 percent LRT and 25 percent BRT), and 14 percent were unsure or neutral.

**Results from December 2015 online survey** (600 responses)




There will be several additional opportunities for the public to ask questions and provide feedback on their preferred mode choice in January and February.

**RELATED CONSIDERATIONS**


- access to key places, p. 13
- travel time, p. 16
- reliability, p. 17
- rider experience, p. 18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**What differences are there between BRT and LRT in terms of equity?**

***Populations with increased access to high capacity transit***

Both BRT and LRT would increase access to many educational opportunities and job centers throughout the corridor for a range of demographic groups, including those with higher than average rates of poverty, English as a second language, seniors and youth. Because LRT would provide faster and more reliable travel times and people generally prefer riding in trains over buses, more people would view LRT as a viable mode of transportation and shift over from driving, biking or walking (see ridership, p. 26).

In the future, BRT would reach its maximum capacity at rush hour sooner than LRT (see capacity for current & future demand, p. 19). Over-crowded buses during the peak hour would lead people to wait longer for an emptier vehicle, adjust their travel schedules to avoid the busiest times, or choose a different way to travel.

***Walk/bike improvements and access for seniors, youth and people who don't drive***

Based on current designs, both modes would improve bike and pedestrian facilities along the length of the HCT line. Either mode would also include improvements to increase safety and access for people traveling to HCT stations, which would be eligible for 50 percent federal funding as part of the transit package. These projects would include bike lanes, sidewalks and new crosswalks. See road, bike & pedestrian projects, p. 20, for more information.

***Access to education***

Increasing access to educational opportunities in the corridor is one of the top priorities identified by the public when they are asked what benefits they want to see from the Southwest Corridor project. Either mode would connect people to a variety of high schools, colleges and universities throughout the corridor. These connections would increase access for a diverse group of residents to educational and career opportunities, which could impact family stability, earning potential, and regional economic development.

In particular, increasing region-wide access to PCC Sylvania has been identified as an important project outcome. Direct HCT access to the campus could be provided at little additional capital cost with BRT, but would require a costly tunnel for LRT. Other approaches to improving access to PCC along with an LRT alignment on Barbur Boulevard are also being studied, such as a bus hub concept, an aerial tram and a special branded bus that could share the LRT transitway. See access to key places, p. 13, for more information.

***Access to job centers***

Increasing access to job centers and employment opportunities in the corridor is also one of the top project priorities identified by the public. Selecting LRT or BRT as the preferred mode would not directly impact how the HCT line would connect to existing and future job centers in the corridor.

**RELATED CONSIDERATIONS**


- land use and development, p. 11
- access to key places, p. 13
- road, bike & pedestrian projects, p. 20
- ridership, p. 26


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ridership, p. 26

capital cost, p. 27

operating and maintenance costs, p. 28

**Why does cost-effectiveness matter?**

Because there are considerable differences between BRT and LRT in terms of both costs and benefits, it is important to understand these trade-offs. This section includes the current estimates of ridership, capital cost and operating cost for each mode, but the goal of this report is not to provide a quantitative cost-benefit analysis of these factors. There is no simple approach to weighing the one-time cost of construction against the ongoing operating and maintenance costs, and such a comparison is further complicated due to the difference in funding sources between capital and operating costs.

It is also critical to understand that the estimates of ridership and operating cost represent one snapshot in time, namely 2035, and would change over time along with changes in population and travel patterns. The current project timeline estimates an opening year around 2025, so the estimates represent approximately 10 years after opening. Ridership demand would likely be lower in the opening year, and would continue to rise beyond 2035.

**Key questions:**

- How would ridership compare between modes? How would ridership differ with direct HCT service to PCC Sylvania?
- How would capital cost differ between BRT and LRT?
- How would the operating and maintenance cost differ between BRT and LRT?

**Key findings:**

- Assuming the base alignment for both modes, LRT would attract approximately 31 percent more new system transit trips and 39 percent more line riders than BRT in 2035. The BRT alignment to PCC would have similar ridership to the base alignment because the trips gained by providing direct access to the campus would be offset by the trips lost as a result of the slower travel time. Compared to the base alignment, the LRT tunnel to PCC Sylvania would increase line ridership by 7 percent and new system trips by 13 percent.
- For the base alignment, LRT would cost about 80 percent more than BRT due to the costs of tracks, electrification, utility relocation, etc. The PCC tunnel would add around $330 million, or 18 percent, to the base cost for LRT, while the PCC option for BRT would only add about $10 million (2014$, not including finance costs and escalation). Assuming the PCC alignment for both modes, LRT would cost just over twice as much as BRT.
- Based on 2035 ridership, BRT would cost approximately $2.24 to $2.32 per rider to operate and maintain, and LRT would cost around $1.48 to $1.59.

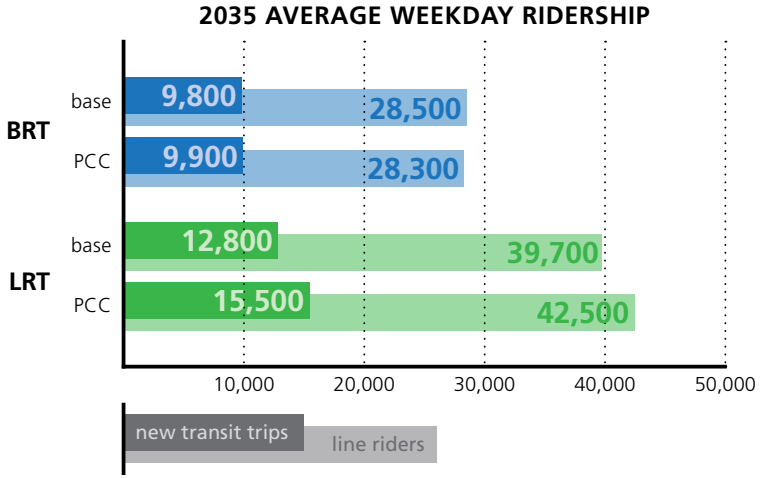
**RELATED PROJECT GOALS**

- Provide transit service that is cost effective to build and operate with limited local resources

Two key numbers are used to measure ridership performance: new system transit trips and line ridership. New system transit trips measures the overall growth in transit ridership across the system, calculated as the difference in the total number of daily transit trips between a scenario with the project and a no-build scenario without the project. These new transit trips could have otherwise been taken by car, bike or walking. Line ridership, in contrast, is the number of trips on the new HCT line each day, irrespective of how those trips would have been taken if the project didn't exist. This measure includes both the new transit trips and the existing transit riders who would benefit from the improved reliability and travel times that the HCT project would provide.

**How would ridership compare between modes?**

Assuming the base alignment for both modes, LRT would attract approximately 31 percent more new system transit trips and 39 percent more line riders than BRT on weekdays in 2035.




***Why would LRT attract more riders?***

Light rail is projected to attract more riders than BRT for three reasons. First, LRT service would be faster and more reliable than BRT service, especially during rush hour. Second, it is documented and accepted by the Federal Transit Administration that rail modes attract more riders than buses or BRT. This rider preference for LRT over BRT is programmed into Metro's travel demand model, as it is in other models utilized throughout the country. Third, LRT would interline with either the existing Green or Yellow MAX line, providing a one-seat ride between the Southwest Corridor and areas east of the Willamette River, which would require transfers with a BRT line that would terminate near Union Station.

**How would ridership differ with direct HCT service to PCC Sylvania?**

Compared to the base alignment, the LRT tunnel to PCC Sylvania would increase line ridership by 7 percent and new system trips by 13 percent. The BRT alignment to PCC would have similar ridership to the base alignment because the trips gained by providing direct access to the campus would be offset by the trips lost as a result of the slower travel time. In addition, a new park-and-ride lot along Barbur Boulevard near 53rd Avenue is assumed for both the BRT and LRT base alignments and the LRT to PCC alignment, which would all pass by the park-and-ride lot location. BRT to PCC, however, could not access the site because of its route along Capitol Highway, so the park-and-ride lot is not assumed to be included and the resulting ridership is not captured.

Ridership projections do not assume redevelopment at the PCC Sylvania campus location, which could be induced by new HCT service, or alternative connection options such as a PCC Sylvania bus hub or an aerial tram. Actual ridership could be higher depending on future campus development and other connection scenarios.

**RELATED CONSIDERATIONS**


- access to key places, p. 13
- rider experience, p. 18
- capacity for current & future demand, p. 19
- equity, p. 24
- service frequency, p. 31
- federal funding, p. 36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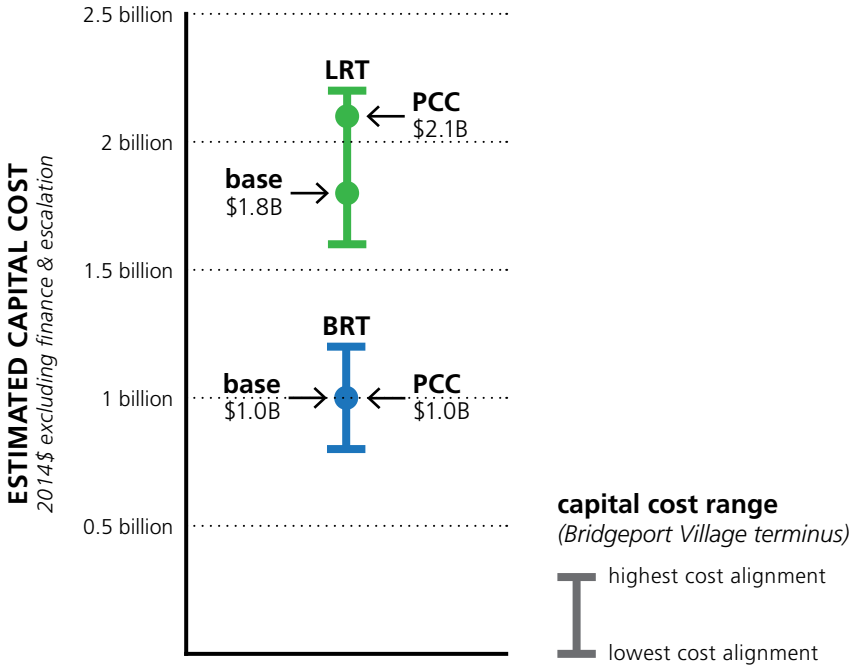
**How would capital cost differ between BRT and LRT?**

For the base alignment, LRT would cost about 80 percent more than BRT. The PCC tunnel would add around $330 million, or 18 percent, to the base cost for LRT, while the PCC option for BRT would add about $10 million (2014$, not including finance costs and escalation). With the PCC alignment included for both modes, LRT would cost just over twice as much as BRT.




***Why is LRT more expensive than BRT?***

In general, LRT is more expensive to construct than BRT because the trains require tracks, utility relocation, electrification systems, signal upgrades and more/wider structures. LRT would also include more property acquisition costs because the trains would require a slightly wider transitway and a wider turn radius than BRT.

Sixteen percent of the BRT alignment is assumed to run in mixed traffic for these cost estimates. (See reliability, p. 17, for a map of where BRT is currently assumed to operate in mixed traffic.) Operating in mixed traffic can reduce capital cost by avoiding the need to widen the roadway, which often requires rebuilding bridges or acquiring properties. For example, these cost estimates assume that BRT would operate in an exclusive busway on Capitol Highway and 49th Avenue for the PCC alignment and along Barbur Boulevard south of Crossroads for the base alignment. Shifting to a mixed traffic alignment in either of these segments would reduce the project capital cost by around $30 million (2014$, not including finance costs and escalation). Final decisions as to where BRT would run in mixed traffic have not been made.

