600 NE Grand Ave.
Portland, OR 97232-2736

Metro | *Agenda*

Meeting: **Metro Council Work Session**
Date: Thursday, April 21, 2016
Time: 3:00 p.m.
Place: Metro Regional Center, Council Annex

CALL TO ORDER AND ROLL CALL

3:00 PM	**1.**	**CHIEF OPERATING OFFICER COMMUNICATION**	
3:10 PM	**2.**	**SOUTHWEST CORRIDOR PLAN UPDATE**	**Malu Wilkinson, Metro** **Chris Ford, Metro**
3:55 PM	**3.**	**COUNCILOR LIASON UPDATES AND COUNCIL COMMUNICATION**	

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ការគោរពសិទ្ធិពលរដ្ឋរបស់ ។ សំរាប់ព័ត៌មានអំពីកម្មវិធីសិទ្ធិពលរដ្ឋរបស់ Metro ឬដើម្បីទទួលពាក្យបណ្តឹងរើសអើងសូមចូលទស្សនាគេហទំព័រ www.oregonmetro.gov/civilrights។
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Metro | *Making a great place*

November 2014

Agenda Item No. 2.0

SOUTHWEST CORRIDOR PLAN UPDATE

Metro Council Work Session
Thursday, April 21, 2016
Metro Regional Center, Council Annex

METRO COUNCIL

Work Session Worksheet

PRESENTATION DATE: 04/21/16 **LENGTH:** 45 minutes

PRESENTATION TITLE: SW Corridor Plan update

DEPARTMENT: Planning & Development

PRESENTER(S): Malu Wilkinson (x1680, malu.wilkinson@oregonmetro.gov), Chris Ford (x1633, chris.ford@oregonmetro.gov)

WORK SESSION PURPOSE & DESIRED OUTCOMES

- **Purpose:** Update Council on progress and upcoming steps for Southwest Corridor Plan.
- **Outcome:** Receive Council input on upcoming decisions on transit mode and connection to PCC Sylvania campus.

TOPIC BACKGROUND & FRAMING THE WORK SESSION DISCUSSION

The Southwest Corridor Plan is a package of transit, roadway, bicycle and pedestrian projects that can help reduce congestion, increase transportation options, improve safety and enhance quality of life in Southwest Portland and southeastern Washington County.

Since the last update to Council in June 2015, the Southwest Corridor Steering Committee has made several refinements to the high capacity transit (HCT) alignment, decisions supported by staff analysis and public engagement. In May, the Steering Committee is scheduled to make recommendations on transit mode (bus rapid transit or light rail) and further study of a light rail tunnel to the Portland Community College Sylvania campus. These recommendations will complete an 18-month workplan established by the Steering Committee in December 2014 in preparation for evaluation in a Draft Environmental Impact Statement (DEIS).

Project partner staff has recommended light rail as the transit mode, and removing the PCC Sylvania tunnel from further study. These are the most difficult decisions of the refinement process, with significant ramifications around project financing and political support across the region. Staff will provide an update on decisions made since last June, explain the reasons for these recommendations, and ask Council for input.

Public engagement on the Southwest Corridor Plan has been extensive. In addition to a public forum prior to each decision point, project staff frequently present to community and business groups including Southwest Neighbors Inc (SWNI), Implementation & Development Southwest (IDSW), TPAC, Portland Business Alliance and Westside Economic Forum. Metro has also developed an interactive map tool which is used to share information about locations and options and solicit feedback. Staff also email project updates to interested parties and conduct online surveys regarding project recommendations, and compose stories about the people and places in the corridor.

The Southwest Corridor Plan is one of the major projects in the Investment Areas group of Planning & Development, and will implement an important initiative of the Regional Transportation Plan. The Southwest Corridor Plan touches upon a number of other Metro programs and regional issues, notably around active transportation, fulfillment of the 2040 Growth Concept, and equitable housing.

Next steps for the Southwest Corridor Plan are:

- May 9 – Steering Committee recommendations on mode and PCC Sylvania tunnel
- June 13 – Steering Committee endorsement of Preferred Package of HCT mode and alignments
- July – staff returns to Metro Council and comes to JPACT to ask for endorsement of Preferred Package
- Mid-August through September – DEIS public scoping

QUESTIONS FOR COUNCIL CONSIDERATION

- What questions does Council have regarding staff recommendations on upcoming decisions?
- What region-wide issues should staff and project partners keep in mind as the Plan moves forward?

PACKET MATERIALS

- Would legislation be required for Council action ☐ Yes ☒ No
- If yes, is draft legislation attached? ☐ Yes ☒ No
- What other materials are you presenting today?
    - How did we get here? handout
    - High Capacity Transit Options map
    - October 2014 - July 2015 Public Engagement Summary
    - July – October 2015 Mt Sylvania outreach summary
    - Staff Recommendations for May 2016 Decisions: Transit Mode and PCC Sylvania Tunnel
    - Southwest Corridor High Capacity Transit Mode Comparison + summary table
    - High Capacity Transit Technical Evaluation: Direct and Indirect Connection Options to PCC Sylvania Campus + summary table

How did we get here?

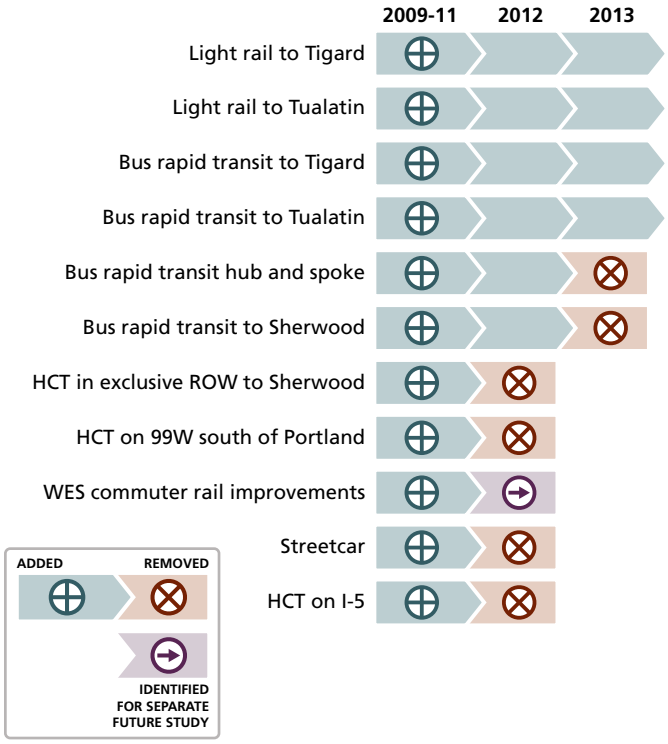
A brief history of Southwest Corridor high capacity transit refinement

2009 to 2013

In 2009, Metro's Regional High Capacity Transit (HCT) System Plan identified the Southwest Corridor as a near-term priority for new high capacity transit. With rapid growth in households and employment and increasingly cumbersome congestion, the Southwest Corridor needs a fast, reliable transportation option to improve access both within the corridor and to other parts of the region.

With this call to action, staff from Metro, TriMet, ODOT and the Southwest Corridor jurisdictions began evaluating a broad array of transportation investments for the area, including roadway, bike and pedestrian improvements in addition to several different high capacity transit types.

Since then, the HCT element of the Southwest Corridor Plan has been narrowed down to an alignment running between downtown Portland and Tualatin, via Tigard, using either bus rapid transit or light rail. The chart below shows the other HCT options that have been considered.



2013 to 2015

In 2013, the Southwest Corridor Steering Committee directed project staff to continue studying a light rail or bus rapid transit alignment between downtown Portland and Tualatin, via Tigard. Since then, project partners have been carefully evaluating a wide range of alignment options along that route.

Here are some of the alignment options the steering committee has removed from consideration since 2013 and why they were taken off the map:

SW Hunziker Street in downtown Tigard

The Hunziker Street downtown loop alignment in Tigard was removed first for light rail in March 2014 because the center-running trackway would have impeded truck access to the industrial businesses along the road. In June 2014, the alignment was removed for bus rapid transit as well because mixed traffic operations would have been necessary in order to maintain truck access, which would have resulted in slower and less reliable travel times.

Bored tunnels to Marquam Hill, Hillsdale and Multnomah Village

Three different bored tunnels have been considered to access Marquam Hill. The longest, which would have continued south under Hillsdale and Multnomah Village to emerge near the Barbur Transit Center, was removed in June 2014 largely because it failed to serve the historic highway portion of SW Barbur Boulevard. The two shorter tunnels, one just under Marquam Hill and the other extending under Hillsdale to emerge in Burlingame, were evaluated further and then removed in July 2015. The high cost and impacts of these tunnels did not justify the moderate gains in ridership and travel time compared to surface options, and the tunnels would not have served the South Portland neighborhood or provided bike and pedestrian improvements along Barbur Boulevard.

SW Hall Boulevard

Hall Boulevard alignment options were removed from consideration in June 2014 due to the residential character of the area and slower travel times compared to alignments adjacent to the WES tracks.

72nd Avenue

Alignments on 72nd Avenue were removed from consideration in March and June 2014 due to slow travel times and restricted access for industrial businesses along the street.

South Waterfront

In 2014, three South Waterfront alignments were evaluated and removed from consideration. All three options ran on the Portland-Milwaukie light rail tracks between downtown Portland and the South Waterfront, resulting in longer travel times than the more direct alignments along Barbur Boulevard and Naito Parkway. Two alignments used a combination of structures and tunnels to get from the South Waterfront to Barbur Boulevard, while the third entered a deep-bored tunnel along Moody Avenue to connect with the other Marquam Hill tunnel alignment options.

Key steering committee decision points

July 2013: Steering committee decided to study bus rapid transit or light rail between downtown Portland and Tualatin via Tigard.

March 2014: Steering committee removed less promising options prior to a detailed evaluation report to inform a June 2014 decision.

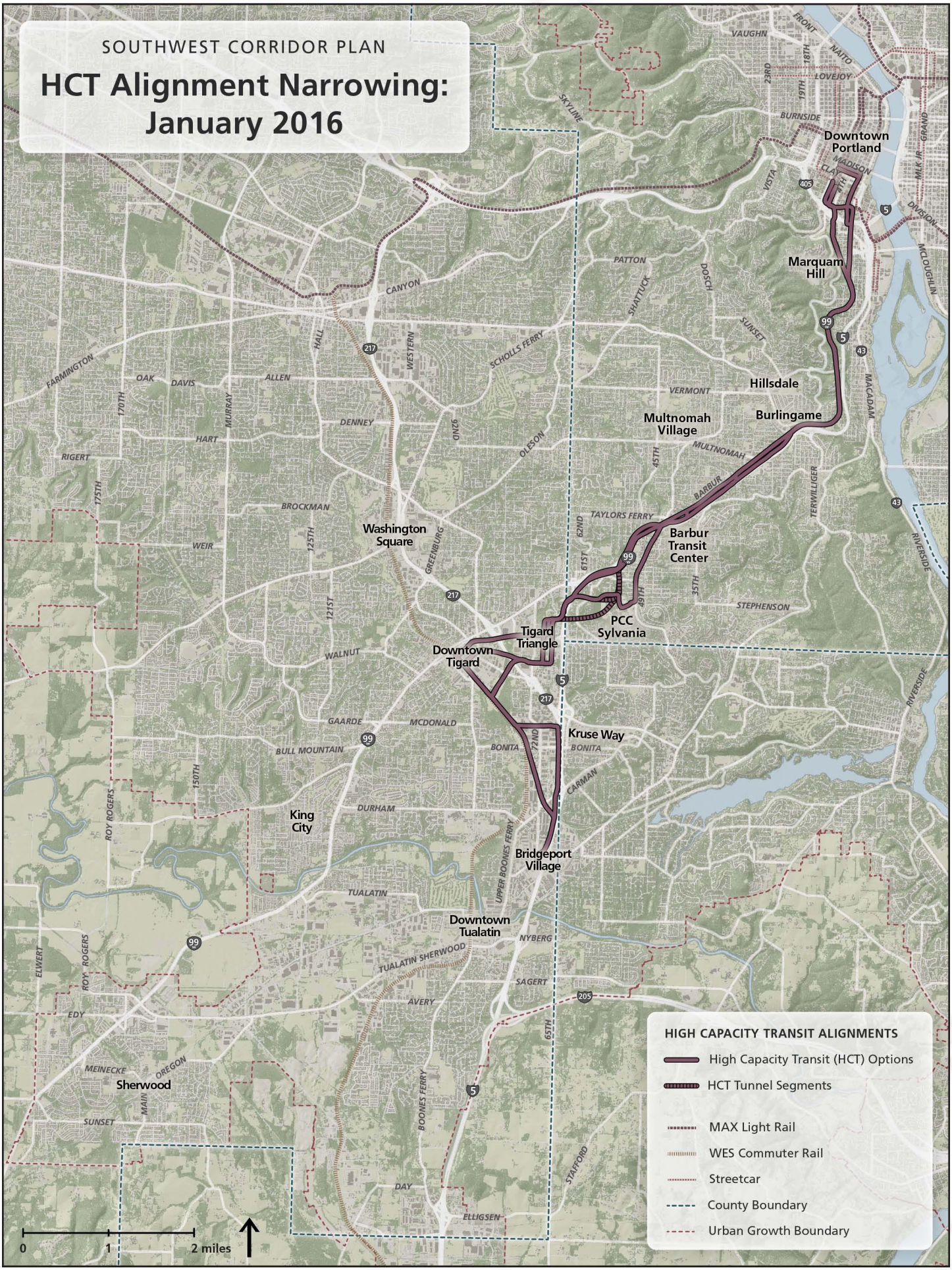
June 2014: Steering committee removed several alignment options and directed project staff to address questions about remaining options.

July 2015: Steering committee approved modifications based on information provided in response to the June 2014 questions and removed tunnel options in South Portland and Hillsdale.

December 2015: Steering committee will narrow alignment options in Tigard and Tualatin, and narrow options for possible terminus locations.

February 2016: Steering committee will determine whether to continue studying a light rail tunnel to PCC Sylvania campus, and select which high capacity transit mode, light rail or bus rapid transit, to continue studying.

April 2016: Steering committee will decide on a package of investments to study further, including HCT and supporting roadway, pedestrian and bike projects.


SOUTHWEST CORRIDOR PLAN
HCT Alignment Narrowing: January 2016
Downtown Portland
Marquam Hill
Hillsdale
Multnomah Village
Burlingame
Barbur Transit Center
PCC Sylvania
Tigard Triangle
Downtown Tigard
Kruse Way
Bridgeport Village
Downtown Tualatin
Washington Square
King City
Sherwood
HIGH CAPACITY TRANSIT ALIGNMENTS
High Capacity Transit (HCT) Options
HCT Tunnel Segments
MAX Light Rail
WES Commuter Rail
Streetcar
County Boundary
Urban Growth Boundary
0
1
2 miles

July 2015

GREAT PLACES
SW Corridor
Portland • Sherwood • Tigard • Tualatin
Beaverton • Durham • King City
Washington County • ODOT • TriMet • Metro

October 2014 - July 2015 Public Engagement Summary

The purpose of this public engagement summary is to document the activities and outcomes of Southwest Corridor Plan outreach activities from October 2014 through June 2015. This work builds on public engagement activities conducted from the beginning of the Southwest Corridor Plan process.

The Southwest Corridor of the Portland metropolitan region contains diverse cities and neighborhoods, natural areas and landmarks that contribute to its identify and regional significance. Interstate 5, Highway 217 and 99W-Pacific Highway carry cars, buses and trucks in and around the corridor each day. Community leaders are creating walkable and bikeable town centers. People come from throughout the region to enjoy natural areas such as the Fanno Creek Trail and the Tualatin River Greenway Trail. The Southwest Corridor is home to tens of thousands of the region's residents and provides a quarter of the region's jobs. These numbers are expected to double by 2035, making safer, more efficient travel in and around the corridor a top priority for the entire region.

Five years ago, regional leaders began envisioning a set of transportation and land use solutions to address key challenges and enhance livability in the Southwest Corridor. The Southwest Corridor Plan is a package of transit, roadway, bicycle and pedestrian solutions that can help reduce congestion, improve circulation and improve quality of life in the corridor. The Southwest Corridor Plan defines transportation investments to help realize the local land use visions adopted by each community in the area. Community members, business leaders, transit providers, the state and local governments are working together now to plan for these transportation and community development improvements in this corridor.

CONNECT
www.swcorridorplan.org
@SWCorridor
trans@oregonmetro.gov
503-797-1756

2015-2016: Creating a Preferred Package

From January 2015 through spring of 2016, the project workplan is to define and select the most promising high capacity transit (HCT) alignment, terminus and mode (light rail or bus rapid transit) options that best meet the project goals and that will be forwarded into the federal environmental review process. This period will also identify a funding strategy and implementation timeline for more than 80 roadway, bicycle and pedestrian projects that will work collectively with a high capacity transit investment to improve mobility, safety and transportation choices in the region.

Importance of Engagement

The success of this plan will rely on a strong foundation of input and energy from diverse stakeholders in the corridor and throughout the region. Some stakeholders have been very engaged in past stages, while others who will be impacted by the implementation of the plan are new to the conversation. We need to hear from everyone.

Connecting input to decision makers

Decision-makers know this is a complex, technical project that will have real impact on people's lives. Feedback from the public highlights the different needs and choices that each community is facing. Each month, project staff and decision-makers receive visual and verbal updates on what we are hearing from the public. At each steering committee meeting, engagement staff highlights key themes that have emerged from our discussions with the public. Based on these updates, decision-makers give feedback to engagement staff on what else we should ask the public and what additional information decision makers want to see as part of their deliberations. Key findings and themes from our online and in-person outreach were integrated into the staff draft recommendations to the steering committee on their July 2015 decisions regarding HCT alignment options.

Public Engagement Objectives

- Provide relevant information to the public about upcoming project deliberations
- Generate public feedback and ideas and ensure that feedback is presented to decision makers
- Communicate with stakeholders in a way that generates understanding and enthusiasm for the project
- Build on existing relationships with engaged members of the public and build new relationships with public whose perspectives have been underrepresented to date
- Demonstrate that decision makers are receiving and considering community input when deliberating decisions

Public Engagement Desired Outcomes

- Input on key issues and trade-offs specific to each key community in the corridor
- Summary of stakeholder perspectives on HCT alignment choices
- Input on desired benefits that Southwest Corridor Plan investments can bring to communities in the region
- Elevated voices of champions for the project
- Public stakeholders feel they have access to project details, technical staff and decision makers
- Decision-makers understand and consider public input in their decision making

What We Heard Overall:
Key findings from online and in-person input

- Many survey respondents and meeting participants were supportive of transportation improvements in the Southwest Corridor that will increase choices and create better transit service.
- Most people who responded online and in person felt that directly serving Marquam Hill and PCC Sylvania with high capacity transit was very important.
- Many online respondents felt that transit tunnels offered the most benefit in terms of direct access to key destinations and travel time, while others felt that tunnels were not worth the project cost and impacts to communities.
- Many people online and in person felt that the high cost of tunnels made them a non-viable option. A smaller group felt it was worth it to spend the money to assure that the project delivers top benefit to the region in the long term.
- Walk and bike improvements were very important to many people online and in person. Roadway improvements were less important to online respondents, while maintaining road capacity was occasionally discussed at in-person meetings.
- People who participated in-person at meetings felt more strongly than online respondents that construction impacts should be a major factor for decision-makers to consider.

Key themes from place-based dialogues

South Portland neighborhood groups and institutions:

- Provide benefit to local neighborhoods, don't just pass through on the way to someplace else
- Avoid or mitigate negative impacts to local traffic and business access on Barbur Boulevard and neighborhoods surrounding Marquam Hill
- Investing in safer walk and bike facilities should be part of any HCT project
- High capacity transit should link parts of the community together, not be a wall that divides the community
- Marquam Hill (OHSU, VA Hospital) is an important regional destination that needs improved transit service
- OHSU and National College of Natural Medicine are engaged partners supportive of HCT and transportation investments in the area
- Current transit service to Marquam Hill is inadequate
- Transportation improvements in South Portland should improve access to South Waterfront

Hillsdale neighborhood and business groups:

- Residents and businesses want to maintain the character of Hillsdale town center
- There are concerns about the high number of transit transfers and providing adequate park and ride lots
- Tunnel construction would have negative impacts to businesses, schools and families
- There are viable alternatives for improved transportation in and around Hillsdale through local transit, bike and pedestrian improvements
- Improved sidewalks and bike lanes are important to local livability and safety

Mt. Sylvania neighborhood groups and institutions:

- PCC is an important regional destination that needs improved transit service
- Residents want to maintain the local character of neighborhoods
- Tunnel construction would have significant impacts on local residents
- There are current challenges to walking and biking to campus from Barbur Boulevard
- PCC is an engaged partner supportive of HCT and transportation investment for the campus community

Tigard & Tualatin themes from online comments

- Desire for less congestion on the roads; concern that HCT may take away driving lanes
- Provide fast, reliable transit service with adequate park and rides; improve local bus service
- Strong support for investment in bicycle infrastructure
- Safety concerns for people who take transit, walk and ride bikes
- Mix of support for either light rail or bus rapid transit as preferred mode; small group against any new investment in HCT
- Interest in how transportation investment can serve other communities including Lake Oswego, Kruse Way, Wilsonville, King City

Our Approach

Building on previous outreach, from November 2014 to June 2015 project staff had many opportunities to connect with people interested in the Southwest Corridor. Staff met with hundreds of people in person through local community meetings, small group discussions, individual conversations, a planning forum and open houses. The outreach strategy focused on the key places throughout the corridor to better understand the unique opportunities, challenges and community perspectives that exist. Staff also gathered public input on how the Southwest Corridor Plan can provide benefits to both individual communities and the corridor as a whole.

In-Person Engagement

Tools/Methods	What We Did/Who We Met With
My Place Dialogues Meetings with local civic, business and resident groups to connect with the public in key places in the corridor. These events focus on area-specific issues to elevate the unique local benefits and impacts of the project and also set each community's choices in the context of corridor-wide project performance and decision-making.	• National College of Natural Medicine • South Portland Neighborhood Association • Hillsdale Neighborhood Association • Far Southwest Neighborhood Association • Homestead Neighborhood Association • Southwest Neighborhoods, Inc. Transportation Subcommittee • Hillsdale residents • Concerned Citizens for Social Justice • Drinking Liberally in Tigard • Portland Business Alliance • Tigard Downtown Alliance • Tigard Transportation Advisory Committee
Online information and surveys Online surveys to generate specific feedback to staff and decision-makers on project decisions. Up-to-date web site that provides access to project materials, upcoming events and summaries of steering committee decisions. See appendix.	• Online survey, May 8-22 • Online survey, June 12-26 • Monthly updates to web site design and content
Corridor-wide planning forums Structured events geared at large numbers of public stakeholders, opportunities to provide in-depth project detail and generate feedback.	• Southwest Corridor planning forum, May 12, 2015, Wilson High School
Open houses and tabling events Semi-structured opportunities for interested people to drop by to talk and ask questions of staff and decision makers.	• Southwest Corridor Plan Open House, June 17, 2015 • Tabling, National College of Natural Medicine, November 2014 • Tabling, PCC Sylvania Earth Day, April 2015 • Tabling, OHSU Farmers Market, June 2015
Community Conversations Opportunities to talk and build relationships with people whose perspectives are too often left out of the planning process. Our goal is to meet groups and individuals where they are and to hear their ideas about transportation needs and solutions.	• Supa Fresh Farm, Youth Source • Oregon Somali Family Education Center • Greenburg Oaks residents, Community Partners for Affordable Housing

In-Person Engagement, Continued

Tools/Methods	What We Did/Who We Met With
ID Southwest Appointed committee of community leaders who can activate local dialogue that shapes transportation and land use investment in the corridor, and can make the most of public-private partnerships	• ID Southwest Meeting, May 2015 • Membership in ID Southwest is representative of communities and expertise throughout the study area.
Individual and small group stakeholder meetings Additional opportunities to engage one-on-one and in small groups with interested stakeholders.	• Lair Hill residents and business owners • Southwest Neighborhoods Inc. leadership • PCC Sylvania leadership • Upstream Public Health • 1000 Friends of Oregon • Coalition for a Livable Future • Center for Intercultural Organizing
Focused discussions Public meetings with a specific focus on technical or special interest topics.	• Technical Workshop: Southwest Neighborhoods Inc. • Marquam Hill Design Connection: Ahavath Achim synagogue, Friends of Terwilliger, OHSU, Veterans Hospital, Southwest Neighborhoods Inc.

Online Engagement

Tools/Methods	What We Did
Storytelling and project newsfeeds Stories and newsfeeds are an important way to learn about the people and places that make up the Southwest Corridor.	Based on local stakeholder interviews and historical research, project staff writers developed five place-based stories and several project newsfeeds. Metro stories that are shared on Facebook have reached about 800-900 viewers and receive an average of 50-70 views, and 10-15 likes, comments and shares. See Appendix.
Social media We maintain an active presence on Twitter and Facebook to share up-to-date project activities and provide quick opportunities for interaction with interested followers.	Active tweets and Facebook posts are ongoing. Currently our Twitter account has 561 followers, we are following 757 people, and we have tweeted 782 times. On average, there has been one tweet or retweet per day. In the last three months, Metro's Facebook site has included three posts related to the Southwest Corridor Plan to promote newsfeed articles, online mapping tool and online comment periods. The Southwest Corridor Plan blog became inactive in June 2015 due to lack of site traffic and technical difficulties.
Interactive online map tool The plan's interactive map tool provides hands-on interaction with the project study area. Users can click on different points along the map to learn about road and tunnel transit alignment options; current and future road, bike, pedestrian and transit improvements; and potential redevelopment opportunities in the corridor. Periodically, survey questions on key project decisions are embedded in the map tool to get stakeholder feedback.	Beginning in May, the map highlighted key locations in the project area including South Portland, Hillsdale and Portland Community College, Sylvania Campus that are directly related to the July 2015 steering committee decision. During an 18-day comment period in May 2015, 3,710 visitors viewed the map, and 297 of those visitors left 827 comments using the map tool survey function. Discover the interactive map at www.swcorridorplan.org.
Email and phone dialogue	A monthly email update sent to nearly 700 people; staff routinely engage via email and phone with interested stakeholders
Earned media The Southwest Corridor Plan works with local news media and community newsletters to raise awareness and maintain dialogue about the plan and regional efforts to improve transportation choices in the region.	Media outlets cover Southwest Corridor Plan events and project updates regularly. See appendix.
Paid advertising	Project staff purchased 16 days of Facebook advertising in May 2015 to promote the online comment period and online map tool. The ad resulted in 6,479 views and 249 web clicks.

