

Southwest Corridor Plan

**High Capacity Transit
Technical Evaluation Results and
Methodology Part 1:
South Portland, Hillsdale,
and PCC-Sylvania Areas**

Draft: May 11, 2015



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Introduction

This document, the Technical Evaluation Results and Methodology, Part 1, has been produced by the Southwest Corridor project team to support the decisions of the Southwest Corridor Steering Committee. In July 2015, the Steering Committee will decide whether to continue studying certain alignments of the proposed high capacity transit (HCT) line through Southwest Portland. These alignments provide direct access to important destinations, but also increase the costs and risks of building the HCT system.

This document summarizes and compares the performance of the alignment options across a number of factors. A subsequent recommendation from project staff, due in early June 2015, will balance the importance of various factors and consider the data in a broader context.

Project Purpose and Need

The purpose of the Southwest Corridor project is to interconnect Tualatin, Tigard, Southwest Portland and central Portland through high capacity transit and other transportation investments in the congested I-5 corridor in order to improve mobility and create the conditions that will allow communities in the corridor to achieve their established land use visions. The project is needed to address the following issues:

- Transit service to places where people need or want to go is limited;
- Limited street connectivity and gaps in pedestrian and bicycle networks create barriers and unsafe conditions for transit access and active transportation;
- Travel is slow and unreliable on congested roadways;
- There is increasing unmet demand for transit service in the corridor;
- There is a limited supply and range of housing options with good access to multimodal transportation networks;
- The corridor is rich in natural resources that need to be protected or enhanced; and
- Areas of the corridor lack access to parks, trails, and natural areas.

The factors analyzed in this document were selected for their relationship to the project's 13 goals. Appendix A lists these project goals and relates them to the studied factors.

Using this document and the related Key Issues memos

The Southwest Corridor project partners are taking a place-based approach to understanding the key issues related to potential HCT and transportation investments as they relate to local concerns and community aspirations. Key Issues memos have been released for the South Portland, Hillsdale and PCC-Sylvania areas. Each memo describes in detail the HCT alignments under consideration in the area and describes them regarding transit performance, community development, mobility, capital cost estimates, engineering complexity and risk, and community impacts. The South Portland, Hillsdale and PCC-Sylvania Key Issues memos have recently been updated with new technical information developed for this analysis, including updated modeling results and cost estimates.

This document supplements the Key Issues memos by providing a greater level of data analysis. It also provides a series of summary tables allowing for a quick overview of how the alignments perform in comparison to one another.

The tables in this document are shaded to visually distinguish outcomes between alignment options. However, the reader should not extrapolate conclusions from these colors. Please keep the following in mind:

- The darkest color does not necessarily represent the best performing option. Some factors can be interpreted as good, bad, or a complex mix. One example is redevelopment potential, which can suggest either investment and better construction or unwanted change and displacement, depending on the reader's circumstances and personal perspective. The colors assigned to redevelopment potential outcomes simply distinguish between "more" and "less" without suggesting which is better.
- Outcomes reported are not weighted, rather all reported equally. In reality, certain factors may be more important or impactful than others.
- The document contains a mix of "rating" and "ranking" outcomes. Results for some measures are rated by comparing how they perform to some scale and others are ranked by how they perform compared to each other.
- The analysis in this document is preliminary in nature. The project is at approximately three percent of design, meaning a great deal of uncertainty still remains regarding details of construction and operations. As a result, some data may change significantly between issuance of this document and the preparation of the federally-required Draft Environmental Impact Statement.

Next Steps and Opportunities for Input

This document is being released in conjunction with the Southwest Corridor Steering Committee meeting of May 11, 2015 and a community forum at Wilson High School in SW Portland on May 12, 2015. An online interactive map tool is also open for public review and input from May 8 through May 19. This map shows the locations of proposed HCT alignments in Southwest Portland, as well as other key locations throughout the project area. Clicking on locations will provide a brief summary of basic information, links to more detailed documents, and the opportunity to provide input on important factors for decision-makers to consider.

Public comments submitted through these opportunities will be factored into a recommendation report from project staff focusing on the HCT alignment options in the South Portland, Hillsdale and PCC-Sylvania areas. The recommendation report will summarize the major findings from the Key Issues memos, stakeholder feedback, and this document and provide a draft recommendation to the Steering Committee on alignment options to study further. This report will be available at least 30 days prior to the July 13 Steering Committee meeting.

In July, the Steering Committee will discuss each alignment option analyzed in this document and decide whether to continue studying it. Note that each segment further evaluated will cost money and time, and may require geotechnical investigations necessitating drilling or other physical action. In other words, there may be trade-offs to studying alignments deemed ineffective or undesirable.

The December Steering Committee decision will focus on the remaining HCT alignments in Tigard and Tualatin and terminus options as well as a decision to select light rail (LRT) or bus rapid transit (BRT) as the best mode to serve the corridor. Further technical analysis, place-based public outreach, and partner conversations will precede the December decisions. See the "Project Background and Decision Timeline" section in this document for more details.

This document is available on the project website at:

<http://www.oregonmetro.gov/public-projects/southwest-corridor-plan>

Project Background and Decision Timeline

Southwest Corridor Plan overview

The Southwest Corridor Plan is a comprehensive approach to achieving community visions through integrated land use and transportation planning. The Southwest Corridor Plan incorporates high capacity transit (HCT) alternatives, roadway, bicycle and pedestrian projects and adopted local land use visions, including the Barbur Concept Plan, the Tigard High Capacity Transit Land Use Plan, Linking Tualatin and the Sherwood Town Center Plan. The Plan is exploring Bus Rapid Transit (BRT) and Light Rail Transit (LRT) alternatives for several alignments that connect the Portland Central City, Southwest Portland, Tigard, and Tualatin.

In July 2013, the Southwest Corridor Plan Steering Committee recommended a Shared Investment Strategy that includes key investments in transit, roadways, active transportation, parks, trails and natural areas. A refinement study was initiated in August 2013 to narrow HCT options, identify a preferred alternative and create a subset of road and active transportation projects. In June 2014, the Steering Committee accepted the recommendation of a narrowed set of HCT design options and requested additional refinement work from staff.

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 is anticipated to be defined in spring 2016.

After the Steering Committee approves the Preferred Package, the identified HCT mode, alignment options, roadway, bicycle and pedestrian projects will receive full environmental review in a Draft Environmental Impact Statement (DEIS) under the National Environmental Policy Act (NEPA). It is anticipated that additional roadway, transit, bicycle and pedestrian projects will be further studied, funded and implemented through other collective federal, state, regional and local efforts.

Desired outcome: Preferred Package

Project partners will work together to develop a Preferred Package by spring 2016 that addresses the needs and aspirations of Southwest Corridor residents and businesses. The Preferred Package will include the following components:

HCT Preferred Alternative: Preferred HCT alignments to study further in a DEIS, including 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

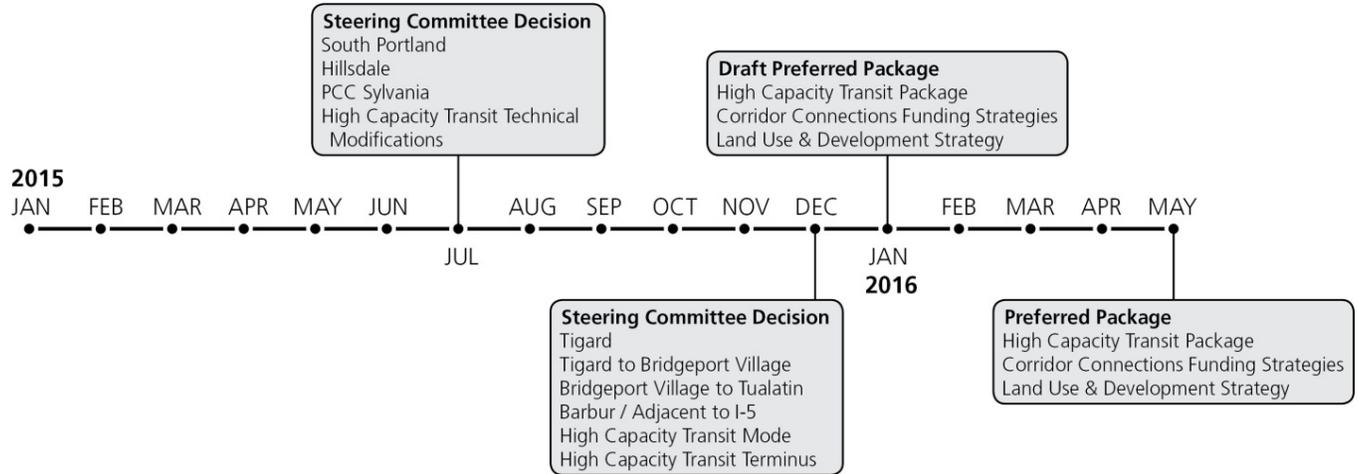
Land use and development strategy: Partnership agreements and other pre-development work to activate land use and place-making strategies identified in local land use visions

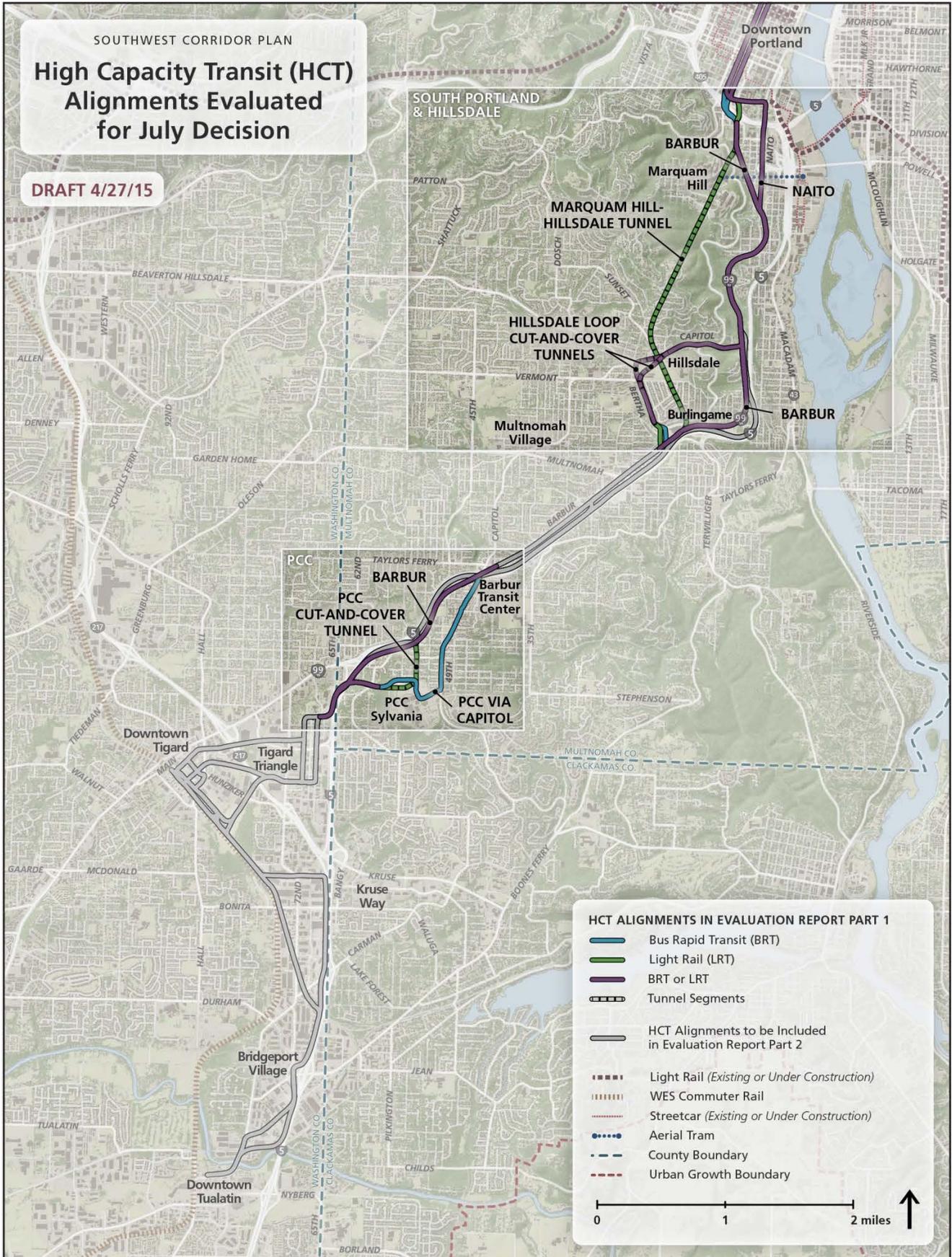
Identifying the Preferred Package: 2015-2016 timeline overview

To reach a Preferred Package by spring of 2016, two key Steering Committee decision-making points have been identified in 2015: July and December. Technical analysis, place-based public outreach, and partner conversations will precede each Steering Committee decision. A draft recommendation report will be presented at community forums before each decision-making point, including public comment gathered during the place-based outreach period and any additional technical analysis compiled.

The July Steering Committee decision will focus on direct versus indirect access to key destinations in the corridor including Marquam Hill, Hillsdale, and the Portland Community College (PCC) Sylvania Campus, as well as technical modifications to other HCT alignments. The December Steering Committee decision will focus on

the remaining HCT alignments and terminus options as well as an HCT mode decision between LRT and BRT. In January 2016, the Steering Committee will identify a Draft Preferred Package, including HCT mode, alignment options, terminus options, and associated roadway and active transportation projects for further study in a DEIS, a funding strategy for additional priority roadway, bicycle, and pedestrian projects throughout the corridor, and integrated land use and development strategies.





Results Summary

Alignments evaluated

This report focuses on the alignments in the South Portland, Hillsdale and PCC-Sylvania areas, highlighted on the map on the previous page and listed in the table on the left below. These alignments are explained in more detail in the Alignment Definitions section of this document.

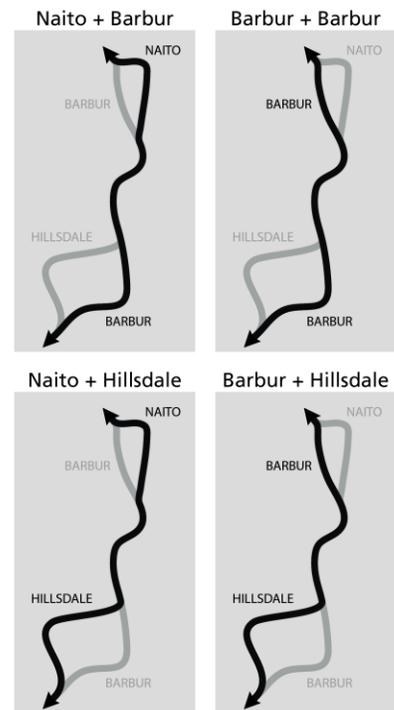
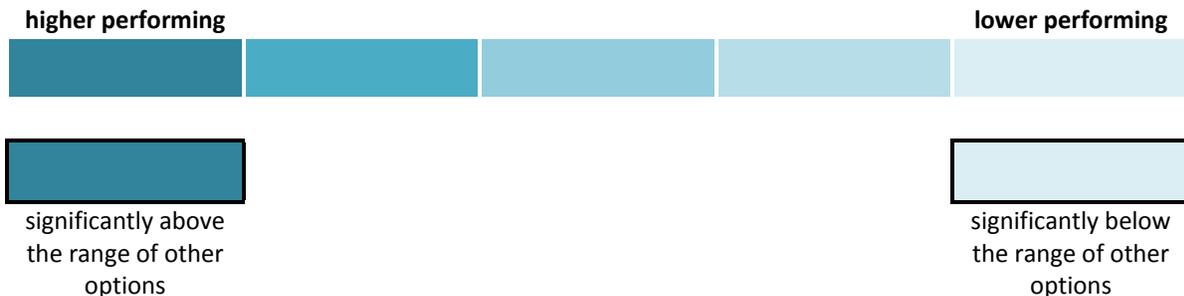
Alignment options in South Portland and Hillsdale were combined for the purpose of analysis because the Marquam Hill-Hillsdale deep-bored tunnel spans both areas. The resulting four surface and cut-and-cover tunnel alignments that were evaluated are defined in the maps on the right below.

	LRT	BRT
South Portland and Hillsdale		
<i>Naito + Barbur*</i>	✓	✓
<i>Barbur + Barbur*</i>	✓	✓
<i>Naito + Hillsdale</i>	✓	✓
<i>Barbur + Hillsdale</i>	✓	✓
<i>MH-H tunnel</i>	✓	
PCC-Sylvania area		
<i>Barbur*</i>	✓	✓
<i>PCC via tunnel</i>	✓	
<i>PCC via Capitol</i>		✓

* No decision is expected on this alignment in July 2015. It will continue to be evaluated into the DEIS process.

Key

The tables on the following tabloid pages summarize the results. As shown in the key below, darker colors in the tables indicate higher performance in each measure. Alignments that are significantly above or below the performance range of other options are highlighted with a black outline. See the Detailed Methodology and Results section at the end of this report for more information on how the information was developed and how colors were assigned.