**RELATED CONSIDERATIONS**


- access to key places, p. 13
- road, bike & pedestrian projects, p. 20
- federal funding, p. 36
- local funding, p. 37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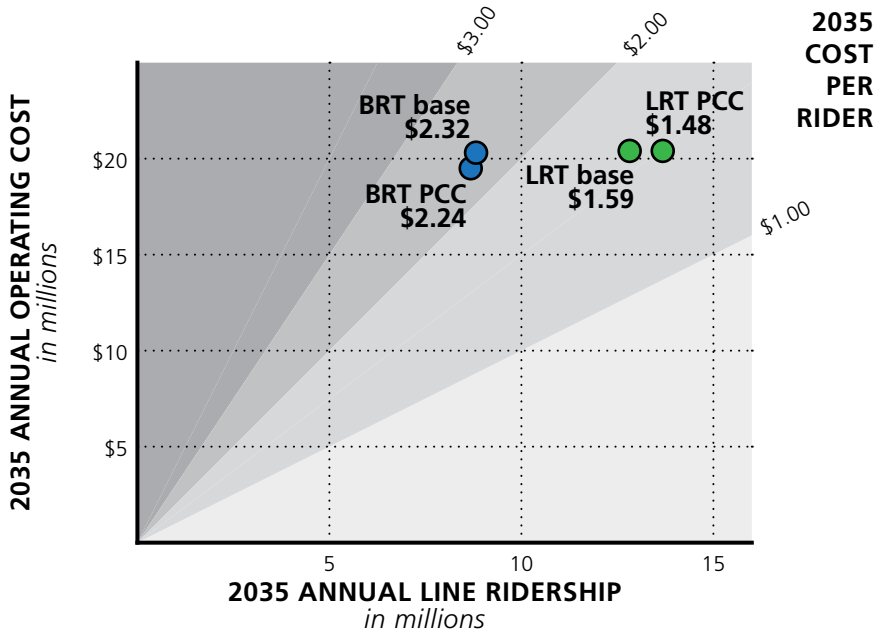
**How would the operating and maintenance cost differ between BRT and LRT?**

The chart below illustrates the differences in operating and maintenance (O&M) cost between BRT and LRT, in terms of both the total annual cost and the average cost per rider, based on ridership projections for 2035.




While each two-car LRT train would cost 153 percent more to operate per hour than each articulated BRT bus ($296 and $117 per hour, respectively), each train would hold 210 percent more passengers than each bus (see vehicle capacity, p. 30). As a result of its lower vehicle capacity, BRT would need to operate at a higher service frequency in order to meet the ridership demand, and accordingly would have a higher total number of operating hours than LRT (see service frequency, p. 31). This higher service frequency of BRT paired with a lower cost per vehicle hour balances out to a similar total annual operating cost for both modes of around $20 million. However, because LRT would attract more line riders than BRT (see ridership, p. 26), the per-rider O&M cost would be lower for LRT. While LRT would cost around $1.59 per ride for the base alignment, the BRT base would cost around $2.32 per ride, or 46 percent more than LRT.

For both BRT and LRT, the PCC alignment would have a lower O&M cost per rider than the base alignment. For LRT, this difference is a result of the higher ridership that the PCC station would attract, paired with no difference in the total O&M cost. For BRT, the line ridership would be similar between the two alignments while the total O&M cost would be lower with the PCC alignment because less frequent service would be required during rush hour than with the base alignment (see service frequency, p. 31).

**RELATED CONSIDERATIONS**

- local bus service, p. 21
- service frequency, p. 31
- interlining, p. 33
- federal funding, p. 36
- local funding, p. 37

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vehicle capacity, p. 30

service frequency, p. 31

transit mall capacity, p. 32

interlining, p. 33

transit signal treatment, p. 34

**Why do operational considerations matter?**

The technical details of how each mode would operate are important in evaluating whether BRT or LRT is the best fit for the Southwest Corridor.

Because TriMet has experience operating the MAX light rail network but not a BRT system, the operational logistics of a Southwest Corridor BRT alignment are less well understood. As a result, the information in this section addresses BRT in more detail than LRT.

**Key questions:**

- How would vehicle capacity compare between BRT and LRT? Would platooning, or running two buses together, be feasible?
- How frequently would HCT vehicles need to run in order to meet ridership demand? What is the most frequent service that BRT or LRT could provide?
- What effect would transit mall capacity have on BRT and LRT operations?
- How would interlining differ between BRT and LRT?
- How are signal treatments used for transit in the Metro region today? How would signal treatments differ between LRT and BRT?

**Key findings:**

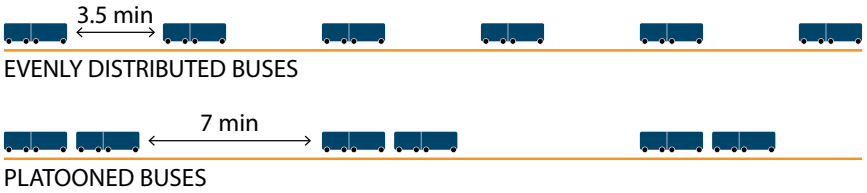
- Each BRT bus would have a maximum capacity of approximately one third the number of passengers as an LRT train. Platooning buses appears operationally infeasible.
- By 2035, BRT vehicles would need to run 3 to 3.3 minutes apart in order to meet ridership demand during the peak hour and LRT trains would run 6.7 minutes apart. It is assumed that 3 minutes is the maximum service frequency that either mode could accommodate.
- Transit Mall capacity is a concern for BRT in the peak periods at Union Station (the northern terminus) and at the intersection of SW Lincoln Street and 4th Avenue.
- LRT would interline with either the yellow or green MAX line, while BRT would not interline with another transit line because there would be no BRT lines from the north to connect to.
- Both LRT and BRT would have opportunities for enhanced transit signal treatments, but the high service frequency of BRT would limit how often the buses could receive signal priority during rush hour.

### How would vehicle capacity compare between BRT and LRT?

Light rail would have a capacity of 266 passengers per two-car train. For BRT, the largest capacity vehicle available in the region would be an 86-passenger single-articulated bus. While larger-capacity buses are used in other countries, only 86-passenger vehicles are built in the United States, which is a requirement for federal New Starts funding.

### Would platooning, or running two buses together, be feasible?

In order to increase the capacity of a BRT system, one idea is to operate buses in pairs, known as platooning. These pairs of buses would, ideally, arrive at each station together, and travel through intersections together.




With platooning, less frequent service could be provided while serving the same number of riders, as illustrated in the diagram above. This reduced frequency could potentially speed up travel times and improve reliability by reducing delay time at signals, because each pair of buses would be more likely to receive signal priority. However, platooning may not work as intended in practice, as it would be difficult to balance passenger loads and boarding times between the two paired buses, resulting in varying station dwell times (i.e. the time it takes for passengers to get on and off). Differing dwell times could lead to the platoon splitting up, thereby eliminating its intended benefits.

Los Angeles Metro considered platooning to address overcrowding on its Orange Line BRT, and concluded that the concept should not be implemented because the scheduled platoons can become delayed in an attempt to keep the pair of buses together, and platooning would increase dwell times at stations.

An additional challenge of platooning in the Portland region is the required length of the stations. A pair of buses would occupy a station platform of about two-thirds the length of a downtown Portland city block. In the Transit Mall, this would constrain locations suitable for Southwest Corridor BRT stations, and limit their use by other bus lines. Other bus lines, including new BRT lines such as Powell-Division, would mostly have to be consolidated in the remaining blocks not used by MAX or Southwest Corridor BRT.

**RELATED CONSIDERATIONS**

- capacity for current & future demand, p. 19
- service frequency, p. 31

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### How frequently would HCT vehicles need to run in order to meet ridership demand?

The table below shows the service frequencies that would be required to meet the projected 2035 ridership demand while maintaining a minimum level of service of 15 minute frequencies. Because transit demand is higher closer to downtown Portland, more frequent service would be required along the northern portion of the alignment in order to provide sufficient passenger capacity without a disproportionate increase in operating and maintenance costs. (Today, many MAX and bus lines include some vehicles that turn around before the end of the line.) A more detailed service plan will be developed prior to project opening, including opening year service frequencies and locations where some vehicles may turn around before the end of the line.

| | | 2035 | |
|---|---|---|---|
| | | peak (rush hour) | off-peak |
| BRT | Portland to Tigard | base: 2.9<br>PCC: 3.3 | 12 |
| | south of Tigard | 8.6 | 15 |
| LRT | Portland to Tigard | 6.7 | 15 |
| | south of Tigard | 15 | 15 |

**Number of minutes between HCT vehicles in each direction**

- Same frequency for base and PCC alignments unless noted otherwise
- 15 minute service frequencies reflect TriMet minimum standard for frequent service operations
- Numbers in red indicate frequencies that exceed the 3 minute limit

***Why would BRT need to operate at a higher frequency than LRT?***

Because BRT buses accommodate fewer passengers than LRT trains (86 to 266), BRT would need to run more frequently than light rail in order to meet the projected demand (see vehicle capacity, p. 30).

### What is the most frequent service that BRT or LRT could provide?

The current assumption is that either BRT or LRT could operate at a frequency of up to 3 minutes, or 20 vehicles per hour, without significant issues on the Transit Mall (see transit mall capacity, p. 32). Ridership projections suggest that the BRT base alignment would need to provide a rush hour service frequency of 2.9 minutes, or 21 vehicles per hour, by 2035. In other words, ridership demand would exceed the capacity that 3 minute headways would provide (20 vehicles per hour). BRT to PCC would require 3.3 minute frequencies during rush hour in 2035 to meet the ridership demand, or 19 vehicles per hour. As a result, the BRT vehicles would likely be overcrowded during rush hour and some passengers may need to wait until the next bus (see capacity for current & future demand, p. 19).

**RELATED CONSIDERATIONS**


- travel time, p. 16
- rider experience, p. 18
- capacity for current & future demand, p. 19
- ridership, p. 26
- operating and maintenance costs, p. 28
- vehicle capacity, p. 30
- transit mall capacity, p. 32


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**What effect would transit mall capacity have on BRT and LRT operations?**

Today, the Transit Mall on 5th and 6th Avenues in downtown Portland carries 16 TriMet bus lines along with the Green and Orange/Yellow MAX lines all day, as well as five C-TRAN bus lines in the morning and afternoon. Estimates show that the mall can carry up to 120 buses per hour. Stations for LRT are separate from bus stops, and LRT vehicles and buses weave along the route, leapfrogging each other to reach their respective stop locations.

A Southwest Corridor LRT line would interline with either the existing Yellow or Green Line MAX. Southwest Corridor LRT would utilize the same MAX tracks and stations, and with similar service frequencies, which would result in few or no additional LRT vehicles on the Transit Mall. Local bus service planning with a light rail project will not occur until later in the planning process, but it is likely that duplicative local bus service would be reduced, resulting in fewer standard buses on the Transit Mall.

A Southwest Corridor BRT line would introduce new vehicles to the Transit Mall because it would not interline with any existing service and could not interline with the Powell-Division BRT route since both would connect to the southern end of the Transit Mall. Current plans assume the northern terminus of a Southwest Corridor BRT would be near Union Station. As with LRT, BRT service would likely result in fewer standard buses on the mall from reductions in duplicative local service.

Projected BRT service frequencies (see service frequency, p. 31) generate concerns about bus bunching at Transit Mall stations and at the northern terminus, where the vehicles would not only stop for passengers but also lay over to provide breaks for drivers. If BRT is chosen as the preferred mode, routing to the Transit Mall will be evaluated in detail during the Draft Environment Impact Statement.

The current assumption is that either BRT or LRT could operate at a frequency of up to 3 minutes, or 20 vehicles per hour, without significant issues on the Transit Mall. This 3-minute headway restriction is an estimate of the frequency threshold at which transit service would deteriorate because transit vehicles could not be granted sufficient signal priority at intersections outside of downtown Portland and the vehicle bunching entering and progressing along the Transit Mall would cause intersection blockages and delays at stations. A 3-minute headway provides a baseline to compare peak capacities of each mode.