November 2015

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Mt Sylvania outreach summary

At a July Southwest Corridor Steering Committee meeting, committee members postponed a decision on whether to continue study of a light rail tunnel to directly serve the PCC Sylvania campus so that staff could conduct additional technical analysis and public outreach. This report summarizes public feedback from targeted outreach activities to Mt. Sylvania residents and stakeholders at the PCC Sylvania campus during July-October. Outreach activities included in-person dialogue at neighborhood and PCC events, an online survey targeted to PCC Sylvania students and staff, and two online neighborhood surveys.

Neighborhood discussions & surveys

In August and September, Metro, TriMet and City of Portland staff attended the Far Southwest and West Portland Park Neighborhood Associations. The discussions focused on new technical information that identified a bored tunnel option to serve the campus that would have fewer community impacts than a cut-and-cover tunnel, information on a bus rapid transit option on Capitol Highway, and concepts for several shuttle/walk/bike connections from Barbur Blvd. to

the Sylvania campus that are being considered if a high capacity transit line runs along Barbur Blvd.

Many residents expressed concern over the impact a transit tunnel would have on surrounding neighborhoods, and questions about how a bus rapid transit route along Capitol Hwy. would impact pedestrian safety and neighborhood livability. There were concerns that not enough community members were aware of the project, and suggestions for how t.v., radio and print news outlets could be more heavily used to tell residents about the Southwest Corridor Plan.

Many residents at both meetings were supportive of increased high capacity transit and local bus service in the area, even if there was disagreement about the best way to make this happen. Both meetings included active discussion about how improving TriMet local bus service and PCC campus shuttle service should be strongly considered.

Next Steps:

In February the Steering Committee will determine whether to continue studying a light rail tunnel to directly serve the PCC Sylvania campus.

Southwest Corridor Steering Committee meeting
February 8th, 2015
9-11 a.m. Location TBD, check online calendar

CONNECT

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503-797-1756

Far Southwest Neighborhood survey

Neighborhood leaders developed questions for an online survey in September that generated 58 responses.

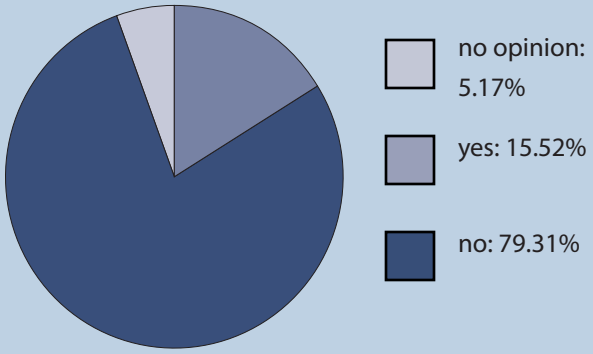
Key Findings:

- Results show a majority opposition to both a bored tunnel (67% oppose) and a cut and cover tunnel (79% oppose) to directly serve the Sylvania campus.
- Support (53%) and opposition (43%) for a bus rapid transit option was divided almost equally.
- A majority of respondents (65%) expressed that TriMet should develop an express bus from downtown Portland directly to PCC Sylvania. Open-ended comments suggest this is likely because this option is the least disruptive to the surrounding neighborhood.
- Respondents were divided in their support (56%) or opposition (40%) for Metro continuing plans for any high capacity transit.
- Twenty six respondents provided open-ended comments. Many comments expressed opposition to light rail and bus rapid transit in favor of increasing the frequency of current bus lines or creating new express bus lines to PCC Sylvania from downtown Portland. Often, comments cited neighborhood disruption, cost concerns and that current transit options are underutilized.

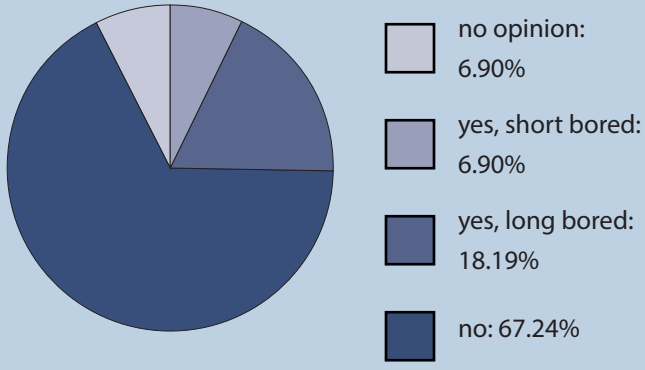
"A dedicated bus line from Barbur to PCC would easily serve our needs now and in the future. A tunnel and underground station is a huge waste of money."

"Doing less [than a tunnel] will greatly minimize the overall ridership to PCC."

Do you favor further study of the cut-and-cover tunnel option under SW 53rd Ave. from Barbur Blvd. to PCC Sylvania (and on to the Tigard Triangle)?



Do you favor further study of the new bored tunnel option under SW 53rd?



West Portland Park survey

Neighborhood leaders developed questions for an online survey in September that generated 69 responses.

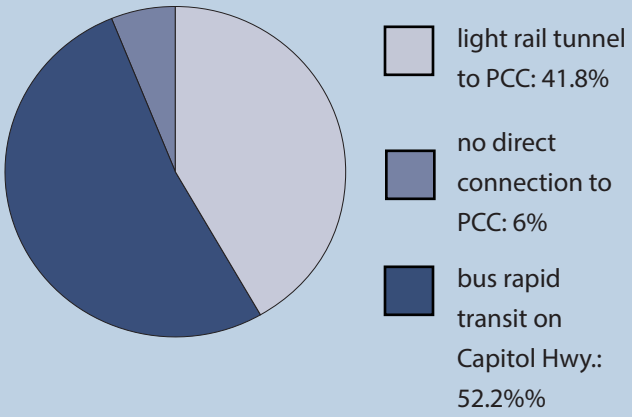
Key Findings:

- Survey results indicated overall support for the Southwest Corridor project (83%), and support in general for a high capacity transit connection to PCC Sylvania and the West Portland Park area (74% support).
- Support was split evenly between a light rail tunnel (42%) and bus rapid transit (52%) as the preferred high capacity transit option for the area.
- A majority of respondents (72%) support bus rapid transit on Capitol Hwy.

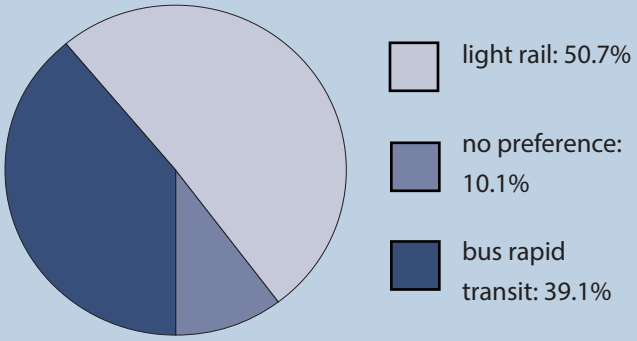
"I fully support the MAX improvements, but I'm not sure about the cost to benefit of getting the rails out this way."

"One cannot depend on public transit if one has to be on time for a job."

Which of the following options would you prefer as a HCT option for West Portland Park Neighborhood?



Do you have a general preference for bus rapid transit (BRT) or Light Rail (LRT) as a mode for the HCT?



PCC student and staff survey

Project staff engaged with PCC Sylvania students and staff in several ways, including hosting an informational table at PCC Sylvania New Student Welcome Day, and PCC Sylvania Staff In-Service Day. Students and staff were excited about the potential of a light rail station directly to campus, though many expressed that it seemed like a costly way to increase transit service to the campus. There were questions about how many students or staff might actually use possible shuttle/walk/bike connections that are being proposed from Barbur Blvd to campus if the high capacity transit line runs along Barbur Blvd. and not directly to the Sylvania campus. Project staff worked with campus leadership to develop a survey targeted to students and staff; the survey was publicized through campus social media, newsletters and email networks and generated 676 responses.

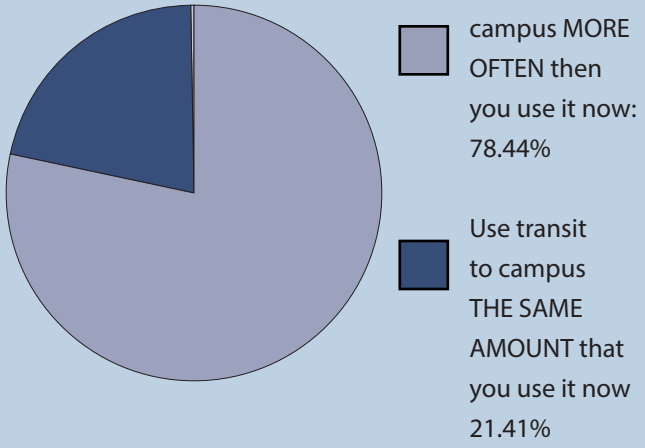
Key Findings:

- Most respondents (78%) would use transit more if there was improved transit service to PCC Sylvania.
- A majority of respondents (61%) think a light rail tunnel is the most viable way to serve campus.
- A majority of respondents (74%) said they were somewhat likely or very likely to use a mechanized connection between a high capacity transit stop on Barbur Blvd. and campus.
- A majority of respondents (60%) said they were somewhat likely or very likely to use improved bike and pedestrian access along SW 53rd Ave. to campus.

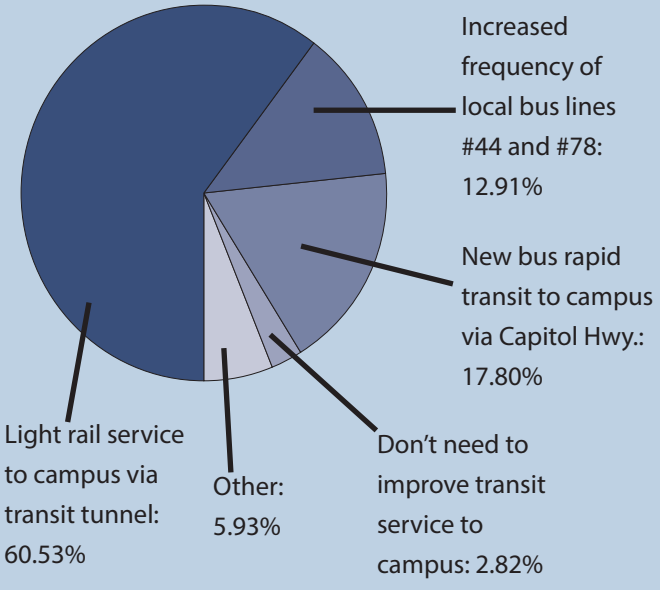
"Light rail to campus would be fantastic! Don't make us walk up that hill to PCC, people really won't do it."

- Two hundred thirty three open-ended comments addressed a variety of issues including: a preference for direct access to campus in inclement weather and for respondents with disabilities, a need to improve frequency and reliability of existing TriMet routes and campus shuttles, cost concerns, concerns over disruption to the nearby neighborhoods, and support for increased bike and pedestrian infrastructure throughout the area.

If there were improved transit service to PCC Sylvania campus would you likely:



Which do you think is the most viable way to improve transit service directly to the PCC Sylvania campus?



Southwest Corridor Plan

Staff Recommendations for May 2016 Decisions

Transit Mode and PCC Sylvania Tunnel

April 4, 2016

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Overview

The Southwest Corridor Plan is a package of transit, roadway, bicycle and pedestrian projects that can help reduce congestion, increase transportation options, improve safety and enhance quality of life in Southwest Portland and southeastern Washington County. The Plan defines investments to help realize the local land use visions adopted by each community in this 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 planning process has been the analysis and evaluation of both bus rapid transit (BRT) and light rail transit (LRT) performance on potential alignments to link Central Portland, Southwest Portland, Tigard and Tualatin.

The Plan is being developed by a group of partners, including jurisdictions in the project area and agencies involved in funding, constructing and operating the selected transportation investments. 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:

- 2013, adopting 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.
- 2014, narrowing the high capacity transit design options under consideration and directing staff to develop a Preferred Package of transportation investments to support community land use goals.
- July 2015, removing high capacity transit (HCT) tunnels to Marquam Hill and Hillsdale from further consideration and adopting several technical modifications to transit alignments.
- January 2016, removing two HCT alignment options in downtown Tigard, a terminus in downtown Tualatin and the adjacent to I-5 alignment north of SW 13th Avenue from further consideration, and making Bridgeport Village the preferred HCT terminus.

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

May 2016 Decisions

The decisions on mode and the PCC tunnel will complete the 18-month workplan established by the steering committee in December 2014. The workplan calls for the development of a Preferred Package of transportation investments to support community land use goals, including a preferred transit mode and terminus. The Preferred Package outlines what proposed actions will be studied in the Draft Environmental Impact Statement (DEIS) under the National Environmental Policy Act.

On May 9, 2016, the Southwest Corridor Plan Steering Committee will consider two major, inter-related questions: What is the preferred high capacity transit mode, BRT or light rail, for the Southwest Corridor? If light rail is the preferred mode, should a light rail tunnel directly serving the PCC Sylvania campus be advanced into the DEIS?

Summary of Staff Recommendations

Based on direction from the committee, technical analysis, and consideration of input from community and business groups and the general public, staff proposes the following recommendations for steering committee consideration:

- Light rail is the preferred high capacity transit mode for the Southwest Corridor
- Remove the light rail tunnel alignment to PCC Sylvania from further consideration
- Continue to explore and refine alternative options for improved transit connections to the Sylvania campus

The main reasons to select light rail are:

Greater long-term carrying capacity

- Growth in ridership demand beyond 2035 could be accommodated with light rail, but not with BRT.
- The lack of long-term peak hour capacity for BRT implies it could not be extended to other destinations in the future. The high volume of BRT buses during peak service (20 per hour) would also impact vehicular traffic on roadways throughout the corridor.

Better transit performance

- Light rail would provide faster and more reliable transit service than bus rapid transit.
- Light rail would attract more riders to the HCT line and more new riders to the overall transit system than bus rapid transit.
- Light rail would be more cost-effective to operate, with a projected lower cost per boarding.

Ability to integrate into the existing light rail system

- Light rail would have little effect on existing Transit Mall operations because a Southwest Corridor LRT line would interline with an existing MAX line (Green line or Yellow Line).
- Concerns exist about the number of BRT buses needed to serve the 2035 peak hour demand and subsequent impacts to bus traffic and light rail operations on SW Lincoln, through the Jackson Street Terminus, and along the Portland Transit Mall.

- During peak periods in 2035, Southwest Corridor BRT would add up to 20 buses an hour to the Transit Mall in each direction, utilizing capacity that light rail would preserve for future transit service needs.

Higher level of public support

- Input gathered through community engagement efforts shows a clear public preference for light rail over BRT for the Southwest Corridor.

The main reasons to remove the PCC tunnel from further study are:

- Ridership gains are not commensurate with the cost of tunnel construction, thereby reducing the project's cost effectiveness.
- The capital cost of a tunnel option could substantially reduce funding available for station connectivity projects throughout the alignment, such as locally desired bike and pedestrian investments.
- A tunnel option would likely result in a light rail terminus at the Tigard Transit Center due to the additional capital cost of the tunnel, resulting in no LRT service to Bridgeport Village and a significant drop in line ridership and cost effectiveness compared to a "no tunnel" LRT alignment.
- Tunnel construction would result in greater construction-period noise and traffic impacts along and near SW 53rd Avenue, compared to a surface alignment on Barbur/I-5, as well as residential displacement in an established neighborhood.
- Future investment on the Sylvania campus in response to an on-campus station is unclear.
- Several viable options that would connect the Sylvania campus to the light rail line on Barbur/I-5 have been developed and analyzed. These options would not perform as well as a tunnel and on-campus station, but would improve convenience, system ridership and travel times for campus transit users over existing conditions at a much lower construction cost.

High Capacity Transit Mode

Staff evaluated two high capacity transit modes for the Southwest Corridor: BRT and light rail. On December 31, 2015, staff released a comparative analysis of the mode options, the *Southwest Corridor High Capacity Transit Mode Comparison* document, which is available on the project website, www.swcorridorplan.org, and at this location:

http://www.oregonmetro.gov/sites/default/files/SWCP-ModeComparisonMemo-20151231b.pdf

The *Mode Comparison* document explains the modes and assumptions made in the analysis. The analysis evaluated the modes against twenty criteria:

- Thirteen criteria measured the modes against the project goals identified in the Southwest Corridor Plan Purpose and Need.[1]
- Seven criteria measured the modes against logistical considerations that reflect operational and financial realities—vehicle capacity, service frequency, Transit Mall capacity, transit signal treatment, interlining, federal funding and local funding.

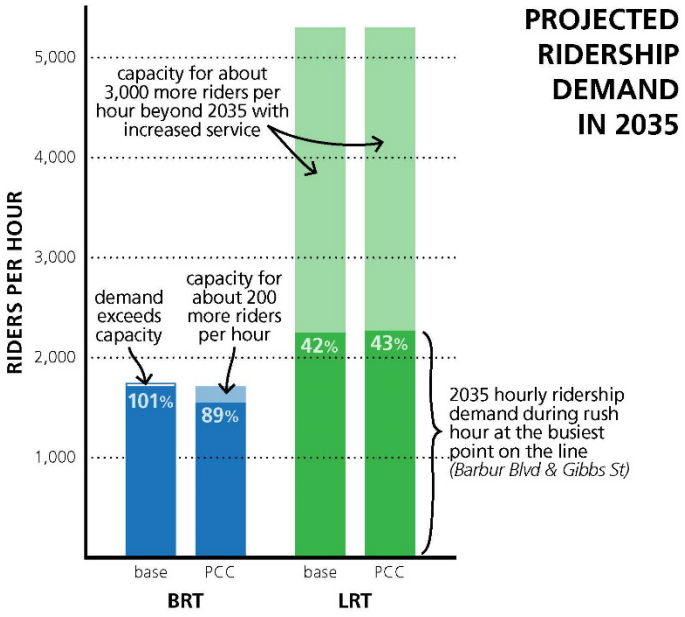
The *Mode Comparison* found that both modes would support Southwest Corridor goals for the corridor and the region. The analysis also noted that each mode has some advantages but found some major concerns related to long-term capacity of BRT to meet future travel demand in the Southwest Corridor.

The steering committee is being asked to select a preferred mode because studying both modes in the DEIS would require substantial additional time and money due to the greater scope and complexity of analysis required.

[1] The criteria used follow, with the related project goal(s) as listed on page one noted: land use and development (5, 6), access to key places (8), travel time (3), reliability (2), rider experience, capacity for current and future demand (1), road bike & pedestrian projects (8, 9, 10), local bus service (8), public opinion, equity (7), ridership (1), capital cost (11), and operating and maintenance costs (11).

Light rail benefits

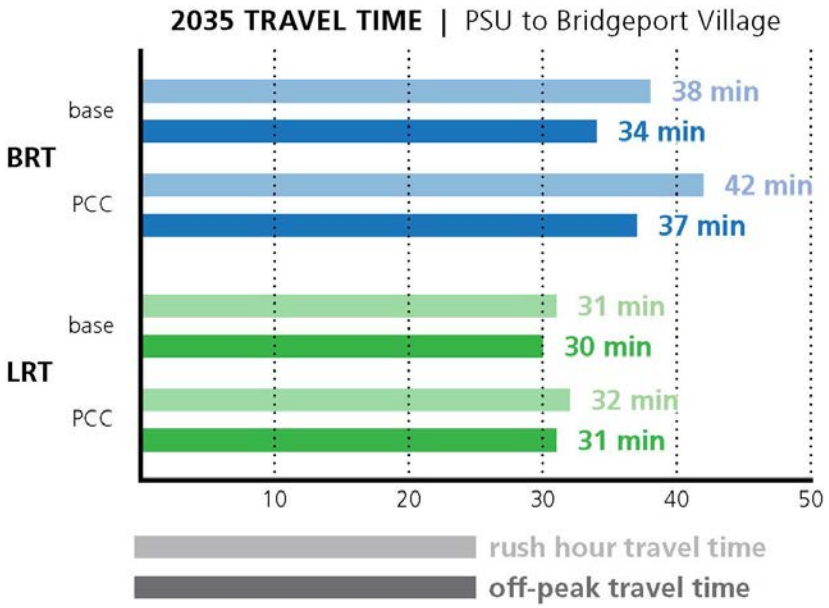
The primary advantage of light rail is its superior rider capacity and resulting ability to accommodate future transit ridership growth.



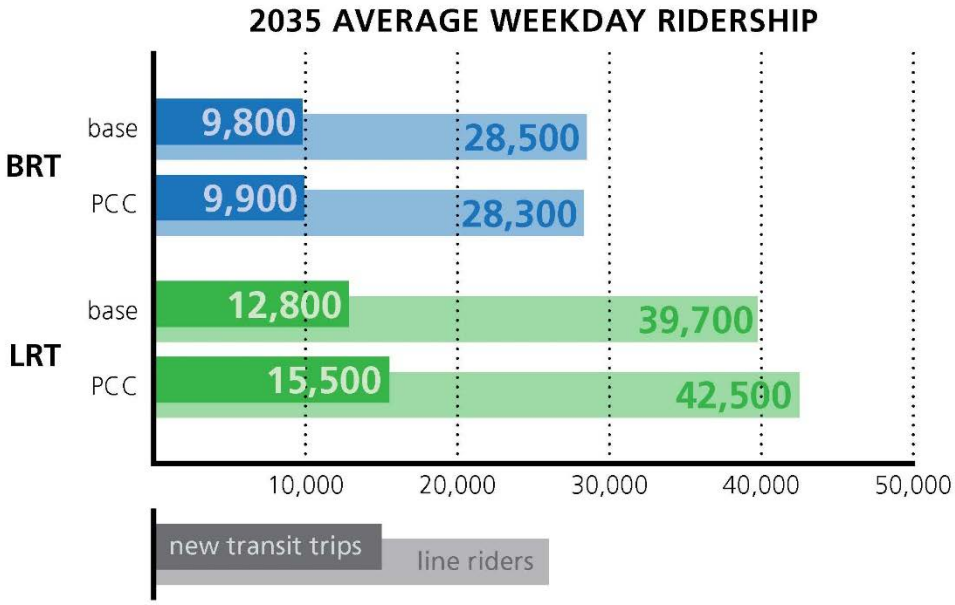
- A light rail vehicle can carry 266 people per two-car train while BRT can carry about 86 people per bus. Therefore, it would require far fewer light rail trips than BRT trips to meet rush hour demand.
- As a result, light rail could operate at about 7 minute frequencies to accommodate rush hour demand in 2035, while BRT would need to run every 3 minutes during rush hour.
- A 3-minute service frequency is roughly the maximum frequency for transit service to effectively operate in the corridor and on the Transit Mall. Consequently, as shown on the adjacent chart, BRT would already be at rush hour capacity in 2035, ten years after opening, while light rail would have capacity far beyond 2035. Light rail could add extra capacity by running more frequent trains, while BRT would already be at the maximum frequency.
- In addition, a 3-minute frequency means 20 articulated BRT bus vehicles in each direction during rush hour, navigating in mixed-use traffic segments of Barbur Boulevard and the Tigard Triangle, and possibly Capitol Highway and SW 49th Avenue. This volume of buses would likely affect local traffic operations.
- Due to its greater ridership capacity, a light rail line in the Southwest Corridor has the ability to be extended to other destinations in a later phase. Because BRT would be at rush hour capacity by 2035, it would be impractical to extend the line.

Light rail would also provide faster and more reliable transit service through the corridor, due to its use of a 100% exclusive right-of-way and greater ability to gain traffic signal priority. The following chart shows 2035 travel times during rush hour and other times, both a “base” alignment along Barbur/I-5 and an alignment that directly connects to the PCC Sylvania campus. Light rail would be faster on the base alignment by 7 minutes during rush hour and 4 minutes at other times.

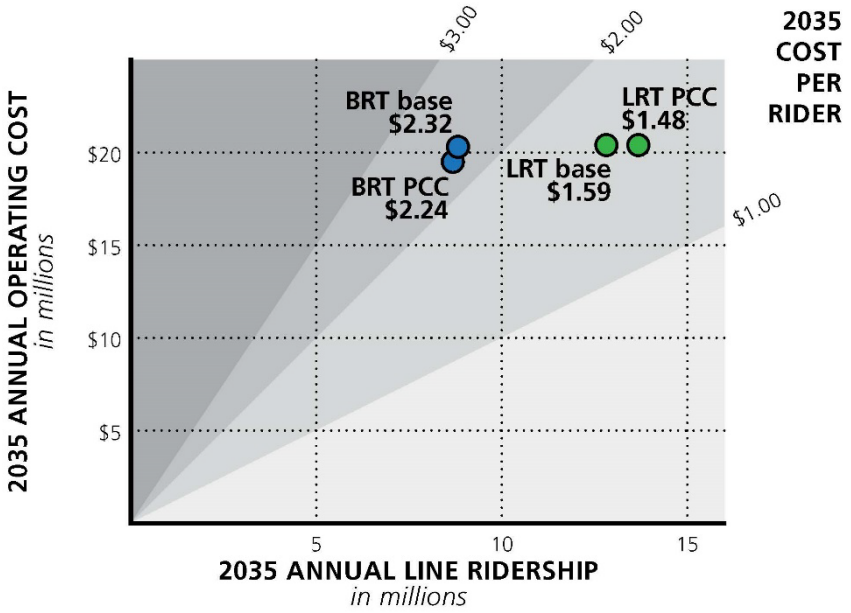
Staff analyzed whether placing BRT in a fully exclusive right-of-way would eliminate these differences, but found that a notable discrepancy in travel time and reliability would persist due to required vehicle frequencies to meet projected demand.