South Portland and Hillsdale: LRT

	Surface alignments		Cut-and-cover tunnel alignments		Deep-bored tunnel
	Naito + Barbur	Barbur + Barbur	Naito + Hillsdale	Barbur + Hillsdale	MH-H Tunnel
Transit performance					
New system transit trips <i>2035 with HCT - 2035 low build</i>	15,700 <i>daily new system transit trips</i>	15,700 <i>daily new system transit trips</i>	14,200 <i>daily new system transit trips</i>	14,200* <i>daily new system transit trips</i>	16,900 <i>daily new system transit trips</i>
Line ridership <i>2035 HCT in SW Corridor</i>	43,500 <i>daily line riders</i>	44,100 <i>daily line riders</i>	41,800 <i>daily line riders</i>	42,400* <i>daily line riders</i>	52,400 <i>daily line riders</i>
Travel time <i>2035 Portland State University to Tualatin</i>	31.2 minutes	30.3 minutes	33.8 minutes	32.9 minutes	29.1 minutes
Signalized intersections crossed <i>along segment</i>	14 <i>intersections</i>	12 <i>intersections</i>	15 <i>intersections</i>	13 <i>intersections</i>	3 <i>intersections</i>
Access and development					
Equitable access to transit <i>areas with above-average rates of people of color, low income, and limited English proficiency</i>	moderate access	moderate access	low to moderate access	low to moderate access	moderate to high access
Redevelopment potential <i>based on acres of redevelopable land within ¼ mile from stations along segment</i>	47 acres	43 acres	72 acres	69 acres	64 acres
Support for existing plans <i>including Barbur Concept Plan</i>	high support	moderate support	moderate to high support	moderate support	low to moderate support
Mobility					
Freight <i>based on overlap with local, regional and state freight networks</i>	substantial local overlap	substantial local overlap	substantial local overlap	substantial local overlap	some local overlap
Traffic <i>based on V/C ratio, vehicle delays, and vehicle queuing</i>	some opportunity for improvement	negligible impact	some opportunity for improvement	negligible impact	negligible impact
Transportation safety <i>opportunity to address high-crash locations</i>	low to moderate improvement potential	low to moderate improvement potential	low to moderate improvement potential	low to moderate improvement potential	negligible impact
Street connectivity <i>change in street connections, including bike and pedestrian connections</i>	9-11 new connections	1 new connection	9-11 new connections	1 new connection	no change
Bike improvements <i>miles of bike gaps filled (included in project cost estimates)</i>	2.0 miles <i>along 3.4 mile segment</i>	0.4 miles <i>along 3.4 mile segment</i>	2.1 miles <i>along 3.7 mile segment</i>	0.4 miles <i>along 3.7 mile segment</i>	0 miles <i>along 2.9 mile segment</i>
Pedestrian improvements <i>miles of sidewalks gaps filled (included in project cost estimates)</i>	3.3 miles <i>along 3.4 mile segment</i>	3.1 miles <i>along 3.4 mile segment</i>	3.3 miles <i>along 3.7 mile segment</i>	3.1 miles <i>along 3.7 mile segment</i>	0 miles <i>along 2.9 mile segment</i>
Cost					
Capital cost: segment <i>millions of 2014 dollars</i>	\$610 million	\$440 million	\$840 million	\$670 million	\$1,340 million
Operations and maintenance costs <i>based on average weekday vehicle hours</i>	moderate cost	low to moderate cost	moderate to high cost	moderate cost	low to moderate cost
Engineering complexity					
Construction impacts <i>qualitative analysis of temporary impacts that could occur during project construction</i>	low to moderate impact	low impact	moderate to high impact	moderate impact	high impact
Engineering risk <i>qualitative analysis of relative risks associated with special elements of design options</i>	low to moderate risk	low risk	moderate to high risk	moderate risk	high risk
Community and environmental impacts					
Property impacts <i>qualitative analysis of potential impacts to properties</i>	moderate impact	moderate impact	moderate to high impact	moderate to high impact	high impact
Property access impacts <i>changes to driveway access along alignment</i>	1-5 driveways <i>along 3.4 mile segment</i>	5-10 driveways <i>along 3.4 mile segment</i>	15-20 driveways <i>along 3.7 mile segment</i>	20-25 driveways <i>along 3.7 mile segment</i>	1-5 driveways <i>along 2.9 mile segment</i>
Property impacts to historically under-represented populations <i>areas with above-average rates of people of color, low income, and limited English proficiency</i>	low impact	low to moderate impact	low impact	low to moderate impact	low impact
Visual impacts <i>based on degree of visual change</i>	moderate degree of change	moderate degree of change	moderate to high degree of change	moderate to high degree of change	moderate degree of change
Impacts to parks and historic properties <i>potential impacts to parks, wetlands, and historic properties</i>	moderate impact	moderate impact	moderate to high impact	moderate to high impact	high impact

* estimate based on related model runs

South Portland and Hillsdale: BRT

	Surface alignments		Cut-and-cover tunnel alignments	
	Naito + Barbur	Barbur + Barbur	Naito + Hillsdale	Barbur + Hillsdale
Transit performance				
New system transit trips <i>2035 with HCT - 2035 low build</i>	8,400 <i>daily new system transit trips</i>	8,400* <i>daily new system transit trips</i>	7,700* <i>daily new system transit trips</i>	7,700* <i>daily new system transit trips</i>
Line ridership <i>2035 HCT in SW Corridor</i>	30,800 <i>daily line riders</i>	31,200* <i>daily line riders</i>	29,300* <i>daily line riders</i>	29,700* <i>daily line riders</i>
Travel time <i>2035 Portland State University to Tualatin</i>	34.1 minutes	33.3 minutes	36.9 minutes	36.1 minutes
Mixed traffic <i>miles of operations in mixed traffic</i>	1.4 miles <i>along 3.7 mile segment</i>	1.4 miles <i>along 3.5 mile segment</i>	0.2 miles <i>along 3.9 mile segment</i>	0.2 miles <i>along 3.8 mile segment</i>
Signalized intersections crossed <i>along segment</i>	14 <i>intersections</i>	12 <i>intersections</i>	18 <i>intersections</i>	16 <i>intersections</i>
Access and development				
Equitable access to transit <i>areas with above-average rates of people of color, low income, and limited English proficiency</i>	moderate access	moderate access	low to moderate access	low to moderate access
Redevelopment potential <i>based on acres of redevelopable land within ¼ mile from stations along segment</i>	41 acres	39 acres	67 acres	64 acres
Support for existing plans <i>including Barbur Concept Plan</i>	high support	moderate support	moderate to high support	moderate support
Mobility				
Freight <i>based on overlap with local, regional and state freight networks</i>	substantial local overlap	substantial local overlap	substantial local overlap	substantial local overlap
Traffic <i>based on V/C ratio and vehicle queuing</i>	some opportunity for improvement	negligible impact	some opportunity for improvement	negligible impact
Transportation safety <i>opportunity to address high-crash locations</i>	low to moderate improvement potential	low to moderate improvement potential	low to moderate improvement potential	low to moderate improvement potential
Street connectivity <i>change in street connections, including bike and pedestrian connections</i>	9-11 new connections	1 new connection	9-11 new connections	1 new connection
Bike improvements <i>miles of bike gaps filled (included in project cost estimates)</i>	2.0 miles <i>along 3.4 mile segment</i>	0.4 miles <i>along 3.4 mile segment</i>	2.1 miles <i>along 3.7 mile segment</i>	0.4 miles <i>along 3.7 mile segment</i>
Pedestrian improvements <i>miles of sidewalks gaps filled (included in project cost estimates)</i>	3.3 miles <i>along 3.4 mile segment</i>	3.1 miles <i>along 3.4 mile segment</i>	3.3 miles <i>along 3.7 mile segment</i>	3.1 miles <i>along 3.7 mile segment</i>
Cost				
Capital cost: segment <i>millions of 2014 dollars</i>	\$330 million	\$140 million	\$470 million	\$280 million
Operations and maintenance costs <i>based on average weekday vehicle hours</i>	moderate cost	low to moderate cost	moderate to high cost	moderate cost
Engineering complexity				
Construction impacts <i>qualitative analysis of temporary impacts that could occur during project construction</i>	low to moderate impact	low impact	moderate to high impact	moderate impact
Engineering risk <i>qualitative analysis of relative risks associated with special elements of design options</i>	low to moderate risk	low risk	moderate to high risk	moderate risk
Community and environmental impacts				
Property impacts <i>qualitative analysis of potential impacts to properties</i>	moderate impact	moderate impact	moderate to high impact	moderate to high impact
Property access impacts <i>changes to driveway access along alignment</i>	1-5 driveways <i>along 3.4 mile segment</i>	5-10 driveways <i>along 3.4 mile segment</i>	20-25 driveways <i>along 3.7 mile segment</i>	25-30 driveways <i>along 3.7 mile segment</i>
Property impacts to historically under-represented populations <i>areas with above-average rates of people of color, low income, and limited English proficiency</i>	low impact	low to moderate impact	low impact	low to moderate impact
Visual impacts <i>based on degree of visual change</i>	low to moderate degree of change	low to moderate degree of change	moderate to high degree of change	moderate to high degree of change
Impacts to parks and historic properties <i>potential impacts to parks, wetlands, and historic properties</i>	moderate impact	moderate impact	moderate to high impact	moderate to high impact

* estimate based on related model runs

PCC-Sylvania area: LRT

	Walk to PCC	Direct PCC access
	Barbur	PCC via tunnel
Transit performance		
New system transit trips <i>2035 with HCT - 2035 low build</i>	15,700 <i>daily new system transit trips</i>	17,800 <i>daily new system transit trips</i>
Line ridership <i>2035 HCT in SW Corridor</i>	43,500 <i>daily line riders</i>	46,200 <i>daily line riders</i>
Travel time <i>2035 Portland State University to Tualatin</i>	31.2 minutes	31.9 minutes
Signalized intersections crossed <i>along segment</i>	4 <i>intersections</i>	3 <i>intersections</i>
Access and development		
Equitable access to transit <i>areas with above-average rates of people of color, low income, and limited English proficiency</i>	moderate access	high access
Redevelopment potential <i>based on acres of redevelopable land within ¼ mile from stations along segment</i>	18 acres	2 acres
Support for existing plans <i>including Barbur Concept Plan</i>	moderate to high support	moderate support
Mobility		
Freight <i>based on overlap with local, regional and state freight networks</i>	substantial local overlap	substantial local overlap
Traffic <i>based on V/C ratio and vehicle queuing</i>	some negative impact	some negative impact
Transportation safety <i>opportunity to address high-crash locations</i>	low to moderate improvement potential	low to moderate improvement potential
Street connectivity <i>change in street connections, including bike and pedestrian connections</i>	1 new connection	1 new connection
Bike improvements <i>miles of bike gaps filled (included in project cost estimates)</i>	1.7 miles <i>along 1.9 mile route</i>	1.1 miles <i>along 2.4 mile route</i>
Pedestrian improvements <i>miles of RATP sidewalks gaps filled (included in project cost estimates)</i>	1.7 miles <i>along 1.9 mile route</i>	1.1 miles <i>along 2.1 mile route</i>
Cost		
Capital cost: segment <i>millions of 2014 dollars</i>	\$270 million	\$520 million
Operations and maintenance costs <i>based on average weekday vehicle hours</i>	moderate cost	moderate cost
Engineering complexity		
Construction impacts <i>qualitative analysis of temporary impacts that could occur during project construction</i>	low to moderate impact	high impact
Engineering risk <i>qualitative analysis of relative risks associated with special elements of design options</i>	low to moderate risk	high risk
Community and environmental impacts		
Property impacts <i>qualitative analysis of potential impacts to properties</i>	moderate impact	high impact
Property access impacts <i>changes to driveway access along alignment</i>	35-40 driveways <i>along 1.9 mile segment</i>	25-30 driveways <i>along 2.1 mile segment</i>
Property impacts to historically under-represented populations <i>areas with above-average rates of people of color, low income, and limited English proficiency</i>	low impact	low to moderate impact
Visual impacts <i>based on degree of visual change</i>	moderate degree of change	moderate degree of change
Impacts to parks and historic properties <i>potential impacts to parks, wetlands, and historic properties</i>	low to moderate impact	low to moderate impact

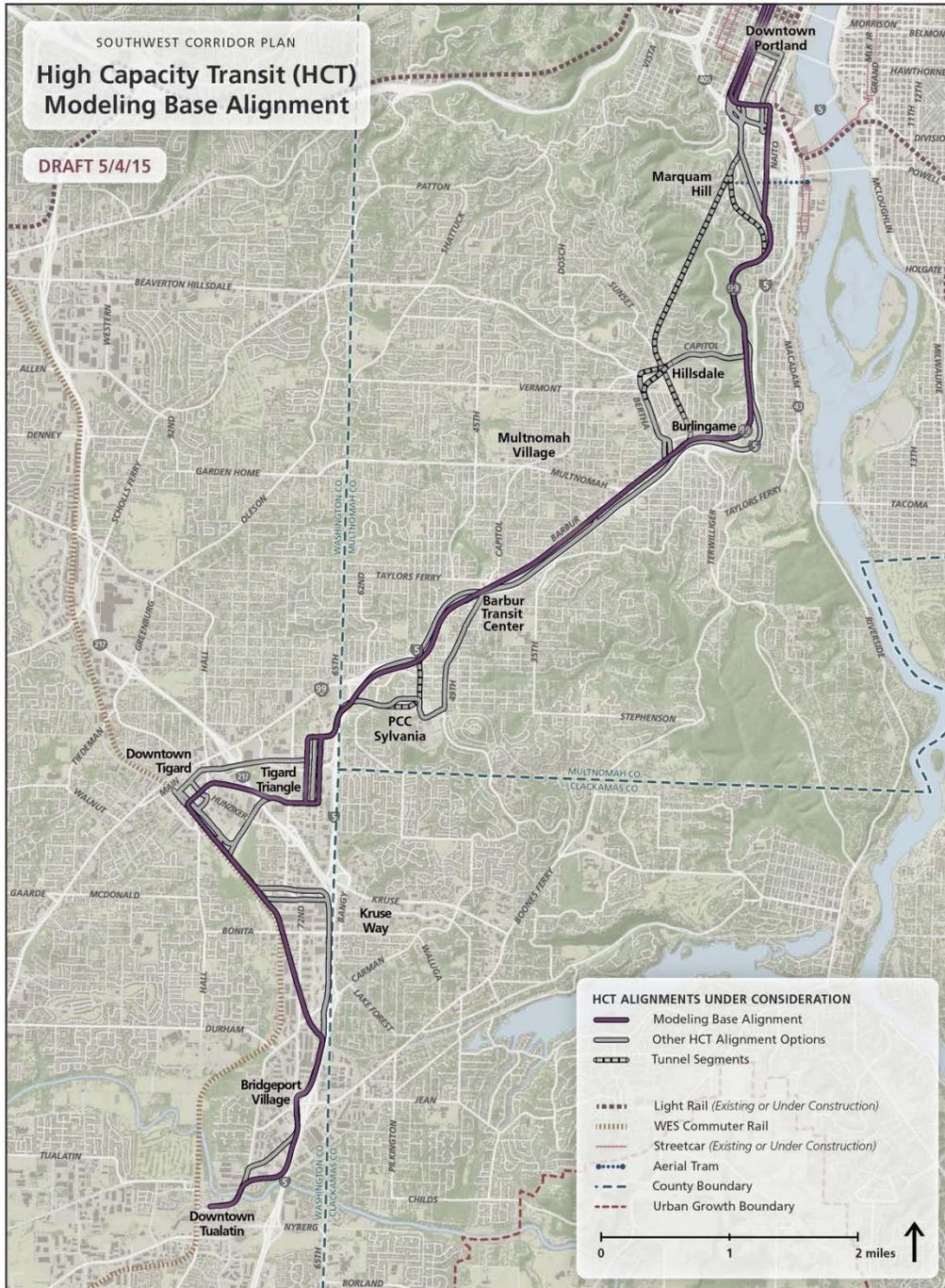
PCC-Sylvania area: BRT

	Walk to PCC Barbur	Direct PCC access PCC via Capitol
Transit performance		
New system transit trips <i>2035 with HCT - 2035 low build</i>	8,400 <i>daily new system transit trips</i>	9,700 <i>daily new system transit trips</i>
Line ridership <i>2035 Portland State University to Tualatin</i>	30,800 <i>daily line riders</i>	32,900 <i>daily line riders</i>
Travel time <i>PSU to Tualatin</i>	34.1 minutes	35.7 minutes
Mixed traffic <i>miles of operations in mixed traffic</i>	0 miles <i>along 1.8 mile segment</i>	0 miles <i>along 2.3 mile segment</i>
Signalized intersections crossed <i>along segment</i>	4 <i>intersections</i>	8 <i>intersections</i>
Access and development		
Equitable access to transit <i>areas with above-average rates of people of color, low income, and limited English proficiency</i>	moderate access	high access
Redevelopment potential <i>based on acres of redevelopable land within ¼ mile from stations along segment</i>	18 acres	25 acres
Support for existing plans <i>including Barbur Concept Plan</i>	moderate to high support	moderate support
Mobility		
Freight <i>based on overlap with local, regional and state freight networks</i>	substantial local overlap	minimal or no overlap
Traffic <i>based on V/C ratio and vehicle queuing</i>	some negative impact	negligible impact
Transportation safety <i>opportunity to address high-crash locations</i>	low to moderate improvement potential	low to moderate improvement potential
Street connectivity <i>change in street connections, including bike and pedestrian connections</i>	1 new connection	1 new connection
Bike improvements <i>miles of bike gaps filled (included in project cost estimates)</i>	1.7 miles <i>along 1.9 mile route</i>	1.1 miles <i>along 2.4 mile route</i>
Pedestrian improvements <i>miles of sidewalks gaps filled (included in project cost estimates)</i>	1.7 miles <i>along 1.9 mile route</i>	0 miles <i>along 2.4 mile route</i>
Cost		
Capital cost: segment <i>millions of 2014 dollars</i>	\$140 million	\$140 million
Operations and maintenance costs <i>based on average weekday vehicle hours</i>	moderate cost	moderate to high cost
Engineering complexity		
Construction impacts <i>qualitative analysis of temporary impacts that could occur during project construction</i>	low to moderate impact	low to moderate impact
Engineering risk <i>qualitative analysis of relative risks associated with special elements of design options</i>	low to moderate risk	low to moderate risk
Community and environmental impacts		
Property impacts <i>qualitative analysis of potential impacts to properties</i>	moderate impact	high impact
Property access impacts <i>changes to driveway access along alignment</i>	35-40 driveways <i>along 1.9 mile segment</i>	40-45 driveways <i>along 2.4 mile segment</i>
Property impacts to historically under-represented populations <i>areas with above-average rates of people of color, low income, and limited English proficiency</i>	low impact	low to moderate impact
Visual impacts <i>based on degree of visual change</i>	low to moderate degree of change	moderate degree of change
Impacts to parks and historic properties <i>potential impacts to parks, wetlands, and historic properties</i>	low to moderate impact	low to moderate impact

General Assumptions

Base modeling alignments

While most evaluation measures focus on a particular segment of the full HCT alignment, certain measures are inherently corridor-wide. For these measures, the modeling base alignment is assumed beyond the segment in question. The following map illustrates the modeling base alignment, including slight differences between BRT and LRT.