*TriMet map of the Transit Mall*

## RELATED CONSIDERATIONS

- capacity for current & future demand, p. 19
- local bus service, p. 21
- service frequency, p. 31
- interlining, p. 33

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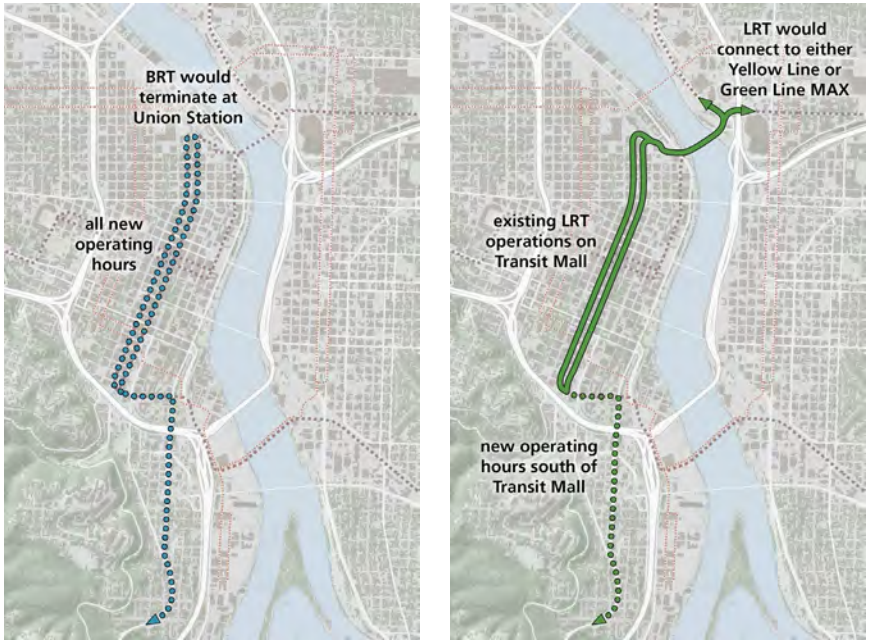
**How would interlining differ between BRT and LRT?**

A Southwest Corridor LRT alignment would be interlined with either the MAX Yellow Line, which currently interlines with the Orange Line, or the Green Line, which currently terminates at the south end of the downtown Portland Transit Mall. The decision on which of these lines would interline with each other would be made at a later date based on service frequencies, travel patterns and public input.

Because there are no existing BRT alignments on the Transit Mall, a Southwest Corridor BRT alignment would terminate at the north end of the Transit Mall, near Union Station. A Southwest Corridor BRT alignment would not be able to interline with the Powell-Division BRT project currently under development because both lines would connect to the Transit Mall from the south. Either the Southwest Corridor or the Powell-Division BRT line could potentially be extended beyond the Transit Mall to the north as part of a future project, but there are no such plans at this time.




The opportunity to interline with an existing MAX line would provide three benefits for LRT: it would preserve Transit Mall capacity, reduce operating costs, and provide one-seat rides for transit riders crossing the Willamette River. Because the Yellow and Green lines already serve the Transit Mall to Portland State University, interlining with either of these would in effect be an extension of the existing service, so few or no additional LRT vehicles would be introduced onto the Transit Mall at any one time and the operating hours along the Transit Mall would already be accounted for by the Yellow or Green Line service. For a Southwest Corridor BRT line, the BRT buses on the mall and the operating costs would both be new to the system. Finally, LRT would provide a one-seat ride across the Willamette River, while BRT would require a transfer because it would terminate at Union Station.

**RELATED CONSIDERATIONS**


- rider experience, p. 18
- operating and maintenance costs, p. 28
- transit mall capacity, p. 32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**How are signal treatments used for transit in the Metro region today?**

There is a range of transit signal treatments in use around the world, from cautious and minimally effective to aggressive and highly effective. The Metro region uses a fairly aggressive signal treatment on the MAX light rail system – preemption – but MAX has never run on a state-owned five-lane arterial, which could occur in some segments of this project. TriMet uses several types of signal priority on the local bus system, including queue jumps and green extensions, which are more cautious.

**How would signal treatments differ between LRT and BRT?**

LRT and BRT would have opportunities for enhanced transit signal treatments, but the type of treatments would likely differ between the two transit modes and the transit treatments cannot supersede emergency vehicle preemption or terminate an active pedestrian clearance phase.

If the selected mode is LRT, it may have the ability to preempt traffic signals, extend green time, and/or utilize other signal treatments. The ability to skip side street or turn phases may be limited in some segments of the corridor to avoid potential safety issues, such as queuing on I-5 exit ramps.

If the selected mode is BRT, the signal treatments would likely be less aggressive due to operational differences between the modes. Serving the forecasted future transit demand in the corridor would require a high frequency of BRT vehicles during the peak hour. Each instance of a bus receiving priority at a traffic signal would require a recovery period in order to adequately serve cross traffic that has been held. Due to the high frequency needed for BRT (up to every 3 minutes in each direction during rush hour) and projected signal cycle lengths of 1.5 to 2 minutes along Barbur Boulevard, consistent signal preemption or priority would not be feasible. Some BRT vehicles would not receive priority, likely resulting in slower and less reliable operations for BRT during peak periods compared to light rail. (This is not expected to be an issue during off-peak periods due to less frequent BRT service.) LRT also would experience this issue during peak periods, but to a lesser degree than BRT.

See travel time, p. 16, for an overview of the estimated 2035 travel times for each mode, including signal delay time.

As the project progresses, it is expected that continued review, coordination, and analysis will determine the appropriate transit signal treatments at specific locations throughout the corridor.

**RELATED CONSIDERATIONS**


- travel time, p. 16
- reliability, p. 17
- service frequency, p. 31


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federal funding, p. 36

local funding, p. 37

**Why does finance matter?**

Both local and federal sources of funding for high capacity transit projects are becoming increasingly scarce and competitive. Although a detailed funding strategy for the Southwest Corridor project has not yet been developed and will continue to be discussed throughout the federal environmental review process, it is important to begin to understand how the operating and capital costs of LRT and BRT relate to the potential sources of funding.

**Key questions:**

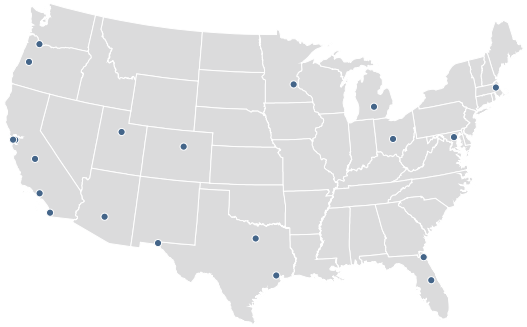
- How would access to federal funding differ between BRT and LRT?
- Where has local funding come from for past high capacity transit projects in the region? How would access to local funding sources differ between BRT and LRT?

**Key findings:**

- The Portland region's history of receiving federal New Starts funding for MAX projects, paired with the anticipated strength of a Southwest Corridor LRT line, suggests that LRT could be competitive for federal funding. The absence of comparable high-level BRT projects in the United States makes it more difficult to gauge the competitiveness of a Southwest Corridor BRT project for federal funding.
- While a BRT project would cost less to construct than an LRT project, LRT would outperform BRT in terms of ridership, travel time and capacity for future ridership growth. Due to this difference in both costs and benefits between the two modes, it is difficult to assess the relative feasibility of receiving the necessary local funding.

**How would access to federal funding differ between BRT and LRT?**

Federal funding for high capacity transit projects typically comes from the Federal Transit Administration (FTA) through their competitive New Starts and Small Starts grant programs. New Starts requires a total project capital cost of over $250 million, and at least 50 percent of the alignment must be in exclusive transitway, while Small Starts is geared toward smaller projects with a maximum grant award of $75 million. Current New Starts practice allows projects to receive up to 50 percent federal funding for the capital cost. The Portland region has been successful at securing New Starts funding for all but one of its MAX light rail projects. (Airport MAX Red Line did not apply for federal funds because a large portion of the project was privately funded.) Currently there are over 20 projects across the country that may be seeking New Starts funding in the near future (see map on the right).



*Location of high capacity transit projects likely competing for New Starts funding*

The communities in the Southwest Corridor already contain a high concentration of people and jobs, significant traffic congestion and areas for future business and residential growth. These elements lead to strong transit ridership projections and support a project's competitiveness nationally. The anticipated strength of an LRT project as currently assumed, paired with the Portland region's history of successful New Starts grant applications, suggests that a Southwest Corridor LRT project could be competitive for federal funding. However, based on 50 percent local funding match, a Southwest Corridor LRT alignment as envisioned currently could require a New Starts grant around $1 billion. Although a number of light rail projects have been awarded around $1 billion from the New Starts program, many of those have provided a local share greater than 50 percent.

BRT is a new concept for the Portland metro region, and a Southwest Corridor BRT line would be a larger investment than other BRT projects considered for the United States so far. A BRT line is being concurrently planned for the Powell-Division corridor, and C-TRAN is constructing The Vine BRT in Vancouver, but both of these are expected to operate mostly in mixed traffic. As envisioned, a Southwest Corridor BRT line would achieve a higher standard due largely to extensive exclusive busway operations – 84 percent in current assumptions. In fact, the Southwest Corridor BRT as planned would likely score the highest in the United States on a scale developed by the Institute for Transportation & Development Policy. Only five lines in the United States score highly enough on the scale to be ranked according to the BRT Standard, with one line, the Cleveland Health Line, achieving the "silver" level and the other four achieving "bronze." The absence of comparable high-level true BRT projects in the United States makes it more difficult to gauge likelihood of FTA funding. Over the last decade only three BRT projects have received funding in the New Starts category of the FTA grant program, and those received $275 million from FTA. Based on 50 percent local match, a Southwest Corridor BRT alignment as envisioned currently would require a $500 million New Starts grant.

### WHAT IS NEW STARTS?

- Fixed guideway projects such as light rail, busway, subway and commuter rail
- Funded by FTA discretionary funding
- Very competitive program – five times as many projects as funds available

### RELATED CONSIDERATIONS


- ridership, p. 26
- capital cost, p. 27
- operating and maintenance costs, p. 28
- local funding, p. 37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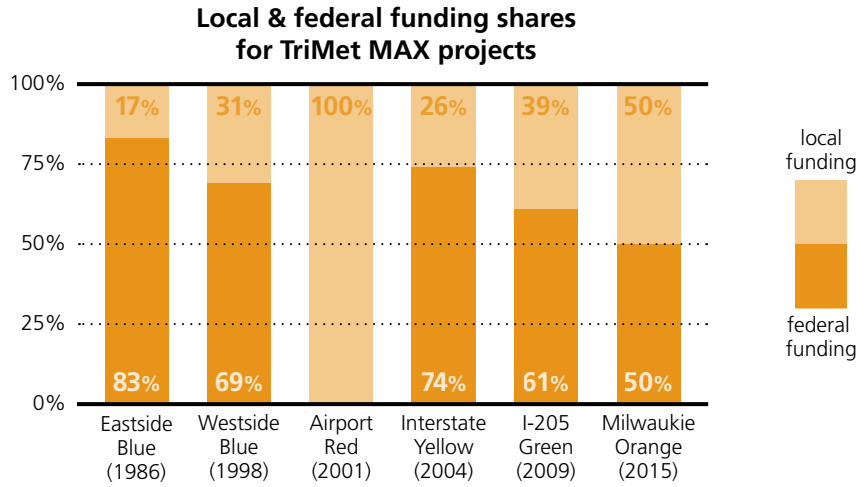
### Where has local funding come from for past high capacity transit projects in the region?

Current New Starts practice would allow a Southwest Corridor HCT project to receive up to 50 percent federal funding for the capital cost, so the remaining half would require local funding. Although previous MAX light rail projects have received up to 83 percent federal funding, the federal share has decreased over time, so the local share has increased. (No federal funding was sought for the Airport Red Line MAX because a large portion was privately funded.)




The local funding share for past MAX light rail projects' construction costs has come from a number of sources, including the State of Oregon, TriMet, Metro, counties and local cities benefiting from a project. While recent projects in this region did not rely on general obligation bonds for local funding, a bond measure may be necessary to contribute to the local share of a Southwest Corridor HCT line and the associated roadway, bike and pedestrian projects.