As a result of its better travel time, higher rider preference (per federal modeling guidelines) and greater vehicle capacity, light rail is projected to attract nearly 40 percent more daily line riders than BRT in the year 2035. The below chart shows that light rail is projected to have around 11,000 more daily riders than BRT in 2035 on the base alignment.



The differences in ridership and service frequency would also affect operating costs, with a light rail cost per rider about 55 percent lower than BRT in 2035, as shown in the following chart.



Finally, light rail would be able to interline with the existing regional MAX system and avoid adding many additional vehicles on the Transit Mall.

- Just as the Orange line MAX operates as an extension of the Yellow Line, a Southwest Corridor LRT line could utilize Green line MAX vehicles that already travel along the Transit Mall. As a result, few if any new light rail vehicles would be added to the Transit Mall.
- In contrast, BRT would add up to 20 additional buses per hour onto the Transit Mall because it could not interline with TriMet's only other anticipated BRT line, the Powell-Division line (both BRT lines would enter and exit the Transit Mall from the south).

Bus rapid transit benefits

Although staff does not recommend BRT as the preferred HCT mode for the Southwest Corridor due to the high future travel demand, BRT does offer some benefits. The chief benefit of a BRT alignment would be its lower capital cost. BRT does not require construction of tracks or electrification systems and has less substantial utility relocation requirements. BRT would also require fewer structures and result in slightly less property acquisition because trains require a slightly wider transitway and a wider turn radius. BRT can also operate in mixed traffic, reducing capital costs and property impacts by avoiding the need to widen the roadway in places. The capital costs of the base BRT alignment assumed in the analysis would be about 44 percent lower than the capital costs of the base light rail alignment.

Another advantage of BRT in the Southwest Corridor is the ability to connect directly to PCC Sylvania without an underground tunnel. Due to the steep grades between the campus and the Tigard Triangle, a direct light rail connection would require a tunnel that would increase construction costs for an alignment that goes to both Tigard Transit Center and Bridgeport Village by 21 percent compared to an alignment that is in Barbur Blvd or adjacent to I-5. BRT could be routed along SW Capitol Highway and SW 49th Avenue to reach the campus without significant differences in costs compared to a route remaining on Barbur Boulevard below the campus.

Public Input: Light rail or bus rapid transit

Throughout the last year there were several opportunities to connect with stakeholders to understand their questions, concerns and preferences regarding whether bus rapid transit (BRT) or light rail is the best choice to serve residents in the Southwest Corridor and surrounding communities. To date, project partners have collected public input on a preferred mode through open-ended questionnaires, online surveys and in-person dialogues.

During all types of public outreach, four themes consistently rise to the top when the public is asked what benefits they want a Southwest Corridor project to deliver:

- shorter travel time,
- higher ridership,
- greater reliability,
- increased access to employment and education centers.

When asked specifically about the choice between light rail and bus rapid transit respondents echoed the above themes and added additional factors that people feel are important when making the mode decision:

- capacity to serve future rush hour demand,
- capacity to extend line in the future,
- lower ongoing cost to operate per rider,
- flexibility under road blockages and extreme weather.

"Not completing the [MAX] system would be unfair to the thousands of daily SW commuters who have so far supported MAX to every other part of the metro area."

"High speed bus service can change with the times."

"Simply adding more buses is not going to provide any relief to the growing congestion in that coridor."

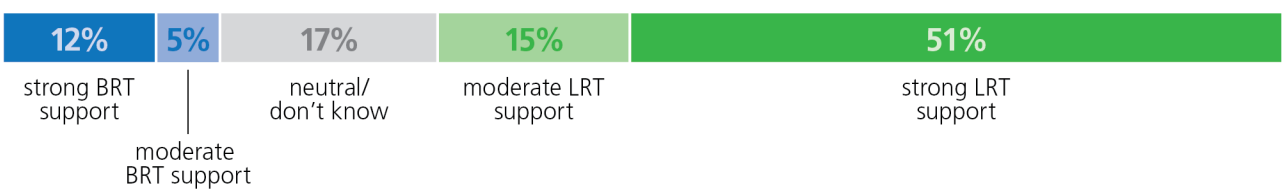
"This is about improving transportation and supporting neighborhood development for the next 50 years. It makes sense to go big."

"Expanding the light rail system is prohibitively expensive to build and operate, and inflexible for changing transportation needs."

Open-ended survey questions and in-person discussions provided a sense of how the public views the trade-offs between the mode options and their perspectives in selecting their preferred mode.The largest number of open-ended comments were in support of light rail, citing the need to think long-term, higher ridership capacity, automatic exclusive right of way and more positive public perceptions of light rail as comfortable and modern. Comments in support of BRT cite the perception that BRT is more flexible, it doesn't require fixed infrastructure, that the fleet is easier to upgrade than MAX, lower construction costs and public perception that MAX is unreliable.

What is your opinion about whether bus rapid transit or light rail is better for the Southwest Corridor?

Results from Jan-Feb 2016 online survey (2,412 responses)



Staff Recommendation

What is the preferred high capacity transit mode for the Southwest Corridor?

Staff recommends light rail for these reasons:

- **Long-term carrying capacity**: The additional construction cost of light rail is justified by its ability to meet demand while maintaining capacity for future transit projects on the Transit Mall. The *Mode Comparison* finds that BRT would not meet rush hour ridership demand in the Southwest Corridor after 2035 and therefore would not be an effective investment for this corridor despite its lower construction costs.
- **Better transit performance:** Light rail would provide faster and more reliable transit service, attract more riders to the HCT line and more new riders to the overall transit system, and be more cost-effective to operate.
- **Ability to integrate into the existing light rail system:** Light rail would have little effect on existing Transit Mall operations because a Southwest Corridor LRT line would interline with an existing MAX line, preserving future capacity for future transit service needs.
- **Higher level of public support:** Input gathered through community engagement efforts shows a clear public preference for light rail over BRT for the Southwest Corridor.

Overall, light rail would best meet the project's Purpose and Need. Compared to BRT, it would be better at serving the existing and projected transit demand in the corridor, improving transit service reliability in the corridor, improving transit travel times and providing transit service that is cost effective to build and operate with limited local resources.

Staff notes this recommendation is specific to the Southwest Corridor. Mode decisions for future HCT alignments each need analysis that accounts for unique features in a project area. In particular, BRT may be a promising option for corridors with lower ridership projected than in the Southwest Corridor.

The implications of this recommendation are:

- BRT would no longer be studied as part of the Southwest Corridor Plan. Only light rail would be evaluated in the DEIS.
- Alignment options that are unique to BRT, including a direct surface connection to PCC Sylvania, would be removed from further consideration.
- The steering committee will consider a separate action on whether to continue study of a light rail tunnel to PCC Sylvania. The staff recommendation on this decision is outlined in the following section.

Tunnel to PCC Sylvania campus

The PCC Sylvania campus is a major regional destination and direct HCT service would serve its employees and students, who travel from across the region. PCC Sylvania was identified as an "essential place" in the SW Corridor during existing conditions analysis in 2012, and project partners are in strong support of improving transit access to the campus. Better transit connections would allow PCC to further develop the campus and reduce its expenditures on inter-campus shuttles, lower transportation costs and/or travel times for students, and help meet climate action goals related to vehicle greenhouse gas emissions.

The Sylvania campus, however, is difficult to reach by light rail, requiring a tunnel for access. In June 2014, the steering committee identified a cut-and-cover option as the most promising tunnel approach to serve the campus. The committee removed from consideration longer bored tunnels via SW Barbur Boulevard and via SW Capitol Highway because both would cost considerably more than the cut-and-cover option without providing significantly greater benefits in terms of ridership and travel time.

In July 2015, the steering committee directed project staff to conduct additional analysis and public outreach to better understand trade-offs of direct service versus cost and construction impacts, and to learn more about future campus planning efforts. In response, staff:

- Explored additional tunnel designs that would reduce neighborhood impacts and indirect connection options to the campus
- Worked with PCC to develop campus visioning and identify potential redevelopment in response to an investment in an light rail station on campus, and collect student and staff travel data
- Engaged the neighborhoods surrounding the campus and the college community
- Met with PCC staff to define an ongoing partnership in support of the Southwest Corridor Plan.

Staff documented its efforts in a series of published reports:

On August 14, 2015, staff released the *PCC Sylvania Light Rail Options Technical Memo* (http://www.oregonmetro.gov/sites/default/files/SWCP-PCC-Tunnel-Technical-Memo-20150814-web.pdf). This document reported research on different tunnel design options and possible mechanized and pedestrian connection options from a station on SW Barbur Boulevard to the campus. A bored tunnel option under SW 53rd Avenue was introduced as a way to reduce neighborhood impacts at a comparable cost to a cut-and-cover tunnel design.

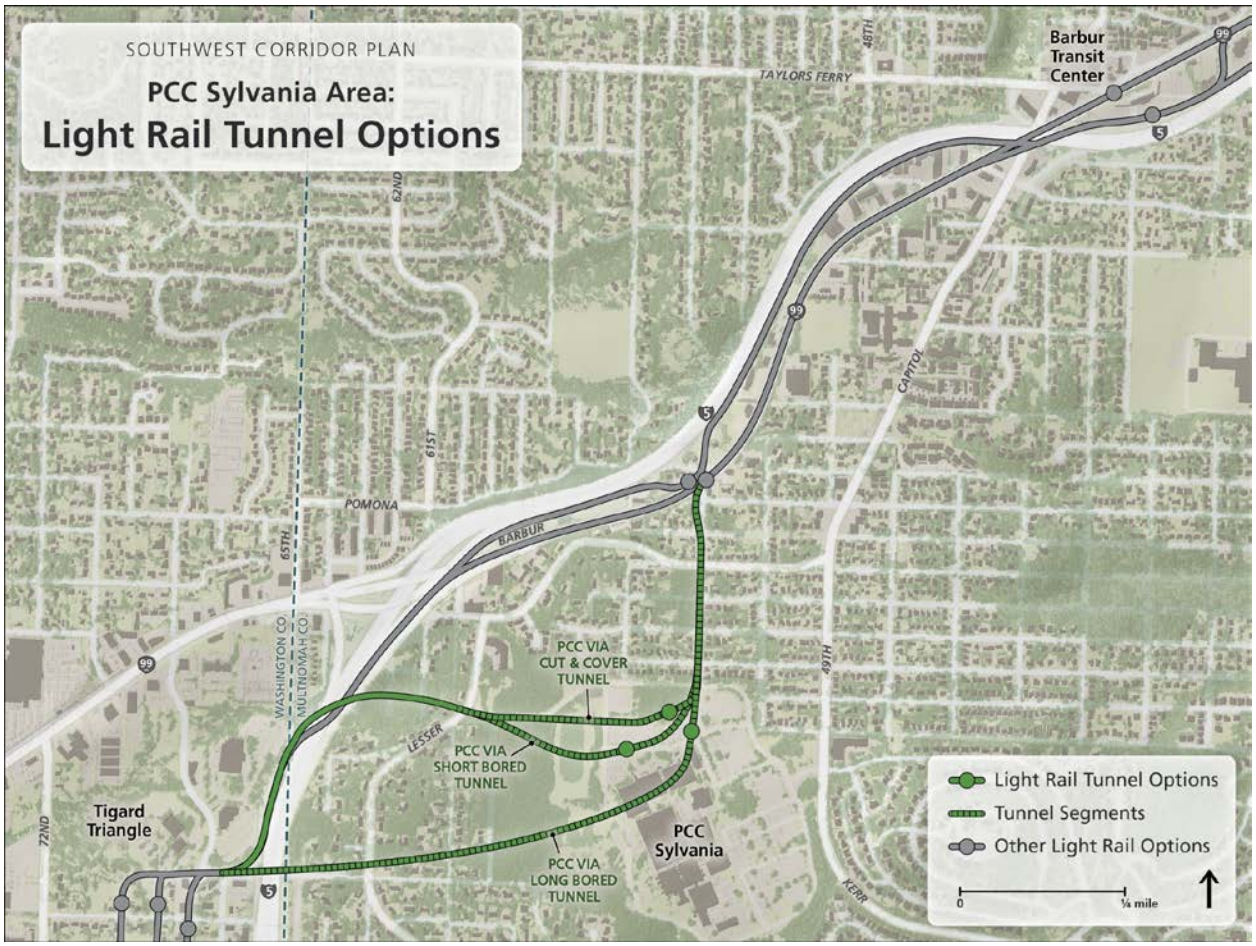
On September 11, 2015, staff released the *PCC Sylvania Connection: Status of Further Investigation* (http://www.oregonmetro.gov/sites/default/files/SWCP-PCC-Status-Memo-20150911.pdf). This document reported staff's progress refining tunnel designs and exploring alternative connection options; PCC's progress in developing campus visioning and providing student and staff travel data; and joint progress in engagement with surrounding neighborhoods and the campus community as well as defining a formal partnership.

On December 31, 2015, staff released the *PCC Sylvania Enhanced Connection Options Technical Memo* (http://www.oregonmetro.gov/sites/default/files/SWCP-PCCConnections-TechnicalMemo-20151231.pdf). This document described potential non-HCT connections to PCC Sylvania and provided basic information on relative performance and feasibility.

On March 11, 2016, staff released the *High Capacity Transit Technical Evaluation: Direct and Indirect Connection Options to PCC Sylvania Campus* (http://www.oregonmetro.gov/sites/default/files/SWCP-PCC-connection-options-tech-evaluation-20160311.pdf). This document quantitatively assessed the tradeoffs and comparative performance between various options for direct and indirect HCT access to the campus.

Tunnel options

There are three tunnel designs under consideration—a cut-and-cover tunnel, a short bored tunnel with a bridge over I-5 and a long bored tunnel that would pass under I-5. All of the tunnel options would include a station and park-and-ride lot near Barbur and 53rd and an underground station in the northern portion of the PCC Sylvania campus. The tunnel designs would vary in their impacts on surrounding neighborhoods, but would be similar in cost and performance.



A tunnel would provide the best transit access for the campus compared to an indirect connection. According to 2035 projections, a light rail tunnel to PCC Sylvania would improve transit mode share at the campus compared to an alignment along Barbur, with almost 70 percent more transit ons and offs. That increase is mainly because, compared to a walking connection to station at Barbur and 53rd, a tunnel would provide a notably faster travel time between the Sylvania campus and regional destinations such as Portland State University (saves 6 minutes), Barbur Transit Center (3 minutes), Tigard Transit Center (6 minutes), Bridgeport Village (7 minutes) and other PCC campuses (7 to 9 minutes). A tunnel would increase travel time for light rail riders traveling between downtown Portland and Tigard by about one minute.

Input provided by the campus community has indicated strong support for a direct HCT connection to PCC Sylvania, and general public input shows interest in further study of a tunnel.

Despite these advantages, the tunnel would result in numerous issues that would threaten the Southwest Corridor Plan's ability to operate effectively and reach other destinations:

- **Overall cost, shortened alignment and lower ridership:** A tunnel to PCC Sylvania would increase total light rail project construction costs by about 21 percent. This capital cost would exceed the project's ability to reach Bridgeport Village within projected funding levels, so staff modeled a tunnel alignment that terminates at the Tigard Transit Center and would cost about the same as a light rail alignment along Barbur with a walk/bike connection to the campus and terminus at Bridgeport Village. The analysis, documented in *Direct and Indirect Connection Options*, found that in comparison, the cost-constrained tunnel alignment would have many more transit boardings on the campus (+69%, about 2,200 more boardings) and more households within a 60 minute transit trip of the campus (+2%), but would result in
    - Fewer system and line riders (18% and 6% less, respectively)
    - Higher operating costs per rider (10% higher)
    - Fewer households with a one-seat ride to campus (3% less)
- **Reduced bike/walk network investments**: High construction costs may preclude funding for complementary pedestrian, bike and roadway projects in the SW Corridor—both priority Shared Investment Strategy projects and locally identified needs for station access

In addition, the Far Southwest Neighborhood Association, representing the area most affected by a tunnel, has indicated strong opposition to a tunnel alignment for the following reasons:

- **Substantial construction-period impacts** (noise and traffic, among others) to surrounding neighborhoods
- **Possible permanent noise and vibration** impacts to nearby residences
- **Displacement of residences** from an established neighborhood

The return on a tunnel investment is also unclear:

- **Seasonal use of Sylvania campus**: An on-campus station would have limited use during weekends and in summer when classes are not in session
- **No updated campus plan:** There is no specific plan for a campus response to this major regional investment. PCC staff has discussed possibilities for the Sylvania campus, but the College's long-term vision for the campus and development in response to an HCT investment remain undefined.

Alternative connections

Staff has developed and analyzed several enhanced ways to connect the campus to a light rail station around 53rd and Barbur. (The indirect connection scenarios all assumed a light rail mode, because a direct BRT alignment to PCC Sylvania would have been possible without a tunnel.) These alternative connections include:

- A bus hub, which would re-route local buses and/or add new bus service to the campus, thereby providing one-seat rides (no transfer) to PCC Sylvania from all directions (north, east, south and west).
- A TriMet shuttle, which would run frequent dedicated buses between PCC Sylvania and the light rail stations at Barbur Transit Center and in the Tigard Triangle. Unlike the bus hub option, the shuttle would only need to run when the campus is in session and could be timed with light rail train arrivals in order to minimize waiting time.
- An aerial tram or some other mechanized connection between a light rail station at 53rd/Barbur and the campus.

In addition, an enhanced pedestrian and bicycle connection between a light rail station around 53rd and Barbur and the Sylvania campus would be included in any light rail alignment.

See *Direct and Indirect Connection Options* (dated March 11, 2016) for further description and comparison of these options. Based on the analysis to date, there are multiple viable alternatives to a direct tunnel connection. The alternatives do not provide the same level of transit ridership or travel time savings for the campus as an underground on-campus station, however they would:

- Cost substantially less to construct and have a lower level of neighborhood impacts than a tunnel
- Result in higher line ridership, system ridership, and comparative operational costs per rider and household access to the campus, compared to the cost-constrained tunnel (Tigard Transit Center terminus)
- Save time for PCC Sylvania transit riders and increase system ridership, compared to a walk/bike connection only

Additional technical analysis is required for a final assessment of performance.

Access to PCC Sylvania campus

The public has a diverse set of opinions about the need to improve transit access to PCC Sylvania and what direct and indirect options are most preferred. Staff generated input through open-ended questionnaires, online surveys and in-person discussions from winter 2015-winter 2016.

Key overall themes

- A majority of people who responded online and in person felt that directly serving the campus with high capacity transit or increased bus service was important.
- Many people online and in person felt that the high cost of tunnels exceeded their benefits. Others felt the cost was worth it to create opportunity and deliver the most benefit to the region over the long term.
- People who participated in-person at meetings felt more strongly than online respondents that construction impacts to communities should be a major factor for decision makers to consider.
- Many respondents felt that improved local buses or campus shuttles were the best way to connect to campus.
- Many respondents wanted the project to improve campus connections from communities in Washington County.

January-February 2016 online survey (2,424 respondents)

We presented high-level details and links to additional technical information on each of the eight options to directly or indirectly serve the PCC Sylvania campus with high capacity transit or improved local bus service. We asked repondents to select any and all options that they felt were promising.

- 25-38% of respondents selected bored light rail tunnel (38%), light rail on Barbur Blvd. with local bus hubs (38%), improved walk/bike facilities on SW 53rd Ave. (32%), cut-and-cover tunnel (30%), use of shared transit way and "branded" buses (26%) as promising options.
- 11-23% of respondents selected aerial tram plus walk/bike improvements along SW 53rd Ave. (22%) and bus rapid transit options on Capitol Hwy. (23%) and Barbur Blvd. (19%) as promising options.

The input highlighted in this report occured throughout many months during which new options for serving the campus were added or refined. Not all surveys asked about the same set of connection options.

Spring 2015: cut-and-cover tunnel to campus, light rail on Barbur Blvd with SW 53rd Ave. walk/bike improvements and bus rapid transit on Capitol Hwy. or Barbur Blvd.

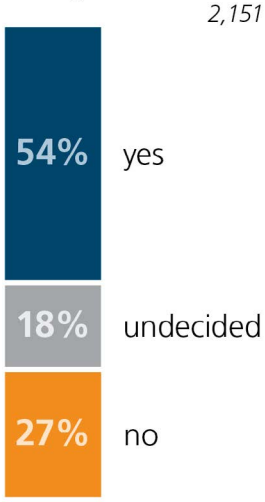
Fall 2015: light rail bored tunnel option and mechanized connections from Barbur Blvd. to campus added

Winter 2015: aerial tram, local bus improvements using shared transitway, bus hub and branded lines added

Spring 2016: additional evaluation of all options being considered

Should the steering committee continue more detailed study of the light rail tunnel options?

2,151 responses



West Portland Park Neighborhood Association

Neighborhood leaders developed their own online survey in September 2015 that generated 69 responses.

- Survey results indicated overall support for the Southwest Corridor project (83%), and support in general for a high capacity transit connection to PCC Sylvania and the West Portland Park area (74% support).
- Support was split somewhat evenly between a light rail tunnel (42%) and bus rapid transit (52%) as the preferred high capacity transit option for the area.

Far Southwest Neighborhood Association

Neighborhood leaders developed their own online survey in September 2015 that generated 58 responses.

- Results show a majority opposition to both a bored tunnel (67% oppose) and a cut-and-cover tunnel (79% oppose) to directly serve the Sylvania campus.
- A majority of respondents (65%) and many open-ended comments favored increasing the frequency of current bus lines or creating new express bus lines to PCC Sylvania from downtown Portland.
- Respondents were divided in their support (56%) or opposition (40%) for Metro continuing plans for any high capacity transit.

"I understand the need to improve access to PCC. However, I urge the committee to focus its efforts on the other options [than the tunnel]."

"Tunnels always greatly exceed budget predictions."

"PCC or bust. Not serving a major regional destination with a major regional transit line would be a huge mistake."

"A light rail line [to campus] would greatly assist students and decrease excessive on-campus parking."

"Please keep in mind that Sylvania is in session something like 180 days a year. It's not a business where employees go on a daily basis."

PCC student and staff survey

Project staff engaged in person and developed an online survey for PCC students, faculty and staff in September-October 2015. The survey generated 676 responses.

Key findings:

- Most respondents (78%) would use transit more if there was improved transit service to PCC Sylvania.
- A majority of respondents (61%) think a light rail tunnel is the most viable way to serve campus.
- A majority of respondents (60%) said they were somewhat likely or very likely to use improved bike and pedestrian access along SW 53rd Ave. to campus.
- Open-ended comments addressed a variety of issues including a need to improve frequency and reliability of existing TriMet routes and campus shuttles, and concerns regarding cost and neighborhood distruption with tunnel construction.

You can read the previously published full summaries of these online surveys and public discussions, and appendices of all survey data at the project library, www.swcorridorplan.org.

Staff Recommendation

Should a light rail tunnel directly serving the PCC Sylvania campus be advanced into the Draft Environmental Impact Statement?

PCC is an important partner and the Sylvania campus is a high-profile destination that needs to be well-served by transit for the Southwest Corridor Plan to be successful. A tunnel would clearly succeed in growing transit ridership to the campus. However:

- The **significant cost** of constructing a tunnel and **potentially high neighborhood impacts** would not be commensurate to the ridership benefits and would jeopardize construction of a cost-effective LRT project that includes station connectivity projects and local pedestrian, bike and roadway investments.
- Preliminary analysis suggests there are **viable other ways to link the Sylvania campus to light rail** which would improve convenience, system ridership and travel times for campus transit users over existing conditions at a much lower cost than a tunnel.
- Because the **long-term plan for the Sylvania campus is unclear**, it is not possible to evaluate the amount and type of new development that would result from a direct versus an indirect LRT connection. Project and PCC staff have been meeting to discuss the benefits and disadvantages of a tunnel compared to indirect connection options. PCC staff has stated its preference for a direct HCT connection, but also acknowledged the issues listed above. The **College is willing to support an alternative connection** that greatly improves upon its existing transit service in lieu of a direct tunnel connection.

Overall, a light rail alignment on Barbur/I-5 with an improved link to the PCC Sylvania campus would best meet the project's Purpose and Need. Due to the cost trade-offs of a tunnel option, an alignment without a tunnel would be the better option to serve the existing and projected transit demand in the corridor, 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, and provide transit service that is cost effective to build and operate with limited local resources.

Staff therefore recommends:

- Removing a light rail tunnel to PCC Sylvania from further consideration.
- Continued exploration and refinement of alternative transit connections to the campus, working with PCC to plan appropriate service improvements.
- Renewed emphasis on the importance of robust bike and pedestrian connectivity both to the Sylvania campus and throughout Southwest Portland.

As a result of this recommendation, the DEIS would include light rail alignments in Barbur Boulevard and adjacent to I-5 in the area from Barbur Transit Center to Portland city limits. Both alignments include a station at or around SW 53rd Avenue, a park-and-ride facility near the station, and enhancements to SW 53rd Avenue to improve the pedestrian and bike connection from light rail to the campus.

Next Steps

Project staff will present these recommendations to the Southwest Corridor Steering Committee at the April 6, 2016 steering committee meeting, which will be followed by a public forum allowing for discussion of these recommendations. Staff will also provide opportunities for online public feedback on these recommendations, and will reach out to PCC as well as community members in neighboring areas to solicit their comments. One week prior to the May 9, 2016 meeting, staff will share any feedback regarding these recommendations and report any adjustments for steering committee consideration.

After the May 9, 2016 decisions, staff will publish a *Draft Preferred Package* document summarizing the HCT project resulting from the refinement decisions made in July 2015, January 2016 and May 2016. At its June 13, 2016 meeting, the steering committee will review the *Draft Preferred Package* and make any adjustments necessary to finalize and endorse it. That will conclude the Refinement Phase of the Southwest Corridor Plan and initiate the beginning of the Environmental Review and Project Development Phase. The below table summarizes the currently anticipated schedule.