Mode

For many measures, such as capital cost and new system transit trips, there is a relatively broad gap between BRT and LRT performance. Because the purpose of this report is to inform alignment narrowing decisions and not a mode decision, BRT and LRT are colored according to a different scale when appropriate. In general, the coloration of evaluation measures should not be directly compared between the BRT and LRT tables.

A separate mode evaluation report will be completed in the fall of 2015, in anticipation of a December Steering Committee decision on which mode to carry forward into a DEIS.

Alignment Definitions

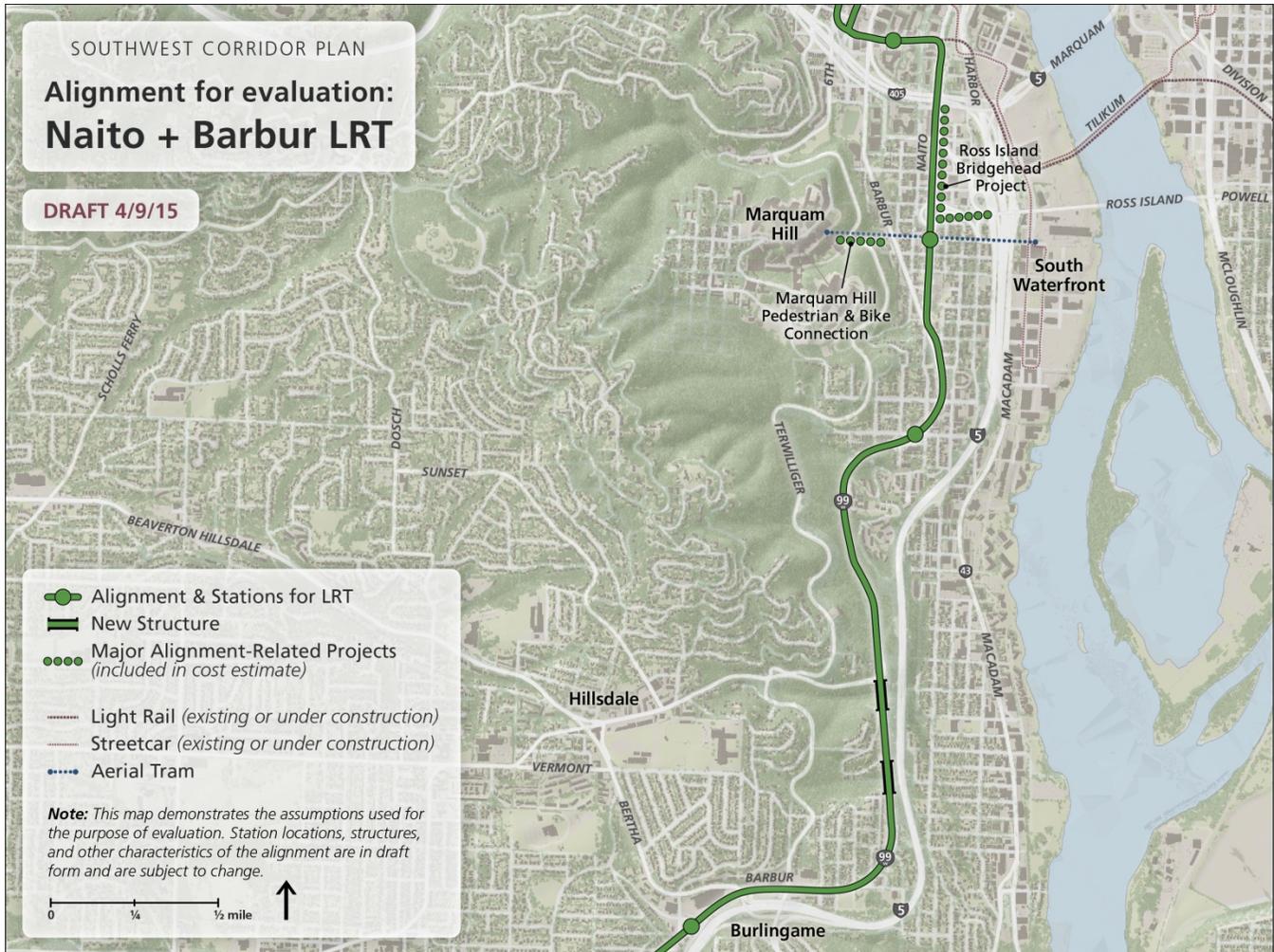
The following maps illustrate what is assumed to be included with each alignment option for the purpose of analysis, including structures, stations, key roadway and active transportation projects, and mixed traffic segments. The alignments are currently at a three percent level of design, so these assumptions are subject to change upon further study.

South Portland and Hillsdale: LRT

Naito Parkway and Barbur Boulevard

Naito + Barbur

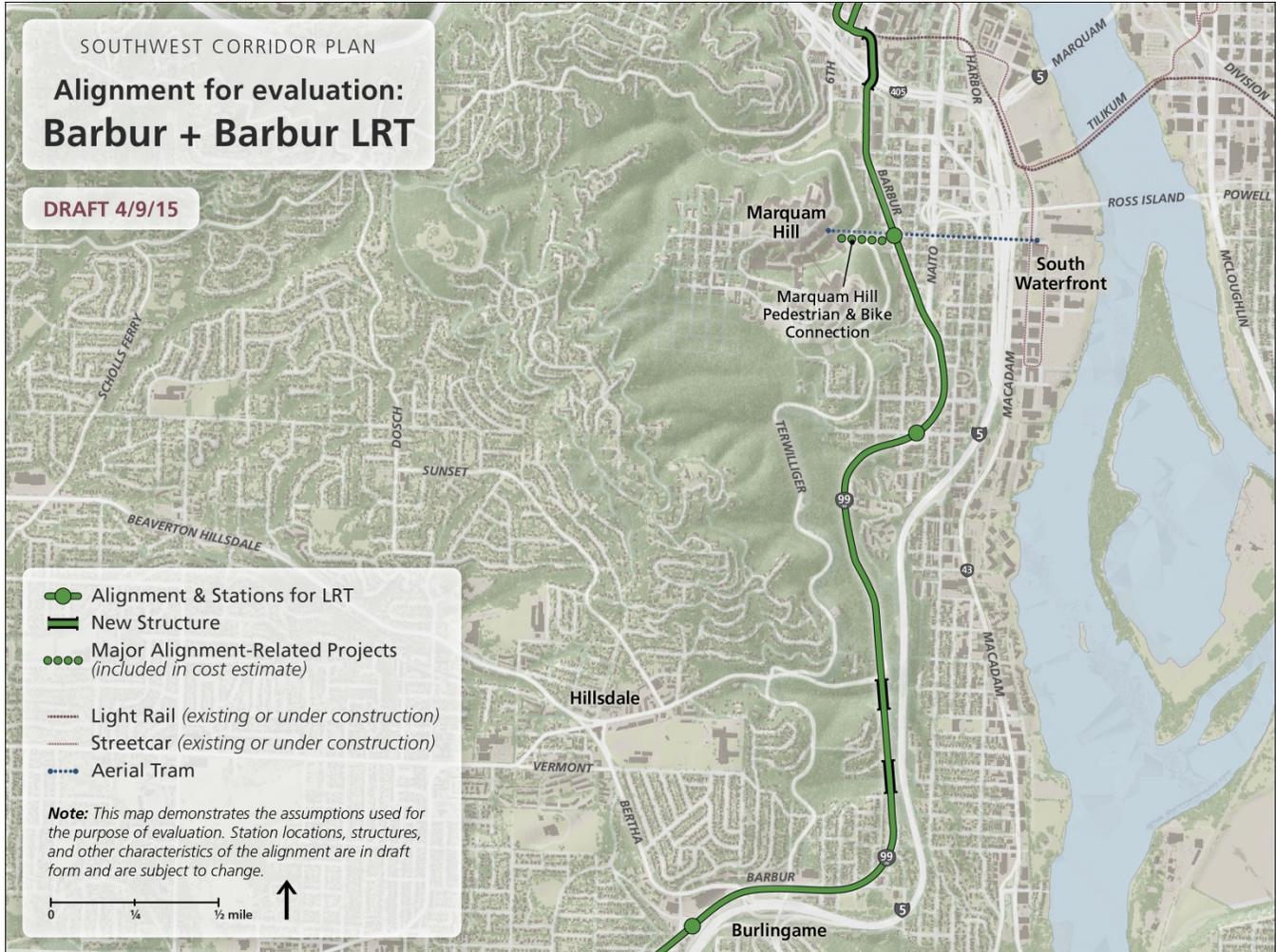
This alignment combines the Naito Parkway option in South Portland with the Barbur Boulevard alignment in the Hillsdale area. The alignment is assumed to include stations at Lincoln Street (currently under construction for Portland-Milwaukie Light Rail), Gibbs Street, Hamilton Street and 13th Avenue. The Ross Island Bridgehead project and a Marquam Hill bike and pedestrian connection are both included in the alignment for the purpose of analysis, including cost and mobility measures.



Barbur Boulevard and Barbur Boulevard

Barbur + Barbur

This alignment combines the Barbur Boulevard alignment in South Portland with the Barbur Boulevard alignment in the Hillsdale area. The alignment is assumed to include stations at Gibbs Street, Hamilton Street and 13th Avenue. The Marquam Hill bike and pedestrian connection is included in the alignment for the purpose of analysis, including capital cost and ridership measures.

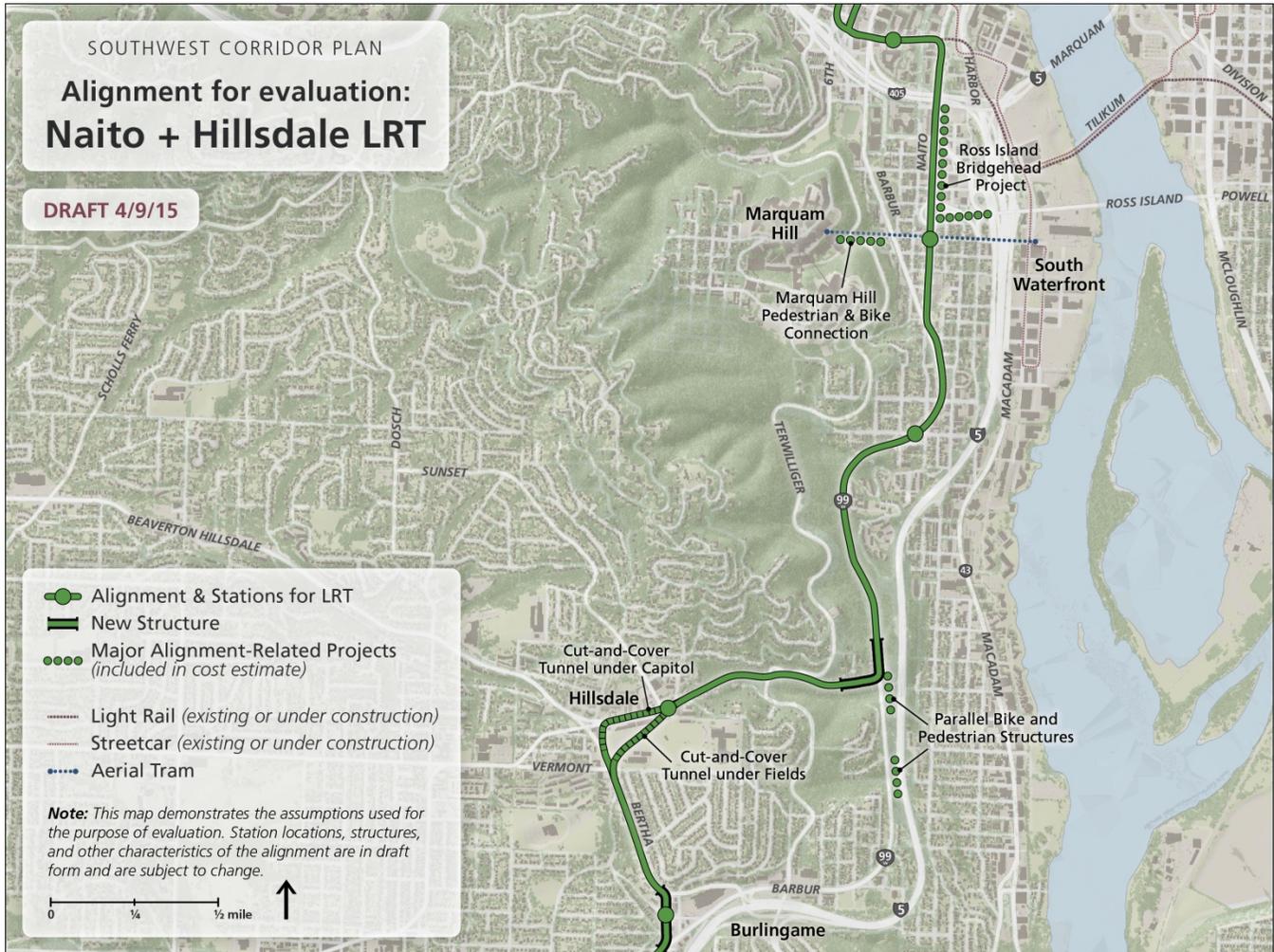


Naito Parkway and Hillsdale loop with cut-and-cover tunnel

Naito + Hillsdale

This alignment combines the Naito Parkway option in South Portland with the cut-and-cover tunnel that loops through Hillsdale. The alignment is assumed to include stations at Lincoln Street (currently under construction for Portland-Milwaukie Light Rail), Gibbs Street, Hamilton Street, the Hillsdale town center and 13th Avenue.

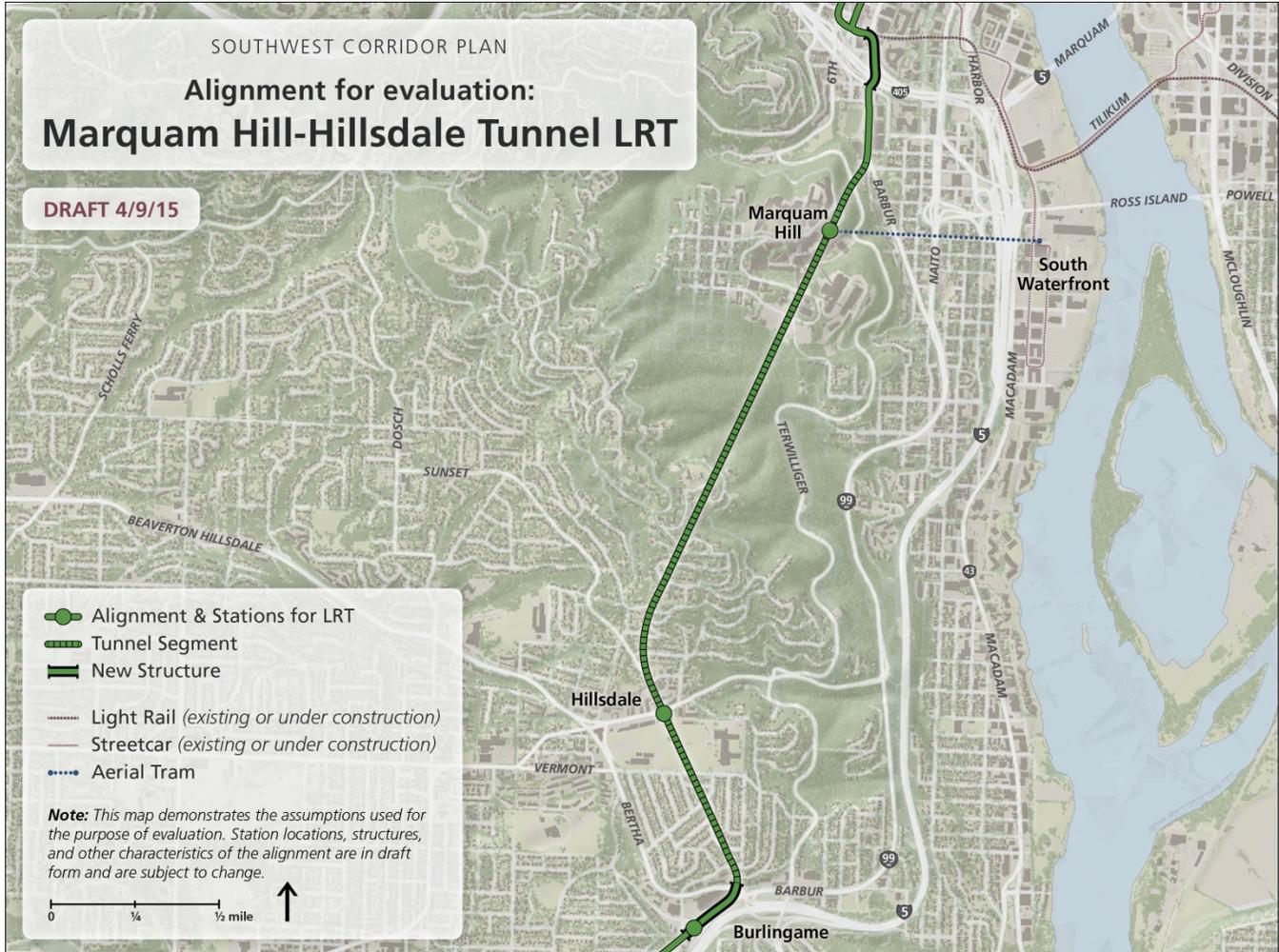
Unless noted otherwise, the results apply to both the tunnel under Capitol Highway and the tunnel that runs under the fields in between Capitol and Rieke Elementary School.