### How would access to local funding sources differ between BRT and LRT?

Both capital and operating requirements must be considered in comparing the local funding aspects of the alternative modes. The capital finance plan for either LRT or BRT may include a regional funding measure, a state contribution and local funding contributions. Funding plans in support of previous Portland region transit projects found that generally each of these potential funding contributors preferred investing in light rail over bus alternatives. This preference must be weighed against the additional local funding requirement associated with LRT.

While up to half of the capital cost is eligible for federal funding, operating costs are almost entirely locally funded for the lifetime of service. The estimated annual operating costs of LRT and BRT are relatively similar for 2035, but by 2035 LRT would carry four to five million more riders annually than BRT (see operating and maintenance costs, p. 28). Additionally, BRT would have little capacity to increase service after 2035, so future growth in the corridor would need to be accommodated with regular bus service, which is less cost-efficient to operate than BRT or LRT. In comparison, LRT would have substantial capacity for cost-efficient service increases beyond 2035 as ridership demand grows. (See capacity for current & future demand, p. 19.)

#### RELATED CONSIDERATIONS

- road, bike & pedestrian projects, p. 20
- public opinion, p. 23
- capital cost, p. 27
- operating and maintenance costs, p. 28
- federal funding, p. 36

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**REFINEMENT PHASE**

**January 2016**

**Decision** on HCT alignment and terminus options in Tigard and Tualatin

**Public feedback** to inform decision on HCT mode and light rail tunnel to PCC Sylvania

**February 2016**

**Decision** between light rail or bus rapid transit as the mode choice for the corridor

**Decision** on whether to continue studying light rail tunnel to PCC Sylvania

**Recommendation** on strategy to fund road, bikeway, sidewalk and trail projects to serve the entire corridor and on land use and development strategy

**March to April 2016**

**Public feedback** to inform adoption of Preferred Package of Alternatives

**May 2016**

**High Capacity Transit Preferred Package of Alternatives**: Identify high capacity transit alignments and terminus options to receive further study, associated road, bikeway, sidewalk and trail projects, and choice between light rail or bus rapid transit

**Corridor Connections**: Potential funding source and timeframe for each of the roadway, bike, sidewalk and trail projects in the Shared Investment Strategy

**ENVIRONMENTAL REVIEW PHASE**

**2017-2018**

10% high capacity transit design, analysis of potential impacts, ongoing public outreach and selection of Locally Preferred Alternative

**PROJECT DEVELOPMENT PHASE**

**2019-2020**

Local funding commitments, 30% high capacity transit design and application for federal funding

**ENGINEERING AND CONSTRUCTION PHASE**

**2021-2025**

Final design and construction of high capacity transit line

## OTHER DOCUMENTS

A separate memo addressing the LRT tunnel to PCC and other PCC connection options is being released concurrently with this document, and can be accessed on the project website at www.swcorridorplan.org.

By the end of January 2016 a staff recommendation memo will be released for the February 2016 steering committee decisions. The committee is scheduled to consider which HCT mode to study further and whether to continue studying the LRT tunnel to PCC.

After the February decision, the preferred transit mode will be incorporated into a draft 'Preferred Package' of investments for the Southwest Corridor for further public review, which will be finalized at the May 2016 steering committee meeting.

## UPCOMING PUBLIC ENGAGEMENT OPPORTUNITIES

An online comment period will be open from early January through early February for the public to provide input for the Steering Committee's February 29th decisions regarding mode and whether to continue study of an underground transit station to serve the PCC Sylvania campus.

Project staff will also be attending multiple neighborhood, business and civic meetings in January and February to present information about the project and engage with interested stakeholders. Please let us know if you are interested in scheduling a presentation by project staff by emailing swcorridorplan@oregonmetro.gov.

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JANUARY 2016

# Light rail or bus rapid transit? Answers to frequently asked questions

One of the major decisions for the Southwest Corridor plan is whether light rail (LRT) or bus rapid transit (BRT) is the preferred mode for high capacity transit (HCT) in the area. On December 30, 2015 project staff released a comprehensive HCT Mode Comparison memo (available on the project website) that presents detailed information on a wide range of considerations and relationships between key factors. On February 29, 2016 the steering committee will make a recommendation about which mode will continue into the project's Draft Environmental Impact Statement. Throughout the last several months, project staff have discussed this decision with many individuals and groups to better understand what information the public wants to know about the performance and trade offs of each mode. This document presents answers to some of the most frequently asked questions during our public outreach and provides a high-level comparison of the two modes. You can read the complete list of frequently asked questions and answers regarding mode at www.swcorridorplan.org.

## Comparing the two modes

**Will one mode be more reliable than the other?** Light rail is projected to be more reliable due to 100% exclusive transitway and more consistent signal priority. In mixed-traffic segments, BRT buses may be slowed by traffic. However, light rail is more likely than bus rapid transit to be disrupted by hot weather, power outages and other extreme circumstances.

**Would one mode be constructed earlier than the other? Would one be able to be put in service earlier?** It is difficult to say at this time. While BRT may have less significant capital construction in some segments of the alignment, other segments will require as extensive construction as LRT. BRT is also a new mode for the region which could require more time to refine operations.

Monday, Feb 29 Steering Committee Meeting

9 - 11 am

Location: Metro Regional Center
600 NE Grand Ave, Portland, Oregon

The steering committee will recommend whether light rail or bus rapid transit should be the preferred mode for the corridor, and recommend whether to continue studying an underground light rail tunnel to directly serve the PCC Sylvania campus. The public is invited to provide testimony at the beginning of the meeting.

**Does one mode come with more bike and pedestrian improvements than the other?** Both modes would include road, bike and pedestrian improvements along the length of the alignment as well as improved access to stations. Because a funding strategy for either mode has not yet been developed, it is too early to tell what implications the difference in project capital cost between BRT and LRT would have on the capacity to fund other bike and pedestrian projects in the corridor.

**Are there alignment differences between the modes?** There are few differences in route between the modes. One exception is how the project could serve the PCC Sylvania campus. A bus rapid transit route could run on Capitol Highway and provide a station on campus. Due to steep grades southwest of the campus, light rail is not a viable surface option. To provide a light rail station on campus and also make connections in the Tigard Triangle requires an underground light rail tunnel.

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**What are the overall costs for each?** Based on conceptual designs, construction costs for bus rapid transit are estimated at $1 billion in 2014 dollars; estimated construction costs for light rail are $1.8 billion-$2.1 billion. Daily operational costs per rider are less expensive for light rail because the vehicles hold more passengers.

**Where will the money come from?** Funding for either mode will come from a combination of federal and local sources. The project is eligible for up to 50% of project construction costs from the federal government, but projects must apply for funding through a competitive process. The local funding could come from contributions by state and local jurisdictions and regional bond measure.

**Would both light rail and bus rapid transit stations be equally attractive for building shops, housing and offices?** Research has shown that the development of light rail stations can increase property values and catalyze local development. Since there are few BRT lines in the United States with a design similar to that of the proposed Southwest Corridor BRT, there is a lack of viable data to establish the impact that BRT may have on property values and development. However, the BRT envisioned for the Southwest Corridor would include many of the design elements of light rail and streetcar projects that are known to encourage private investment and is likely to induce some level of development. There is insufficient data to quantify if the level of investment would be equal to that of LRT.

## Traffic impacts

**Where would transit get preferential treatment at signals?** LRT and BRT would receive signal priority over auto traffic at most intersections when traffic conditions allow. At busy intersections or freeway off ramps it is more challenging for high capacity transit to receive signal priority, especially during peak rush hours. During rush hour in 2035, LRT is expected to be delayed 1-2 minutes and BRT delayed 6 minutes from estimated travel times due to high traffic volume at busy intersections.

**Can local buses use the same exclusive right of way as the bus rapid transit or light rail vehicles?** Generally no, local buses cannot use right of way that is designated for light rail or bus rapid transit because of operational, safety and travel time considerations. There can be some exceptions to this when a Shared Transit Way is developed. A Shared Transit Way provides a paved section that allows local buses to use the dedicated high capacity transit lane. There are additional construction requirements and property impacts to develop a Shared Transit Way. Three segments of the alignment are being considered for Shared Transit Ways: near the I-5 crossing between PCC Sylvania and Tigard Triangle areas, in "the woods" section of Barbur north of Capitol Highway, and between Barbur Transit Center and "the woods". Since fewer LRT vehicles are necessary to serve the forecasted ridership demand, it is more likely that some buses could share the right of way with LRT vehicles.

**Would the transit-only lanes be added as new lanes to roads, or would existing lanes be converted to transit only? Will either of these options reduce Barbur Blvd. down to one lane?** In most cases, transit only lanes are created by widening the roadway with a new lane, or using the center turn lane or under utilized parking. There are a few locations in the current design where the traffic volumes are low and there

*(FAQ continued on page 4.)*

# Light rail and bus rapid transit side by side



| | |
|---|---|
| 11 to 12 mile alignment serving 14 to 15 stations between downtown Portland and Bridgeport Village | 11 to 12 mile alignment serving 14 to 15 stations between downtown Portland and Bridgeport Village |
| Would connect with either the Green or Yellow MAX Line in downtown Portland to provide a one-seat ride across the Willamette River | Would terminate near Union Station at the north end of the downtown Transit Mall because there are no existing BRT lines to connect to from the north |
| Would run entirely in exclusive transitway, which would provide faster and more reliable travel times than existing bus service | Would operate mostly in exclusive transitway like light rail, but also mixed with traffic in regular auto lanes for about 15 to 20% of the line |
| Electric two-car trains that would each hold around 266 passengers | 60-foot articulated buses that would each hold around 86 passengers (fuel/propulsion type not yet determined) |
| 30 to 32 minute in-vehicle travel time from Portland State University to Bridgeport Village | 34 to 42 minute in-vehicle travel time from Portland State University to Bridgeport Village |
| A light rail station on the PCC Sylvania campus would require an underground tunnel and underground station (an additional expense) | Could provide direct service to PCC Sylvania at the same cost as a BRT alignment on Barbur Boulevard, but would add travel time |
| Could cost around twice as much to build as bus rapid transit | Could cost around half as much to build as light rail |
| Total operating costs would be similar between light rail and bus rapid transit, but light rail would be cheaper to operate on a per rider basis because of higher ridership projections | Total operating costs would be similar between bus rapid transit and light rail, but bus rapid transit would be more expensive to operate on a per rider basis because of lower ridership projections |
| Cannot navigate around obstacles on the tracks | Would be able to navigate around obstacles on the busway |
| New and expanded park-and-ride lots | New and expanded park-and-ride lots |
| Advanced fare collection | Advanced fare collection |

*(continued from page 2.)*

appears to be excess capacity for autos. In these areas, additional study will be needed to determine if converting existing lanes to transit only can be accomplished without impacting traffic. In some cases, choosing to convert an existing lane to transit only, or running BRT in mixed traffic, can avoid property impacts associated with widening a roadway.

Current designs assume that two travel lanes in each direction would be maintained on Barbur Blvd. from its confluence with Naito Parkway to the Barbur Transit Center. Current designs only consider converting auto lanes to transit use where preliminary traffic analysis indicate it might be possible without negatively impacting traffic flow. We will evaluate this in more detail during the Draft Environmental Impact Statement in 2017.

## BRT specific

**Why is BRT not in 100% dedicated right of way? Where would the 20% mixed-traffic segments for BRT be located?** BRT will not run in 100% dedicated right of way because there are areas along the alignment where there is relatively less congestion and running BRT in mixed traffic does not significantly impact travel times. This approach can reduce impacts or costs of building an exclusive busway. BRT as currently envisioned would run in mixed traffic along portions of Lincoln Street in SW Portland, along Barbur Blvd from Capitol Highway (east of Hillsdale) to Terwilliger Blvd, and through the Tigard Triangle. There are other mixed-traffic segments under consideration on Capitol Highway/49th Ave and on Barbur Blvd south of Crossroads (Barbur Transit Center).