The Preferred Package as well as selected roadway, bicycle and pedestrian projects[2] will receive full environmental review in an Environmental Impact Statement (EIS) under the National Environmental Policy Act. Public input on the scope of the EIS is currently anticipated to occur in August and September, 2016. Further details on the EIS process and schedule will be released in upcoming months.

Upcoming Southwest Corridor Plan Schedule	
April 2016	• Public comment on staff recommendations for mode and PCC Sylvania tunnel • April 6 steering committee meeting and public forum – presentation and discussion of staff recommendations
May 2016	• May 2 – release of steering committee packet, including summary of public input received on staff recommendations • May 9 steering committee meeting – decisions on mode and PCC Sylvania tunnel • Publication of *Draft Preferred Package* • Public engagement on road/bike/pedestrian projects
June 2016	• June 13 – adjustments to and endorsement of *Draft Preferred Package* • Publication of *Final Preferred Package* • End of Refinement Phase, Start of Environmental Review and Project Development • Public engagement on road/bike/pedestrian projects

[2] A public input process will occur in spring and summer 2016 to help select which roadway, bicycle and pedestrian projects are studied in the DEIS. These road/bike/pedestrian projects will be largely drawn from the set of priority Shared Investment Strategy projects adopted by the steering committee in July 2013, and may include other projects identified locally.

GREAT PLACES
SW Corridor
Portland • Sherwood • Tigard • Tualatin
Beaverton • Durham • King City
Washington County • ODOT • TriMet • Metro

Southwest Corridor High Capacity Transit Mode Comparison

Released December 31, 2015

Updated January 13, 2016 to fix minor errors – see Errata, p. 39

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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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:

Buttons in the graphic table of contents:

ridership, p. 26

Links to related information in the sidebar and body text:

service frequency, p. 31

Links in the summary tables:

equity, p. 24

Shortcuts to return to the table of contents:

return to the table of contents, p. 3

CONSIDERATIONS: PROJECT GOALS

LAND USE

COMMUNITY

MOBILITY

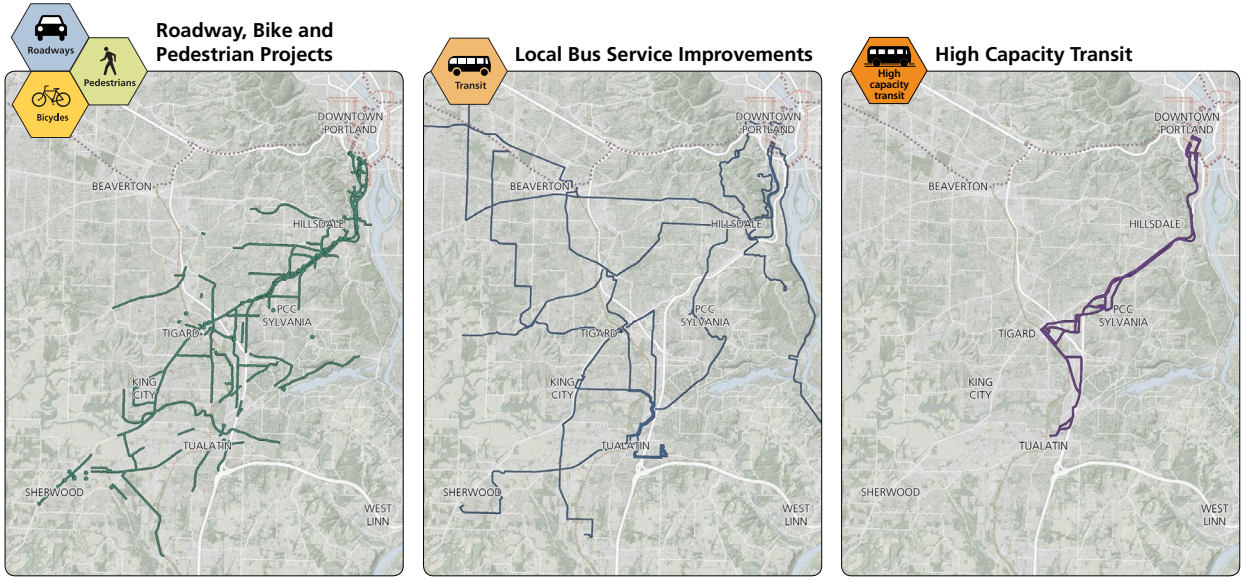
COST-EFFECTIVENESS

CONSIDERATIONS: LOGISTICS

OPERATIONS

FINANCE

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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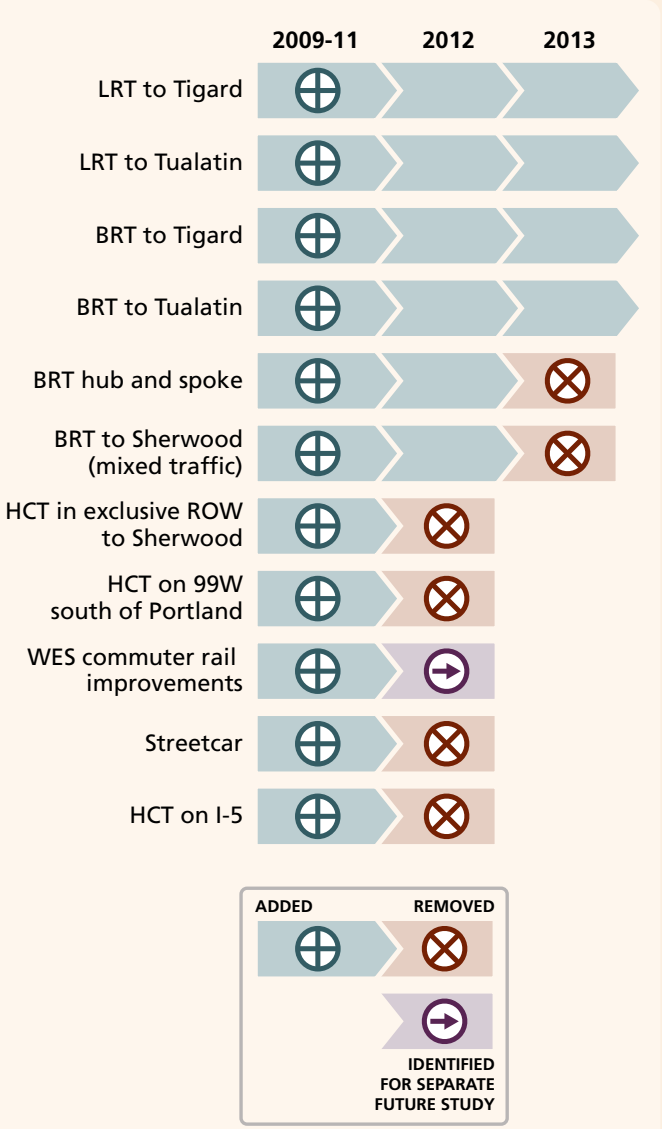
EARLY NARROWING OF MODE AND ALIGNMENT

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

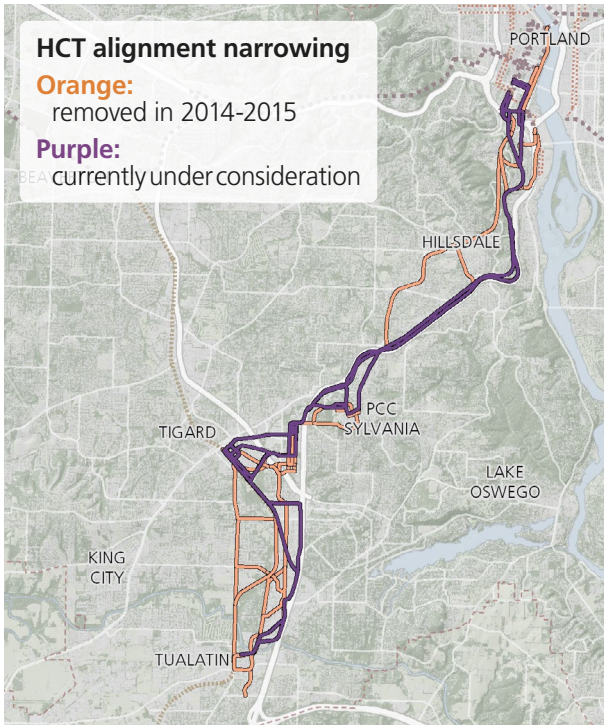
The steering committee removed tunnels to Marquam Hill and Hillsdale and accepted technical modifications to the remaining options.

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

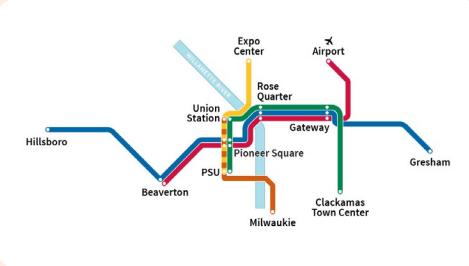
2009 WES Commuter Rail
I-205 MAX Green Line

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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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:

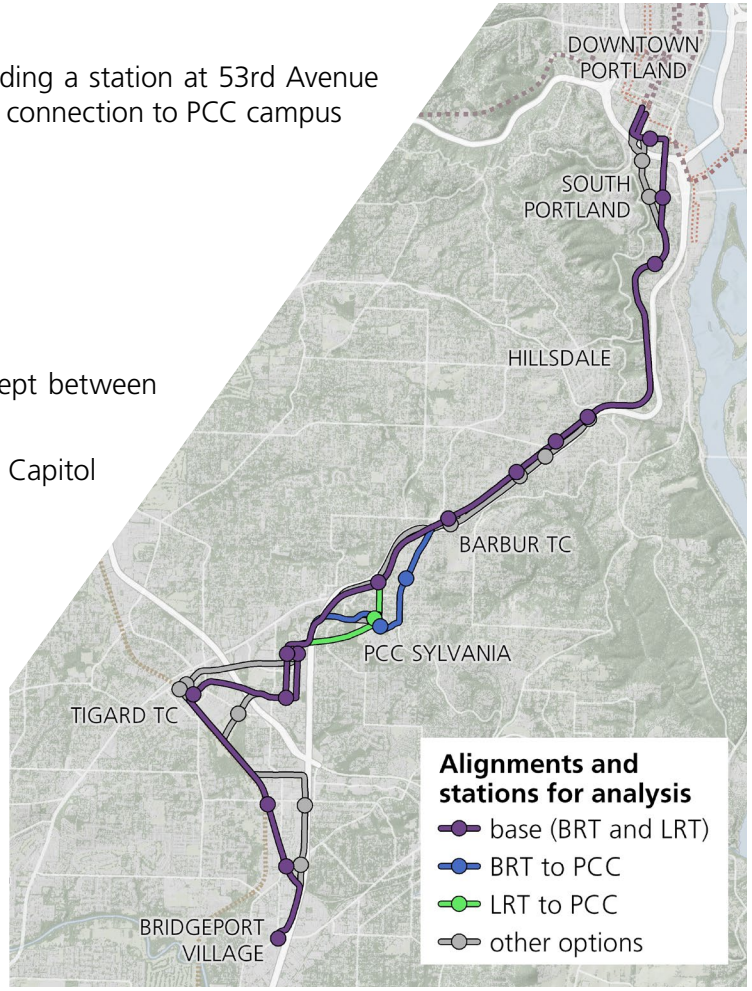
- Naito Parkway in South Portland
- Barbur Boulevard from Naito to 60th Avenue, including a station at 53rd Avenue with a park-and-ride lot and an enhanced walk/bike connection to PCC campus
- 68th/70th Avenue couplet in the Tigard Triangle
- Ash Avenue option in downtown Tigard
- Adjacent to freight 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** *2035 PSU to Bridgeport Village*	38 min peak 34 min off-peak	42 min peak 37 min off-peak	31 min peak 30 min off-peak	32 min peak 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** *2035 average daily new system transit trips and line riders*	9,800 new transit trips 28,500 line riders	9,900 new transit trips 28,300 line riders	12,800 new transit trips 39,700 line riders	15,500 new transit trips 42,500 line riders
	capital cost, p. 27 *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 *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 *2035 PSU to Tigard* *(see p. 29 for frequencies south of Tigard)*	3.0 min peak *(demand for 2.9 min)* 12 min off-peak	3.3 min peak 12 min off-peak	6.7 min peak 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:

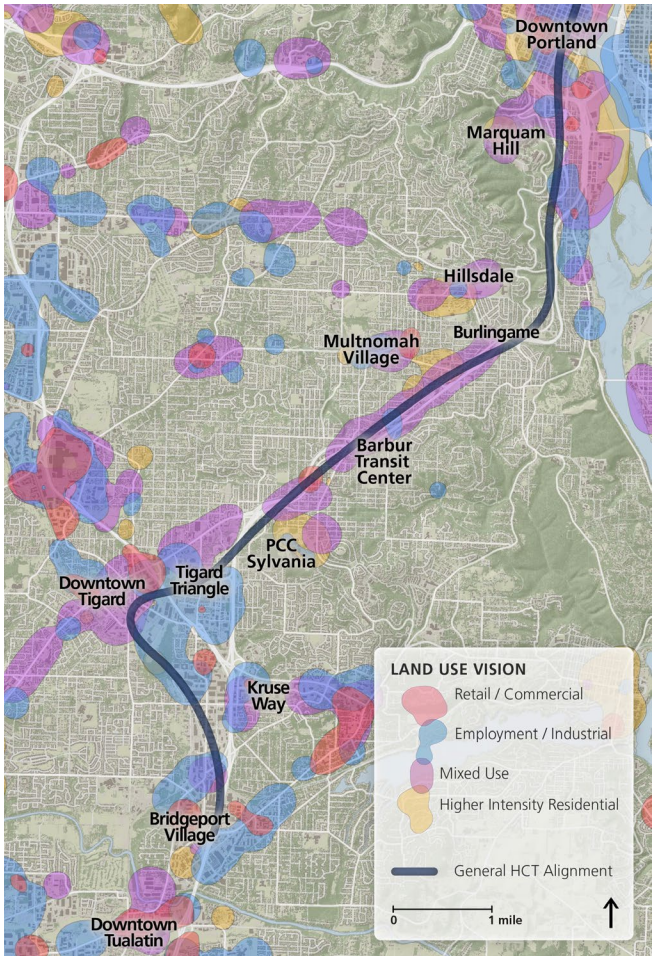
- Both BRT and LRT would serve many of the areas prioritized for future development in the corridor land use vision.
- Introduction of LRT has a documented impact on development, attracting private investment to station areas. While BRT includes many of the same amenities as LRT and streetcar that attract 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.

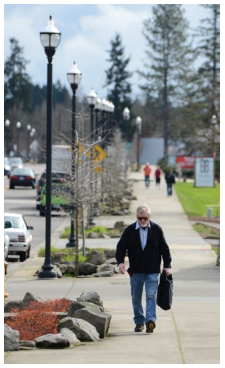
How well would BRT and LRT support the land use visions of the corridor communities?

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.

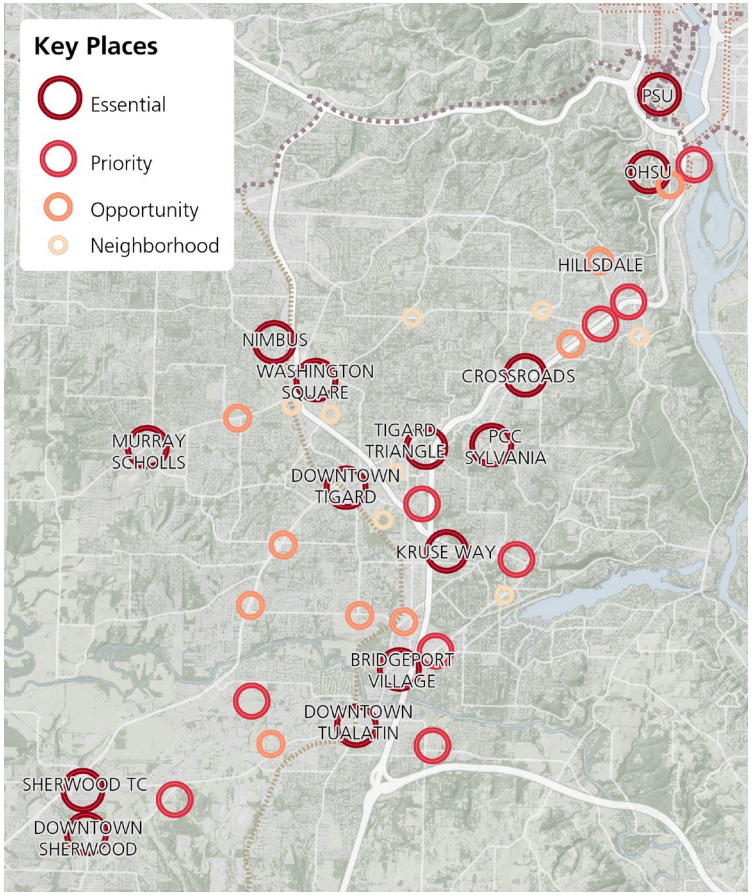
RELATED CONSIDERATIONS

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

return to the table of contents, p. 3

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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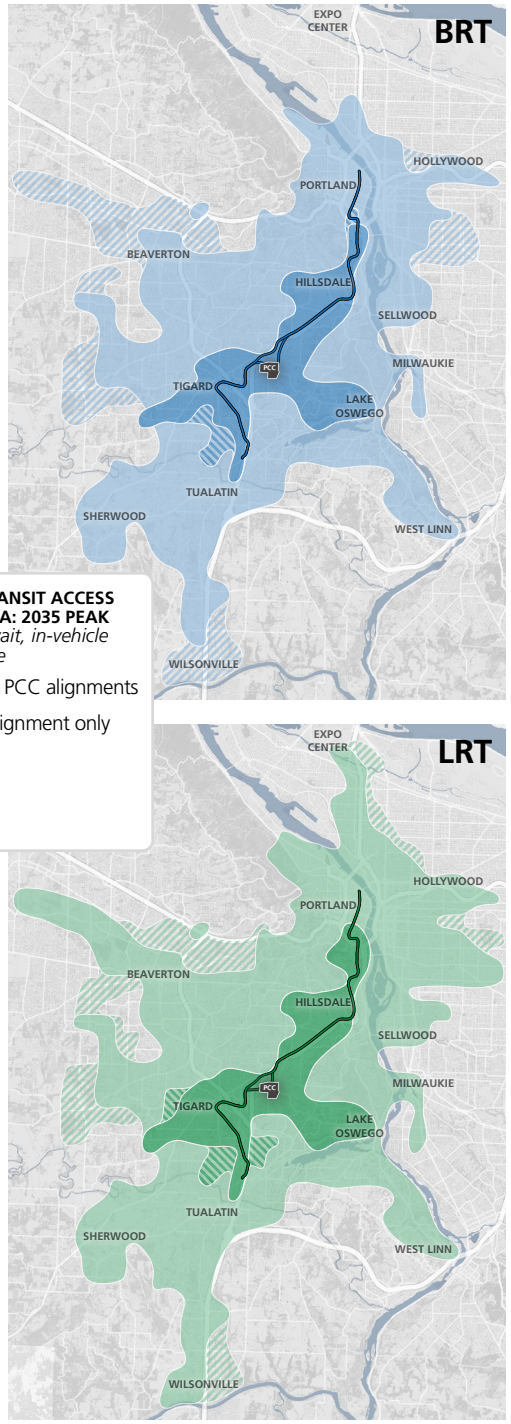
Sylvania has the largest enrollment of the four PCC campuses. In the fall 2015 term, the campus had 14,200 students, or a full-time equivalent of 3,100. Yet due to its location in a residential area on a hill, the Sylvania campus is challenging to serve with transit. While some students, teachers and 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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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:

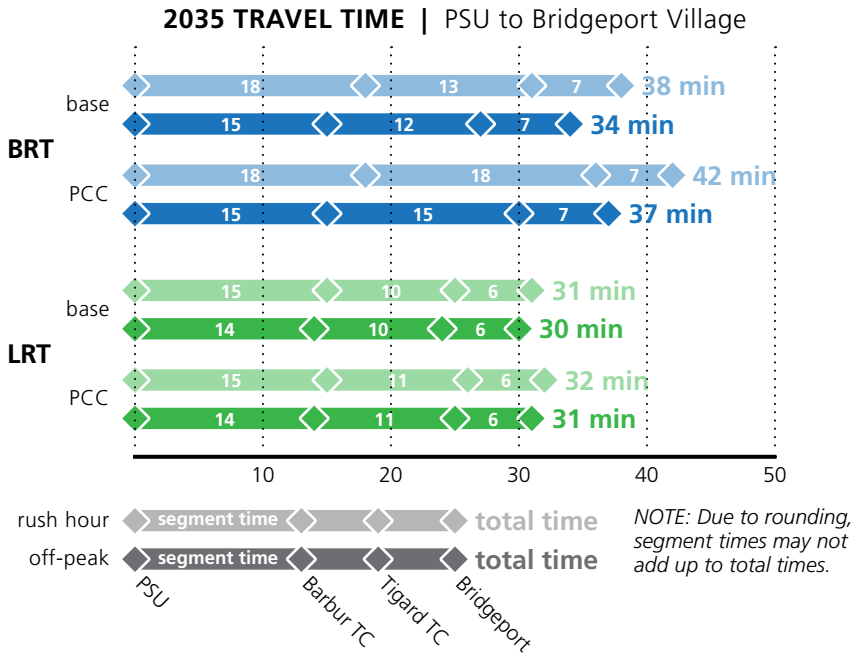
- How would travel time compare between BRT and LRT? Why would BRT be slower than LRT?
- How would reliability compare between BRT and LRT?
- How would the rider experience differ from standard buses and between BRT and LRT?
- Would each mode serve the projected ridership demand both today and into the 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 slower 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

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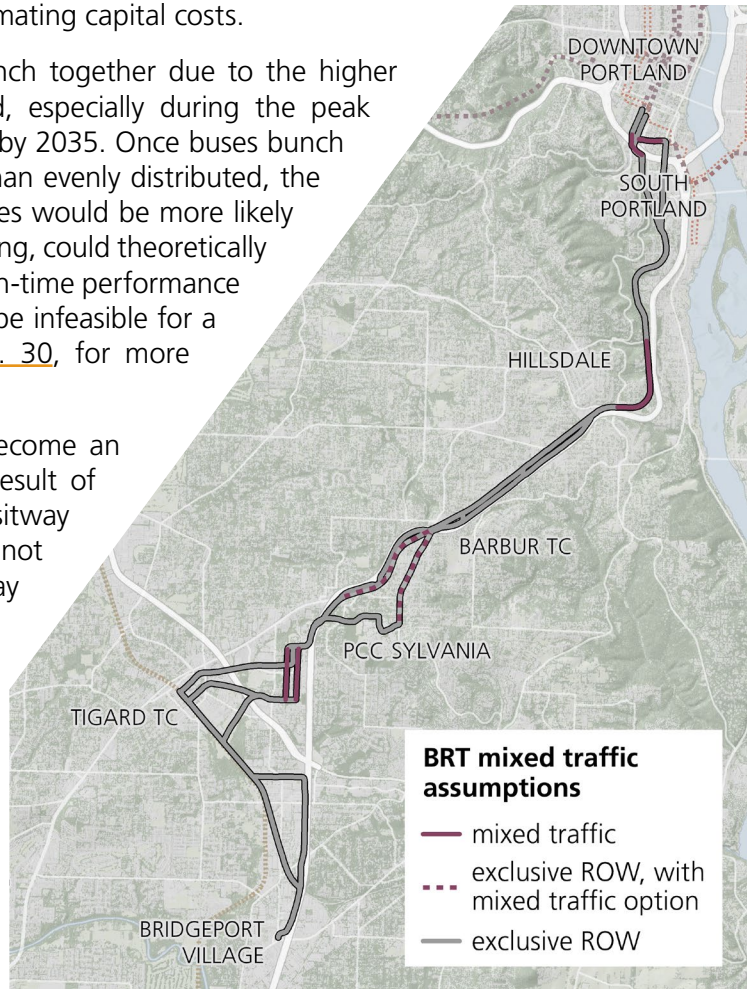
How would reliability compare between BRT and LRT?

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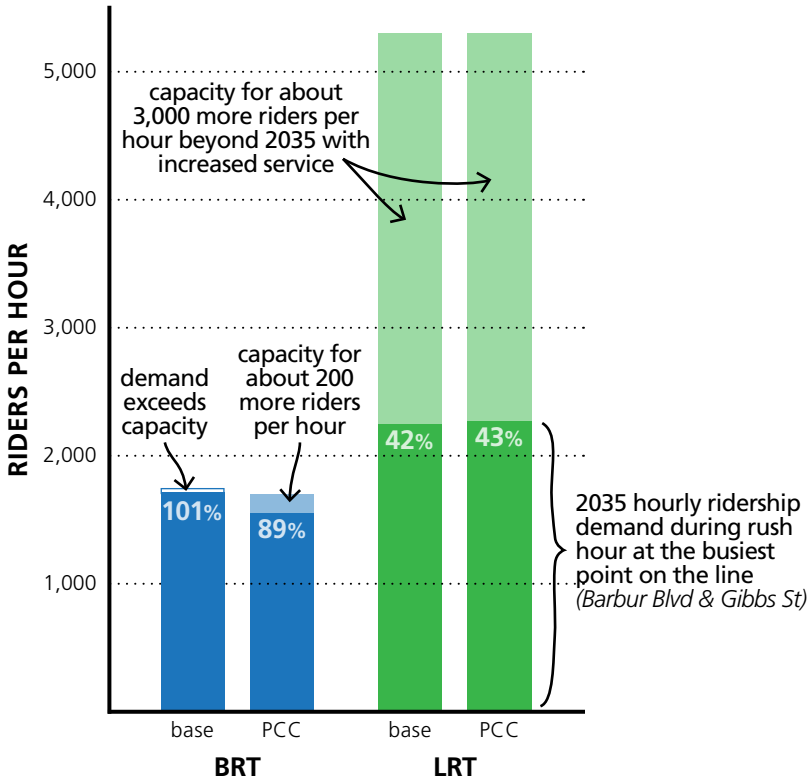
Would each mode serve the projected ridership demand both today and into the future?