Marquam Hill-Hillsdale tunnel

MH-H tunnel

The Marquam Hill-Hillsdale tunnel is a deep-bored tunnel that runs under the hills west of Barbur Boulevard between Hooker Street and Bertha Boulevard. The alignment is assumed to include an underground station at Marquam Hill, providing access to the Oregon Health & Sciences University (OHSU), the Veterans Affairs Hospital (VA), and other facilities, and a second underground station in the Hillsdale town center.

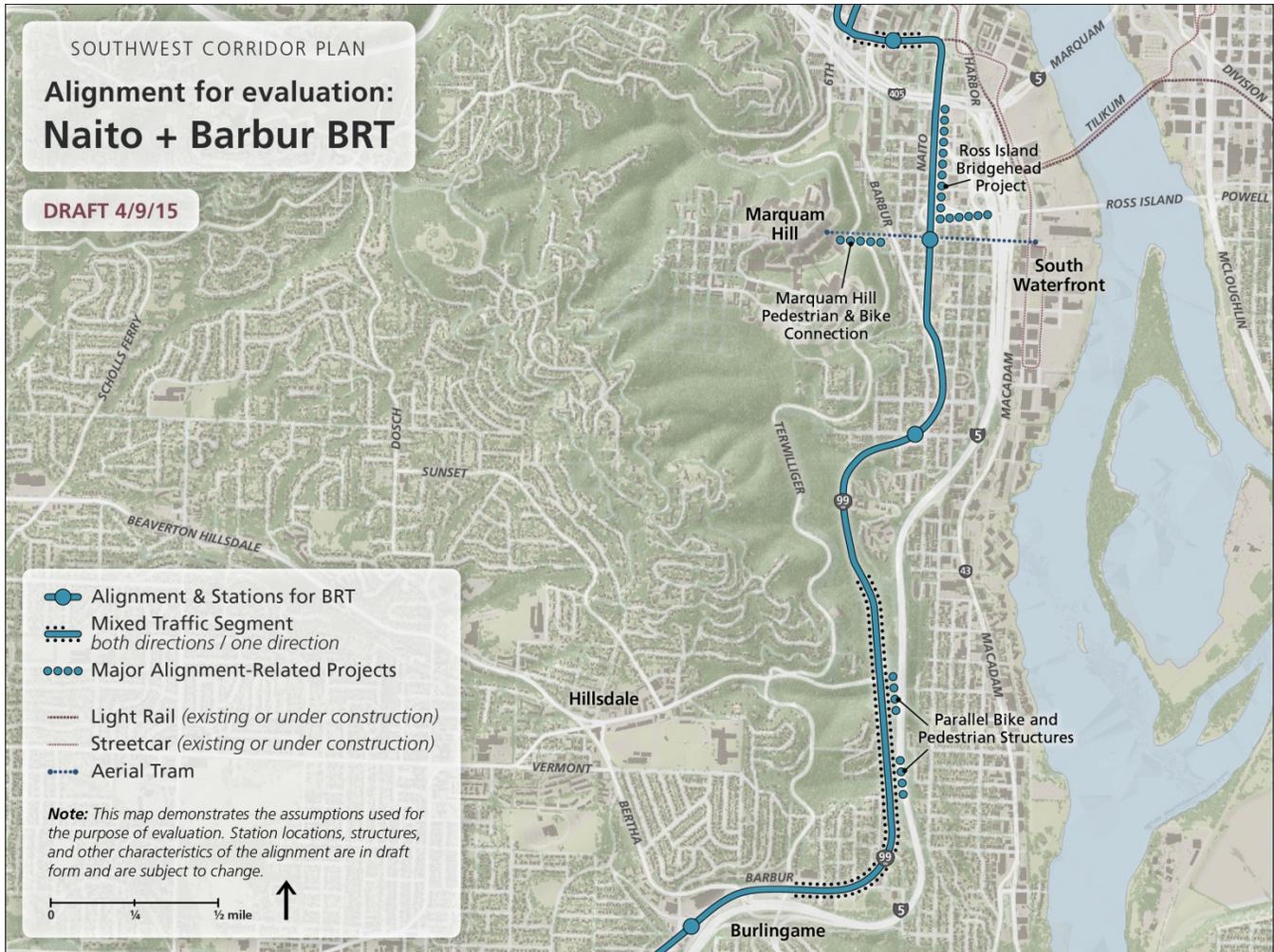


South Portland and Hillsdale: BRT

Naito Parkway and Barbur Boulevard

Naito + Barbur

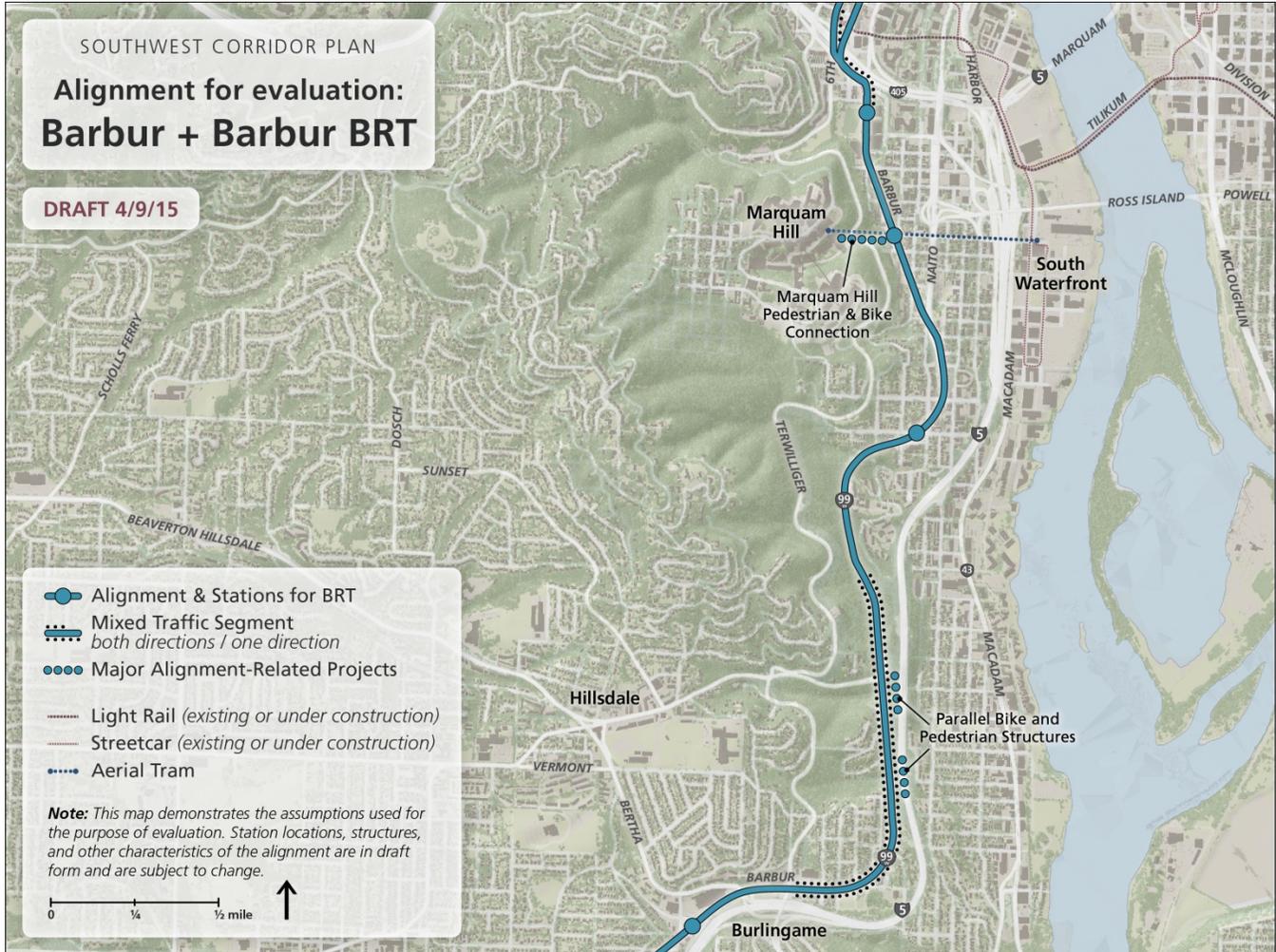
This alignment combines the Naito Parkway option in South Portland with the Barbur Boulevard alignment in the Hillsdale area. The alignment is assumed to include stations at Lincoln Street (currently under construction for Portland-Milwaukie Light Rail), Gibbs Street, Hamilton Street and 13th Avenue. The Ross Island Bridgehead project and a Marquam Hill bike and pedestrian connection are both included in the alignment for the purpose of evaluation, including cost and mobility measures.



Barbur Boulevard and Barbur Boulevard

Barbur + Barbur

This alignment combines the Barbur Boulevard alignment in South Portland with the Barbur Boulevard alignment in the Hillsdale area. The alignment is assumed to include stations at Gibbs Street, Hamilton Street and 13th Avenue. The Marquam Hill bike and pedestrian connection is included in the alignment for the purpose of analysis, including capital cost and ridership measures.

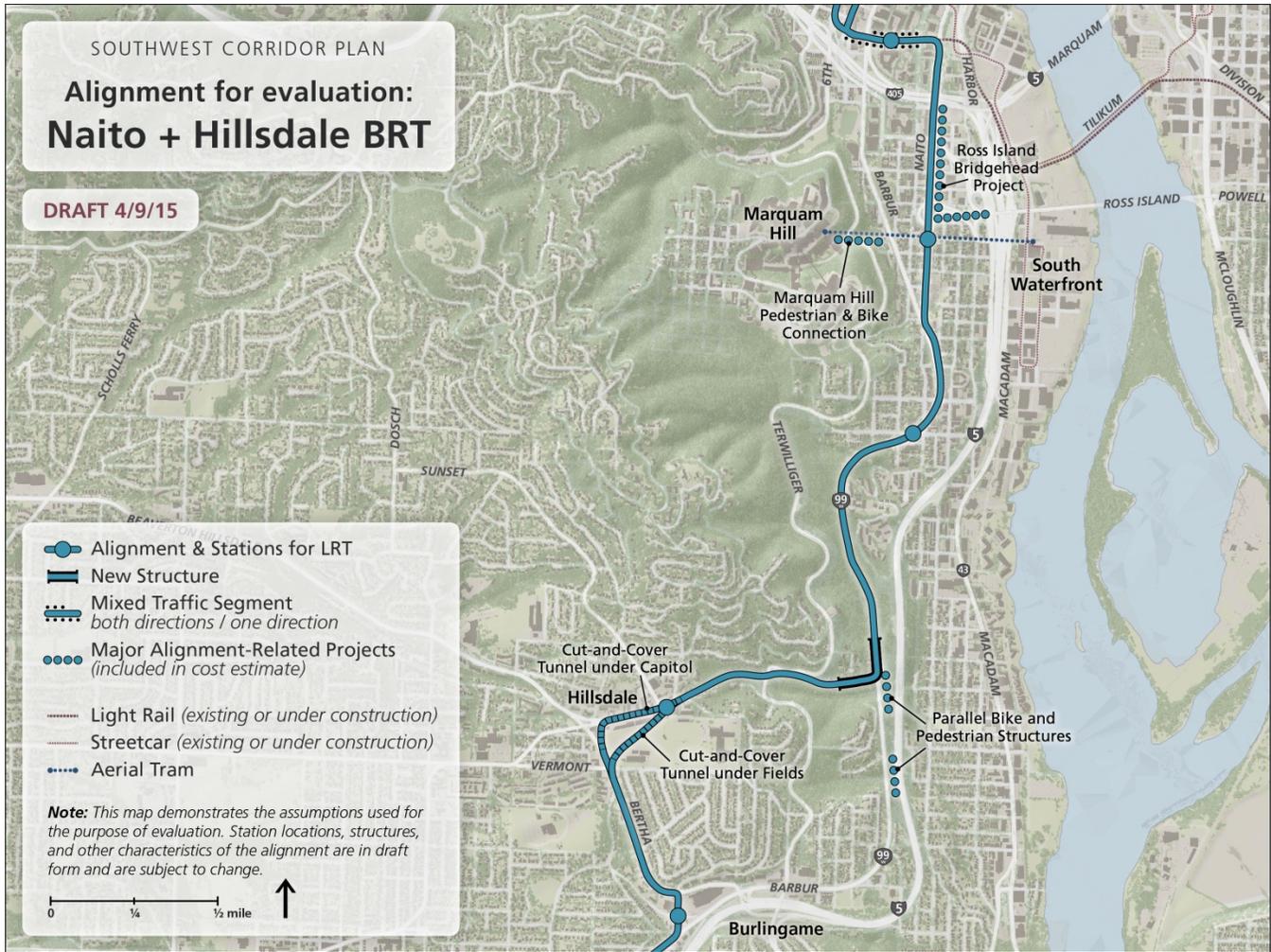


Naito Parkway and Hillsdale loop with cut-and-cover tunnel

Naito + Hillsdale

This alignment combines the Naito Parkway option in South Portland with the cut-and-cover tunnel that loops through Hillsdale. The alignment is assumed to include stations at Lincoln Street (currently under construction for Portland-Milwaukie Light Rail), Gibbs Street, Hamilton Street, the Hillsdale town center and 13th Avenue. The Marquam Hill bike and pedestrian connection is included in the alignment for the purpose of analysis, including capital cost and ridership measures.

Unless noted otherwise, the results apply to both the tunnel under Capitol Highway and the tunnel that runs under the fields in between Capitol and Rieke Elementary School.

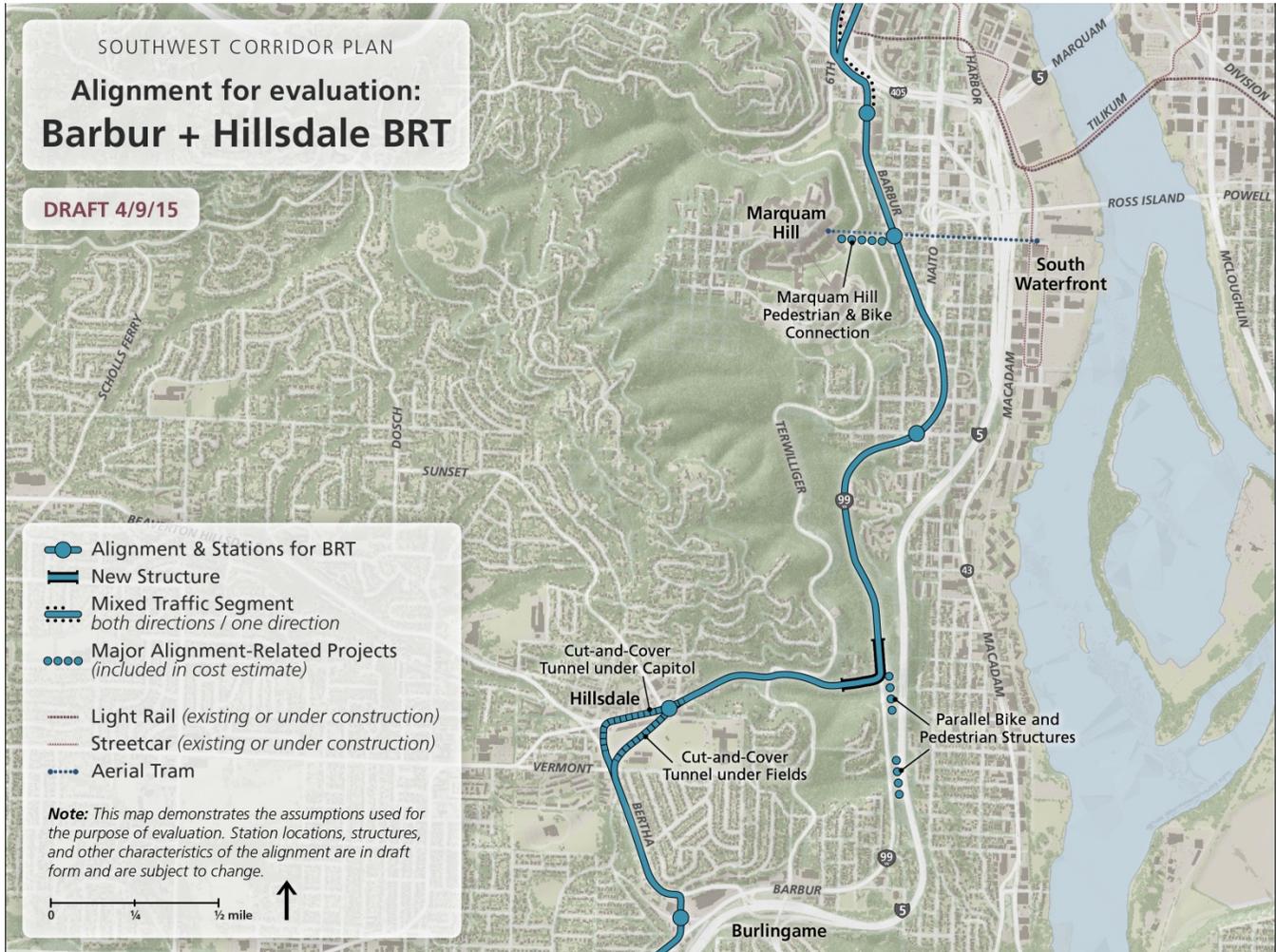


Barbur Boulevard and Hillsdale loop with cut-and-cover tunnel

Barbur + Hillsdale

This alignment combines the Barbur Boulevard option in South Portland with the cut-and-cover tunnel that loops through Hillsdale. The alignment is assumed to include stations at Gibbs Street, Hamilton Street, the Hillsdale town center and 13th Avenue. The Marquam Hill bike and pedestrian connection is included in the alignment for the purpose of analysis, including capital cost and ridership measures.