You can access a comprehensive Mode Technical Memo via the project's online library at www.swcorridorplan.org. The full mode memo details information on a range of factors including land use, mobility, travel time, reliability, access to key places, future demand, transit signal treatment, public opinion, equity, cost-effectiveness and financing.

**Is BRT different from traditional "express buses" or "express routes"?** Yes, express buses typically only stop at transit centers and other major destinations. They sometimes run on the freeway and most only run during the weekday rush hours. The goal of BRT is to provide faster and more reliable travel times like express buses, but with service all day and on weekends and more frequent stations every ½ to ¾ mile to serve the land use nodes.

## Impact to existing local bus service

**Will existing local bus lines in the area be changed?** The addition of high capacity transit in the area could free up operating hours for new bus lines and service improvements in the under-served areas of the corridor. With either BRT or LRT some existing bus lines may be re-routed to optimize service and provide increased access to the high capacity transit line for areas that are currently not well served. The process to determine the details of how and which local bus routes will begin about two years before the project opens for service and will include extensive public outreach.

**How would either mode connect to existing TriMet lines?** More than a dozen existing local bus lines would connect to the high capacity transit line, including several lines at the Barbur and Tigard transit centers. LRT would interline with either the existing Yellow or Green MAX line so that riders would not have to change MAX trains to cross the Willamette River. Because no NRT lines will connect to downtown Portland from the north, a BRT alignment would terminate at the north end of the Transit Mall near Union Station.

###

## Southwest Corridor Plan

# PCC Sylvania Enhanced Connection Options

## Technical Memo

December 31, 2015

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# Overview

This technical memo presents new information on options to improve transit access to the Portland Community College (PCC) Sylvania campus in conjunction with a Southwest Corridor high capacity transit (HCT) investment. This information is intended to inform and aid the Southwest Corridor Steering Committee in making a decision in late February 2016 on whether to continue study of a direct light rail tunnel to the PCC Sylvania campus. A staff recommendation report will be released by the end of January 2016, which will supplement the information included in this memo with a recommendation for public review.

## Contents

This memo includes an overview of the HCT alignment options developed for the PCC Sylvania area and the decision points and direction provided by the steering committee to date. In July 2015, the steering committee directed project staff to further investigate options for a direct light rail tunnel to the Sylvania campus. In October 2015, project staff requested additional time to analyze alternative connections to PCC Sylvania to inform the steering committee decision on the light rail tunnel.

This memo describes the non-HCT connections to PCC Sylvania that have been examined by project staff and provides basic information on relative performance and feasibility. These alternative connection options could augment an HCT alignment routed on SW Barbur Boulevard or adjacent to I-5 with a station at SW 53rd Avenue. This memo also analyzes the performance of the connection options compared to both a representative alignment of center-running light rail on Barbur with an improved bike/walk connection on 53rd Avenue and a bored tunnel option with a light rail station on the Sylvania campus. The analysis includes available information on capital cost, operating cost, risks and benefits, such as potential transit ridership increases at the PCC Sylvania campus.

## Summary of findings

The alternative connection options evaluated in this memo would each provide a lower-cost approach to improving access to the PCC Sylvania campus compared to a light rail tunnel with a station on campus, while eliminating the neighborhood impacts associated with tunnel construction.

## Next steps

This technical information will be considered by the steering committee at their February 2016 meeting, along with a status report from staff on other efforts related to PCC Sylvania, such as the College's progress on envisioning future campus development and community input. A staff recommendation will outline the potential choices available to the steering committee regarding PCC tunnels, including eliminating all PCC tunnel options, or retaining one or more tunnel alignment options for study in the Draft Environmental Impact Statement.

# Background

This section explains the context and background events leading up to this memo.

## Southwest Corridor Plan process to date

The Southwest Corridor Plan is a package of transit, roadway, bicycle and pedestrian solutions that can help reduce congestion, improve circulation and enhance quality of life in this corridor. The Southwest Corridor Plan defines investments to help realize the local land use visions adopted by each community in the area. These visions include the City of Portland's *Barbur Concept Plan*, the *Tigard High Capacity Transit Land Use Plan*, *Linking Tualatin* and the *Sherwood Town Center Plan*. A major component of the Southwest Corridor Plan is the analysis and evaluation of both bus rapid transit (BRT) and light rail transit (LRT) travel modes for several potential routes alignments to link Central Portland, Southwest Portland, Tigard, and Tualatin.

Initial study of HCT in the Southwest Corridor began in 2010, with potential HCT destinations, routes and travel modes evaluated at a high level. Beginning in 2012, the Southwest Corridor partners worked to identify a set of collective investments that would help achieve local visions and link the Southwest Corridor communities with a more effective, reliable and safe regional transportation network. The project partners engaged the public on the investments that would make it easier, safer and more enjoyable to get around in their communities and studied the viability of different options for new transit to serve the whole corridor. In 2013, the Southwest Corridor Steering Committee adopted a comprehensive Shared Investment Strategy that established a vision of investments in parks, trails, sidewalks, transit and roadways from Portland to Sherwood, Beaverton to Lake Oswego to support community goals. Some projects in the strategy are already underway; others require further study or funding for implementation.

From late 2013 through 2014, the Southwest Corridor Plan partners conducted a focused refinement study of the usage, community benefits, traffic impact and potential costs of high capacity transit options. In December 2014, the steering committee directed project staff to use these findings and further community input to develop a Preferred Package of transportation investments to support community land use goals. The Preferred Package will include the following components:

- ***HCT Preferred Alternatives:*** Preferred HCT alignments to study further in a Draft Environmental Impact Statement, including travel mode, alignments, terminus and associated roadway, bicycle, and pedestrian projects
- ***Corridor Connections:*** Potential funding source and timeframe for each of the roadway, bicycle and pedestrian projects identified in the Shared Investment Strategy
- ***Land use and development strategy:*** Partnership agreements and other pre-development work to activate land use and place-making strategies identified in local land use visions

## PCC Sylvania access options

### Initial refinement

A number of HCT alignment options were removed from further consideration by the steering committee in April and June 2014. During that refinement process, it was determined that a direct connection to the PCC Sylvania campus with light rail could only be achieved using a tunnel, because of the steep slope and substantial elevation difference between the campus and the Tigard Triangle.

## Evaluation of three HCT alignment options

A key issues memo analyzing potential HCT alignment options in the PCC Sylvania area was released in April 2015, evaluating three routes:

- The **Barbur option** would remain on or parallel to Barbur Boulevard and connect with the PCC Sylvania campus via one or more enhanced connections. This option is possible for both BRT and light rail and would likely include a park-and-ride structure at SW 53rd Avenue.
- The **Capitol Highway BRT option** would include a BRT station on the Sylvania campus. The alignment would depart from Barbur at the Crossroads intersection (near Barbur Transit Center) and use SW Capitol Highway and SW 49th Avenue to reach the campus. Between the campus and the Tigard Triangle, BRT would operate on a new structure over I-5 north of the Haines Street bridge. This option is not possible for LRT because the steep slopes west of the campus exceed light rail's capabilities. This option would not include park-and-ride spaces at PCC Sylvania or at Barbur and SW 53rd Avenue.
- The **light rail tunnel option** would create a direct connection to the campus, departing Barbur at SW 53rd Avenue and running in a cut-and-cover tunnel underneath SW 53rd toward an underground station near the northern edge of campus. The alignment would then run westward and emerge from the tunnel near Lesser Road, then run on a new structure stretching from Lesser Road across I-5 to the Tigard Triangle. This option is only being considered for light rail, as it would cost significantly more than BRT via Capitol. This option would likely include a station and park-and-ride structure at SW 53rd Avenue.

## Further research of light rail tunnel options

In July 2015, the steering committee considered whether to continue further study of the Capitol BRT and light rail tunnel options (The Barbur option remains under consideration and is expected to be evaluated in the Draft Environment Impact Statement). The committee recommended continued study of the Capitol Highway BRT option and rescheduled the decision regarding the light rail tunnel option to October 2015. In postponing the decision, the committee cited reasons to study the light rail tunnel option further but acknowledged its impacts and noted that the Sylvania campus master plan is outdated and existing plans do not anticipate HCT on campus.

To better inform the October decision, the steering committee requested that project staff expand on the options for connecting light rail to the PCC campus. Staff continued to refine preliminary tunnel designs in order to better define tunnel impacts and potential mitigation strategies. A technical memo on light rail tunnel options to PCC Sylvania was released in August 2015, which reported on ways to reduce impacts, costs and risks while maintaining or improving performance, including new tunnel alternatives. The expanded list of tunnel options included:

- **Original cut-and-cover tunnel**. A cut-and-cover (C&C) tunnel was initially assumed due to its lower construction costs compared to a bored tunnel for relatively short and shallow tunnels. This option would result in several issues, most notably the likelihood of temporary or permanent displacements of residents, construction period traffic disruption, and complexities of the tunnel design and construction techniques resulting in longer and riskier construction. Further investigation determined that at the depth required for a tunnel to the Sylvania campus, a C&C tunnel may be less cost-effective than a bored tunnel. After engaging consultants David Evans and Associates (DEA) and McMillen Jacobs and Associates (MJA), the cut-and-cover tunnel costs were revised to more accurately reflect the conditions and construction techniques for this alignment.

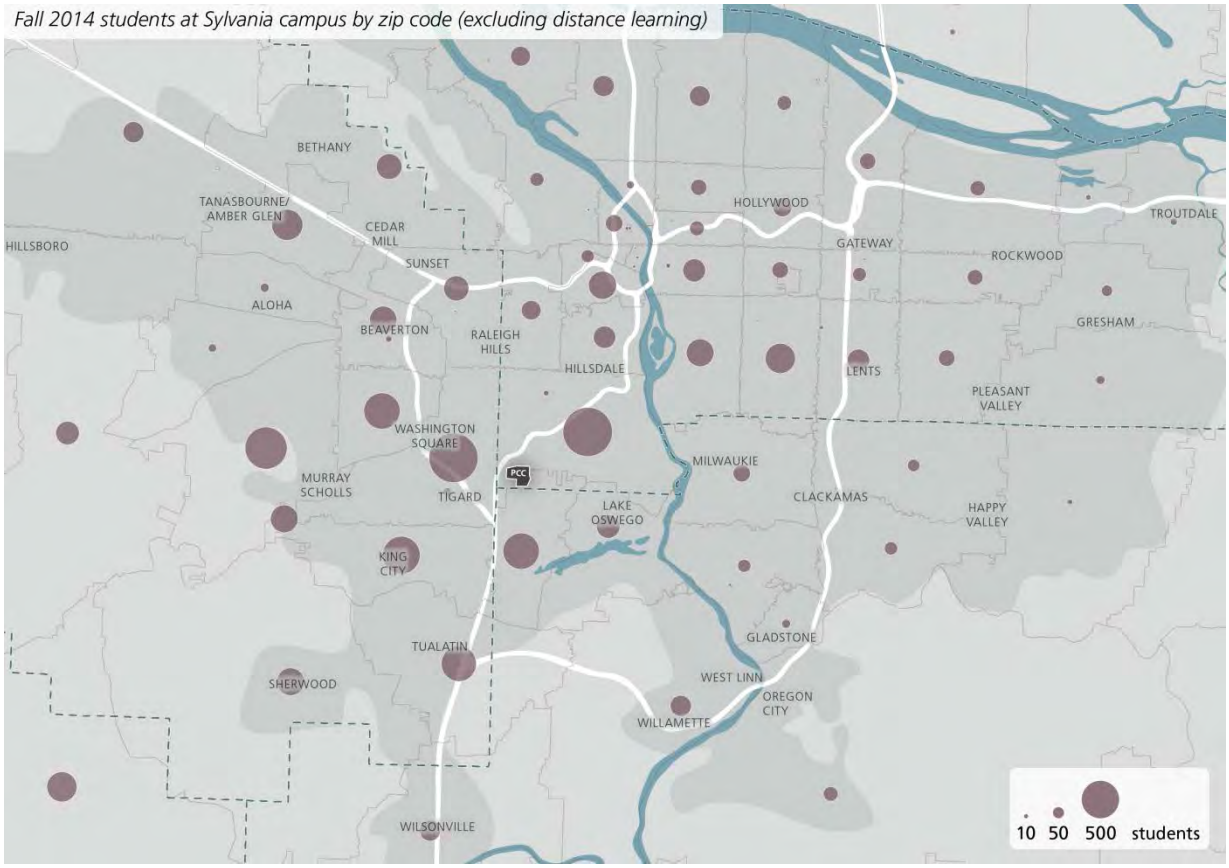
- **Revised cut-and-cover tunnel**. This option is largely consistent with the original option with an adjustment to construction technique to reduce local traffic impacts during construction. The revised C&C tunnel would be constructed in multiple segments linked by "lidded" excavation at road intersections to allow continued traffic flow. Significant residential impacts would still occur during construction with this revised approach. The cost delta over the Barbur alignment for this tunnel option is $394 million (2014$, not including finance costs).
- **Short bored tunnel**. This option would utilize a 2,900 foot long bored tunnel between a north portal near 53rd Avenue and Barbur and a south portal located west of Lesser Road. Compared to a C&C tunnel, this approach would result in a shorter construction period and lessened impacts on local traffic and to adjacent properties, including fewer residential displacements. A bored tunnel would also be more cost effective than a C&C tunnel approach due to the tunnel depth required at the PCC campus. The cost delta over the Barbur alignment for this tunnel option is $320 million (2014$, not including finance costs).
- **Long bored tunnel**. This option would utilize a 5,200 foot long bored tunnel between a north portal location at 53rd Avenue and Barbur and a south portal to the west of I-5 near SW Atlanta Street in the Tigard Triangle. This alignment would pass under I-5, eliminating the need for the 1,400 foot long elevated structure used by the other options and its related property impacts. This option would have the same reduced relative impacts as the short bored tunnel option around 53rd Avenue, as well as fewer impacts to the residential area around Lesser Road. The cost delta over the Barbur alignment for this tunnel options is $331 million (2014$, not including finance costs).

