

Southwest Corridor Plan

PCC Sylvania Enhanced Connection Options

Technical Memo
December 31, 2015



Overview

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

Contents

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

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

Summary of findings

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

Next steps

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

Background

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

Southwest Corridor Plan process to date

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

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

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

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

PCC Sylvania access options

Initial refinement

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

Evaluation of three HCT alignment options

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

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

Further research of light rail tunnel options

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

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

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

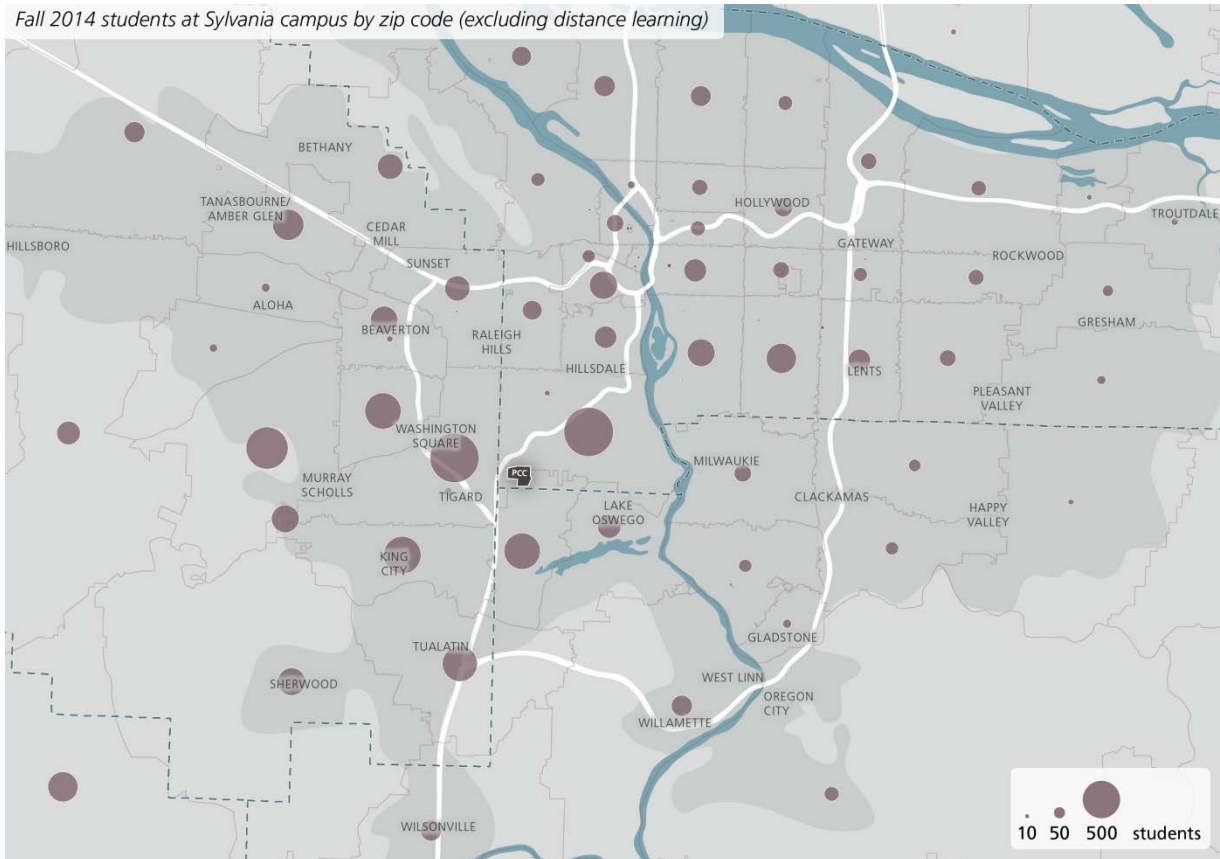
- **Revised cut-and-cover tunnel.** This option is largely consistent with the original option with an adjustment to construction technique to reduce local traffic impacts during construction. The revised C&C tunnel would be constructed in multiple segments linked by “lidded” excavation at road intersections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

Further research of alternative connection options

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

PCC campus vision

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



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

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

PCC connection refinement process

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

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

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

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

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

Alternative PCC connection options: local bus improvements

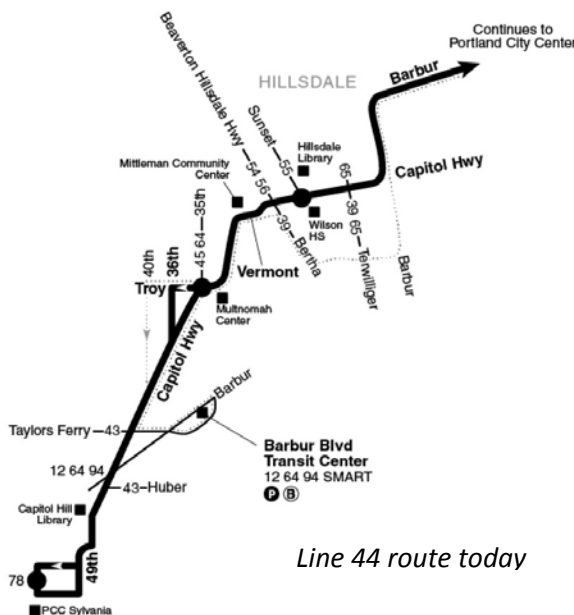
Staff developed the following three options that would utilize shared transitway segments, branded lines, and route changes to improve bus connectivity and travel times to the PCC Sylvania campus:

1. **Branded line 44 to PCC Sylvania with shared transitway on Barbur north of Capitol Highway:** Buses would run in a shared transitway on Barbur Boulevard from Capitol Highway (in “The Woods”) to the Transit Mall.
2. **New branded bus line to PCC Sylvania via Barbur with shared transitway north of Barbur Transit Center:** Buses would run in a shared transitway on Barbur from the Barbur Transit Center to the Transit Mall.
3. **PCC Sylvania bus hub with shared transitway connection to the Tigard Triangle:** Bus lines would connect to PCC from all directions, and could run in a shared transitway between the campus and the Tigard Triangle.

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

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

Line 44



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

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

TriMet has completed the Southwest Service Enhancement Plan (SWSEP), which identifies priorities for local bus improvements within the southwest corridor. The plan proposed upgrading the line 44 to frequent service between downtown

Portland and PCC Sylvania, and extending the line south from the campus to Bridgeport via Lake Grove.

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

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

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

Shared transitway on Barbur north of Capitol Highway



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

To access the shared transitway, buses would need to merge to and from mixed traffic at dedicated bus lanes near the Capitol Highway overpass in the Woods. Buses could receive transit signal treatments at intersections along the shared transitway. Buses would also stop at the Hamilton and Gibbs Street stations before

proceeding to the downtown Transit Mall. To reduce property impacts and travel time impacts to light rail, limited stops serving only primary destinations would be considered.

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

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

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

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

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

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



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

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

Given the conceptual nature of this option, further design refinement is needed to confirm final capital and operating costs. However, rough order of magnitude costs have been developed.

The new branded line with a shared transitway from Barbur Transit Center to the Transit Mall is estimated to add \$84 million to the light rail capital cost. As an additional bus line service, the operating costs would increase, resulting in higher costs than the branded 44 line discussed above. Operating costs for this new branded bus line are estimated at \$5 million annually in addition to the cost of light rail operations.

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

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

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

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

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

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

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

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

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

Line 44

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

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

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

Line 78

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

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

Line 93

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

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

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

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



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

New line 97

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

In this bus hub scenario, the line 97 would be extended through Bridgeport Village to travel north on Boones Ferry

Road to Kerr Parkway, which would connect the PCC Sylvania campus to Lake Grove, Tualatin and Sherwood, and terminate at the Barbur Transit Center.

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

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

PCC Sylvania bus hub summary

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

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

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

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

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

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

SW 53rd Avenue pedestrian and bike improvements

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

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

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

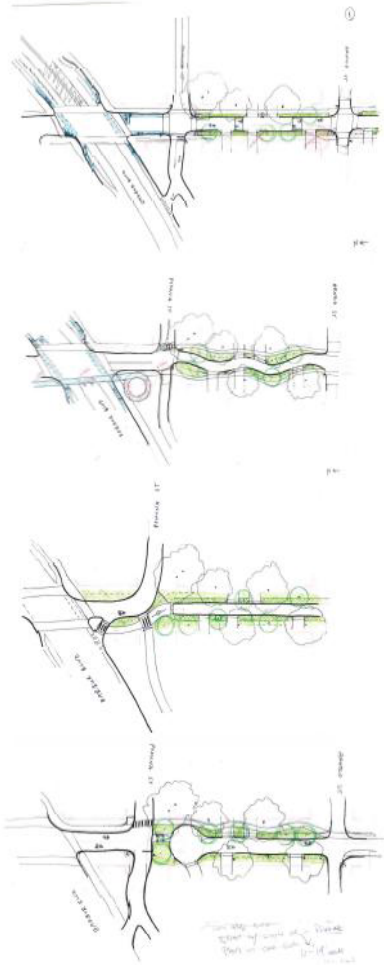
- Discussion with PCC staff to understand the unique issues that the campus has dealt with related to off-campus parking and thoughts around access from SW 53rd Avenue
- Attended Far SW Neighborhood Association meeting to hear concerns and answer questions about potential HCT alignment options and the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

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

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

Mayer-Reed concepts for enhanced SW 53rd Avenue connection

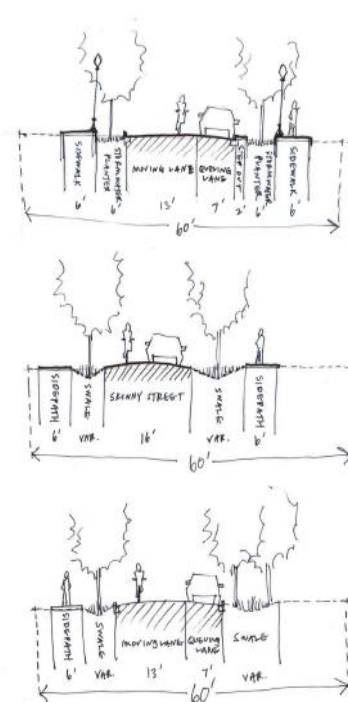
Conceptual designs for the connection from Barbur Blvd to Capitol Hwy



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



Conceptual cross-sections of SW 53rd Ave



Aerial tram

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

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

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

Overall summary PCC Sylvania connection options

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

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

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

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

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

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

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

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

Next steps

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

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

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