Unless noted otherwise, the results apply to both the tunnel under Capitol Highway and the tunnel that runs under the fields in between Capitol and Rieke Elementary School.

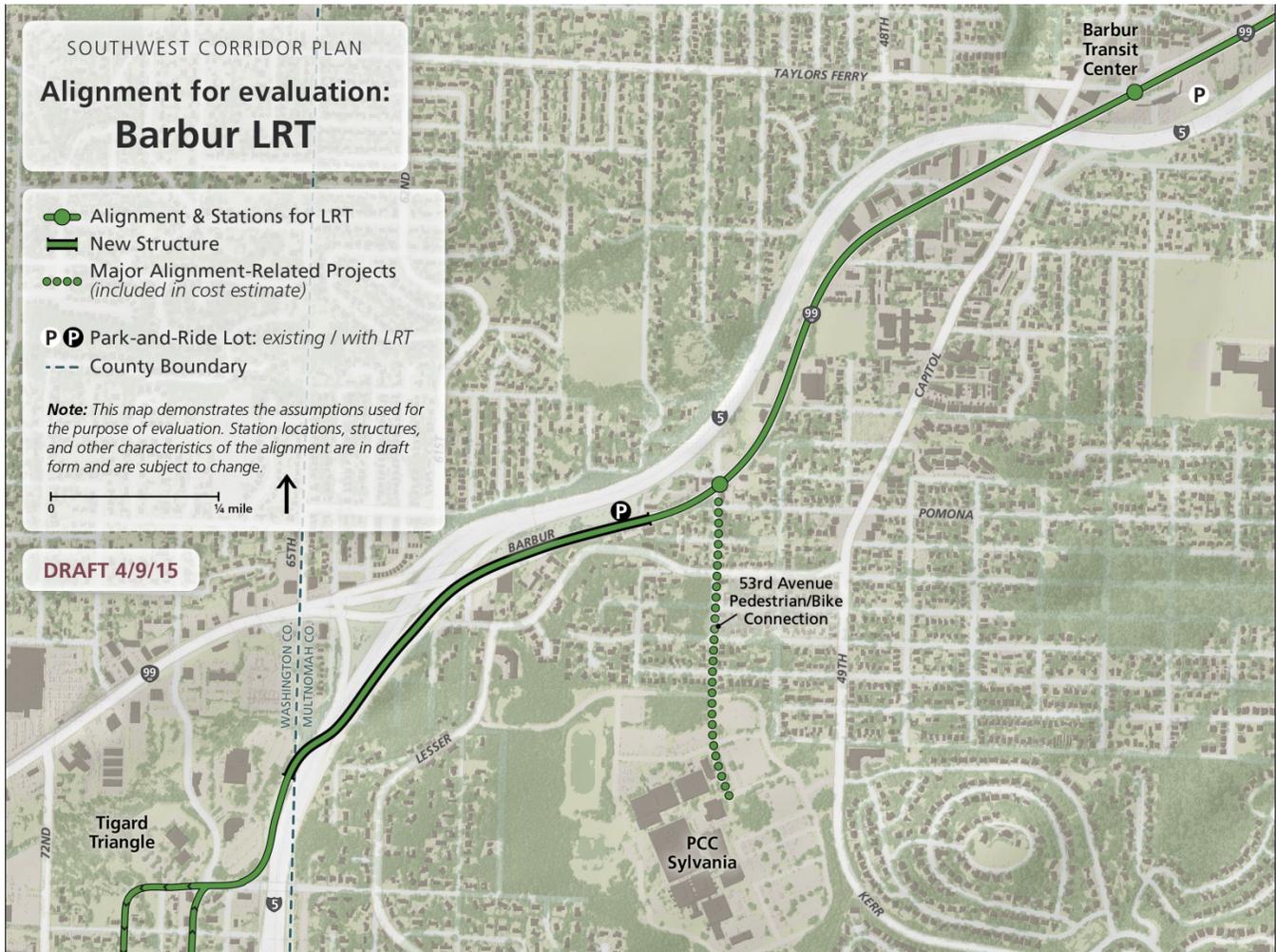


PCC-Sylvania area: LRT

Barbur Boulevard

Barbur

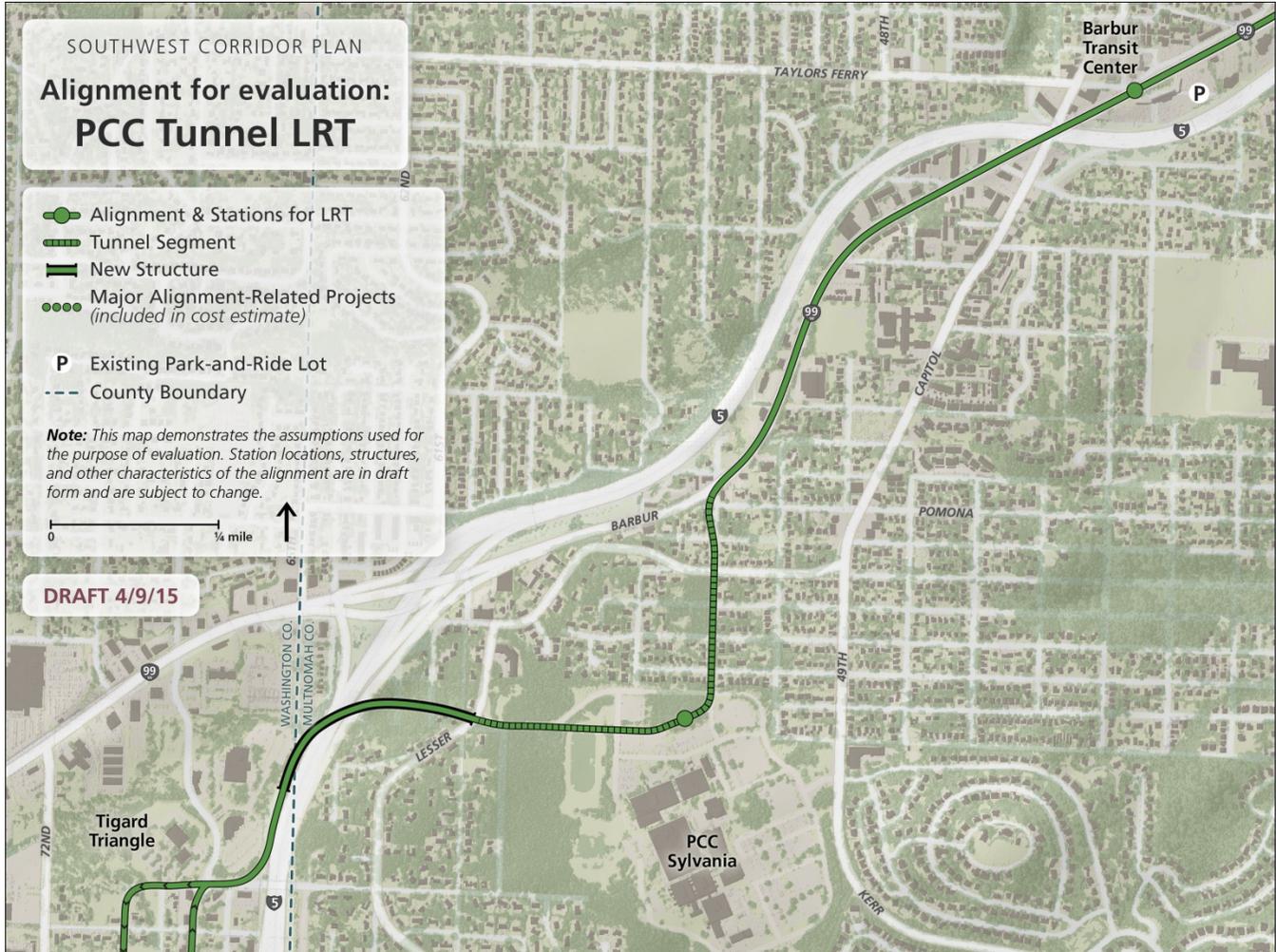
This alignment runs along Barbur Boulevard between Capitol Highway and 60th Avenue. The alignment is assumed to include a station at 53rd Avenue with a new 230-space park-and-ride lot nearby and an improved pedestrian and bike connection to the PCC-Sylvania campus along 53rd Avenue.



PCC via cut-and-cover tunnel

PCC via tunnel

This alignment runs along Barbur Boulevard between Capitol Highway and 53rd Avenue. The alignment runs in a cut-and-cover tunnel under 53rd Avenue and along the northern edge of campus. West of Lesser Road, the alignment crosses I-5 on a new structure for transit, bicyclists, and pedestrians. The alignment is assumed to include an underground station on the northern edge of campus.

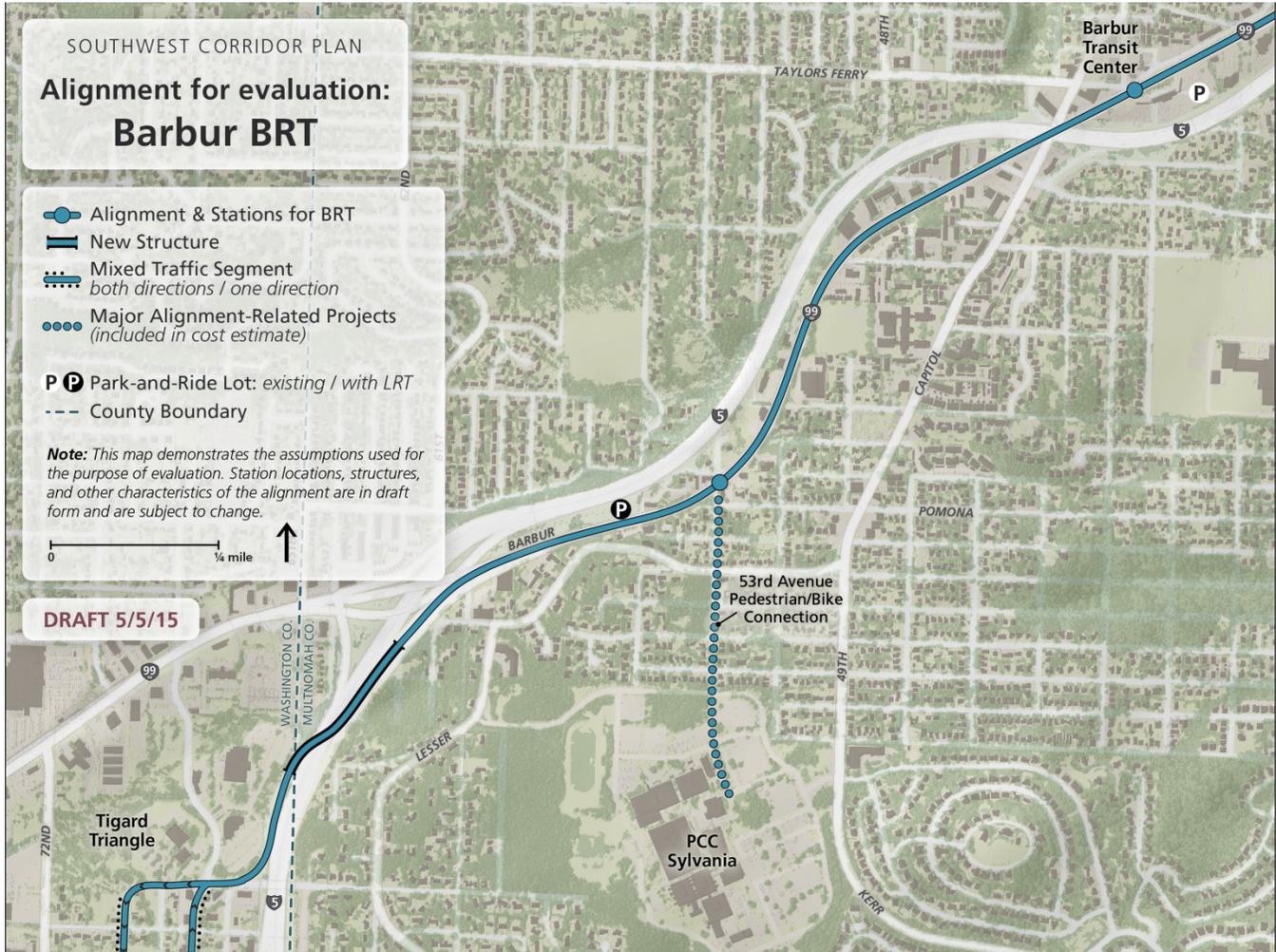


PCC-Sylvania area: BRT

Barbur Boulevard

Barbur

This alignment runs along Barbur Boulevard between Capitol Highway and 60th Avenue. The alignment is assumed to include a station at 53rd Avenue with a new 230-space park-and-ride lot nearby and an improved pedestrian and bike connection to the PCC-Sylvania campus along 53rd Avenue.



PCC via Capitol Highway

PCC via Capitol

This alignment runs on Capitol Highway and 49th Avenue between Barbur Boulevard and the PCC-Sylvania campus, along the northern edge of campus, and across I-5 on a new structure for transit, bikes, and pedestrians. The alignment is assumed to include stations at Comus Street on Capitol Highway and on the PCC campus.



Detailed Methodology and Results

Transit performance

	higher performing				lower performing	
Change in system transit trips	##### <i>daily new system transit trips</i>	#### <i>daily new system transit trips</i>	### <i>daily new system transit trips</i>	## <i>daily new system transit trips</i>	# <i>daily new system transit trips</i>	<i>corridor</i>
Line ridership	##### <i>daily line riders</i>	#### <i>daily line riders</i>	### <i>daily line riders</i>	## <i>daily line riders</i>	# <i>daily line riders</i>	<i>corridor</i>
Travel time	# minutes	## minutes	### minutes	#### minutes	##### minutes	<i>corridor</i>
Mixed traffic (BRT only)	0 miles <i>along # mile segment</i>	# miles <i>along # mile segment</i>	## miles <i>along # mile segment</i>	### miles <i>along # mile segment</i>	#### miles <i>along # mile segment</i>	<i>segment</i>
Signalized intersections crossed	# <i>intersections</i>	## <i>intersections</i>	### <i>intersections</i>	#### <i>intersections</i>	##### <i>intersections</i>	<i>segment</i>
	smaller number				larger number	
	#	##	###	####	#####	

New system transit trips

Methodology

New system transit trips, or new riders, measures the growth of the total transit system ridership with implementation of the proposed project compared to a transit no-build alternative (where no new HCT project is assumed). For the purpose of analysis, the modeling base alignment is used outside of the segment in question for all model runs and the local bus network remains constant between model runs (see page 13 for more information on the modeling base alignment).

Most alignment options are represented by model runs defined to isolate those options relative to the modeling base alignment. Some alignment options are not reflected in model runs; those alignments are assessed by estimates of ridership based on related alignments. Estimated ridership numbers are indicated with an asterisk.

Due to a combination of several factors, BRT has much fewer new system transit riders than LRT. In order to inform the July alignment decisions, BRT and LRT values have been colored based on their respective ranges. As a result, LRT and BRT tables are not directly comparable in terms of color.

Colors are assigned to reflect the differences between alignment options, rather than set numerical ranges.



Results

LRT: South Portland and Hillsdale

	<i>New system transit trips</i>
Naito + Barbur	15,700
Barbur + Barbur	15,700
Naito + Hillsdale	14,200
Barbur + Hillsdale	14,200*
MH-H tunnel	16,900

*Estimate based on related model runs

BRT: South Portland and Hillsdale

	<i>New system transit trips</i>
Naito + Barbur	8,400
Barbur + Barbur	8,400*
Naito + Hillsdale	7,700*
Barbur + Hillsdale	7,700*

*Estimate based on related model runs

LRT: PCC-Sylvania area

	<i>New system transit trips</i>
Barbur	15,700
PCC via tunnel	17,800

BRT: PCC-Sylvania area

	<i>New system transit trips</i>
Barbur	8,400
PCC via Capitol	9,700

Line ridership

Methodology

BRT or LRT projected line ridership is an output of Metro’s travel demand model. Model runs were performed for a 2035 horizon year. Line ridership measures the number of daily riders on the specific HCT line (between the terminus and downtown Portland).