## Further research of alternative connection options

At the October 2015 steering committee meeting, project staff requested more time to analyze alternative connection options to campus due to concerns about the high construction cost and neighborhood impact of any light rail tunnel option. These alternative connections could be implemented in combination with an HCT alignment either center-running on Barbur or adjacent to I-5. This memo describes the outcomes of that effort.

## PCC campus vision

PCC is an important partner for the project. Connecting the campus is essential for the students, staff and faculty traveling to the campus, as well as helping PCC realize their visions for future growth. PCC is engaged in a preliminary campus planning exercise to better understand how this campus will grow. Project staff has met with PCC representatives on several occasions to both share information related to the alternative PCC connection options and learn more about the campus' vision for future expansion.




Sylvania has the largest enrollment of the four Portland Community College (PCC) campuses, and students travel from all across the region to attend classes at the campus. In the fall 2015 term, the campus had 14,200 students, or a full-time equivalent of 3,100. Yet due to its location in a residential area on a hill, the Sylvania campus is challenging to serve with transit. While some students, teachers and staff ride the line 78 and 44 buses or use the hourly PCC shuttles today, a majority drive alone.

As part of the City of Portland's Comprehensive Plan update (in progress), PCC Sylvania is recommended to receive the "Institutional Zone" designation on the Comprehensive Plan Map. High capacity transit service to the PCC Sylvania campus would support this new designation and subsequent classification as a Campus Institutional Zone on the City's zoning map. Application of the Campus Institutional Zone to the PCC campus would enable additional transit-supportive campus development, including new educational facilities and potentially student housing.

## PCC connection refinement process

After the October 2015 steering committee meeting, project staff met with TriMet Operations to envision alternative connection options to improve access to the PCC Sylvania campus in conjunction with a light rail alignment on Barbur or adjacent to I-5. Project staff explored both potential adjustments to local bus routes that could improve bus travel times and connectivity to the PCC campus, as well as options for improving the connection to the campus from a light rail station on Barbur at SW 53rd Avenue.

Today, the 44 and 78 bus lines provide direct service to the PCC Sylvania campus, but neither is frequent service. The tools considered for improving travel times and connectivity to the campus via local buses included:

- **Shared transitway**. Project staff identified two locations where local buses could potentially travel within the light rail trackway, which could improve bus travel times and reliability: on Barbur Boulevard from the Barbur Transit Center to the downtown Portland Transit Mall, and along the light rail alignment in the northern portion of the Tigard Triangle. These 'shared transitway' segments would operate similar to the Tilikum Crossing, where light rail, streetcar and local buses operate together. Operationally, buses would not be able to share the light rail station platforms and would need to stop prior to each light rail station to allow trains to pass, thereby minimizing potential impacts to light rail performance. Given this, the station designs would need to be modified to provide a separate bus platform. As a result, the station platform lengths and widths would increase, resulting in a 16 percent increase in square feet of adjacent property impacts within this segment, which would increase project capital costs. Additionally, the shared transitway would require embedded track to allow buses to travel within the trackway, which would cost more than the standard trackway.
- **Branded service**. Certain bus lines could be upgraded to 'branded service,' which could include frequent service of 15 minutes or better all day, portions of the route in a shared transitway, signal treatments at intersections along the mixed traffic portion of the route, and special signage or identification to highlight the line as a fast, direct connection to PCC Sylvania.
- **Route changes**. New routes could be connected to the PCC Sylvania campus, such as the upcoming line 97 between Sherwood and Tualatin, and existing routes could be extended to serve the campus, such as the line 93 between Sherwood and Tigard.

The local roadway of SW 53rd Avenue provides the shortest access to the campus from a station on Barbur and represents the most likely route for pedestrians and bicyclists to travel between HCT and PCC Sylvania. SW 53rd Avenue travels uphill to the campus, with several relatively steep segments. The options considered for improving the connection between the Sylvania campus and a light rail station on Barbur at SW 53rd Avenue include:

- **Enhanced bike and pedestrian infrastructure on SW 53rd**. Currently SW 53rd Avenue lacks sidewalks and is unpaved in some portions. Investment would be necessary to create a walk/bike connection that is usable to the general public and meets the City of Portland's street and stormwater standards. Current light rail modeling results and cost estimates assume some form of walking and biking improvements on SW 53rd would be constructed as a part of the project, but the particular design has not been finalized.
- **Aerial tram**. An aerial tram along the alignment of SW 53rd Avenue could provide a fast, accessible connection from a light rail station on Barbur to the campus

# Alternative PCC connection options: local bus improvements

Staff developed the following three options that would utilize shared transitway segments, branded lines, and route changes to improve bus connectivity and travel times to the PCC Sylvania campus:

1. **Branded line 44 to PCC Sylvania with shared transitway on Barbur north of Capitol Highway:** Buses would run in a shared transitway on Barbur Boulevard from Capitol Highway (in "The Woods") to the Transit Mall.

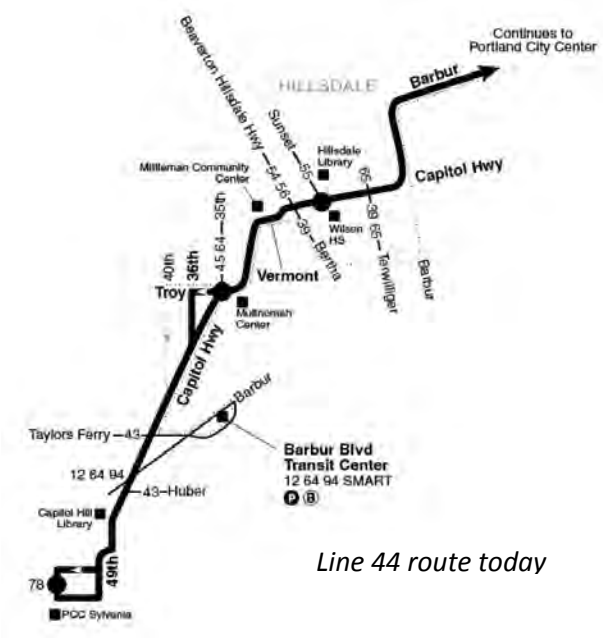
2. **New branded bus line to PCC Sylvania via Barbur with shared transitway north of Barbur Transit Center:** Buses would run in a shared transitway on Barbur from the Barbur Transit Center to the Transit Mall.

3. **PCC Sylvania bus hub with shared transitway connection to the Tigard Triangle:** Bus lines would connect to PCC from all directions, and could run in a shared transitway between the campus and the Tigard Triangle.

The following sections provide an overview of capital and operational costs, travel time impacts and other benefits related to each of these options.

## 1. Branded line 44 to PCC Sylvania with shared transitway on Barbur north of Capitol Highway

### Line 44




*Line 44 route today*

The line 44 is an existing local bus line that provides service to Southwest Portland and PCC Sylvania, and continues across the Willamette River to serve North Portland. The line provides a key direct transit connection between the Sylvania campus and Downtown Portland.

During peak hours, the line 44 provides service every 20 minutes, with 30-40 minute service during the off-peak hours. Line ridership is approximately 2,700 weekday boardings between downtown Portland and PCC Sylvania.

TriMet has completed the Southwest Service Enhancement Plan (SWSEP), which identifies priorities for local bus improvements within the southwest corridor. The plan proposed upgrading the line 44 to frequent service between downtown Portland and PCC Sylvania, and extending the line south from the campus to Bridgeport via Lake Grove.

This alternative option would reconsider the SWSEP by proposing a shared transitway and identifying another potential terminus option for the line. The three terminus options include PCC Sylvania,

Bridgeport, and the Tigard Transit Center. For this analysis, PCC Sylvania was used as the terminus. The line 44 route would become a branded service line, which would include frequent service (15 minutes or better all day) and additional treatments for the buses and stops to distinguish the line from other frequent service routes. The line could also receive transit signal treatments at seven intersections in the mixed traffic portion of the alignment between PCC Sylvania and the shared transitway.

The mixed traffic portion of the route would have approximately eight stop locations, plus up to two additional stations in the shared transitway. A busway and stop would be located on PCC campus. The line 44 would also provide service to the Barbur Transit Center.

## Shared transitway on Barbur north of Capitol Highway


The shared transitway would allow line 44 buses to utilize the light rail trackway to improve travel times and reliability between downtown Portland and Capitol Highway east of Hillsdale. To better understand the concept, designs were created using a Barbur light rail alignment from downtown Portland to Capitol Highway in "the Woods" section as a representative alignment. However, it is believed the shared transitway concept would work on the Naito Parkway alignment as well.

To access the shared transitway, buses would need to merge to and from mixed traffic at dedicated bus lanes near the Capitol Highway overpass in the Woods. Buses could receive transit signal treatments at intersections along the shared transitway. Buses would also stop at the Hamilton and Gibbs Street stations before proceeding to the downtown Transit Mall. To reduce property impacts and travel time impacts to light rail, limited stops serving only primary destinations would be considered.

Given the conceptual nature of this option, further design refinement is needed to confirm final costs. However, rough order of magnitude costs have been developed for the option. The branded line 44 with a shared transitway on Barbur north of Capitol Highway is estimated to add $63 million (2014$, excluding finance costs) to the light rail alignment capital cost. Operating costs for the line 44 would see a modest increase due to the increased service frequency.

The transit signal treatments, reduced number of stops, and dedicated lane provided by the Shared Transitway, could improve travel times for the line 44 by 3-4 minutes in 2035, potentially increasing its weekly boardings by approximately 6,000 based on land use analysis by TriMet.

This option would improve bus service to Barbur Transit Center, Multnomah Village and Hillsdale, increase connectivity to a Southwest Corridor light rail alignment north of Barbur Transit Center, and improve transit choices between the PCC Sylvania campus, OHSU and PSU.