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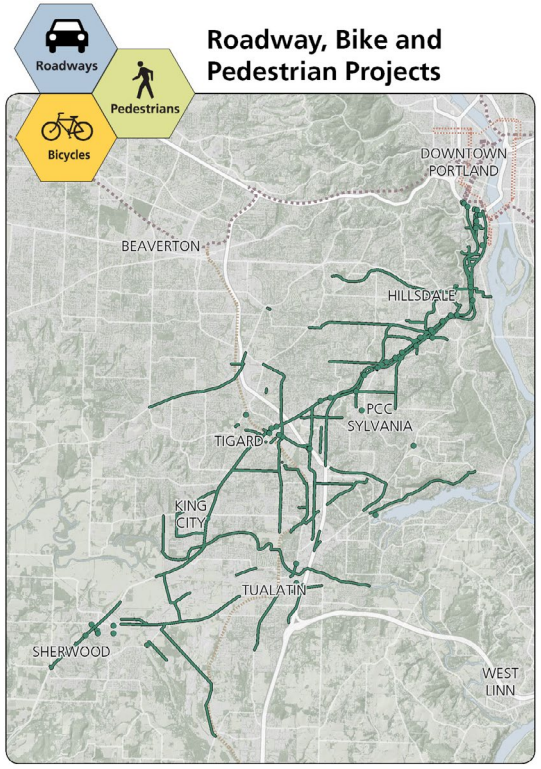
What road, bike and pedestrian projects are included in the Southwest Corridor Plan?

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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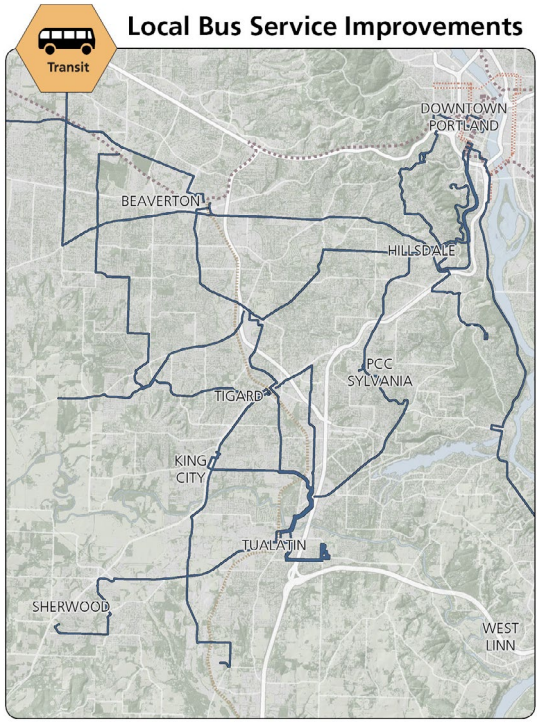
What local bus service changes are proposed for the corridor?

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

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

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.

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:

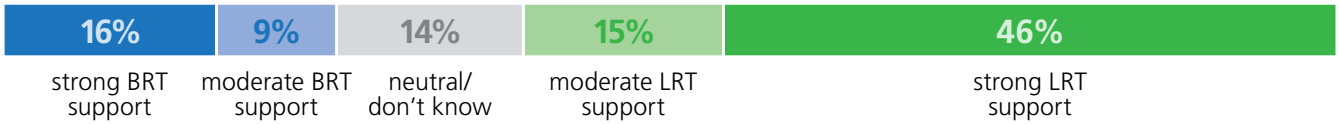
- reliable, fast travel times
- high ridership numbers that will result in fewer cars on the road
- access to employment and education centers

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

return to the table of contents, p. 3

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 21 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.

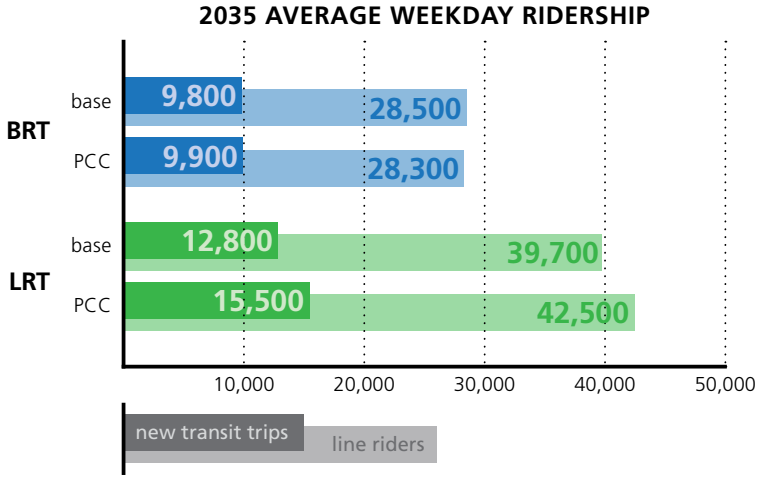
RELATED PROJECT GOALS

- 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 21 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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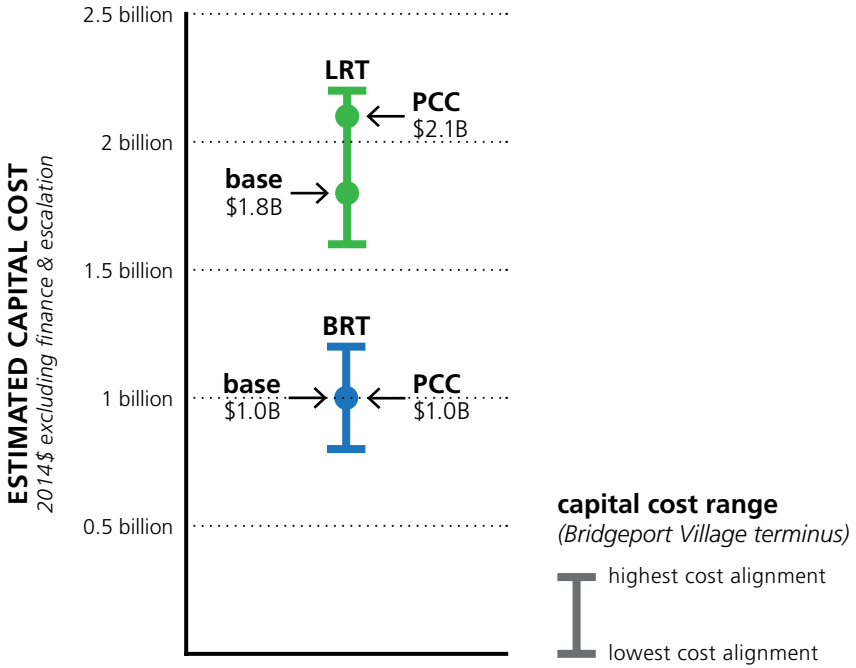
How would capital cost differ between BRT and LRT?

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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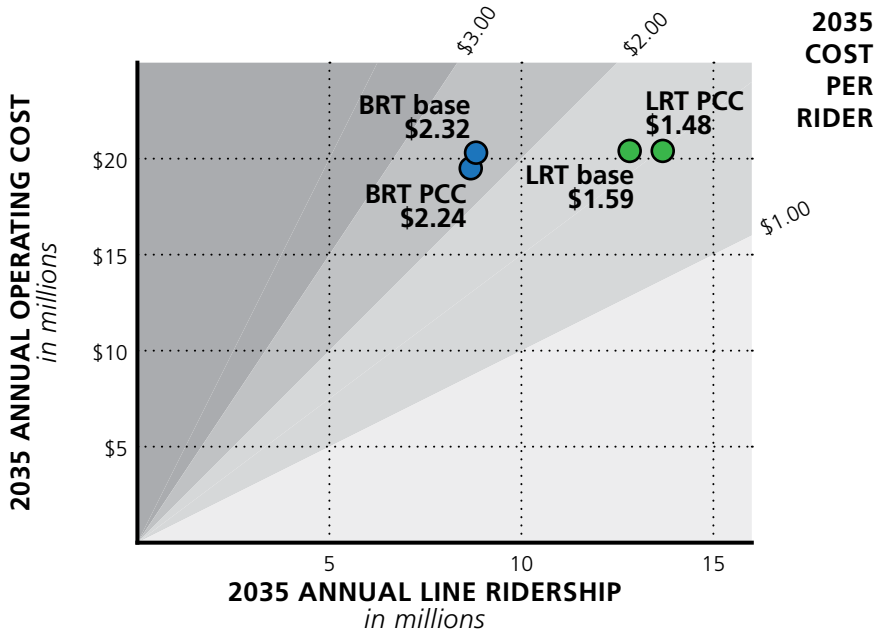
How would the operating and maintenance cost differ between BRT and LRT?

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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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:

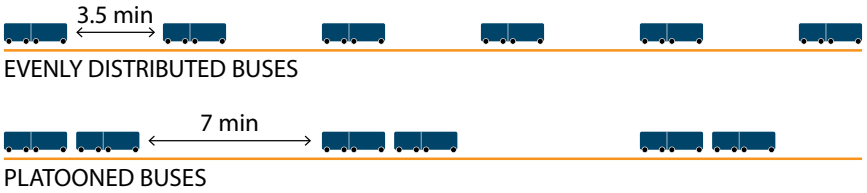
- Each BRT bus would have a maximum capacity of approximately one third the number of passengers as an LRT train. Platooning buses appears operationally infeasible.
- By 2035, BRT vehicles would need to run 3 to 3.3 minutes apart in order to meet ridership demand during the peak hour and LRT trains would 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 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?

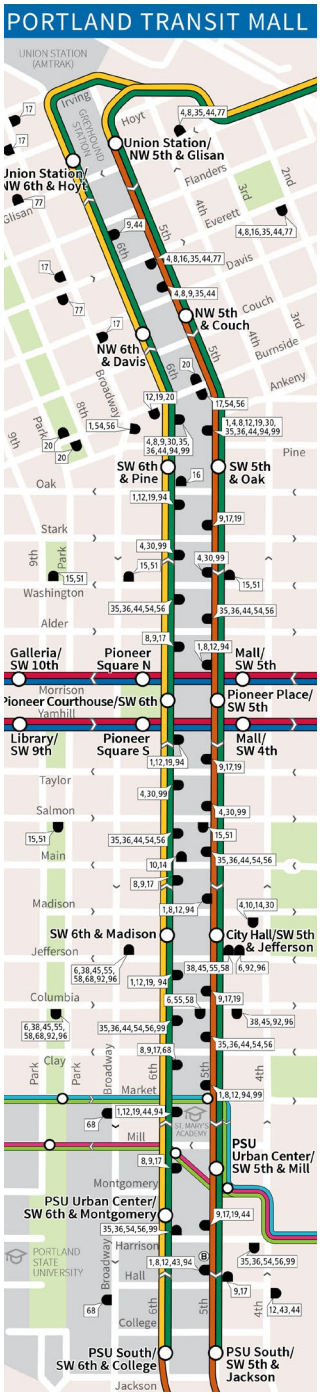
Today, the Transit Mall on 5th and 6th Avenues in downtown Portland carries 16 TriMet bus lines along with the Green and Orange/Yellow MAX lines all day, as well as five C-TRAN bus lines in the morning and afternoon. Estimates show that the mall can carry up to 120 buses per hour. Stations for LRT are 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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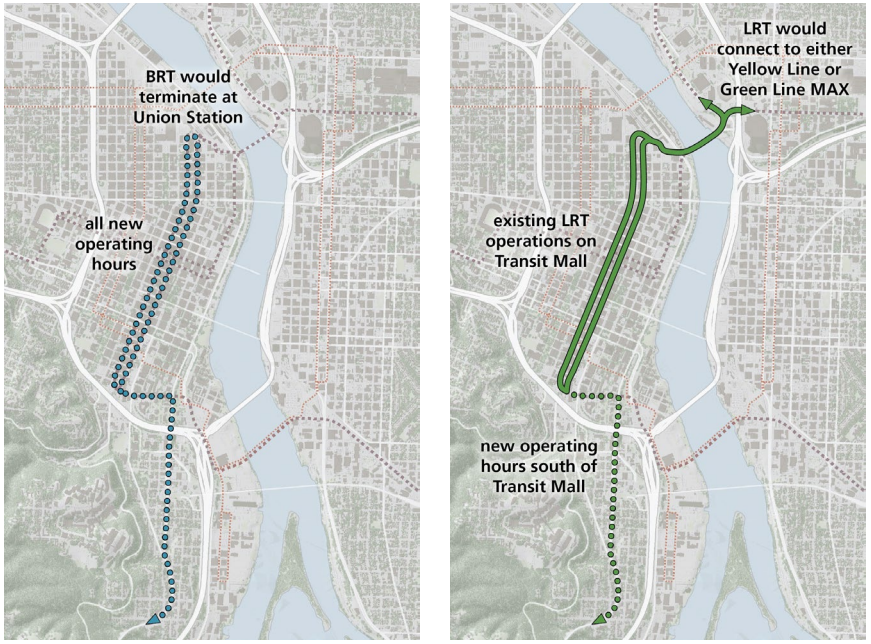
How would interlining differ between BRT and LRT?

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

return to the table of contents, p. 3

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:

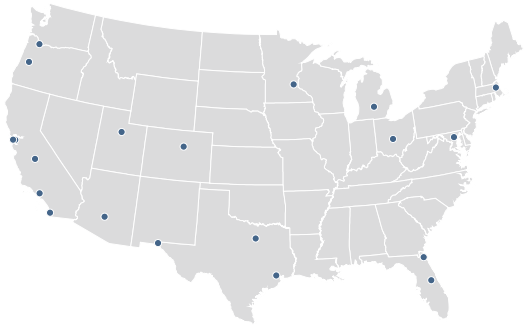
- How would access to federal funding differ between BRT and LRT?
- Where has local funding come from for past high capacity transit projects in the region? How would access to local funding sources differ between BRT and LRT?

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

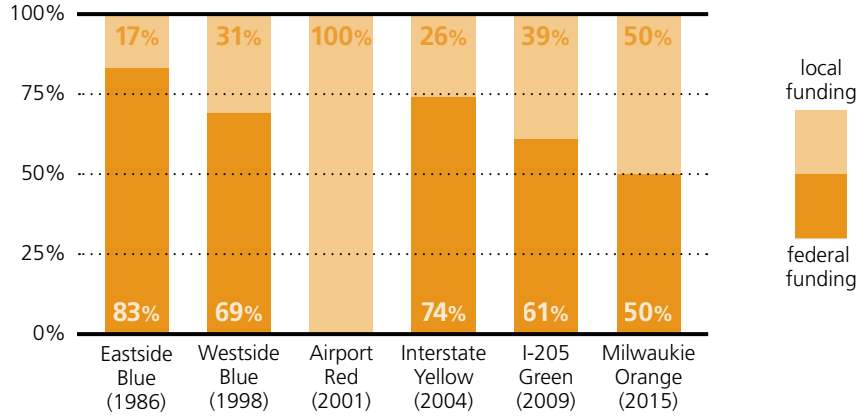
- ridership, p. 26
- capital cost, p. 27
- operating and maintenance costs, p. 28
- local funding, p. 37

return to the table of contents, p. 3

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.)

Local & federal funding shares for TriMet MAX projects



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.

return to the table of contents, p. 3

The following corrections have been made since this document was first published on December 31, 2015:

travel time, p. 16

"BRT would be 4 to 7 minutes ***slower*** ~~faster~~ than LRT for three primary reasons…"

Cost-effectiveness, p. 25, and **ridership, p. 26**

"Compared to the base alignment, the LRT tunnel to PCC Sylvania would increase line ridership by 7 percent and new system trips by ***21*** ~~13~~ percent."

PROJECT GOALS

		bus rapid transit (BRT)		light rail (LRT)	
		base*	**PCC***	**base***	**PCC***
land use	**land use and development**	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	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** *2035 PSU to Bridgeport Village*	38 min peak 34 min off-peak	42 min peak 37 min off-peak	31 min peak 30 min off-peak	32 min peak 31 min off-peak
	reliability	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	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	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	Both modes would include road, bike and pedestrian improvements along the length of the alignment and to provide access to stations.			
	local bus service	For both BRT and LRT, local bus service would be optimized to improve connections to key locations and transit stations.			
community	**public opinion**	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	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** *2035 average daily new system transit trips and line riders*	9,800 new transit trips 28,500 line riders	9,900 new transit trips 28,300 line riders	12,800 new transit trips 39,700 line riders	15,500 new transit trips 42,500 line riders
	capital cost *current estimate in 2014$, w/o finance & escalation*	$1.0 billion	$1.0 billion	$1.8 billion	$2.1 billion
	operating and maintenance costs *based on 2035 ridership*	$2.32 per line rider	$2.24 per line rider	$1.59 per line rider	$1.48 per line rider

LOGISTICS

		bus rapid transit (BRT)		light rail (LRT)	
		base*	**PCC***	**base***	**PCC***
operations	**vehicle capacity**	86 passengers per vehicle		266 passengers per vehicle	
	service frequency *2035 PSU to Tigard* *(see p. 29 for frequencies south of Tigard)*	3.0 min peak *(demand for 2.9 min)* 12 min off-peak	3.3 min peak 12 min off-peak	6.7 min peak 15 min off-peak	
	transit mall capacity	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	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	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**	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	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.			

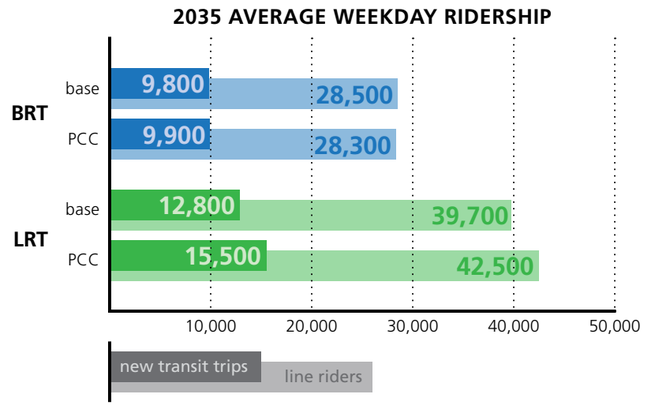
*see *Alignment assumptions, p.7 of the full memo, for more information on the base and PCC alignments*

NOTE

This document is a summary of the full mode comparison memo, which evaluates bus rapid transit (BRT) and light rail transit (LRT) for the Southwest Corridor, including both direct and indirect alignments to the Portland Community College (PCC) Sylvania campus. For more information on each of the factors evaluated and the related assumptions, see the full memo, available on the project website at www.swcorridorplan.org.

Additionally, the full memo includes background information on the Southwest Corridor Plan, high capacity transit (HCT) project narrowing and next steps.

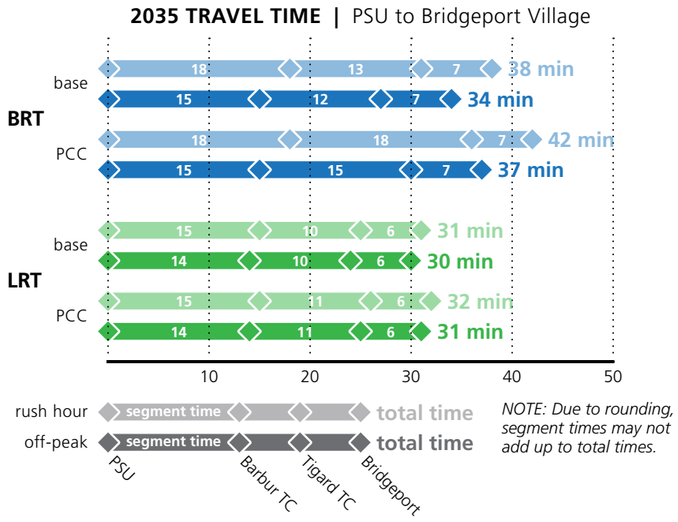
RIDERSHIP



LRT would have higher ridership than BRT in terms of both line riders, or the average daily boardings on the HCT line, and new system transit trips, which are transit trips that would have otherwise been taken by car, bike or foot.

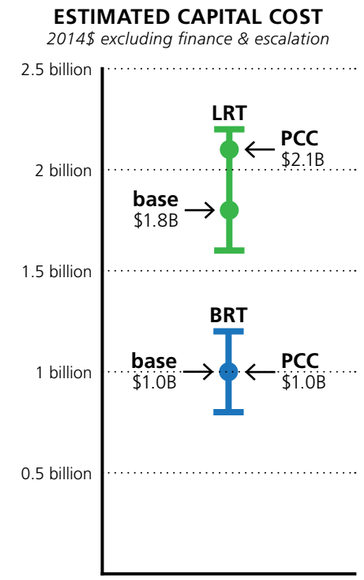
Compared to the base alignment, LRT to PCC would increase line riders by 7% and new system trips by 21% over the base alignment. The BRT alignment to PCC would have ridership similar to the base alignment.

TRAVEL TIME



By 2035 BRT would be delayed 4-5 minutes during rush hour due to the signal priority limitations that would result from its high service frequencies.

CAPITAL COST



For the base alignment, LRT would cost about 80% more than BRT due to the costs of tracks, catenaries, utility relocation, etc.

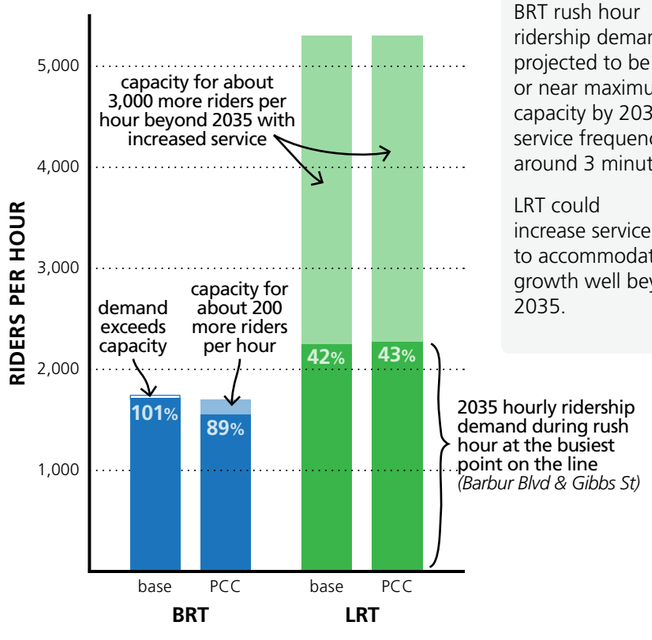
The PCC tunnel would add around $330 million, or 18%, to the base cost for LRT, while the PCC option for BRT would only add about $10 million. Assuming the PCC alignment for both modes, LRT would cost just over twice as much as BRT.

capital cost range
(Bridgeport Village terminus)

highest cost alignment

lowest cost alignment

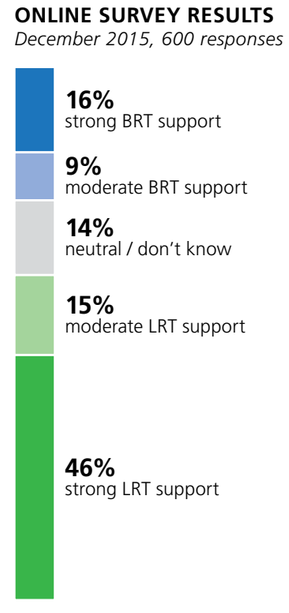
CAPACITY FOR GROWTH



BRT rush hour ridership demand is projected to be at or near maximum capacity by 2035 at service frequencies around 3 minutes.

LRT could increase service to accommodate growth well beyond 2035.

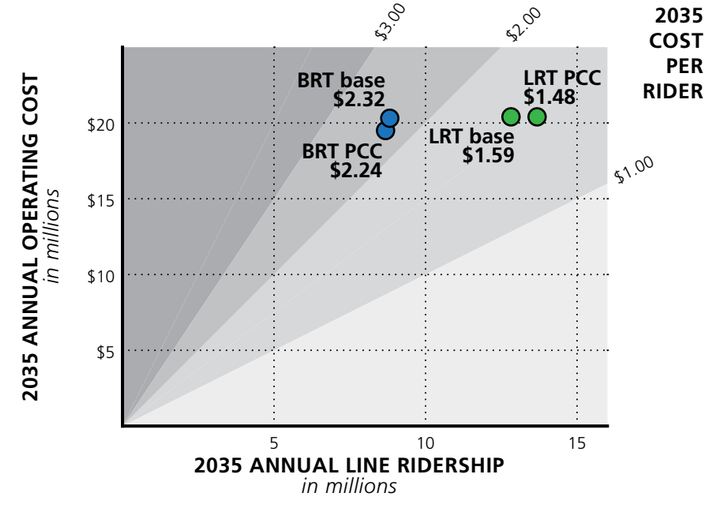
PUBLIC OPINION



In a recent 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.

In addition to this online survey question about mode support, 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. See the full mode comparison memo for a sampling of comments and questions.

OPERATING AND MAINTENANCE COST



While the total annual operating cost would be similar for both modes, LRT would cost less to operate per rider because it would attract more riders. For both modes, the PCC alignment would cost less per rider than the base.

GREAT PLACES
SW Corridor
Portland • Sherwood • Tigard • Tualatin
Beaverton • Durham • King City
Washington County • ODOT • TriMet • Metro

High Capacity Transit Technical Evaluation:

Direct and Indirect Connection Options to PCC Sylvania Campus

March 11, 2016

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CONTENTS

INTRODUCTION

In October 2015, the Southwest Corridor Steering Committee requested additional data to inform a decision regarding high capacity transit service to the Portland Community College (PCC) Sylvania campus. In December 2015, project staff released the 'PCC Sylvania Enhanced Connection Options' memo to provide some additional information and introduce new concepts identified since the October 2015 steering committee meeting. The purpose of this report is to supplement the December memo with more detailed quantitative information on the trade-offs and comparative performance between various options for direct and indirect high capacity transit (HCT) connection to the campus, using criteria based on the steering committee's expressed goals for a successful connection to PCC Sylvania.