Most alignment options are represented by model runs defined to isolate those options relative to the modeling base alignment (see page 13 for more information on the modeling base alignment). Some alignment options are not reflected in model runs; those alignments are assessed by estimates of ridership based on related alignments. Estimated ridership numbers are indicated with an asterisk.

Due to a combination of several factors, BRT has fewer line riders than LRT. In order to inform the July alignment decisions, BRT and LRT values have been colored based on their respective ranges. As a result, LRT and BRT tables are not directly comparable in terms of color.

Colors are assigned to reflect the differences between alignment options, rather than set numerical ranges.



Results

LRT: South Portland and Hillsdale	
	Line ridership
Naito + Barbur	43,500
Barbur + Barbur	44,100
Naito + Hillsdale	41,800
Barbur + Hillsdale	42,400*
MH-H tunnel	52,400

*Estimate based on related model runs

BRT: South Portland and Hillsdale	
	Line ridership
Naito + Barbur	30,800
Barbur + Barbur	31,200*
Naito + Hillsdale	29,300*
Barbur + Hillsdale	29,700*

*Estimate based on related model runs

LRT: PCC-Sylvania area	
	Line ridership
Barbur	43,500
PCC via tunnel	46,200

BRT: PCC-Sylvania area	
	Line ridership
Barbur	30,800
PCC via Capitol	32,900

Travel time

Methodology

Travel times for HCT alignments are developed by TriMet based on preliminary design, and represent the travel time from Portland State University (near Jackson Street on the Transit Mall) to downtown Tualatin. Travel times for segments of BRT in mixed traffic are determined by the model. Outside of the particular segment in question, the modeling base alignment is used in order to determine the full-corridor travel time (see page 13 for more information on the modeling base alignment).

BRT travel times are several minutes slower than the equivalent LRT travel times. In order to inform the July alignment decisions, BRT and LRT values have been colored based on their respective ranges. As a result, LRT and BRT tables are not directly comparable in terms of color.

Colors are assigned to reflect the differences between alignment options, rather than set numerical ranges.



Results

LRT: South Portland and Hillsdale	
	Travel time (min)
Naito + Barbur	31.2
Barbur + Barbur	30.3
Naito + Hillsdale	33.8
Barbur + Hillsdale	32.9
MH-H tunnel	29.1

**Estimate based on related model runs*

BRT: South Portland and Hillsdale	
	Travel time (min)
Naito + Barbur	34.1
Barbur + Barbur	33.3
Naito + Hillsdale	36.9
Barbur + Hillsdale	36.1

**Estimate based on related model runs*

LRT: PCC-Sylvania area	
	Travel time (min)
Barbur	31.2
PCC via tunnel	31.9

BRT: PCC-Sylvania area	
	Travel time (min)
Barbur	34.1
PCC via Capitol	35.7

Mixed traffic (BRT only)

Methodology

Mixed traffic measures the distance of mixed traffic operations within each segment, based on an average of the northbound and southbound miles in mixed traffic. Because light rail operates entirely in exclusive right-of-way, light rail options are not evaluated using the mixed traffic measure at this time.

Colors are assigned to reflect the differences between alignment options, rather than set numerical ranges.



Results

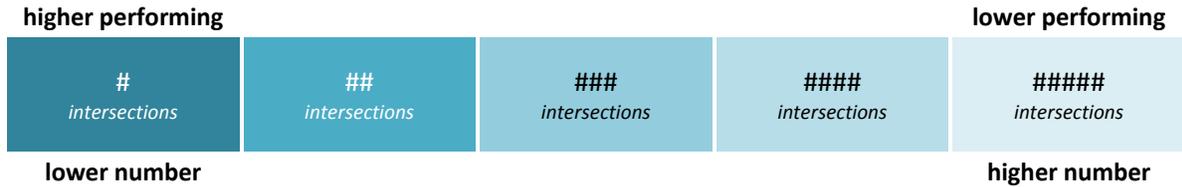
BRT: South Portland and Hillsdale		
	<i>Total segment length (miles)</i>	<i>Mixed traffic in segment (miles)</i>
Naito + Barbur	3.7	1.4
Barbur + Barbur	3.5	1.4
Naito + Hillsdale	3.9	0.2
Barbur + Hillsdale	3.8	0.2

BRT: PCC-Sylvania area		
	<i>Total segment length (miles)</i>	<i>Mixed traffic in segment (miles)</i>
Barbur	1.8	0.0
PCC via Capitol	2.3	0.0

Signalized intersections crossed

Methodology

Crossing signalized intersections creates opportunities for unexpected delay for both BRT and LRT. This measure is a count of the number of signalized intersections each HCT alignment traverses along the segment in question.



Results

LRT: South Portland and Hillsdale	
	<i>Signalized intersections crossed</i>
Naito + Barbur	14
Barbur + Barbur	12
Naito + Hillsdale	15
Barbur + Hillsdale	13
MH-H tunnel	3

BRT: South Portland and Hillsdale	
	<i>Signalized intersections crossed</i>
Naito + Barbur	14
Barbur + Barbur	12
Naito + Hillsdale	18
Barbur + Hillsdale	16

LRT: PCC-Sylvania area	
	<i>Signalized intersections crossed</i>
Barbur	4
PCC via tunnel	3

BRT: PCC-Sylvania area	
	<i>Signalized intersections crossed</i>
Barbur	4
PCC via Capitol	8

Access and development

	higher performing			lower performing		
Equitable access to transit	high access	moderate to high access	moderate access	low to moderate access	low access	<i>corridor</i>
Redevelopment potential	##### acres	#### acres	### acres	## acres	# acres	<i>segment</i>
Support for existing plans	high support	moderate to high support	moderate support	low to moderate support	low support	<i>segment</i>

smaller number				larger number
#	##	###	####	#####

Equitable access to transit

Methodology

This measure is based on the number of 2035 home-based system transit trips originating in areas with above average rates of low income, limited English proficiency, and people of color.

In order to sum transit trips in these areas, 2010 census data were spatially recalculated according to Metro’s transportation analysis zones (TAZs), the boundaries by which the model outputs are organized. Low income and limited English proficiency data were based on census tracts, while people of color data were based on census blocks. In the process of reallocating population data to TAZs, non-residential areas were masked to achieve more accurate distribution. TAZs with a proportion of each group above the regional average were used to sum home-based system transit trips. Each build alternative was compared to the no-build model run in order to calculate the total number of new trips.

Some alignment options are not reflected in model runs; those alignments are assessed by estimates based on other related model runs. Estimated numbers are indicated with an asterisk.



Results

LRT: South Portland and Hillsdale				
	New home-based system transit trips in areas with above average rates of...			Rating
	low income	limited English proficiency	people of color	
Naito + Barbur	4,100	2,000	3,600	moderate access
Barbur + Barbur	4,100	1,900	3,700	moderate access
Naito + Hillsdale	3,600	1,700	3,200	low to moderate access
Barbur + Hillsdale	3,500*	1,600*	3,300*	low to moderate access
MH-H tunnel	4,600	2,100	4,000	moderate to high access

*Estimate based on related model runs

BRT: South Portland and Hillsdale				
	<i>New home-based system transit trips in areas with above average rates of...</i>			<i>Rating</i>
	low income	limited English proficiency	people of color	
Naito + Barbur	2,500	1,000	1,900	moderate access
Barbur + Barbur	2,400*	1000*	1,900*	moderate access
Naito + Hillsdale	2,100*	900*	1,700*	low to moderate access
Barbur + Hillsdale	2,100*	800*	1,700*	low to moderate access

*Estimate based on related model runs

LRT: PCC-Sylvania area				
	<i>New home-based system transit trips in areas with above average rates of...</i>			<i>Rating</i>
	low income	limited English proficiency	people of color	
Barbur	4,100	2,000	3,600	moderate access
PCC via tunnel	4,800	2,600	4,300	high access

BRT: PCC-Sylvania area				
	<i>New home-based system transit trips in areas with above average rates of...</i>			<i>Rating</i>
	low income	limited English proficiency	people of color	
Barbur	4,100	2,000	3,600	moderate access
PCC via Capitol	4,800	2,600	4,300	high access

Redevelopment potential

Methodology

Redevelopment potential measures the total acreage of buildable and redevelopable land within a quarter mile from the HCT stations along the segment in question. This is merely a representation of the potential for land to have new construction on it during and/or after construction of an HCT line. This number does not represent an assurance that HCT will spur redevelopment on a particular location. An analysis of the impact of HCT on site-specific redevelopment parcels will occur later in the project.

The methodology for this calculation is:

- Step 1: Identify vacant tax lots (and complement developed tax lots) by zoning class
- Step 2: Remove tax lots from the BLI that don't have the potential to provide residential or employment growth capacity (e.g., parks)
- Step 3: Calculate deductions for environmental resources¹
- Step 4: Calculate deductions for "future streets"²
- Step 5: Sum up total remaining acreage that is considered buildable/redevelopable

Because the South Portland and Hillsdale alignments cover a longer distance with more stations than the PCC area alignments, the acreage values differ greatly between the two areas. As a result, colors are assigned to reflect the differences between alignment options, rather than set numerical ranges.



¹ Environmental resources considered include Metro's Title 3, Title 13, FEMA flood way and steep slopes over 25%.

² The BLI accounts for future streets on a tax lot-by-tax lot basis. The buildable area of each tax lot is reduced on the basis of individual tax lot size.

Results

LRT: South Portland and Hillsdale	
	<i>Redevelopable acres</i>
Naito + Barbur	47
Barbur + Barbur	43
Naito + Hillsdale	72
Barbur + Hillsdale	69
MH-H tunnel	64

BRT: South Portland and Hillsdale	
	<i>Redevelopable acres</i>
Naito + Barbur	41
Barbur + Barbur	39
Naito + Hillsdale	67
Barbur + Hillsdale	64

LRT: PCC-Sylvania area	
	<i>Redevelopable acres</i>
Barbur	18
PCC via tunnel	2

BRT: PCC-Sylvania area	
	<i>Redevelopable acres</i>
Barbur	18
PCC via Capitol	25

Support for existing plans

Methodology

Qualitative analysis of the extent to which each alignment supports local plans, such as the Barbur Concept Plan and Tigard Triangle Strategic Plan.

higher performing			lower performing	
high support	moderate to high support	moderate support	low to moderate support	low support
<i>Alignment identified in a local land use plan as integral to the successful implementation of the plan goals</i>	<i>Alignment still within the boundaries of the plan and will play a large role in the implementation of the plan goals</i>	<i>Alignment will serve some of the plan goals in one area, while possibly bypassing other areas altogether</i>	<i>Alignment will offer minimal support of a local adopted land use plan</i>	<i>Alignment offers no tangible benefit to local adopted land use plans</i>

Results

LRT: South Portland and Hillsdale		
	<i>Support for existing plans</i>	<i>Rating</i>
Naito + Barbur	This alignment is most supportive of the Barbur Concept Plan by offering direct access to the key nodes identified by the City of Portland along Naito and Barbur.	high support
Barbur + Barbur	Indirectly supports the Barbur Concept Plan in the S. Portland key area, but is consistent with the plan for the remaining portion of the alignment	moderate support
Naito + Hillsdale	Offers excellent support to the Kelly Focus Area of the Barbur Concept Plan, but also serves the Hillsdale Town Center when that plan calls only for enhanced bus service.	moderate to high support
Barbur + Hillsdale	Indirectly supports the Barbur Concept Plan in S. Portland. Hillsdale Town Center plan does not call for HCT, but for increased bus service. Remaining portion of Barbur alignment follows the Barbur Concept Plan.	moderate support
MH-H tunnel	This S. Portland alignment offers no support of the adopted Barbur Concept Plan. The tunnel portion accessing Hillsdale will offer limited support of the Hillsdale Town Center Plan, particularly as it's reflected in the limited redevelopment opportunities that exist there.	low to moderate support

BRT: South Portland and Hillsdale		
	<i>Support for existing plans</i>	<i>Rating</i>
Naito + Barbur	This alignment is most supportive of the Barbur Concept Plan by offering direct access to the key nodes identified by the City of Portland along Naito and Barbur.	high support
Barbur + Barbur	Indirectly supports the Barbur Concept Plan in the S. Portland key area, but is consistent with the plan for the remaining portion of the alignment	moderate support
Naito + Hillsdale	Offers excellent support to the Kelly Focus Area of the Barbur Concept Plan, but also serves the Hillsdale Town Center when that plan calls only for enhanced bus service.	moderate to high support
Barbur + Hillsdale	Indirectly supports the Barbur Concept Plan in S. Portland. Hillsdale Town Center plan does not call for HCT, but for increased bus service. Remaining portion of Barbur alignment follows the Barbur Concept Plan.	moderate support

LRT: PCC-Sylvania area		
	<i>Support for existing plans</i>	<i>Rating</i>
Barbur	Alignment follows the desires of the Barbur Concept Plan.	moderate to high support
PCC via tunnel	Tunnel offers direct service to PCC, but there is no current plan with either the City or PCC that calls for HCT to directly serve the campus.	moderate support

BRT: PCC-Sylvania area		
	<i>Support for existing plans</i>	<i>Rating</i>
Barbur	Alignment follows the desires of the Barbur Concept Plan.	moderate to high support
PCC via Capitol	Alignment bypasses PCC focus area of the Barbur Concept Plan. Comus Street station is not identified by City as a key location. Alignment does serve PCC directly.	moderate support

Mobility

	higher performing		lower performing			
Freight	minimal or no overlap	some local overlap	substantial local overlap	some state or regional overlap	substantial state or regional overlap	<i>segment</i>
Traffic	major opportunity for improvement	some opportunity for improvement	negligible impact	some negative impact	major negative impact	<i>segment</i>
Transportation safety	high improvement potential	low to moderate improvement potential	negligible impact	minor negative impact	major negative impact	<i>segment</i>
Street connectivity	## new connections	# new connections	no change	# connections eliminated	## connections eliminated	<i>segment</i>
Bike improvements	#### miles along # mile segment	### miles along # mile segment	## miles along # mile segment	# miles along # mile segment	0 miles along # mile segment	<i>segment</i>
Pedestrian improvements	#### miles along # mile segment	### miles along # mile segment	## miles along # mile segment	# miles along # mile segment	0 miles along # mile segment	<i>segment</i>

smaller number				larger number	
#	##	###	####	#####	

Freight

Methodology

Overlap between freight networks and other modal improvements were identified by comparing project improvements with state, regional, and local freight designations. State designations include the OHP Freight Map and the ORS 366.215 Oversize Freight Map. Regional designations include the RTP Freight Map. Local designations include the Portland Freight Plan Maps. Any transit system would be design to maintain freight access and movement.



Results

LRT: South Portland and Hillsdale

	<i>Freight route overlap</i>	<i>Rating</i>
Naito + Barbur	The portion of Naito north of the Ross Island Bridge and Barbur are locally-designated as Major Truck Streets. No overlap with state or regional freight routes.	substantial local overlap
Barbur + Barbur	Barbur is locally-designated as a Major Truck Street. No overlap with state or regional freight routes.	substantial local overlap
Naito + Hillsdale	The portion of Naito north of the Ross Island Bridge, Barbur, and Bertha are locally-designated as Major Truck Streets. No overlap with state or regional freight routes.	substantial local overlap
Barbur + Hillsdale	Barbur and Bertha are locally-designated as Major Truck Streets. No overlap with state or regional freight routes.	substantial local overlap
MH-H tunnel	Includes some overlap with Barbur, locally-designated as Major Truck Street, north and south of tunnel. No overlap with state or regional freight routes.	some local overlap

BRT: South Portland and Hillsdale		
	<i>Freight route overlap</i>	<i>Rating</i>
Naito + Barbur	The portion of Naito north of the Ross Island Bridge and Barbur are locally-designated as Major Truck Streets. No overlap with state or regional freight routes.	substantial local overlap
Barbur + Barbur	Barbur is locally-designated as a Major Truck Street. No overlap with state or regional freight routes.	substantial local overlap
Naito + Hillsdale	The portion of Naito north of the Ross Island Bridge, Barbur, and Bertha are locally-designated as Major Truck Streets. No overlap with state or regional freight routes.	substantial local overlap
Barbur + Hillsdale	Barbur and Bertha are locally-designated as Major Truck Streets. No overlap with state or regional freight routes.	substantial local overlap

LRT: PCC-Sylvania area		
	<i>Freight route overlap</i>	<i>Rating</i>
Barbur	Barbur is locally-designated as a Major Truck Street. No overlap with state or regional freight routes.	substantial local overlap
PCC via tunnel	Includes substantial overlap with Barbur, locally-designated as Major Truck Street, north of tunnel. No overlap with state or regional freight routes.	substantial local overlap

BRT: PCC-Sylvania area		
	<i>Freight route overlap</i>	<i>Rating</i>
Barbur	Barbur is locally-designated as a Major Truck Street. No overlap with state or regional freight routes.	substantial local overlap
PCC via Capitol	Minimal overlap with Barbur, locally-designated as Major Truck Street. No overlap with state or regional freight routes.	minimal or no overlap

Traffic

Methodology

Impacts to traffic, both negative and positive, of a high-capacity transit project were considered, including volume-to-capacity (V/C) ratio and vehicle queuing, based on the July 2014 traffic analysis completed for the project. This analysis considered the potential for some mode shift to transit, the use of dedicated transit lanes where appropriate, signal pre-emption by transit, and potential lane configurations intended to optimize traffic performance while minimizing needed right-of-way acquisitions. The analysis looked at key bottleneck or capacity constraint locations in the corridor between Portland and Tualatin. Mitigation will be identified to address negative impacts during the environmental phase of the project.