An option to extend the line 44 branded service from the PCC Sylvania campus to the Tigard Triangle is possible, using the Tigard Triangle shared transitway connection discussed later in this document with the PCC Sylvania bus hub concept.

## 2. New branded bus line to PCC Sylvania via Barbur with shared transitway north of Barbur Transit Center

Under this option, the line 44 would remain unchanged and continue on its current route. A new bus line would be established to serve as the branded line. The new route would travel in mixed traffic on Capitol Highway between PCC Sylvania and the Barbur Transit Center and on a shared transitway on Barbur Boulevard between the Barbur Transit Center and the downtown Portland Transit Mall. There would be a busway with one stop located on PCC campus, one priority signal and one bus stop location at SW Pomona Street and one stop at the transit center, as well as at five stations along the shared transitway to the Transit Mall. Buses could receive transit signal treatments at intersections along the shared transitway.


To better understand this concept, the design assumed a center-running Barbur light rail alignment as the representative alignment, however it is believed the shared transitway concept would work on the adjacent to I-5 alignment in the central Barbur area as well.

The five station locations on the shared transitway would require widening and lengthening to accommodate separate bus platforms. As a result, there would be increased impacts to adjacent properties at each of the five locations, resulting in a 43 percent increase in square feet of impacts to adjacent properties within this segment.

Given the conceptual nature of this option, further design refinement is needed to confirm final capital and operating costs. However, rough order of magnitude costs have been developed. The new branded line with a shared transitway from Barbur Transit Center to the Transit Mall is estimated to add $84 million to the light rail capital cost. As an additional bus line service, the operating costs would increase, resulting in higher costs than the branded 44 line discussed above. Operating costs for this new branded bus line are estimated at $5 million annually in addition to the cost of light rail operations.

The transit signal treatments, reduced number of stops and increased length of shared transitway are projected to improve travel times for the new line route by approximately 2-3 minutes over the existing line 44 route, resulting in projected 4,000 weekly riders for this line. This ridership projection was developed by TriMet based on land use served by the route and does not reflect a net gain in system riders, which would be expected to be lower due to duplication of service with LRT throughout the shared transitway.

As with the line 44 shared transitway discussed above, an option to extend the new branded line service from the PCC Sylvania campus to the Tigard Triangle is possible, and could include the Tigard Triangle shared transitway connection discussed later in this document.

## 3. PCC Sylvania bus hub with shared transitway connection to the Tigard Triangle

This option explores a combination of extending existing local bus lines through the campus with a shared transitway segment and new crossings over I-5 and OR-217, in order to improve connections to PCC Sylvania from communities to the north, east, west and south.

***Note:*** *This scenario provides an example of a combination of bus routes that could contribute to a PCC Sylvania bus hub connection. There are several existing bus lines in the Southwest Corridor. Changes to the route or level of service of these lines as part of the HCT project would require extensive community outreach and input.*

To facilitate the proposed bus connection improvements, the following new structures and transitway segments are proposed:

- **A busway through campus**. The busway would connect SW 49th Avenue to Lesser Road and provide a designated path through campus for buses, with a central station located within campus to support current PCC Sylvania activities as well as future expansion plans.
- **A new bridge over I-5**. This bus-only bridge would connect the busway at Lesser Road to a new section of shared transitway, directly to the west of the campus on the west side of I-5. The bridge would be required to address steep grades west of Lesser Road and to provide an overpass over I-5.
- **A new segment of shared transitway**. This shared transitway segment would be located on a structure proposed as part of the Barbur or adjacent to I-5 light rail alignments. The shared transitway would run from the bridge connection point to SW 70th Avenue and Atlanta Street in the Tigard Triangle. Buses would exit the shared transitway at SW 70th Ave to continue south through the Tigard Triangle in mixed traffic.
- **A new bridge over Highway 217**. Certain HCT alignments could include or facilitate construction of a new crossing over Highway 217 from Beveland Street to Hunziker Street, northwest of the existing SW 72nd Avenue crossing. This bridge is not included as part of the bus hub option, but it is mentioned here to note that if this feature was constructed as part of downtown Tigard HCT project, buses could use this crossing to decrease the distance traveled between the Tigard Transit Center and the Tigard Triangle and allow buses to avoid existing congestion at the SW 72nd Avenue crossing.

The addition of these features would improve travel times for buses by providing a dedicated travel lane that would be a more direct route than is currently allowed on existing streets.

The following is an overview of the bus lines considered for serving a PCC Sylvania bus hub.

### Line 44

As discussed above, the line 44 currently provides service to the Southwest Portland neighborhoods, connecting PCC Sylvania to the communities to the north of campus, including the Barbur Transit Center, Multnomah Village, Hillsdale and downtown Portland. During peak hours, the line provides service every 20 minutes, with 30-40 minute service during the off-peak hours. Line ridership is approximately 3,000 weekday boardings between downtown Portland and PCC Sylvania.

With this bus hub option, the line 44 would continue to connect to PCC Sylvania along its current route and at its current frequencies, so no changes to the line's operational costs are anticipated.

As an alternative, this line could be extended to Bridgeport Village in lieu of the Line 97, or extend to the Tigard Transit Center in lieu of the line 93, which are both discussed below.

### Line 78

The line 78 currently provides a transit connection between Beaverton Transit Center and Lake Oswego Transit Center, connecting these communities with Washington Square, Tigard Transit Center, the Tigard Triangle and the PCC Sylvania campus. During peak hours, the line provides service every 20 minutes, with 30-40 minute service during the off-peak hours. Currently, line ridership is approximately 3,000 weekday boardings, with 625 weekday on/offs at PCC. In this bus hub scenario, the line 78 route would be adjusted to utilize the shared transitway. As this is an existing route that may see modest reductions in travel times, the operating costs for this line could see a slight savings.

Additional benefits could be achieved if a new vehicular crossing over Highway 217 was constructed at Beveland, shortening the distance of travel for buses and avoiding congestion at 72nd Avenue and Hunziker Street.

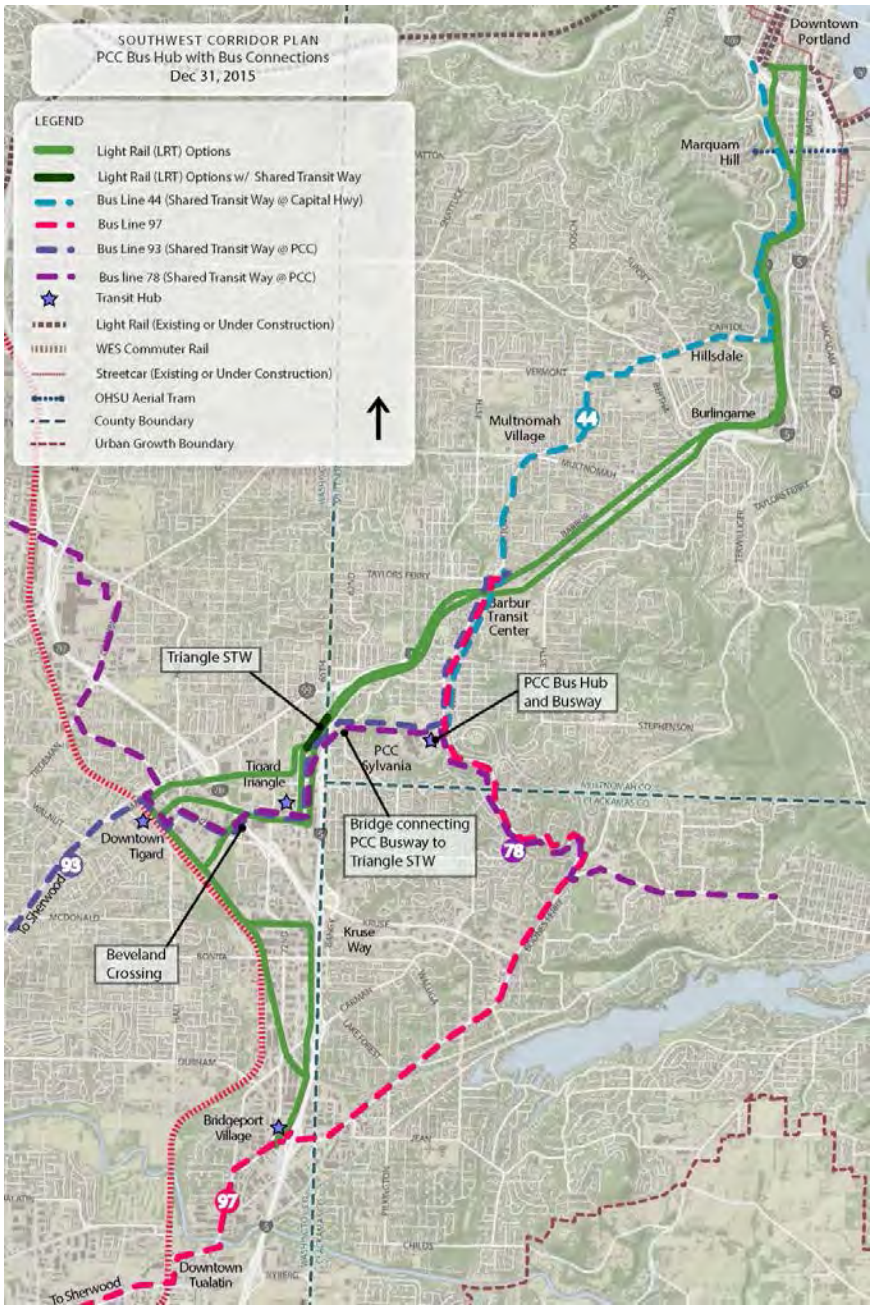
### Line 93

The line 93 currently provides a transit connection between the Tigard Transit Center and Downtown Sherwood, via Pacific Highway, Connecting Sherwood and King City to Tigard. During peak hours, the line provides service every 20 minutes, with 30-40 minute service during the off-peak hours. Currently, line ridership is approximately 710 weekday boardings.

For this scenario, the line 93 would be extended to a new terminus at the Barbur Transit Center via PCC Sylvania. The route would travel over the existing 72nd Avenue crossing, travel through the Tigard Triangle to the Tigard Triangle shared transitway and new bridge to the Sylvania campus, before traveling through the campus to reach mixed traffic on 49th Avenue and Capitol Highway.

This route connects King City, Sherwood, and Tigard to PCC, while providing additional service to the HCT alignments, the Tigard Triangle and the PCC Sylvania campus. As this is an existing route that would be extended, the operational costs for this line would increase by approximately $1.2 million annually. Projected boardings could increase by approximately 2,000 per week based on land use analysis by TriMet.

Additional benefits could be achieved if a Beveland vehicular crossing over Highway 217 was constructed, shortening the distance of travel for buses and avoiding congestion at 72nd Avenue and Hunziker.




As an alternative, the line 44 could be extended from PCC Sylvania to the Tigard Transit Center to provide the same service connection between downtown Tigard and the campus as proposed here for the line 93.

### New line 97

TriMet has completed the Southwest Service Enhancement Plan (SWSEP), which identified priorities for local bus improvements within the Southwest Corridor. As part of this plan, the line 97, which is expected to begin service in summer 2016, will provide an important new connection between Sherwood and Tualatin. The line is anticipated to provide weekday peak service every 30 minutes. Line ridership is projected to be approximately 500 weekday boardings based on land use analysis by TriMet.

In this bus hub scenario, the line 97 would be extended through Bridgeport Village to travel north on Boones Ferry Road to Kerr Parkway, which would connect the PCC Sylvania campus to Lake Grove, Tualatin and Sherwood, and terminate at the Barbur Transit Center.

As an alternative option, the line 97 could terminate at Bridgeport Village, or extend northward to the Tigard Triangle as defined in the Service Enhancement Plan, and the line 44 could be extended beyond the Sylvania campus to Bridgeport Village using the same path of travel outlined above.

As this is an extension of a proposed new service, projected additional annual operational costs for this line would be $2.2 million. Projected boardings would be 4,500 per week based on land use analysis by TriMet.