Two potential HCT station locations to serve the Sylvania campus are under consideration – one north of the campus at SW Barbur Boulevard and SW 53rd Avenue, requiring an approximately ten-minute walk to the heart of the campus, and one on campus. While an on-campus station could attract more redevelopment and result in higher ridership compared to a station on Barbur, for each mode there are trade-offs for the line:

- For light rail (LRT), an expensive tunnel would be required to avoid steep grades, which could result in a shorter overall alignment or other cost-saving measures.
- For bus rapid transit (BRT), reaching the campus would add three to four minutes of travel time over a Barbur or adjacent to I-5 alignment, resulting in higher ridership at PCC Sylvania but little change in overall line ridership.

Capital costs for an on-campus BRT station would be substantially similar to an indirect BRT connection, however. In addition, PCC Sylvania access is one of many factors informing the selection of a preferred mode. As a result, this report focuses only on light rail options.

Please note that Metro's regional travel demand model is calibrated to provide accurate projections of travel behavior at a large scale. The differences between some of the options explored in this document can be trivial when viewed through a regional lens. Consequently, the accuracy of projections reported in this document may not be as strong as for the alignment and mode comparisons presented in other reports. The steering committee should take these limitations into consideration when reviewing this information and making decisions.

Decision timeline

In May 2016 the Southwest Corridor Steering Committee is scheduled decide whether to advance a light rail tunnel to PCC Sylvania into the Draft Environmental Impact Statement for further study.

To inform this decision, and the related decision on the preferred HCT mode, project staff will release a recommendation report in April that synthesizes and interprets the information included in this evaluation report and previous relevant documents. Staff will present their recommendations at the April steering committee meeting.

Although the steering committee decision will focus on whether to continue studying a light rail tunnel to PCC Sylvania, it is anticipated that the staff recommendation and committee decision will also include direction on which other connection options, if any, should be studied further. Public comments on these options can be emailed to swcorridorplan@oregonmetro.gov.

Project background

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.

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

ABOUT PCC SYLVANIA

Information on the students attending PCC Sylvania will help inform upcoming and future decisions on how best to serve the transportation needs of the campus. The graphs on this and the following pages convey the wide range of experiences and possible needs of the students. PCC Sylvania hosts a mix of full- and part-time students, classes throughout daytime and evening, and a wide range of races, ethnicities and ages. A majority of PCC credit students receive financial aid, a factor to consider in planning the type and cost of transportation options.

Connecting students to the Sylvania campus is hampered by the wide distribution of residences. Southwest Portland and western Washington County host the majority of students, but places as dispersed as Sherwood, Amber Glen and southeast Portland are home to many Sylvania students. Because not all students travel to campus directly from home (or vice versa), the available information on where students live does not tell the whole story about travel patterns to campus.

The majority (70 percent) of PCC Sylvania students drive alone to school most of the time, while a notable minority (ten percent) usually take TriMet. These numbers are similar to other PCC campuses, although Sylvania has the lowest proportion of transit users and the highest rate of PCC shuttle users (seven percent). Sylvania students primarily use PCC's inter-campus shuttle system to reach Portland State University and PCC Southeast. About one third of PCC students who use the shuttle system start their day at the Sylvania campus.

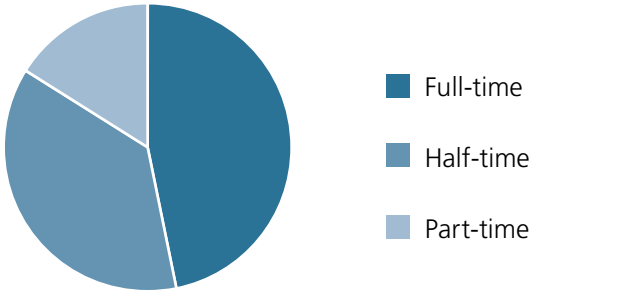
The majority of Sylvania students, faculty and staff say they would regularly take the bus/MAX to campus under the right circumstances. Several reasons for not using transit now are cited, mainly that the travel time is too long, and that transit service is either not close enough to where people live or requires transferring to access the campus.

14,200 *fall 2015 student headcount*

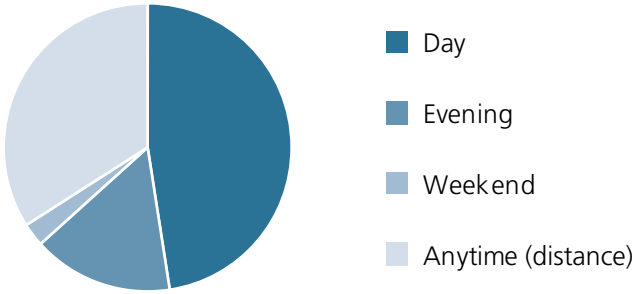
5,360 *students at Sylvania during a typical day*

Fall 2014 PCC Sylvania student headcount by...

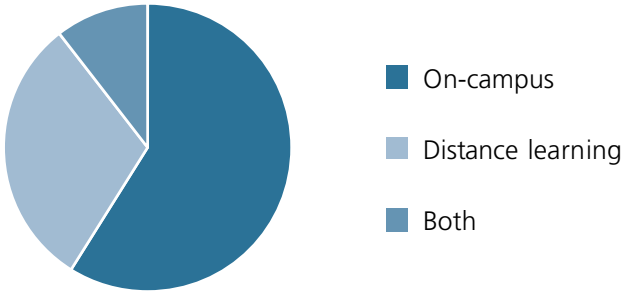
...enrollment status



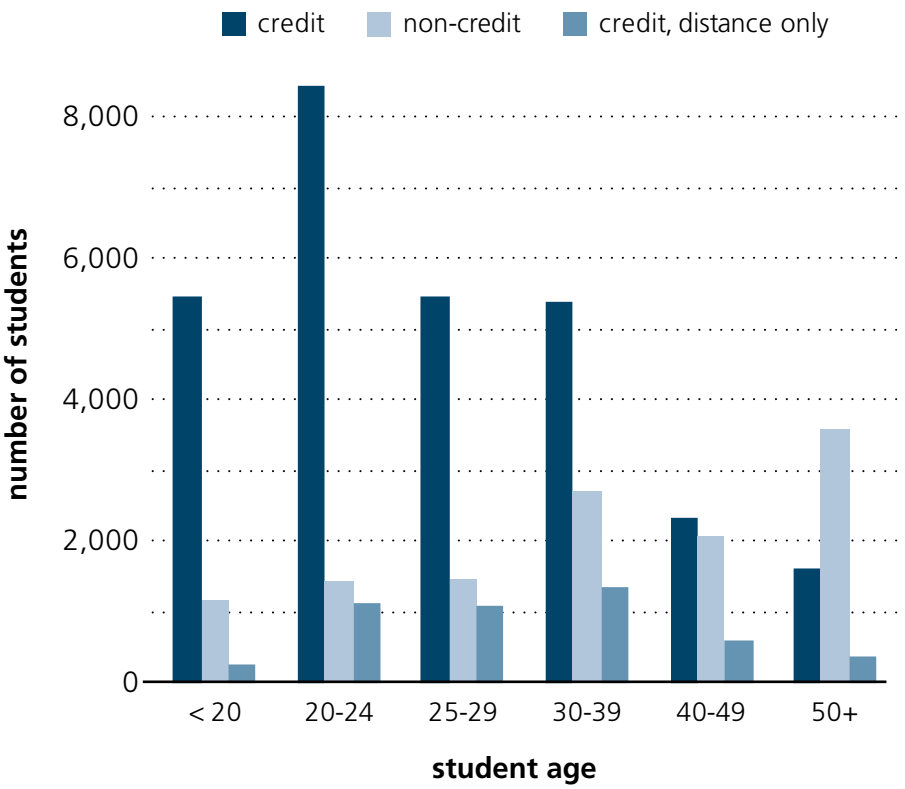
...class time of day



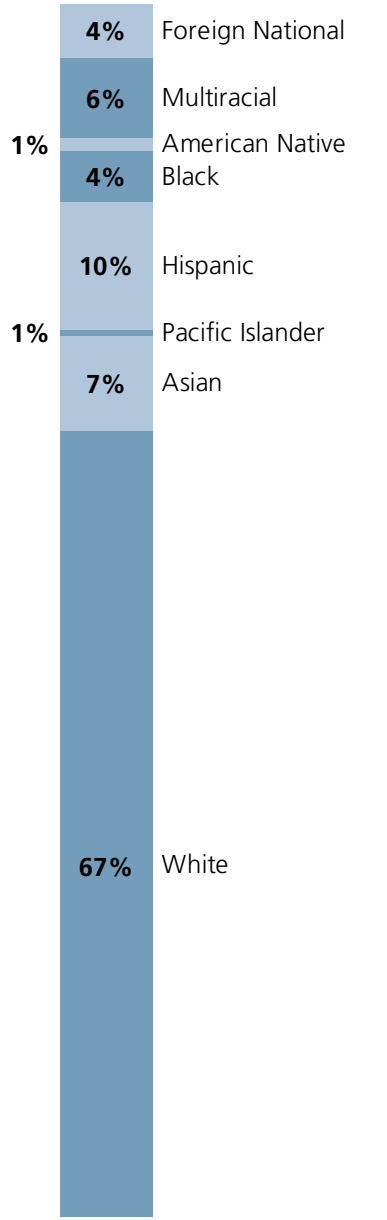
...course delivery method



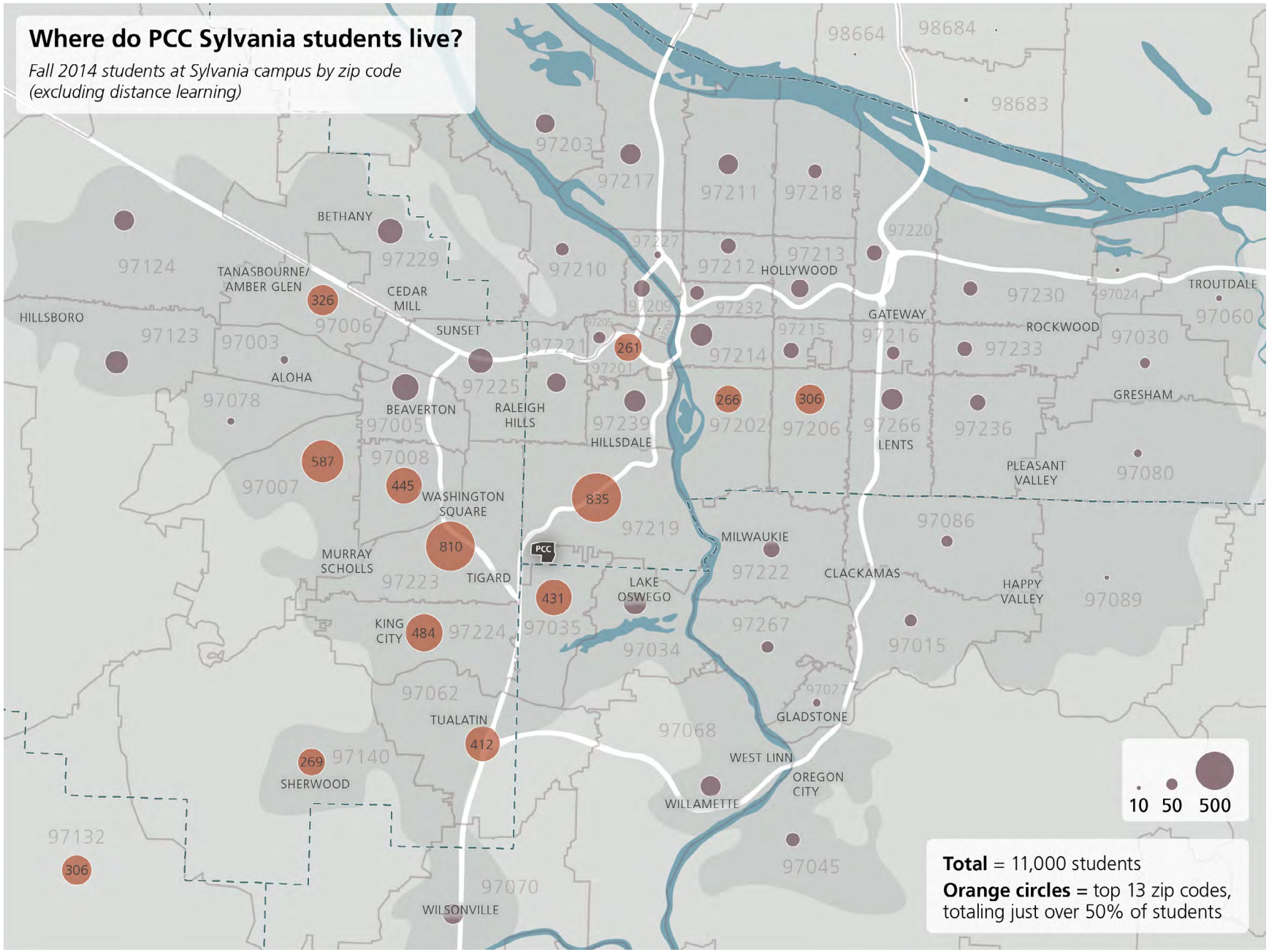
Fall 2015 PCC college-wide enrollment by age



Fall 2015 PCC Sylvania headcount by race/ethnicity

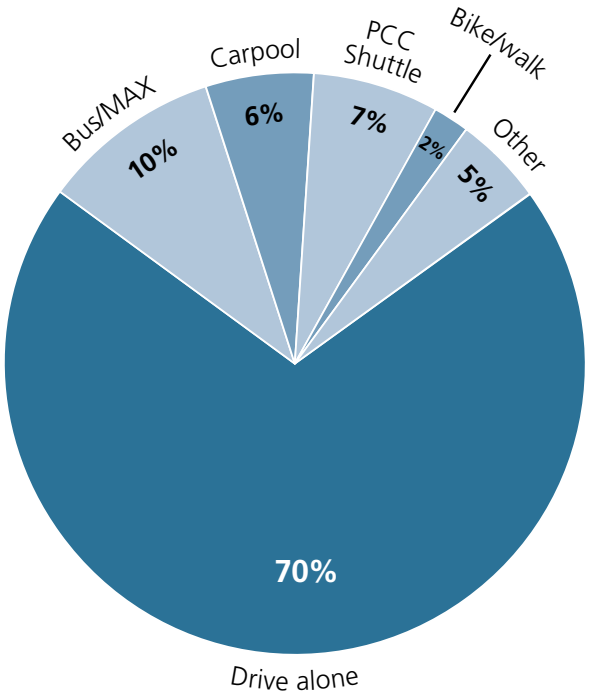


59% *of PCC students college-wide receive financial aid (fall 2014)*


Where do PCC Sylvania students live?
Fall 2014 students at Sylvania campus by zip code
(excluding distance learning)
BETHANY
TANASBOURNE/
AMBER GLEN
CEDAR
MILL
HILLSBORO
SUNSET
ALOHA
BEAVERTON
RALEIGH
HILLS
HILLSDALE
HOLLYWOOD
GATEWAY
ROCKWOOD
TROUTDALE
GRESHAM
LENTS
PLEASANT
VALLEY
MILWAUKIE
CLACKAMAS
HAPPY
VALLEY
LAKE
OSWEGO
MURRAY
SCHOLLS
TIGARD
WASHINGTON
SQUARE
KING
CITY
TUALATIN
SHERWOOD
WEST LINN
OREGON
CITY
WILLAMETTE
GLADSTONE
WILSONVILLE
PCC
326
261
266
306
587
445
835
810
431
484
412
269
306
10 50 500
Total = 11,000 students
Orange circles = top 13 zip codes,
totaling just over 50% of students

How Sylvania students, staff and faculty travel to PCC most of the time

(2011 PCC Transportation Online Survey, Sylvania respondants)

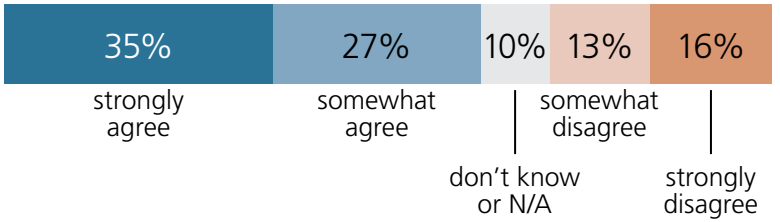


Key reasons Sylvania students drive alone:

(2011 PCC Transportation online survey, Sylvania respondants)

- The travel time is too long (58%)
- Service is not direct from my home (22%)
- Service is not close enough to my home (21%)
- I can't rely on the bus/MAX to get me there on time (17%)
- The bus/MAX fare is too expensive (10%)
- The bus/MAX doesn't run often enough (8%)
- The bus/MAX doesn't operate late enough in the night (2%)

"I would regularly take the bus/MAX to PCC under the right circumstances (i.e. proximity, travel time, cost-effectiveness, availability)" *(2011 PCC Transportation Online Survey, Sylvania respondants)*

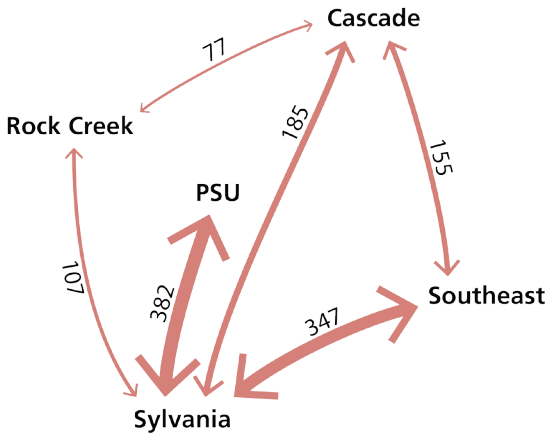


2,421 *parking spaces at Sylvania campus*

86-96% *of spaces are full in the morning*

2012 TRANSPORTATION DEMAND MANAGEMENT REPORT

Fall 2015 average daily PCC shuttle usage



GOALS AND EVALUATION MEASURES

The following table shows the goals identified by project staff for a successful transit connection to the PCC Sylvania campus, paired with the associated measures that have been evaluated in this document. The goals and measures are organized by geographic scale, ranging from regional considerations such as system-wide transit ridership to campus-focused measures such as transit ons and offs on the Sylvania campus.

	Goals for a successful connection to PCC Sylvania	Associated measures
REGION	Increased transit ridership system-wide Affordable and cost-efficient transit system operations Support for regional climate goals	New system transit trips Operating and maintenance cost Operating and maintenance cost per rider
CORRIDOR	Fast and reliable travel times on the project Feasible to fund and construct the project	Light rail line ridership Light rail travel time Total project capital cost
NEIGHBORHOOD	Understand neighborhood impacts and benefits, both short-term and long-term	Property impacts Construction impacts Hourly buses on neighborhood streets
CAMPUS	Broad transit access to campus - from north, south, east and west Fast and reliable transit travel times to the campus Support for future campus development Support for College's transportation and climate goals	Households with one-seat ride to campus Households within 60 minutes from campus by transit Transit ons and offs at PCC Sylvania Transit travel times to campus from key places around the region

CONNECTION OPTIONS TO PCC SYLVANIA

Options evaluated in this document

This document presents detailed technical information on the performance of options for improving access to PCC Sylvania in conjunction with a light rail transit alignment through the Southwest Corridor. The six options described below are evaluated in this document, including four surface alignment options and two tunnel options.

Surface alignment options: LRT station at Barbur Boulevard and 53rd Avenue

A	**Walk/bike connection only** *(enhanced walk/bike connection included in all options)* Light rail on Barbur or adjacent to I-5 between Capitol Highway and 60th Avenue, with a station at 53rd Avenue and an enhanced walk/bike connection to the campus.
B	**Bus hub** New bus connections to the campus from the south and west, stopping at a centralized bus transfer station on campus. Dedicated bus lanes on campus, a new transit bridge over I-5, and a shared transitway segment in the Tigard Triangle could improve bus travel times and reliability.
C	**TriMet shuttle** New shuttle bus connecting Sylvania campus to LRT stations at Barbur Transit Center and Tigard Triangle with timed transfers.
D	**Aerial tram** Aerial tram connecting Sylvania campus to LRT station at Barbur Boulevard and 53rd Avenue.

Tunnel alignment options: underground LRT station on campus

E	**Tunnel: Bridgeport Village terminus** Bored tunnel with underground LRT station on campus: full LRT alignment.
F	**Tunnel: Tigard Transit Center terminus** Bored tunnel with underground LRT station on campus: shortened LRT alignment.

In addition to these six options, a 'no build' scenario has been evaluated to provide a point of comparison relative to the various LRT build alternatives. For the purpose of this analysis, the no build assumes continued local bus service to the PCC Sylvania campus and no new high capacity transit line in the Southwest Corridor.

Alignment assumptions for analysis

For the purpose of evaluation, certain assumptions have been made about which alignments to use for ridership projections, travel times and costs. The surface alignment connection options B, C and D pivot off of the following base alignment, which is represented by option A:

- 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

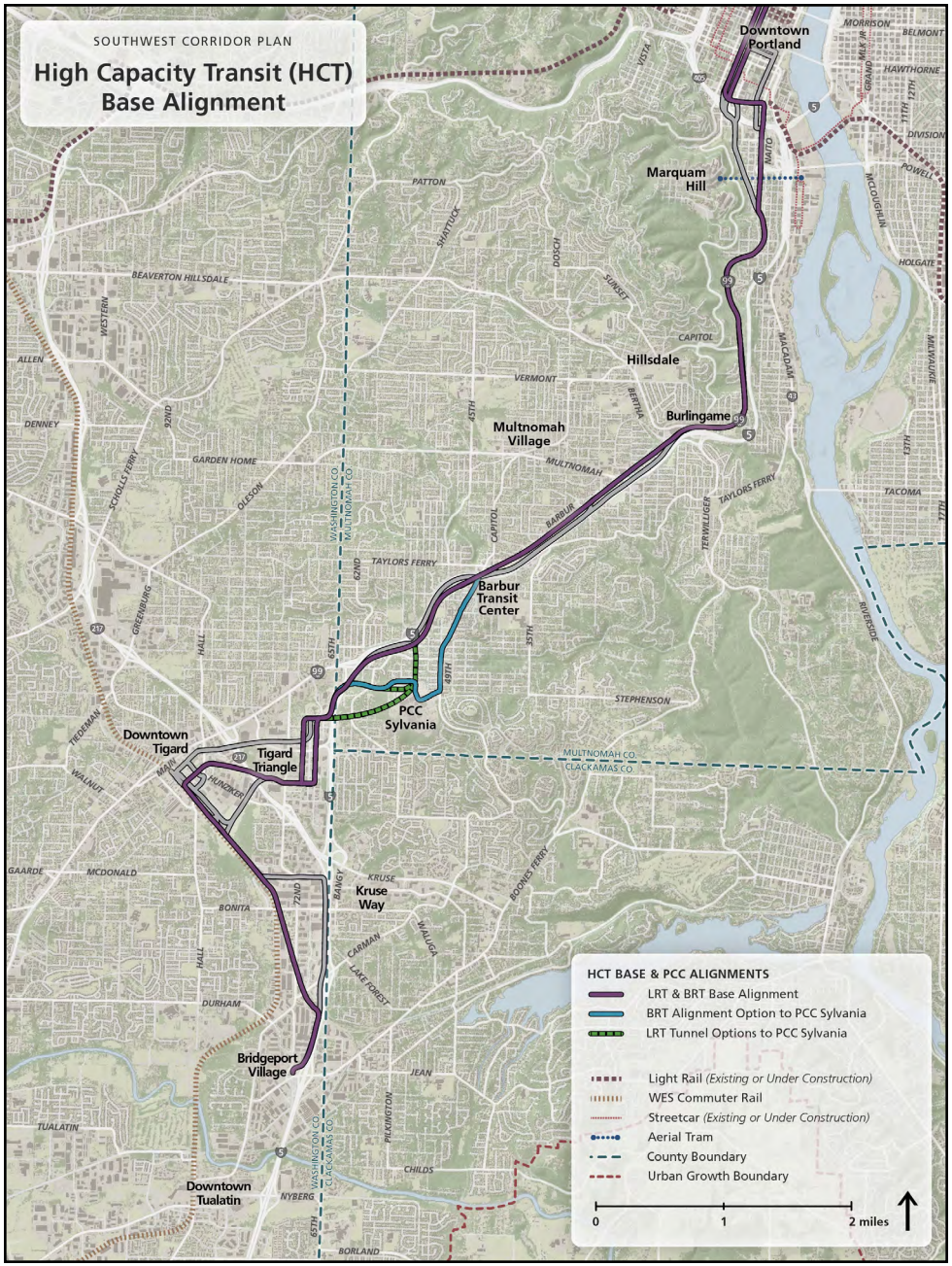
Option E, the tunnel with a Bridgeport Village terminus, is the same as the base alignment except between 53rd Avenue and the Tigard Triangle:

- Long bored tunnel from 53rd Avenue to Tigard Triangle
- Station with park-and-ride lot at 53rd Avenue
- Underground station on the north side of campus

Option F, the tunnel with a Tigard Transit Center terminus, is the same as option E but with a shorter overall alignment that does not serve stations at Bonita Road, Upper Boones Ferry Road, and Bridgeport Village.

For more information on the base alignment and related assumptions, see the December 2015 'Southwest Corridor High Capacity Transit Mode Comparison' report, available at www.swcorridorplan.org.

Note: *the base alignment is for analysis purposes only and does not indicated a preferred alignment.*



Other options under consideration

LRT tunnel via 53rd Avenue and new bridge over I-5: cut-and-cover construction

For the purpose of analysis, the 'long' bored tunnel has been used as the representative LRT tunnel to PCC Sylvania (see page 21 for evaluation results). The three tunnel options currently under consideration are distinguished by their construction method and whether they go under I-5 in the tunnel or cross over it on a new bridge, with resulting differences in the location and severity of construction impacts. Travel time, ridership and capital cost would be relatively similar between the three tunnel options.