higher performing			lower performing	
major opportunity for improvement	some opportunity for improvement	negligible impact	some negative impact	major negative impact
<i>Alignment provides opportunities for improving motor vehicle traffic at key system motor vehicle bottlenecks.</i>	<i>Alignment provides opportunities for improving motor vehicle traffic at non-bottleneck locations.</i>	<i>Alignment results in negligible positive or negative impacts to motor vehicle traffic other than mode shift to transit.</i>	<i>Alignment results in minor negative impacts to motor vehicle traffic.</i>	<i>Alignment results in significant negative impacts to motor vehicle traffic.</i>

Results

LRT: South Portland and Hillsdale		
	Traffic impact	Rating
Naito + Barbur	Alignment provides opportunity to address bottleneck at west end of Ross Island Bridge. Alignment travels through (possibly at-grade) the bottleneck at Barbur & Terwilliger, with minor reduction in V/C. Impacts at Ross Island Bridgehead and Barbur & Hamilton require further study.	some opportunity for improvement
Barbur + Barbur	Alignment travels through (possibly at-grade) the bottleneck at Barbur & Terwilliger, with minor reduction in V/C. Impacts at Barbur & Hamilton require further study.	negligible impact
Naito + Hillsdale	Alignment provides opportunity to address bottleneck at west end of Ross Island Bridge. Alignment avoids impacts in Hillsdale town center via grade separation. Impacts at Ross Island Bridgehead and Barbur & Hamilton require further study.	some opportunity for improvement
Barbur + Hillsdale	Alignment avoids impacts in Hillsdale town center via grade separation. Impacts at Barbur & Hamilton require further study.	negligible impact
MH-H tunnel	Alignment largely avoids impacts via grade separation.	negligible impact

BRT: South Portland and Hillsdale		
	<i>Traffic impact</i>	<i>Rating</i>
Naito + Barbur	Alignment provides opportunity to address bottleneck at west end of Ross Island Bridge. Alignment travels through (possibly at-grade) the bottleneck at Barbur & Terwilliger, with minor reduction in V/C. Impacts at Ross Island Bridgehead and Barbur & Hamilton require further study.	some opportunity for improvement
Barbur + Barbur	Alignment travels through (possibly at-grade) the bottleneck at Barbur & Terwilliger, with minor reduction in V/C. Impacts at Barbur & Hamilton require further study.	negligible impact
Naito + Hillsdale	Alignment provides opportunity to address bottleneck at west end of Ross Island Bridge. Alignment avoids impacts in Hillsdale town center via grade separation. Impacts at Ross Island Bridgehead and Barbur & Hamilton require further study.	some opportunity for improvement
Barbur + Hillsdale	Alignment avoids impacts in Hillsdale town center via grade separation. Impacts at Barbur & Hamilton require further study.	negligible impact

LRT: PCC-Sylvania area		
	<i>Traffic impact</i>	<i>Rating</i>
Barbur	Alignment results in minor negative impacts due to opportunity to convert travel lanes in a segment with low traffic volumes.	some negative impact
PCC via tunnel	Alignment results in minor negative impacts due to opportunity to convert travel lanes in a segment with low traffic volumes.	some negative impact

BRT: PCC-Sylvania area		
	<i>Traffic impact</i>	<i>Rating</i>
Barbur	Alignment results in minor negative impacts due to opportunity to convert travel lanes in a segment with low traffic volumes.	some negative impact
PCC via Capitol	Alignment results in negligible impacts in a segment with low traffic volumes.	negligible impact

Transportation safety

Methodology

Construction of a project alignment would bring the opportunity to address high-crash locations along that alignment, as any high-capacity transit project will include consideration of safety improvements as appropriate, but would also introduce additional complexity with the introduction of a new mode. As a presumed median-running alignment for in-street segments, Highway Safety Manual principles were used to evaluate safety impacts on each alignment, with consideration of the additional complexity created by the new mode. Safety review is generally qualitative.

higher performing		lower performing		
high improvement potential	low to moderate improvement potential	negligible impact	minor negative impact	major negative impact
<i>Alignment includes opportunity to address high-severity crashes, no additional complexity.</i>	<i>Alignment includes opportunity to address high-severity crashes, but introduces additional complexity.</i>	<i>Alignment has a negligible effect on high-severity crashes.</i>	<i>Alignment increases risk of high-severity crashes.</i>	<i>Alignment significantly increases risk of high-severity crashes.</i>

Results

LRT: South Portland and Hillsdale		
	<i>Transportation safety</i>	<i>Rating</i>
Naito + Barbur	Alignment adds a median along route, reducing likelihood of injury crashes but introduces complexity. High rate of high-severity crashes on Barbur east of Terwilliger.	low to moderate improvement potential
Barbur + Barbur	Alignment adds a median along route, reducing likelihood of injury crashes but introduces complexity. High rate of high-severity crashes on Barbur east of Terwilliger.	low to moderate improvement potential
Naito + Hillsdale	Alignment adds a median along route, reducing likelihood of injury crashes but introduces complexity. Moderate rate of high-severity crashes along Capitol-Bertha route.	low to moderate improvement potential
Barbur + Hillsdale	Alignment adds a median along route, reducing likelihood of injury crashes but introduces complexity. Moderate rate of high-severity crashes along Capitol-Bertha route.	low to moderate improvement potential
MH-H tunnel	Alignment largely avoids interaction with traffic.	negligible impact

BRT: South Portland and Hillsdale		
	<i>Transportation safety</i>	<i>Rating</i>
Naito + Barbur	Alignment adds a median along route, reducing likelihood of injury crashes but introduces complexity. High rate of high-severity crashes on Barbur east of Terwilliger.	low to moderate improvement potential
Barbur + Barbur	Alignment adds a median along route, reducing likelihood of injury crashes but introduces complexity. High rate of high-severity crashes on Barbur east of Terwilliger.	low to moderate improvement potential
Naito + Hillsdale	Alignment adds a median along route, reducing likelihood of injury crashes but introduces complexity. Moderate rate of high-severity crashes along Capitol-Bertha route.	low to moderate improvement potential
Barbur + Hillsdale	Alignment adds a median along route, reducing likelihood of injury crashes but introduces complexity. Moderate rate of high-severity crashes along Capitol-Bertha route.	low to moderate improvement potential

LRT: PCC-Sylvania area		
	<i>Transportation safety</i>	<i>Rating</i>
Barbur	Alignment adds a median along route, reducing likelihood of injury crashes but introduces complexity. Low rate of high-severity crashes along route.	low to moderate improvement potential
PCC via tunnel	Alignment adds a median along in-street portion of route, reducing likelihood of injury crashes but introduces complexity. Low rate of high-severity crashes along route.	low to moderate improvement potential

BRT: PCC-Sylvania area		
	<i>Transportation safety</i>	<i>Rating</i>
Barbur	Alignment adds a median along route, reducing likelihood of injury crashes but introduces complexity. Low rate of high-severity crashes along route.	low to moderate improvement potential
PCC via Capitol	Alignment adds a median along route, reducing likelihood of injury crashes but introduces complexity. Low rate of high-severity crashes along route.	low to moderate improvement potential

Street connectivity

This measure is an assessment of the potential impacts each alignment would have on street network connectivity, based on the number of roadway, bicycle and pedestrian connections added or eliminated.



Results

LRT: South Portland and Hillsdale		
	<i>Street connectivity</i>	<i>Rating</i>
Naito + Barbur	Includes 8-10 new street connections as part of the Ross Island bridgehead project and a pedestrian/bike connection between Barbur Boulevard and Terwilliger Boulevard near Gibbs Street	9-11 new connections
Barbur + Barbur	Adds new pedestrian/bike connection between Barbur Boulevard and Terwilliger Boulevard near Gibbs Street	1 new connection
Naito + Hillsdale	Includes 8-10 new street connections as part of the Ross Island bridgehead project and a pedestrian/bike connection between Barbur Boulevard and Terwilliger Boulevard near Gibbs Street	9-11 new connections
Barbur + Hillsdale	Adds new pedestrian/bike connection between Barbur Boulevard and Terwilliger Boulevard near Gibbs Street	1 new connection
MH-H tunnel	Does not change connectivity of network	no change

BRT: South Portland and Hillsdale		
	<i>Street connectivity</i>	<i>Rating</i>
Naito + Barbur	Includes 8-10 new street connections as part of the Ross Island bridgehead project and a pedestrian/bike connection between Barbur Boulevard and Terwilliger Boulevard near Gibbs Street	9-11 new connections
Barbur + Barbur	Adds new pedestrian/bike connection between Barbur Boulevard and Terwilliger Boulevard near Gibbs Street	1 new connection
Naito + Hillsdale	Includes 8-10 new street connections as part of the Ross Island bridgehead project and a pedestrian/bike connection between Barbur Boulevard and Terwilliger Boulevard near Gibbs Street	9-11 new connections
Barbur + Hillsdale	Adds new pedestrian/bike connection between Barbur Boulevard and Terwilliger Boulevard near Gibbs Street	1 new connection

LRT: PCC-Sylvania area		
	<i>Street connectivity</i>	<i>Rating</i>
Barbur	Adds new pedestrian/bike connection between Barbur Boulevard and Tigard Triangle	1 new connection
PCC via tunnel	Adds new pedestrian/bike connection between PCC and Tigard Triangle	1 new connection

BRT: PCC-Sylvania area		
	<i>Street connectivity</i>	<i>Rating</i>
Barbur	Adds new pedestrian/bike connection between Barbur Boulevard and Tigard Triangle	1 new connection
PCC via Capitol	Adds new pedestrian/bike connection between PCC and Tigard Triangle	1 new connection

Bike

Methodology

The regional bicycle facility network was reviewed and compared to existing bicycle facility gaps. The amount of bicycle facility gaps on both sides of the street filled by the project within each project segment was evaluated, based on the working assumption that an in-street transit alignment would include bicycle facilities on both sides. For example, a five-mile segment could potentially have up to ten miles of bike improvements. While this analysis focused only on gaps, deficiencies should be identified in the subsequent design phases to identify needs and opportunities within the project constraints.



Results

LRT: South Portland and Hillsdale	
Naito + Barbur	2.0 miles <i>along 3.4 mile segment</i>
Barbur + Barbur	0.4 miles <i>along 3.4 mile segment</i>
Naito + Hillsdale	2.1 miles <i>along 3.7 mile segment</i>
Barbur + Hillsdale	0.4 miles <i>along 3.7 mile segment</i>
MH-H tunnel	0 miles <i>along 2.9 mile segment</i>

BRT: South Portland and Hillsdale	
Naito + Barbur	2.0 miles <i>along 3.4 mile segment</i>
Barbur + Barbur	0.4 miles <i>along 3.4 mile segment</i>
Naito + Hillsdale	2.1 miles <i>along 3.7 mile segment</i>
Barbur + Hillsdale	0.4 miles <i>along 3.7 mile segment</i>

LRT: PCC-Sylvania area	
Barbur	1.7 miles <i>along 1.9 mile segment</i>
PCC via tunnel	1.1 miles <i>along 2.1 mile segment</i>

BRT: PCC-Sylvania area	
Barbur	1.7 miles <i>along 1.9 mile segment</i>
PCC via Capitol	1.1 miles <i>along 2.4 mile segment</i>

Pedestrian

The regional sidewalk and walkway network was reviewed to identify existing sidewalk gaps. The amount of sidewalk gaps on both sides of the street filled by the project within each project segment was evaluated, based on the working assumption that an in-street transit alignment would include sidewalk on both sides. For example, a five-mile segment could potentially have up to ten miles of sidewalk improvements. While this analysis focused only on gaps, deficiencies should be identified in the subsequent design phases to identify needs and opportunities within the project constraints.



Results

LRT: South Portland and Hillsdale	
Naito + Barbur	3.3 miles <i>along 3.4 mile segment</i>
Barbur + Barbur	3.1 miles <i>along 3.4 mile segment</i>
Naito + Hillsdale	3.3 miles <i>along 3.7 mile segment</i>
Barbur + Hillsdale	3.1 miles <i>along 3.7 mile segment</i>
MH-H tunnel	0 miles <i>along 2.9 mile segment</i>

BRT: South Portland and Hillsdale	
Naito + Barbur	3.3 miles <i>along 3.4 mile segment</i>
Barbur + Barbur	3.1 miles <i>along 3.4 mile segment</i>
Naito + Hillsdale	3.1 miles <i>along 3.7 mile segment</i>
Barbur + Hillsdale	3.1 miles <i>along 3.7 mile segment</i>

LRT: PCC-Sylvania area	
Barbur	2.0 miles <i>along 1.9 mile segment</i>
PCC via tunnel	1.1 miles <i>along 2.1 mile segment</i>

BRT: PCC-Sylvania area	
Barbur	2.0 miles <i>along 1.9 mile segment</i>
PCC via Capitol	0 miles <i>along 2.4 mile segment</i>

Cost

	higher performing				lower performing	
Capital cost: segment	\$ million	\$\$ million	\$\$\$ million	\$\$\$\$ million	\$\$\$\$\$ million	<i>segment</i>
Operations and maintenance costs	low cost	low to moderate cost	moderate cost	moderate to high cost	high cost	<i>corridor</i>
	lower cost				higher cost	
	\$	\$\$	\$\$\$	\$\$\$\$	\$\$\$\$\$	

Capital cost

Methodology

Capital costs include all of the costs associated with planning, designing, permitting, securing right of way, constructing civil works associated with the defined alignment, and the vehicles necessary to operate the high capacity transit scenario. The conceptual cost estimates were developed using drawings that were developed to about a three percent level of design and are subject to change as alignments are refined and more detailed designs are completed. All cost estimates provided in this report are in 2014 dollars and do not include financing or escalation costs.

Cost estimates were developed using a three-step process. First, conceptual engineering drawings were used to define the nature of work and facilitate a "take-off" or measurement of the work to establish quantities. Where defined, actual quantities were used (e.g. feet of track, numbers of parking spaces). The second step was to apply initial cost data to the quantities established in step one, and then to develop unit cost and lump sum cost items. The third step was to consolidate these items into major project cost elements. Engineering and administration cost allocations as well as project contingencies are added on in this phase of the estimate.

The assignment of colors in the tables is based on a comparison of the full-corridor alignment cost for each option to the modeling base alignment. For BRT, the full corridor alignment costs range from \$680 million to \$1 billion for surface alignments and \$880 million to \$1.2 billion for alignments that include the Hillsdale cut-and-cover tunnel. For LRT, the full-corridor alignment costs range from \$1.8 billion to \$2 billion for surface alignments and \$2.1 billion to \$3.2 billion for alignments with tunnels.



Results

LRT: South Portland and Hillsdale	
	<i>Segment capital cost</i>
Naito + Barbur	\$610 million
Barbur + Barbur	\$440 million
Naito + Hillsdale	\$840 million
Barbur + Hillsdale	\$670 million
MH-H tunnel	\$1,340 million

BRT: South Portland and Hillsdale	
	<i>Segment capital cost</i>
Naito + Barbur	\$330 million
Barbur + Barbur	\$140 million
Naito + Hillsdale	\$470 million
Barbur + Hillsdale	\$280 million

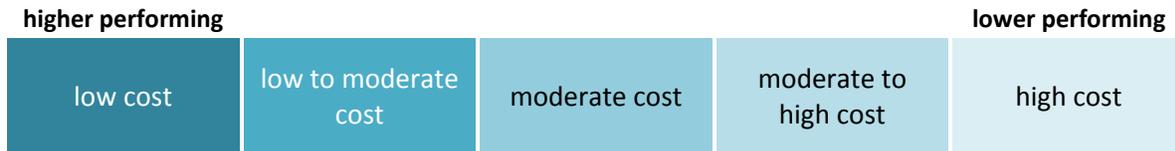
LRT: PCC-Sylvania area	
	<i>Segment capital cost</i>
Barbur	\$270 million
PCC via tunnel	\$520 million

BRT: PCC-Sylvania area	
	<i>Segment capital cost</i>
Barbur	\$140 million
PCC via Capitol	\$140 million

Operations and maintenance costs

Methodology

This measure is a preliminary estimate of operating costs based on average weekday vehicle hours, which vary depending on travel time and vehicle headways. Actual operating cost estimates will be calculated at a later date. Because BRT and LRT vary in terms of travel time, ridership, vehicle capacity and operating cost, the two modes have been rated independently and should not be directly compared.