### PCC Sylvania bus hub summary

To summarize, a Tigard Triangle shared transitway and PCC Sylvania busway could be constructed to facilitate service enhancements to two existing bus lines currently serving the campus, plus an extension of two bus lines to serve the campus, effectively providing significant bus service enhancements from communities located to the north, east, west and south of the PCC Sylvania campus. With the lines 97 and 93 extending to the Barbur Transit Center to accompany the existing line 44, a high level of frequent service would be achieved between PCC Sylvania and Barbur Transit Center, strengthening the connection for passengers choosing to transfer from an HCT alignment on Barbur or adjacent to I-5 that does not serve the campus directly. Those choosing not to transfer could still connect to PCC Sylvania by making the half-mile walk to campus from an HCT station and park-and-ride lot at Barbur and SW 53rd Avenue.

Overall, this PCC bus hub option would provide approximately 6,000 additional households and 16,400 additional jobs with direct one-seat ride service to PCC via transit over the base or tunnel LRT alignments.

The bridge connection for the PCC Sylvania bus hub to the shared transitway would result in a 29 percent increase in adjacent property impacts, mostly to undeveloped parcels. The design of the busway shares circulation with vehicular traffic accessing existing parking lots. As proposed, the busway would result in property impacts on the Sylvania campus, which have been shared with PCC staff and are anticipated in their campus planning efforts. Project staff anticipates the property needed for the busway could be an in-kind contribution to the project.

Given the conceptual nature of this option, further refinement is needed to confirm final costs. However, rough order of magnitude costs have been developed for the option. The bus hub concept, including the Tigard Triangle shared transitway, a new crossing over I-5 and a busway through campus, is estimated to add $41 million to the light rail capital cost.

# Alternative PCC connection options: SW 53rd Avenue light rail station connections

If the Southwest Corridor Steering Committee chooses an HCT alignment that remains on Barbur or adjacent to I-5 instead of directly serving PCC Sylvania, a station near SW 53rd Avenue is likely. This local roadway provides the shortest access to the campus from Barbur and represents the most likely route for pedestrians and bicyclists to travel between HCT and PCC Sylvania. However, SW 53rd Avenue travels uphill to the campus, with several relatively steep segments. The sections below discuss two approaches to improving access between the Sylvania campus and an HCT station on Barbur.

## SW 53rd Avenue pedestrian and bike improvements

Today, SW 53rd Avenue lacks sidewalks and is unpaved in some portions. Investment would be necessary to create a walk/bike connection that is usable to the general public and meets the City of Portland's street and stormwater standards. Current light rail modeling results and cost estimates assume some form of walking and biking improvements on SW 53rd would be constructed as a part of the project, but the particular design has not been finalized.

Earlier in 2015, Metro contracted with the Mayer/Reed design studio to explore concepts for a new SW 53rd Avenue streetscape, focusing on enhanced pedestrian and bicycle facilities while continuing to serve local traffic. The goal of this effort was to provide the existing neighborhood and decision-makers with information on how an enhanced connection might function and how the improvements might encourage future transit usage by PCC Sylvania students.

The initial work on the design concepts started with outreach. Mayer/Reed and Metro staff performed the following outreach with support from the City of Portland and TriMet:

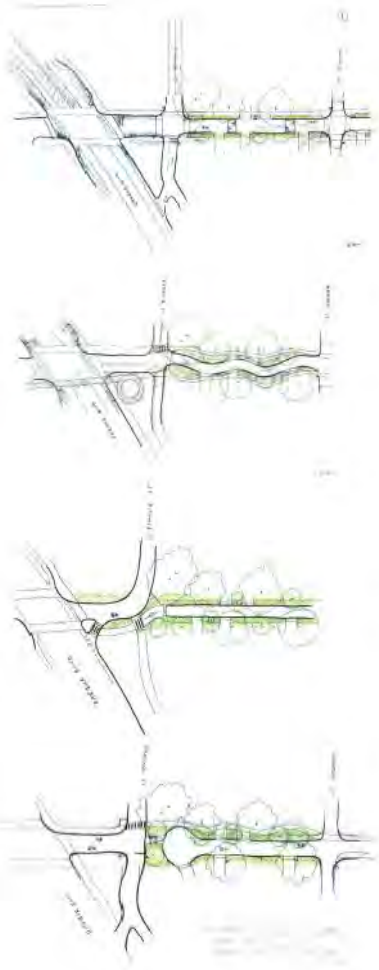
- Discussion with PCC staff to understand the unique issues that the campus has dealt with related to off-campus parking and thoughts around access from SW 53rd Avenue
- Attended Far SW Neighborhood Association meeting to hear concerns and answer questions about potential HCT alignment options and the impacts of each on the neighborhood
- Meetings with the City of Portland Bureau of Transportation and Bureau of Planning to respond to initial design concepts and highlight possible conflict points with City design standards

These refined concepts (see following page) were used for further discussions with PCC staff, City of Portland staff and surrounding neighborhoods. The designs were presented as concepts to refine as the project moves forward.

The refined concepts will continue to be used in ongoing conversations with stakeholders related to connecting HCT to the Sylvania campus. The concepts will likely be evolved into preliminary designs during the environmental review phase of the Southwest Corridor Plan, with advanced design only undertaken if a Barbur or adjacent to I-5 HCT alignment is selected.

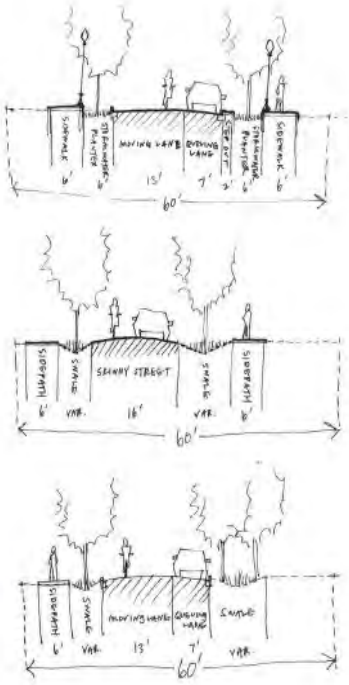
## Mayer-Reed concepts for enhanced SW 53rd Avenue connection

Conceptual designs for the connection from Barbur Blvd to Capitol Hwy



Conceptual renderings of SW 53rd / Capitol intersection with safer crossing

Conceptual cross-sections Of SW 53rd Ave



## Aerial tram

The half mile distance from a Barbur/ SW 53rd Avenue light rail station to the Sylvania campus roughly equates to a 10 to 15 minute walk, depending on an individual's ability. In addition to the sidewalks and other street improvements discussed above, project staff considered mechanized connections to reduce the time and effort needed to travel between the campus and station area. One enhanced connection option is an aerial tram. While a conceptual design has not been completed for a tram, additional research was done to better understand costs and conditions.

As the only aerial tram in the region, the tram connecting OHSU's Marquam Hill campus to the South Waterfront was used as the baseline for this research. The OHSU tram had a budget of $57M and opened in 2007. This cost escalated to 2014$ rises to $70M. In general, the location, elevation change, and distance traveled at OHSU provide opportunity for an iconic structure. The conditions on 53rd Ave provide a lower grade change and therefore, a shallower aerial tram alignment. A PCC Sylvania tram would contain two stations (on campus and at the SW 53rd Avenue HCT station) and require multiple support structures, located at a minimum at SW Barbur and at G Street on the Sylvania campus. Intermediate supports may be needed along the tram alignment. The shallow nature of the alignment raises design challenges related to backyard privacy for the homes below, as well as with matching the rural feeling of the neighborhood aesthetics.

The operating cost for the OHSU tram is approximately $2.1 million annually. It is anticipated operations costs for a new tram at PCC would be similar to the OHSU tram. If an aerial tram connection is chosen for further study in a Draft Environmental Impact Statement then additional design and assessment of impacts would be completed.

# Overall summary PCC Sylvania connection options

Below is a matrix summarizing the cost and benefits of each PCC Sylvania connection option except the enhanced walk/bike connection, which is already assumed to be included in some form in project costs and ridership estimates:

| Item | #1 Branded line 44 with shared transitway | #2 New branded line with shared transitway | #3 PCC Sylvania bus hub with shared transitway | #5 - Aerial tram |
|---|---|---|---|---|
| # of bus routes explored | 1 | 1 | 4 | 0 |
| Weekly boarding increase for bus route(s) | 6,000 | 4,000 ** | 12,000 | N/A |
| Travel time improvements end to end | 3-4 min savings | 2-3 min savings | Varies (multiple lines improved) | Would reduce the 10-15 min walk from station to campus to a 3-5 min tram ride |
| Additional capital costs (2014$) | $63 million | $84 million | $41 million * | $70 million |
| Increase in annual operational costs | Modest increase | $5 million | $3.8 million | $2.1 million |
| ROW impacts (square feet) | 14% increase | 43% increase | 29% increase | Unknown |
| Other benefits | Improved bus service to Multnomah Village and Hillsdale | Allows branded bus to avoid mixed traffic north of Capitol Hwy at SW Barbur Blvd. | Provides direct service to PCC from 6,000 additional households and 16,400 additional jobs over the existing service | Permanent, visible investment in connection between HCT alignment and PCC Sylvania |

*Price shown does not include Beveland Crossing of Hwy 217. If included, this cost would increase to $79M.

**Some of these boardings may be from riders who would otherwise ride LRT through that portion of the shared transitway into downtown Portland.

Overall, each option would improve connectivity to the PCC Sylvania campus in conjunction with an HCT alignment on Barbur Boulevard or adjacent to I-5. In addition, construction of the Beveland auto crossing could further improve bus travel times and help areas of current congestion.

The following matrix compares a Barbur light rail alignment with an enhanced bike and pedestrian connection on SW 53rd Avenue, a Barbur light rail alignment with a PCC Sylvania bus hub and shared transitway in the Tigard Triangle, and a bored light rail tunnel to PCC Sylvania.

**Relative comparison of base, bus hub, and PCC tunnel options for light rail**

| Item | base light rail alignment (Barbur) + walk/bike connection on SW 53rd | base light rail alignment (Barbur) + PCC Sylvania bus hub | PCC Sylvania bored tunnel light rail alignment |
|---|---|---|---|
| Travel time | Worst: Long walk connection or transfer to Line 44 (4 trips per hour) | Better: Frequent connections to HCT and enhanced one seat rides reduce travel time | Best: Direct access to PCC campus and no transfer for most riders |
| Total capital costs for segment (2014$ without finance costs) | $290 million | $330 million | $620 to 630 million |
| Operating cost | Base | $3.7 million additional | Similar to base alignment |
| Property impacts | Lower than tunnel option | Increase over base alignment, but lower than tunnel | Highest impact |
| Benefits | Avoids tunnel construction impacts | Avoids tunnel construction impacts. Enhances connectivity to PCC over base alignment with significantly lower capital costs than tunnel | Would allow for direct light rail access to the PCC campus |

# Next steps

A separate memo on the trade-offs between bus rapid transit and light rail transit travel modes for a Southwest Corridor HCT line is being released concurrently with this document. Project staff will release a recommendation report on both the mode decision and the PCC Sylvania light rail tunnel and connection options by the end of January 2016. At its February 2016 meeting, the Southwest Corridor Steering Committee will consider action on a recommendation for public review on whether to continue studying a light rail tunnel to PCC Sylvania and may provide direction on which alignment option(s) and alternative connection option(s) to advance into a Draft Environmental Impact Study.

Steering committee members and the public can consider and discuss the draft Preferred Package resulting from these decisions in March and April, with the final Preferred Package to be adopted in May 2016.

Throughout 2016, the project partners will evolve details of the proposed HCT system from conceptual to preliminary design and begin comprehensive environmental review of the Preferred Package later in the year. The environmental review process will take 16-18 months and will encompass substantial advancement of HCT design, including details on roadway widening, lane conversions, property impacts and any tunnel construction. Construction of the HCT line could begin as early as 2021.