This tunnel option would include light rail on Barbur Boulevard to 53rd Avenue, with a cut-and-cover tunnel underneath 53rd Avenue and through the PCC Sylvania campus. The southern portal of the tunnel would be located near Lesser Road and G Street. The light rail alignment would cross Lesser to a new bridge across I-5 into the northern Tigard Triangle.

Relative to the long bored tunnel evaluated in this document and the short bored tunnel below, the cut-and-cover tunnel would have more construction impacts to residents along 53rd Avenue.

LRT tunnel via 53rd Avenue and new bridge over I-5: bored construction

This tunnel option follow would follow the same alignment as the cut-and-cover tunnel under 53rd Avenue, but using a bored tunnel construction method instead.

Relative to the long bored tunnel evaluated in this document, this 'short' bored tunnel would have more construction impacts near the southern tunnel portal at Lesser Road and G Street. Relative to the cut-and-cover tunnel above, the short bored tunnel would have fewer construction impacts to residents along 53rd Avenue.

Barbur shared transitway options

These options would route a bus connection from PCC Sylvania to downtown Portland via the exclusive light rail transitway running in Barbur Boulevard or adjacent to I-5. This configuration would function similar to transit operations on the Tilikum Crossing, with bus and light rail vehicles sharing the same transitway. The intent is to allow the PCC bus connection to avoid traffic congestion in the Barbur corridor, resulting in greater reliability and shorter travel times.

There are two primary Barbur shared transitway options under consideration:

- Branded line 44 with shared transitway north of Hillsdale. This option would improve access to PCC Sylvania from the north and east through improvements to the line 44. Travel times on the 44 could be improved by reducing signal delay time, spacing stops farther apart, and operating on the light rail transitway north of Hillsdale. The option would require a reduction in the local bus stops in the Hillsdale and Multnomah Village areas in order to improve travel times for people accessing PCC, and would not improve access to PCC for people coming from south and west of the campus.
- New branded bus line with shared transitway north of Barbur Transit Center. This option would improve access to PCC Sylvania from the north and east through a new bus line to the campus via Barbur Boulevard. The buses would operate on the light rail transitway north of the Barbur Transit Center to downtown Portland.

The feasibility, related capital and operating costs, and possible effects on light rail travel times of a shared transitway approach need to be studied further before detailed analysis is possible.

Mechanized connections between campus and light rail stations

In the August 2015 memo on PCC Sylvania light rail options, several other mechanized connection options were described that could potentially improve access between the campus and nearby light rail stations, including autonomous vehicles/shuttles in mixed traffic and personal rapid transit vehicles on a dedicated guideway.

For the purpose of analysis, the shuttle option evaluated in this document serves as a representative option for a mechanized connection between the campus and nearby light rail stations in the Tigard Triangle and at the Barbur Transit Center. Similarly, the aerial tram option evaluated in this document serves as a representative option for a mechanized connection between the campus and a light rail station at Barbur and 53rd Avenue.

Options considered and removed

Two other bored tunnel options to PCC Sylvania were removed from consideration in June 2014 because the cut-and-cover tunnel option along 53rd Avenue would provide a similar benefit at a lower capital cost. Further study of the cut-and-cover tunnel revealed that a bored tunnel along the same 53rd Avenue alignment could be accomplished at a relatively similar capital cost due to the necessary tunnel depth. The original two bored tunnel options were revisited at that time, but were not proposed for further study because their longer alignments would result in a higher capital cost than the shorter 53rd Avenue bored tunnel options currently under consideration. Additionally, the 53rd Avenue tunnel alignments currently under consideration would allow for a station and park-and-ride lot at Barbur and 53rd, which would not be feasible with either of the two previously removed tunnels.

LRT tunnel via Capitol Highway and 49th Avenue

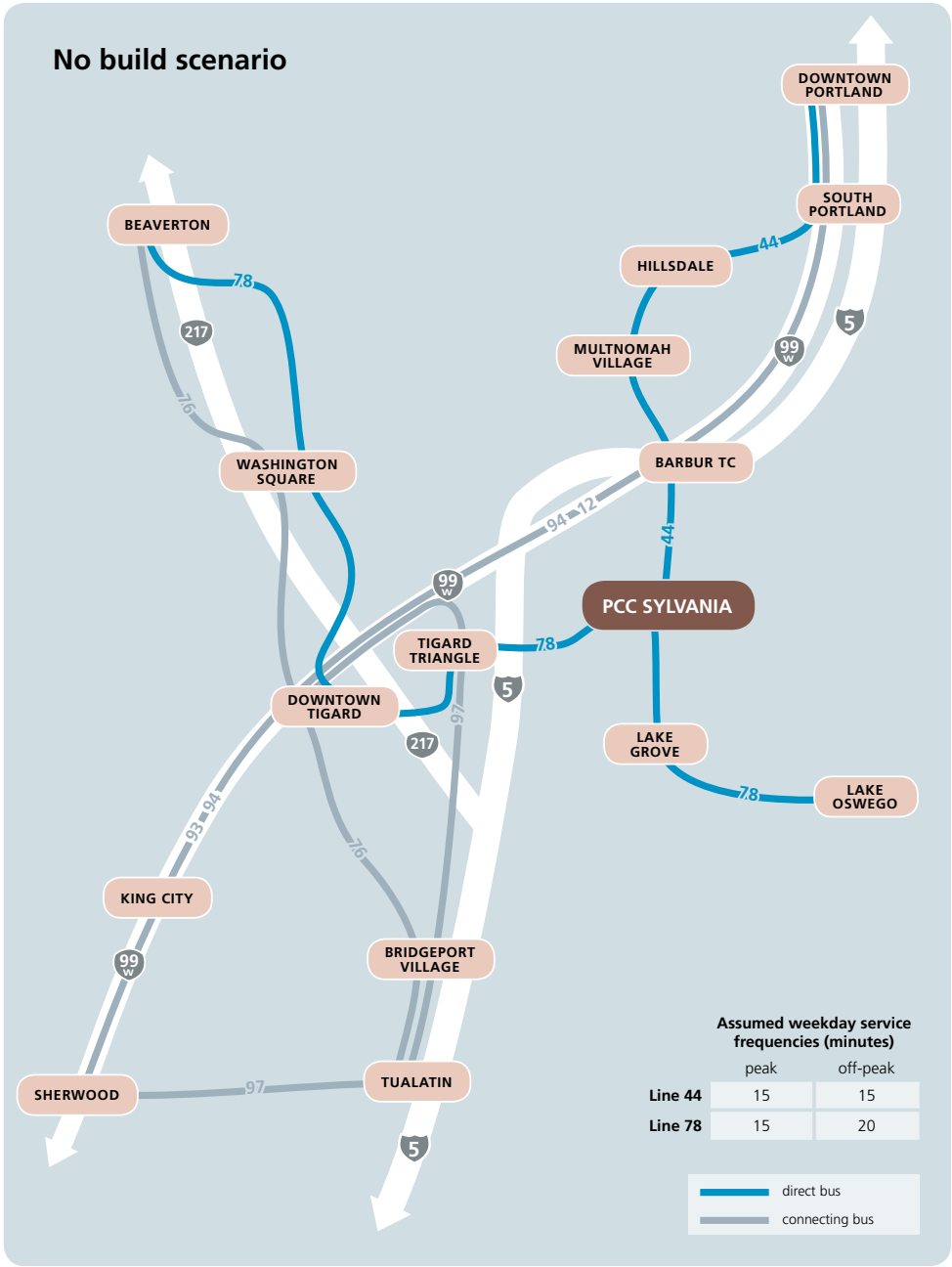
With this tunnel option, light rail would turn onto Capitol Highway near the Barbur Transit Center and include a station near the Capitol Hill Library and Holly Farm Park, similar to the BRT to PCC alignment. Light rail would descend into a bored tunnel along 49th Avenue near Coronado Street and serve the campus via an underground station. Similar to the 'long' bored tunnel currently under consideration, the southern portal would be located on the west side of I-5 near Atlanta Street and 68th Avenue.

LRT tunnel via Barbur Boulevard and 51st Avenue

This tunnel option would be similar to the 'long' bored tunnel currently under consideration, except that it would be located under 51st Avenue instead of 53rd Avenue to the north of the PCC Sylvania campus. As a result, this tunnel would have a longer alignment than the 53rd Avenue tunnel and would not be able to access a potential station and park-and-ride lot location at Barbur and 53rd.

No build scenario

For the purpose of this analysis, the no build scenario assumes that the bus lines 44 and 78 would continue to provide local bus service to the PCC Sylvania campus as they do today, with an upgrade to frequent service (15 minutes or better all day) for the line 44. The no build also includes the line 97, which will open for service in the summer of 2016 on Tualatin-Sherwood Road. In the 2035 no build, line 97 is assumed to continue north from Bridgeport Village to the Tigard Triangle along 72nd Avenue and to downtown Tigard via 99W.



A. Walk/bike connection only

This option assumes a light rail alignment on Barbur Boulevard or adjacent to I-5 near PCC Sylvania, with a station and park-and-ride lot at 53rd Avenue and an enhanced walk/bike connection along 53rd to the campus.

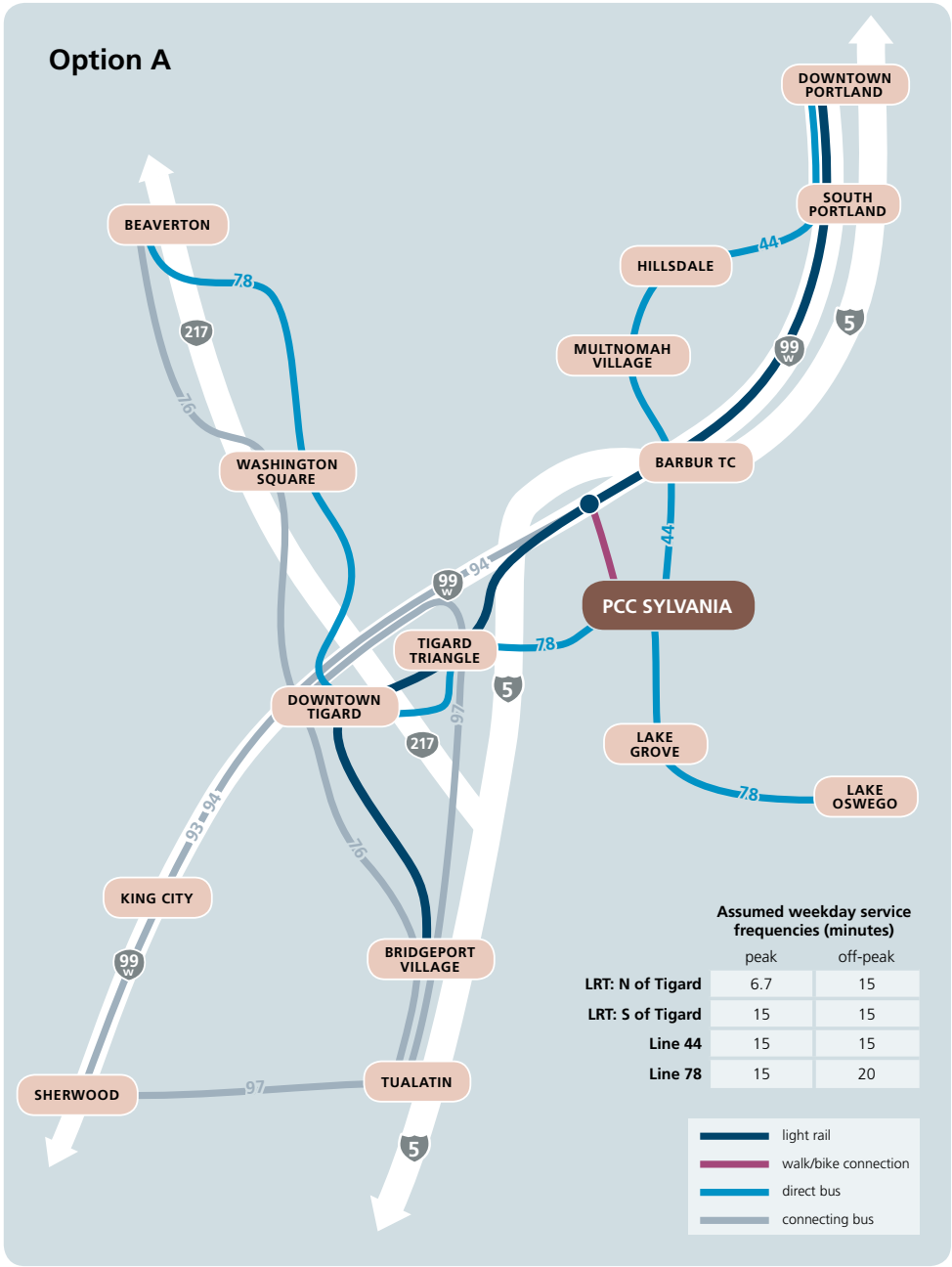
Performance

This option would improve access to PCC Sylvania by providing a station within walking distance from the campus and improving the pedestrian and bike route to campus. Enhancements could include pavement, sidewalks and other amenities.

Compared to the no build scenario, this option would result in:

- Twenty-nine percent more weekday transit ons and offs at the Sylvania campus in 2035, including light rail or bus riders walking to/from the station at Barbur and 53rd
- Approximately 93,000 households across the region gaining transit access to the Sylvania campus within 60 minutes, which represents a 56 percent increase over the no build scenario
- Approximately 34,000 households across the region gaining a one-seat ride to the Sylvania campus by transit (including light rail with a walk/bike connection to campus), which is a 65 percent increase over the no build scenario

Among the options evaluated in this document with a Bridgeport Village light rail alignment terminus, option A would have the lowest capital cost and the least construction and property impacts to the PCC campus and the surrounding neighborhood.



B. Bus hub

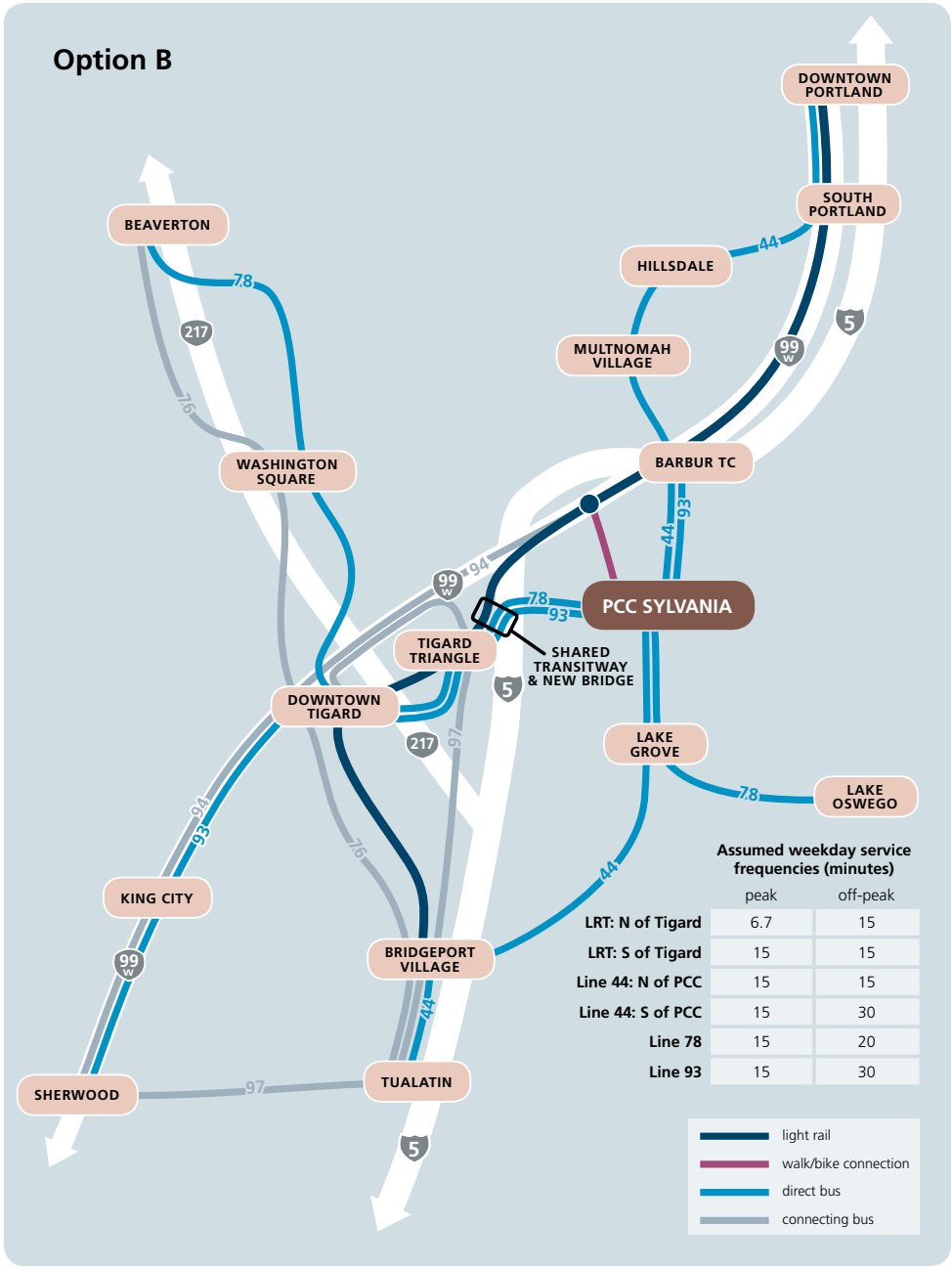
The bus hub option would supplement the walk/bike connection on 53rd Avenue with additional local bus routes serving the campus directly. These buses would provide new opportunities for one-seat rides to PCC Sylvania from south and west of the campus. The light blue lines in the adjacent map show buses that would directly serve the PCC Sylvania campus. The map also illustrates the assumptions used for the bus hub for the purpose of modeling analysis.

Note that unlike the TriMet shuttle and aerial tram options, the bus hub lines would not have reduced service when the campus is closed or not in session. (Currently, the 78 routes along 49th Avenue, Capitol Highway, and Lesser Road when the campus is closed. The 44 turns around on campus except in snow events, when it turns around at Barbur Transit Center.)

Other potential bus hub scenarios

Although the December 2015 PCC Sylvania Enhanced Connection Options memo suggested extending the line 97 to Sylvania via Lake Grove, the modeled bus hub scenario instead extends line 44 to Tualatin from the campus in order to maintain all-day service on 72nd Avenue with line 97 (as proposed in TriMet's Southwest Service Enhancement Plan). Another possible scenario would keep the line 97 on 72nd, but route it onto the shared transitway and over OR-217 to provide another direct connection to PCC Sylvania.

If the bus hub is studied further, the particular bus routing and associated capital investments will be developed in greater detail. Bus routing changes to improve access to the campus could be combined with any of the other connection options under consideration.



Performance

Compared to option A, the walk/bike connection only, the bus hub would improve transit service to campus by:

- Increasing transit service frequency between the campus and downtown Tigard, Barbur Transit Center, and Lake Grove
- Providing new one-seat ride opportunities to an on-campus station from Sherwood, King City, Lake Grove, Bridgeport Village, Tualatin and other areas along OR-99W and Boones Ferry Road

As a result of these service changes, the bus hub would result in modest improvements over option A, walk/bike improvements only:

- One percent fewer weekday light rail line riders in 2035 compared to option A, because some riders shift to the new competing bus lines
- Eleven percent more weekday new system transit trips in 2035 compared to option A, due to improved bus headways and service to new areas
- Five percent more weekday transit ons and offs at the Sylvania campus in 2035 compared to option A, or an increase of 35 percent compared to the no build scenario
- Around 9,000 households along the line 93 and the new line 44 extension would gain a one-seat ride to the Sylvania campus, and around 5,000 households would gain transit access to the campus within 60 minutes (based on 2035 weekday evening rush hour times)

These increases in system-wide and campus transit ridership would largely result from the increase in bus service hours, which equates to an additional $3.5 million in annual operating and maintenance costs relative to option A.

Beyond the additional bus service, the bus hub is assumed to include a new transit bridge over I-5 that would connect to a segment of shared transitway on the light rail alignment, and a dedicated busway through the Sylvania campus. These improvements are estimated to add around $30 million, or two percent, to the total project capital cost compared to option A, the walk/bike connection only (2014$, not including finance costs).

These additional capital improvements would also add some property and construction impacts relative to option A:

- Property impacts to developed and undeveloped lands resulting from the new bridge over I-5, and construction impacts on the surrounding neighborhood
- Property and construction impacts on the Sylvania campus resulting from the dedicated busway and other bus hub improvements

Although the goal of the new bridge and shared transitway segment would be to improve bus travel times and reliability between the campus and downtown Tigard, the model showed little improvement in travel time. As a result, the line 93 extension attracted few additional riders in the model because the line 94 provided a faster connection to the campus from Sherwood and King City using the Barbur and 53rd Avenue station and the improved walk/bike connection. Additionally, line 78 lost some riders due to the line 93 extension providing a competing connection between the Tigard Transit Center and the Sylvania campus. It appears that the majority of the bus hub's new system transit trips in the model resulted from the extension of the line 44 through Lake Grove and Bridgeport Village to Tualatin.

Further study of the bus hub could re-examine the travel times assumed for the shared transitway and new bridge relative to the existing line 78 travel times via Haines Street and Lesser Road. Additionally, further analysis could identify other opportunities for travel time reductions between downtown Tigard and the Sylvania campus, such as a new bridge over OR-217, which could allow buses to bypass the congested intersection of 72nd Avenue and Hunziker Street. A more comprehensive analysis of travel patterns to PCC Sylvania could reveal other opportunities for routing bus lines direct to campus that could provide a greater benefit for students, faculty and staff.

C. TriMet shuttle

This option would supplement the walk/bike connection with shuttle buses running between PCC Sylvania and the light rail stations at Barbur Transit Center and in the Tigard Triangle. Unlike the bus hub option, the shuttle would only need to run when the campus is in session and could be timed with light rail train arrivals in order to minimize waiting time.

Performance

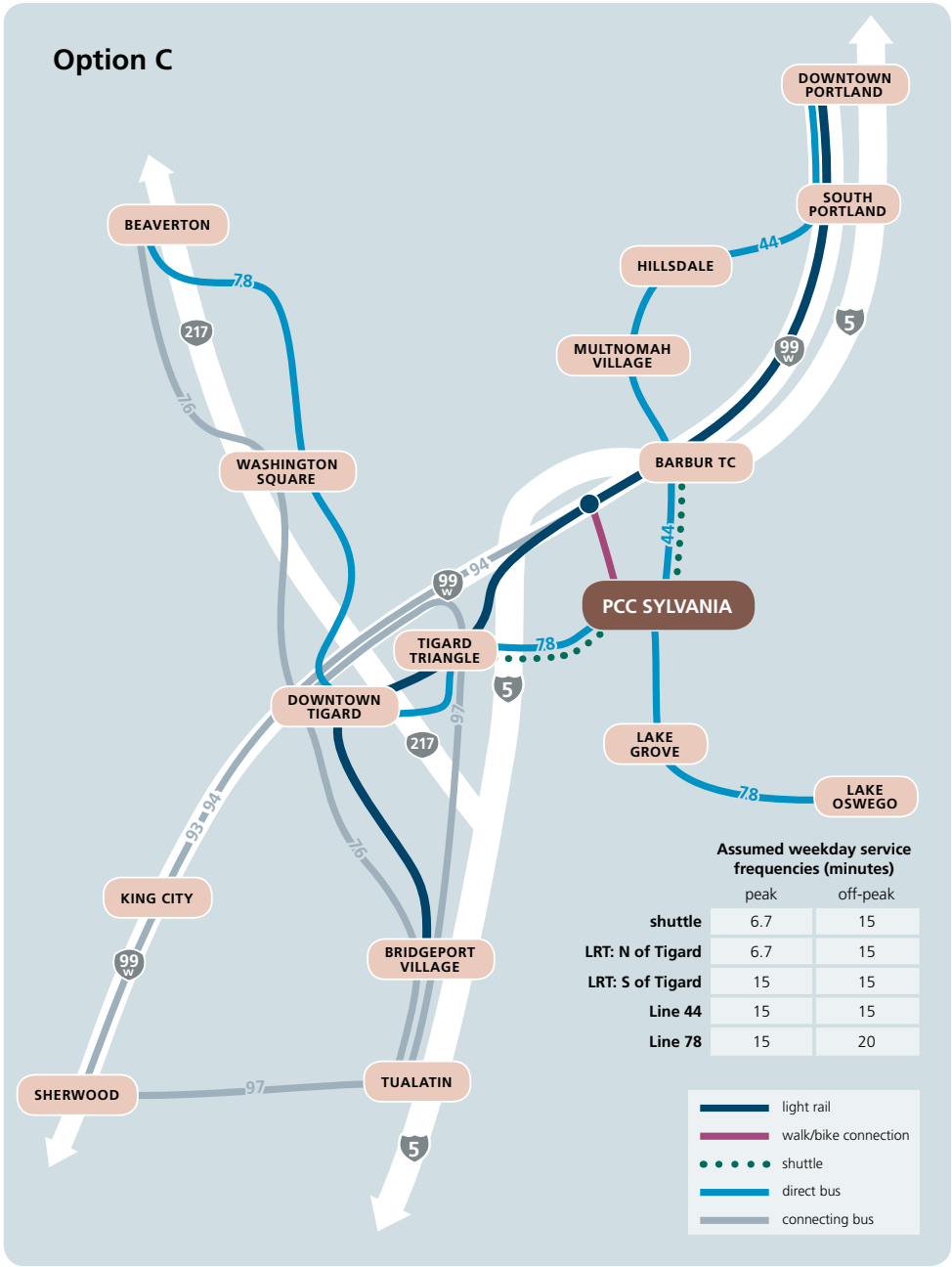
Several model runs were completed to evaluate the performance of the TriMet shuttle. However, additional work will be required to fully understand the ridership implications of the shuttle because of its unique service characteristics, including timed transfers with light rail. In addition, the model is designed to compare alternatives at a regional scale; when focusing on a single specific location, in this case the Sylvania campus, relatively minor changes in input assumptions can lead to wide ranging outcomes.

Initial modeling indicates that a transit connection between the Sylvania campus and nearby light rail stations, such as a shuttle, could improve transit mode share to the campus. At this time, the scale of that improvement is not clear, and further modeling work will be undertaken to refine results.

The shuttle would improve access to PCC Sylvania by providing a faster connection between the light rail alignment and the campus than the walk connection along 53rd Avenue:

- Three minute travel time savings in the peak for riders transferring to the shuttle at Barbur Transit Center
- Five minute travel time savings in the peak for riders transferring to the shuttle in the northern Tigard Triangle

These times do not reflect riders' perceptions of transferring or walking, which affect path choice in the model. For example, riders may choose a one-seat ride with a longer walk over a transfer with a shorter walk despite a longer total travel time.



As a result of the travel time savings described above, the shuttle could provide transit access to the campus within 60 minutes for approximately 10,000 new households around the region compared to option A, the walk/bike connection only.

Initial ridership projections indicate a range of 100 to 500 new average weekday system trips and transit ons and offs at the Sylvania campus in 2035. This range equates to an increase in transit ridership on campus of three to 15 percent over the walk/bike connection only, or 33 to 52 percent over the no build scenario. If the shuttle is studied further, refinements will continue to more accurately estimate the potential transit mode share increase on the Sylvania campus.

The shuttle is estimated to cost approximately $1.6 million to operate annually, and would add around $10 million, or less than one percent, to the total project capital cost to cover the purchase of additional buses and improvements on the Sylvania campus (2014$, not including finance costs).

D. Aerial tram

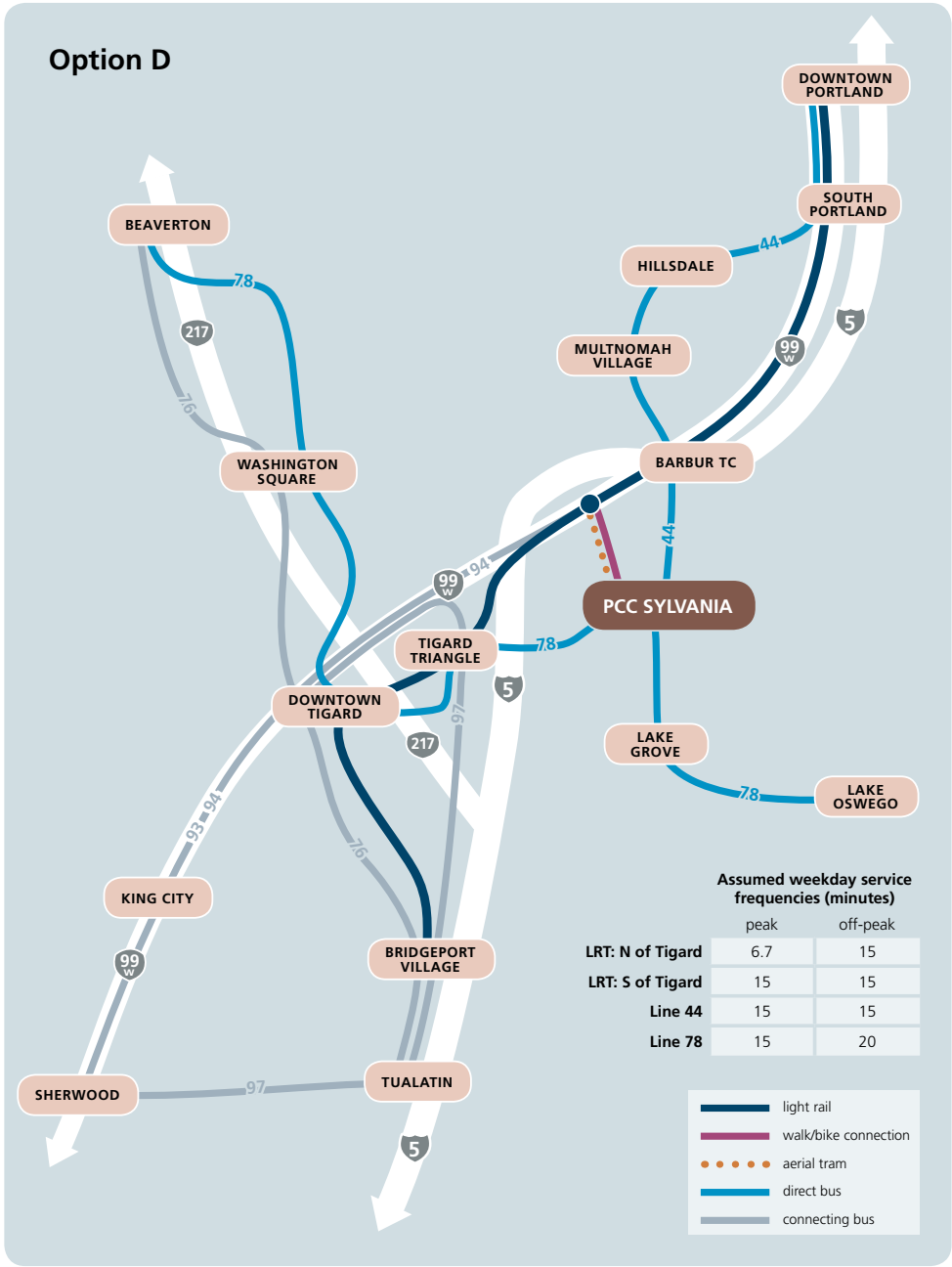
This option would supplement the walk/bike improvements with an aerial tram along 53rd Avenue, providing a fast, frequent and accessible connection between the campus and a station at Barbur and 53rd. As with the TriMet shuttle option, an aerial tram would only need to run when the campus is in session.

Performance

The tram would save transit riders traveling to PCC Sylvania an estimated three minutes compared to walking from the 53rd Avenue light rail station. A tunnel to campus (options E or F) would save riders traveling to the campus an additional three minutes from the north or four minutes from the south.

Similar to the TriMet shuttle option, the tram option introduces complexities in accurately representing the service and its interaction with light rail in the model. The regional transportation model considers not only walk, wait, and in-vehicle times in choosing route combinations to transit users, but also factors in perceptions of those times and penalizes transfers. Slight changes in input assumptions result in relatively large changes in outcomes, especially when examining a specific location in the regional model.

Preliminary model runs of the aerial tram show results similar to the TriMet shuttle, including a range of 100 to 500 additional new system transit trips and transit ons and offs on campus compared to option A. This range equates to an increase in transit ridership on campus of three to 15 percent over the walk/bike connection only, or 33 to 52 percent over the no build scenario. Staff will further refine modeling for both the tram and the TriMet shuttle as the two concepts become more clearly defined.



The operating cost for the OHSU tram is approximately $2.1 million annually. It is anticipated that operations costs for a new tram at PCC would be similar to the OHSU tram, though the cost could be reduced somewhat if the tram only operates while the campus is in session.

In comparison to the OHSU aerial tram connecting Marquam Hill to the South Waterfront, a tram at PCC Sylvania would be slightly shorter and have less elevation change. The shallow nature of the alignment raises design challenges related to backyard privacy for the homes below.

An aerial tram would have more property and construction impacts in the neighborhood than the walk/bike connection alone, but the particular impacts would depend on the location of support structures. Because a PCC Sylvania tram has not been designed, potential property impacts are not clearly defined at this time.

E. Tunnel: Bridgeport Village terminus

The analysis in this document assumes the long bored tunnel option to PCC Sylvania with the LRT alignment terminating at Bridgeport Village. Tunnel portals would be located near Barbur and 53rd Avenue and near Atlanta Street and 68th Avenue in the northern Tigard Triangle.

Performance

Of the connection options evaluated in this memo, option E would have the best performance in terms of corridor and system-wide transit ridership, as well as transit ridership to the PCC Sylvania campus. Compared to option A, this alignment would result in:

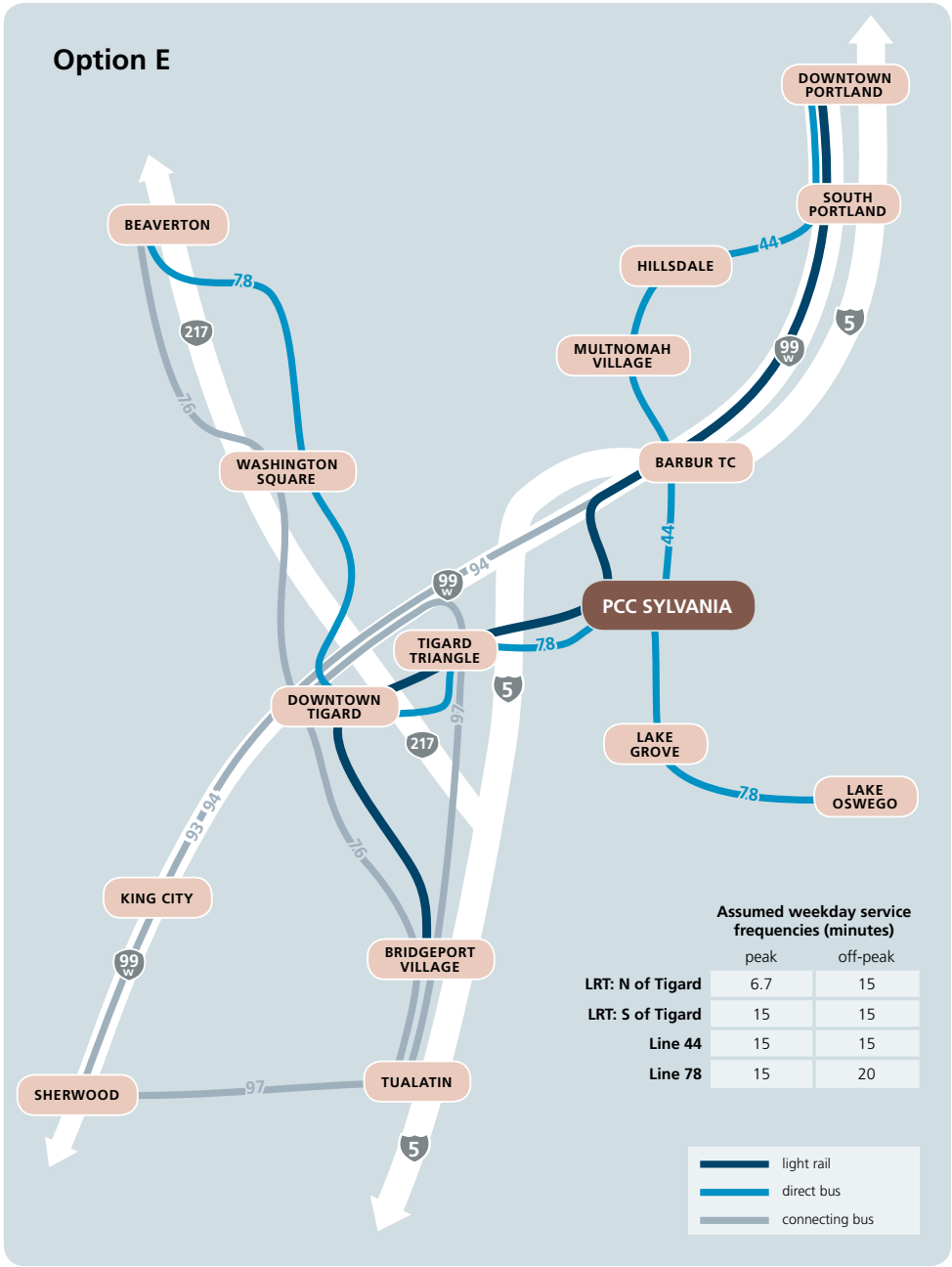
- Six percent more weekday line riders and 17 percent more weekday new system transit trips in 2035
- Seventy-five percent more average weekday ons and offs at the campus in 2035, which indicates that the direct access to campus via light rail is a more competitive option to driving than bus connections and indirect light rail access

However, the tunnel to PCC Sylvania would also be more expensive compared to the surface alignment options, assuming the same alignment terminus of Bridgeport Village:

- A 21 percent increase in capital cost ($370 million) compared to the surface alignment with only a walk/bike connection, resulting in a total project cost of $2.15 billion (2014$, not including finance costs)

Additionally, the tunnel would result in more construction and property impacts to the neighborhood surrounding the Sylvania campus than a surface light rail alignment:

- More permanent and temporary impacts to properties along Barbur Boulevard and 53rd Avenue



- Increased area and severity of noise and vibration impacts compared to surface alignment options
- Increased traffic impacts from additional truck hauling activities during construction compared to surface alignment options
- Longer duration of construction impacts compared to surface options
- Increased construction impacts on the Sylvania campus compared to surface alignment options resulting from large-scale excavation to construct the underground station

F. Tunnel: Tigard Transit Center terminus

This tunnel option assumes the same long bored tunnel to PCC Sylvania described on the previous page, but with the LRT alignment terminating at Tigard Transit Center. This option would provide an on-campus light rail station for approximately the same total project capital cost as for a surface alignment with a Bridgeport Village terminus and the walk/bike connection to the campus.

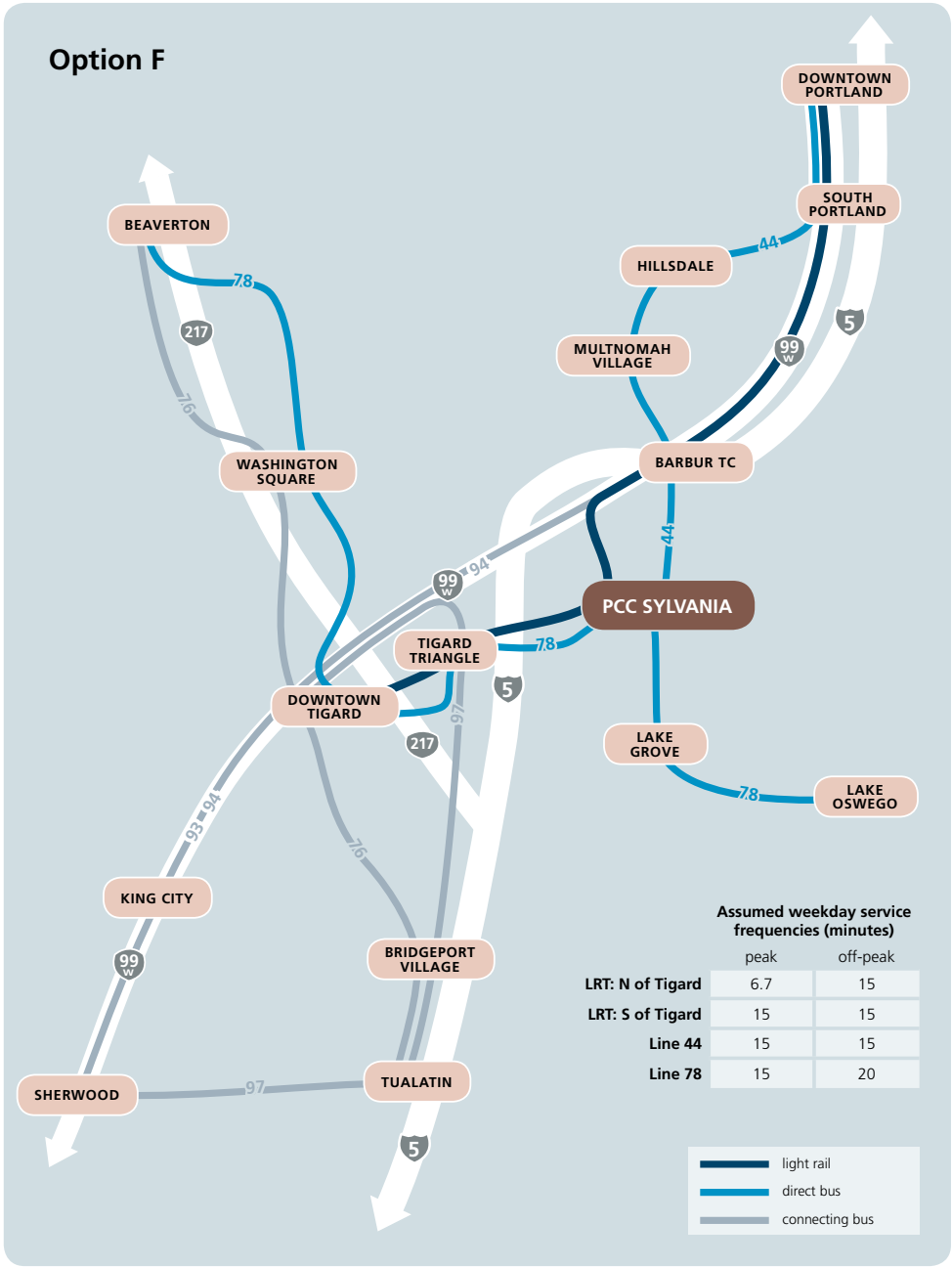
Performance

Of the connection options evaluated in this memo, option F would have the worst performance in terms of corridor and system-wide transit ridership due to the shortened alignment and resulting loss of riders south of downtown Tigard:

- Eleven percent fewer weekday line riders and 18 percent fewer weekday new system transit trips in 2035 compared to option A, the surface alignment with only a walk/bike connection
- Sixteen percent fewer weekday line riders and 30 percent fewer weekday new system transit trips in 2035 compared to option E, the tunnel with a Bridgeport Village terminus

Despite attracting fewer line riders and new system transit trips than other options, the shortened tunnel alignment would perform relatively well in terms of transit ridership to the Sylvania campus, though slightly worse than option E, the full tunnel alignment:

- Sixty-nine percent more average weekday ons and offs at the campus in 2035 compared to option A, the surface alignment with walk/bike connection, due to the reduced walk time between the light rail station and the Sylvania campus
- Four percent fewer average weekday ons and offs at the campus in 2035 compared to option E, the full tunnel alignment with a terminus at Bridgeport Village



The shortened tunnel alignment would have approximately the same capital cost as option A, the surface alignment with a walk/bike connection. While the tunnel segment would add $370 million to the total cost, terminating at Tigard Transit Center would reduce the cost by $370 million, resulting in the same total cost of $1.78 billion (2014$, not including finance cost).

Option F would have the same property and construction impacts in the PCC Sylvania area as the full tunnel alignment. South of the light rail alignment terminus in downtown Tigard, however, option F would have no construction or property impacts.

SUMMARY TABLE

Part 1: Main table

			Surface alignment options: *all Bridgeport Village terminus*			Tunnel alignment options	
		A	B	C	D	E	F
		No build	**Walk/bike connection only**	**Bus hub**	**TriMet shuttle**	**Aerial tram**	**Tunnel** *Bridgeport Village terminus*	**Tunnel** *Tigard Transit Center terminus*
REGION	**new system transit trips** *2035 average weekday vs. no build*	N/A	13,500	15,000	13,600-14,000[1]	13,600-14,000[1]	15,800	11,100
REGION	**operating cost** *2035 annual, in 2014$*	N/A	$20.4 million	$23.9 million	$22.0 million	$22.5 million	$20.4 million	$19.8 million
REGION	**operating & maintenance cost per rider** *2035 annual average, in 2014$*	N/A	$1.46	$1.67[2]	$1.56-1.57[1]	$1.60-1.61[1]	$1.38	$1.60
CORRIDOR	**light rail line ridership** *2035 average weekday*	N/A	43,200	42,800	43,300-43,600[1]	43,300-43,600[1]	45,700	38,300
CORRIDOR	**light rail travel time** *2035 average weekday off-peak to peak PSU to Tigard Transit Center*	N/A	23.6 - 24.3 min	23.6 - 24.3 min	23.6 - 24.3 min	23.6 - 24.3 min	24.7 - 25.4 min	24.7 - 25.4 min
CORRIDOR	**capital cost** *2014$ excluding finance*	N/A	$1.78 billion	$1.81 billion	$1.79 billion	$1.85 billion	$2.15 billion	$1.78 billion
NEIGHBORHOOD	**property impacts** *to neighborhood surrounding campus*	N/A	minimal	medium	minimal	medium	high	high
NEIGHBORHOOD	**construction impacts** *to neighborhood surrounding campus*	N/A	low	medium	low	medium	high	high
NEIGHBORHOOD	**hourly buses on neighborhood streets** *2035 peak / off-peak*	Capitol: 4/4 Lesser/G: 4/3 Haines: 4/3	Capitol: 4/4 Lesser/G: 4/3 Haines: 4/3	Capitol: 8/6 Lesser/G: 8/5 Haines: 0/0	Capitol: 13/8 Lesser/G: 13/7 Haines: 13/7	Capitol: 4/4 Lesser/G: 4/3 Haines: 4/3	Capitol: 4/4 Lesser/G: 4/3 Haines: 4/3	Capitol: 4/4 Lesser/G: 4/3 Haines: 4/3
CAMPUS	**households with one-seat ride to campus by transit** *2035, includes access via station at Barbur/53rd*	52,000	86,000	95,000	86,000	86,000	86,000	83,000
CAMPUS	**households with transit access to campus ≤ 60 min** *2035 peak, includes wait, walk, transfer, in-vehicle time*	165,000	258,000	263,000	268,000	267,000	275,000	263,000
CAMPUS	**transit ons and offs on PCC Sylvania campus** *2035 weekday average*	2,520	3,240	3,410	3,340-3,740[1]	3,340-3,740[1]	5,680	5,470
CAMPUS	**transit travel times to PCC Sylvania from key places around the region**	*See separate table on the other side of this sheet.*						

[1] *This information is presented as a range due to the sensitivity of the model to assumptions about tram/shuttle operational considerations that are not yet clearly defined.*

[2] *For this calculation for the bus hub, bus riders were estimated based on increase in system transit trips*

Part 2: Transit travel times to PCC Sylvania

All times are based on the 2035 PM rush hour and include initial wait time, in-vehicle time, transfer wait time, and walk time from station/stop to Sylvania campus center. Because travel choices in the model are based on perceived times, ridership projections are not directly correlated to the actual travel times shown below.

			Surface alignment options				Tunnel alignment options	
			A	B	C	D	E	F
		No build	Walk/bike connection only	Bus hub	TriMet shuttle	Aerial tram	Tunnel *Bridgeport Village terminus*	Tunnel *Tigard Transit Center terminus*
NE of campus	Portland State University	38 min *via line 44*	30 min *via SW LRT*	30 min *via SW LRT*	27 min *via SW LRT to shuttle*	27 min *via SW LRT to tram*	24 min *via SW LRT*	24 min *via SW LRT*
	Sellwood-Westmoreland	53 min *via 43 to 44*	49 min *via Orange Line to SW LRT*	49 min *via Orange Line to SW LRT*	46 min *via Orange Line to SW LRT to shuttle*	46 min *via Orange Line to SW LRT to tram*	43 min *via Orange Line to SW LRT*	43 min *via Orange Line to SW LRT*
	Barbur Transit Center	14 min *via line 44*	14 min *via line 44*	14 min *via line 44*	14 min *via line 44*	14 min *via line 44*	11 min *via SW LRT*	11 min *via SW LRT*
NW of campus	Beaverton Transit Center	50 min *via line 78*	46 min *via WES to SW LRT*	46 min *via WES to SW LRT*	41 min *via WES to SW LRT to shuttle*	43 min *via WES to SW LRT to tram*	39 min *via WES to SW LRT*	39 min *via WES to SW LRT*
SW of campus	Tigard Transit Center	21 min *via line 78*	22 min *via SW LRT* 21 min *via line 78*	22 min *via SW LRT* 21 min *via line 78*	17 min *via SW LRT to shuttle*	19 min *via SW LRT to tram*	15 min *via SW LRT*	15 min *via SW LRT*
	Bridgeport Village	35 min *via line 97 to line 78*	32 min *via SW LRT*	32 min *via SW LRT* 30 min *via line 44*	27 min *via SW LRT to shuttle*	29 min *via SW LRT to tram*	25 min *via SW LRT*	28 min *via multiple lines to SW LRT*
	Downtown Tualatin	40 min *via multiple lines to line 78*	40 min *via multiple lines to SW LRT*	35 min *via line 44*	35 min *via multiple lines to SW LRT to shuttle*	37 min *via multiple lines to SW LRT to tram*	33 min *via multiple lines to SW LRT*	38 min *via multiple lines to SW LRT*
	Sherwood	47 min *via line 94 to line 78*	53 min *via line 94*	48 min *via line 93* 53 min *via line 94*	53 min *via line 94*	50 min *via line 94 to tram*	45 min *via lines 93 or 94 to SW LRT*	45 min *via lines 93 or 94 to SW LRT*
SE of campus	Lake Grove	24 min *via lines 37 or 38 to line 78*	24 min *via lines 37 or 38 to line 78*	20 min *via line 44*	24 min *via lines 37 or 38 to line 78*	24 min *via lines 37 or 38 to line 78*	24 min *via lines 37 or 38 to line 78*	24 min *via lines 37 or 38 to line 78*
Other PCC campus locations	Southeast	71 min *via Green Line or 4 to 44*	66 min *via Green Line or 4 to SW LRT*	66 min *via Green Line or 4 to SW LRT*	63 min *via Green Line or 4 to SW LRT to shuttle*	63 min *via Green Line or 4 to SW LRT to tram*	59 min *via Green Line or 4 to SW LRT*	59 min *via Green Line or 4 to SW LRT*
	Cascade	65 min *via 72 to 44*	60 min *via 72 to SW LRT*	60 min *via 72 to SW LRT*	57 min *via 72 to SW LRT to shuttle*	57 min *via 72 to SW LRT to tram*	53 min *via 72 to SW LRT*	53 min *via 72 to SW LRT*
	Rock Creek	94 min *via 67 to 78*	92 min *via 67 to SW LRT*	92 min *via 67 to SW LRT*	87 min *via 67 to SW LRT to shuttle*	89 min *via 67 to SW LRT to tram*	83 min *via 67 to SW LRT*	83 min *via 67 to SW LRT*