Results

LRT: South Portland and Hillsdale	
	<i>Operations and maintenance costs</i>
Naito + Barbur	moderate cost
Barbur + Barbur	low to moderate cost
Naito + Hillsdale	moderate to high cost
Barbur + Hillsdale	moderate cost
MH-H tunnel	low to moderate cost

BRT: South Portland and Hillsdale	
	<i>Operations and maintenance costs</i>
Naito + Barbur	moderate cost
Barbur + Barbur	low to moderate cost
Naito + Hillsdale	moderate to high cost
Barbur + Hillsdale	moderate cost

LRT: PCC-Sylvania area	
	<i>Operations and maintenance costs</i>
Barbur	moderate cost
PCC via tunnel	moderate cost

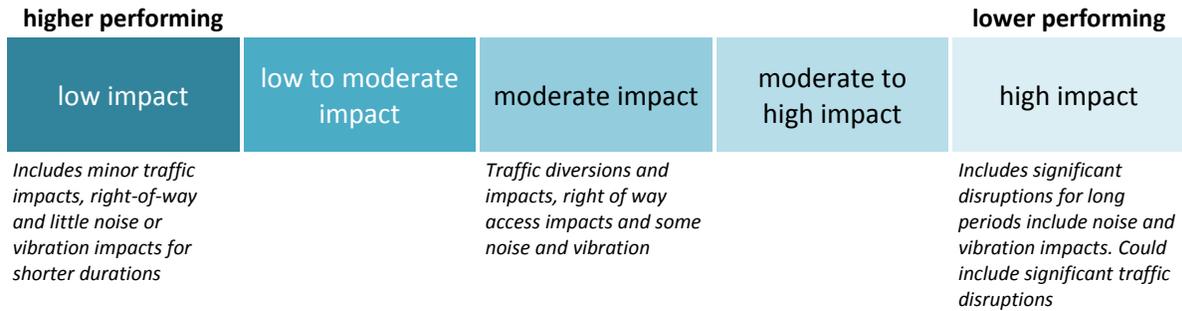
BRT: PCC-Sylvania area	
	<i>Operations and maintenance costs</i>
Barbur	moderate cost
PCC via Capitol	moderate to high cost

Engineering complexity

	higher performing			lower performing		
Construction impacts	low impact	low to moderate impact	moderate impact	moderate to high impact	high impact	<i>segment</i>
Engineering risk	low risk	low to moderate risk	moderate risk	moderate to high risk	high risk	<i>segment</i>

Construction impacts

This measure is a qualitative assessment of the temporary impacts that will likely occur while the project is in construction and need to phase construction in order to minimize disruption caused by complex engineering activities. Types of impacts could include traffic diversion, changes to property access, noise and vibration impacts.



Results

LRT: South Portland and Hillsdale		
	<i>Construction impacts</i>	<i>Rating</i>
Naito + Barbur	This option would include complex construction traffic staging for the Ross Island Bridgehead project in addition to the reconstruction of the SW Iowa and SW Vermont structures.	low to moderate impact
Barbur + Barbur	This option would include the reconstruction of the SW Iowa and SW Vermont structures	low impact
Naito + Hillsdale	This option would include the Ross Island Bridgehead project and structure to Hillsdale and a cut-and-cover tunnel through Hillsdale.	high impact
Barbur + Hillsdale	This option would include the new structure to from Barbur to Hillsdale and a cut-and-cover tunnel through Hillsdale. Construction on Barbur is not complicated by the Ross Bridgehead project	moderate to high impact
MH-H tunnel	A deep-bored tunnel is a substantial long-term mining operation that would have significant noise, vibration, dust and hauling impacts on the surrounding streets and at portal locations, station entries and vent point locations.	high impact

BRT: South Portland and Hillsdale		
	<i>Construction impacts</i>	<i>Rating</i>
Naito + Barbur	This option would include the Ross Island Bridgehead project and includes complex construction traffic staging for Ross Island Bridgehead.	low to moderate impact
Barbur + Barbur	Would include new ped/bike structures adjacent to the SW Iowa and SW Vermont structures. Generally there are few new structures, but would still require construction traffic staging.	low impact
Naito + Hillsdale	Significant construction traffic staging related to cut-and-cover tunnel and new structure from Barbur to Hillsdale. This alignment shares the aforementioned impacts associated with Naito.	high impact
Barbur + Hillsdale	Significant construction traffic staging due to cut-and-cover tunnel and new structure from Barbur to Hillsdale. Less impacts than Naito. Would include new pedestrian/bike structures adjacent to the SW Iowa and SW Vermont structures.	moderate to high impact

LRT: PCC-Sylvania area		
	<i>Construction impacts</i>	<i>Rating</i>
Barbur	This option would have fewer construction impacts due to the location of the alignments.	low to moderate impact
PCC via tunnel	A cut-and-cover tunnel through this area would have impacts on SW 53 rd Ave and on the PCC campus	high impact

BRT: PCC-Sylvania area		
	<i>Construction impacts</i>	<i>Rating</i>
Barbur	This option would have fewer construction impacts due to the location of the alignment and could be reduced further if the traffic analysis suggests BRT can run in mixed traffic in this segment.	low to moderate impact
PCC via Capitol	This option would have moderate construction impacts due to the location of the alignment, but could be reduced significantly if the traffic analysis suggests BRT can run in mixed traffic in this segment.	moderate impact

Engineering risk

Qualitative assessment of the relative risks associated with construction of special elements of the design options. Engineering risk could be unknown subsurface conditions, difficult structures, or complicated designs.

higher performing			lower performing	
low risk	low to moderate risk	moderate risk	moderate to high risk	high risk
<i>Includes few engineering complications with few or no unknowns. A surface alignment with no right of way impacts, through an area where traffic is not concern would qualify as having low engineering risks.</i>	<i>Surface alignments with right-of-way impacts</i>	<i>Surface alignment with right-of-way impacts and significant traffic diversion</i>	<i>Cut and cover tunnels and long structures</i>	<i>Designs include complicated risks where there are many unknowns and difficult technical issues to resolve. Bored tunnels, long structures and significant geological concerns would decrease this rating</i>

Results

LRT: South Portland and Hillsdale		
	Engineering risk	Rating
Naito + Barbur	Includes replacement of SW Naito Parkway bridgehead, vertical connection from Barbur to OHSU and replacement of the Iowa and Vermont viaducts.	low to moderate risk
Barbur + Barbur	Less inherent risk due to fewer and less complicated structures. Includes replacement of the Iowa and Vermont viaducts.	low risk
Naito + Hillsdale	Includes utility relocation and the complexity/risk of a cut-and-cover tunnel in Hillsdale. This alignment shares the aforementioned impacts associated with Naito.	moderate to high risk
Barbur + Hillsdale	Engineering complexity is associated with cut-and-cover tunnel and new structure to Hillsdale. Complexity is less than Naito and the associated Ross Island Bridgehead construction.	moderate risk
MH-H tunnel	A deep bored tunnel is a substantial long term mining operation which will have significant complexity and unknown risks inherent with crossing faults and encountering unexpected materials and conditions.	high risk

BRT: South Portland and Hillsdale		
	<i>Engineering risk</i>	<i>Rating</i>
Naito + Barbur	Includes replacement of SW Naito Parkway bridge head, vertical connection from Barbur to OHSU and new pedestrian and bicycle bridges adjacent to the Iowa and Vermont viaducts.	low to moderate risk
Barbur + Barbur	Less inherent risk due to fewer and less complicated structures. Includes new pedestrian and bicycle bridges adjacent to the Iowa and Vermont viaducts.	low risk
Naito + Hillsdale	Includes utility relocation and the complexity/risk of a cut-and-cover tunnel in Hillsdale. This alignment shares the aforementioned impacts associated with Naito.	moderate to high risk
Barbur + Hillsdale	Engineering complexity is associated with cut-and-cover tunnel and new structure to Hillsdale. Complexity is less than Naito and the associated Ross Island Bridgehead construction.	moderate risk

LRT: PCC-Sylvania area		
	<i>Engineering risk</i>	<i>Rating</i>
Barbur	This option includes a new structure over I-5 would have low to moderate risk related to ground conditions for bridge supports.	low to moderate risk
PCC via tunnel	This option would result in a deep cut-and-cover station and new structure over I-5 with uncertainty related to the ground water and rock type in Mt Sylvania and ground conditions for bridge supports.	high risk

BRT: PCC-Sylvania area		
	<i>Engineering risk</i>	<i>Rating</i>
Barbur	This option includes a new but shorter structure than LRT over I-5 would have low to moderate risk related to ground conditions for bridge supports.	low to moderate risk
PCC via Capitol	Widening for transit and to meet City sidewalk and bike standards will require retaining walls very close to existing properties resulting in additional engineering complexity. This risk could be eliminated if the traffic analysis supports BRT running in mixed traffic on Capitol Hwy in the segment.	low to moderate risk

Community and environmental impacts

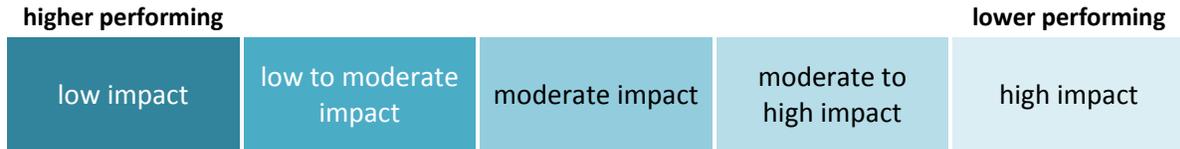
	higher performing			lower performing		
Property impacts	low impact	low to moderate impact	moderate impact	moderate to high impact	high impact	segment
Property access impacts	# driveways <i>along # mile segment</i>	## driveways <i>along # mile segment</i>	### driveways <i>along # mile segment</i>	#### driveways <i>along # mile segment</i>	##### driveways <i>along # mile segment</i>	segment
Property impacts to historically under-represented populations	low impact	low to moderate impact	moderate impact	moderate to high impact	high impact	segment
Visual impacts	low <i>degree of change</i>	low to moderate <i>degree of change</i>	moderate <i>degree of change</i>	moderate to high <i>degree of change</i>	high <i>degree of change</i>	segment
Impacts to parks and historic properties	low impact	low to moderate impact	moderate impact	moderate to high impact	high impact	segment
	smaller number			larger number		
	#	##	###	####	#####	

NOTE: The measures within the community and environmental impacts category represent potential impacts based on a three percent level of design. These potential impacts would be discussed in much more detail during a Draft Environmental Impact Statement and beyond, including opportunities for revising designs and identifying mitigation strategies.

Property impacts

Methodology

This measure is based on impacts to properties due to temporary construction easements or displacement. Since this is a simplified methodology and because designs are preliminary, results are reported as order of magnitude estimates.



Results

LRT: South Portland and Hillsdale	
	<i>Property impacts</i>
Naito + Barbur	moderate impact
Naito + Hillsdale	moderate to high impact
Barbur + Barbur	moderate impact
Barbur + Hillsdale	moderate to high impact
MH-H tunnel	high impact

BRT: South Portland and Hillsdale	
	<i>Property impacts</i>
Naito + Barbur	moderate impact
Naito + Hillsdale	moderate to high impact
Barbur + Barbur	moderate impact
Barbur + Hillsdale	moderate to high impact

LRT: PCC-Sylvania area	
	<i>Property impacts</i>
Barbur	moderate impact
PCC via tunnel	high impact

BRT: PCC-Sylvania area	
	<i>Property impacts</i>
Barbur	moderate impact
PCC via Capitol	high impact

Property access impacts

Methodology

This measure assesses potential changes to access that might result from a transit alignment on each alignment option were reviewed. A median-running transit alignment would not require driveway closures, but would require re-routing of left turns in some cases. The approximate number of driveways with access changes was identified for each alignment option compared to the length of the segment.



Results

LRT: South Portland and Hillsdale	
Naito + Barbur	1-5 driveways <i>along 3.4 mile segment</i>
Barbur + Barbur	5-10 driveways <i>along 3.4 mile segment</i>
Naito + Hillsdale	15-20 driveways <i>along 3.7 mile segment</i>
Barbur + Hillsdale	20-25 driveways <i>along 3.7 mile segment</i>
MH-H tunnel	1-5 driveways <i>along 2.9 mile segment</i>

BRT: South Portland and Hillsdale	
Naito + Barbur	1-5 driveways <i>along 3.4 mile segment</i>
Barbur + Barbur	5-10 driveways <i>along 3.4 mile segment</i>
Naito + Hillsdale	20-25 driveways <i>along 3.7 mile segment</i>
Barbur + Hillsdale	25-30 driveways <i>along 3.7 mile segment</i>

LRT: PCC-Sylvania area	
Barbur	35-40 driveways <i>along 1.9 mile segment</i>
PCC via tunnel	25-30 driveways <i>along 2.1 mile segment</i>

BRT: PCC-Sylvania area	
Barbur	35-40 driveways <i>along 1.9 mile segment</i>
PCC via Capitol	40-45 driveways <i>along 2.4 mile segment</i>

Property impacts to historically under-represented populations

Methodology

This measure is based on potential property impacts to historically under-represented populations, focused on areas with rates of limited English proficiency, people of color and low-income above the regional average, based on 2010 census data. The assessment focuses on impacts to residential properties and does not account for commercial property impacts.

Because this assessment is based on 2010 census data at the tract and block level, it does not identify whether the impacted properties are in fact owned or occupied by someone who is of limited English proficiency, low income or person of color. The assessment only identifies if there is an impact in an area where there is a potential for impact to those sensitive populations.



Results

LRT: South Portland and Hillsdale				
	Potential residential displacements in areas with above average rates of...			Rating
	low income	limited English proficiency	people of color	
Naito + Barbur	0	0	0	low impact
Barbur + Barbur	1-5	1-5	0	low to moderate impact
Naito + Hillsdale	0	0	0	low impact
Barbur + Hillsdale	1-5	1-5	0	low to moderate impact
MH-H tunnel	0	0	0	low impact

BRT: South Portland and Hillsdale				
	<i>Potential residential displacements in areas with above average rates of...</i>			<i>Rating</i>
	low income	limited English proficiency	people of color	
Naito + Barbur	0	0	0	low impact
Barbur + Barbur	1-5	1-5	0	low to moderate impact
Naito + Hillsdale	0	0	0	low impact
Barbur + Hillsdale	1-5	1-5	0	low to moderate impact

LRT: PCC-Sylvania area				
	<i>Potential residential displacements in areas with above average rates of...</i>			<i>Rating</i>
	low income	limited English proficiency	people of color	
Barbur	0	0	0	low impact
PCC via tunnel	0	0	1-5	low to moderate impact

BRT: PCC-Sylvania area				
	<i>Potential residential displacements in areas with above average rates of...</i>			<i>Rating</i>
	low income	limited English proficiency	people of color	
Barbur	0	0	0	low impact
PCC via Capitol	0	0	1-5	low to moderate impact

Visual impacts

Methodology

The results of the built environment are qualitative; the process of avoiding or minimizing the impacts to the built environment has not been completed. If impacts cannot be avoided or minimized, potential mitigation would be discussed as part of the conceptual design and environmental analysis conducted during the NEPA process.

For each design option, there is a potential for **visual impacts or degree of change** created by the physical improvements required by the HCT designs. This qualitative assessment does not reflect the quality or benefit of the change but rather the degree of the change. This assessment of the potential visual impacts is defined as low, moderate or high degree of change. For example, HCT within an existing transportation facility may be a low degree of change. However, introduction of a new transit guideway where a transportation facility does not exist today, may be high degree of change. The table below describes the methodology used in the qualitative assessment of the potential visual impacts.

NOTE: This is a qualitative assessment. Current designs are not completed at a level detail appropriate for an in-depth technical assessment. The most promising concepts will be designed in a manner to avoid or minimize potential impacts in the next phase of study. Additionally, potential mitigation measures would be evaluated during the NEPA process.

higher performing			lower performing	
low degree of change	low to moderate degree of change	moderate degree of change	moderate to high degree of change	high degree of change
<i>Low displacements of structures or buildings</i>		<i>Moderate displacements of structures or buildings</i>		<i>Significant displacements of structures or buildings</i>
<i>Limited new structures (e.g. elevated structures, tunnel portals)</i>		<i>Moderate new structures (e.g. elevated structures, tunnel portals)</i>		<i>Significant new structures (e.g. elevated structures, tunnel portals)</i>
<i>Limited new parking (surface or structured), especially where there is none today</i>		<i>Moderate new parking (surface or structured), especially where there is none today</i>		<i>Significant new parking (surface or structured), especially where there is none today</i>
<i>Minor removal of vegetation (e.g. screening to residential areas)</i>		<i>Some removal of vegetation (e.g. screening to residential areas)</i>		<i>Significant removal of vegetation (e.g. screening to residential areas)</i>

Results

LRT: South Portland and Hillsdale		
	<i>Visual impacts</i>	<i>Rating</i>
Naito + Barbur	Light rail operations in Naito would widen the road and change some of the adjacent streets around the Ross Island Bridge. Includes new pedestrian and bicycle connection to Marquam Hill. Few instances where vegetation between road and neighborhoods is removed. Rebuilds two structures along Barbur	moderate <i>degree of change</i>
Barbur + Barbur	Includes a new structure over I-405. Existing roadway would be expanded for light rail operations. Includes new pedestrian and bicycle connection to Marquam Hill. Few instances where vegetation between road and neighborhoods is removed. Rebuilds two structures along Barbur.	moderate <i>degree of change</i>
Naito + Hillsdale	Light rail operations in Naito would widen the road and change some of the adjacent streets around the Ross Island Bridge. Includes new pedestrian and bicycle connection to Marquam Hill. Few instances where vegetation between road and neighborhoods is removed. New structures from Barbur to Capital Hwy and from Bertha to Barbur. Two portal entrances in Hillsdale. Also includes two new bike pedestrian structures adjacent to Barbur.	moderate to high <i>degree of change</i>
Barbur + Hillsdale	Includes new structure of I-405. Existing roadway would be expanded for light rail operations. Includes new pedestrian and bicycle connection to Marquam Hill. Few instances where vegetation between road and neighborhoods is removed. Two portal entrances in Hillsdale. Also includes two new bike pedestrian structures adjacent to Barbur.	moderate to high <i>degree of change</i>
MH-H tunnel	Includes a new structure over I-405. Light rail while in a tunnel would not have a visual impact; the portals into the tunnel would be a significant change. Includes a structure from south tunnel portal to Barbur.	moderate <i>degree of change</i>

BRT: South Portland and Hillsdale		
	<i>Visual impacts</i>	<i>Rating</i>
Naito + Barbur	BRT would be operating within Naito. Some widening would be required. Includes some changes to the street network around the Ross Island Bridge. Few instances where vegetation between road and neighborhoods is removed. Includes new pedestrian and bicycle connection to Marquam Hill and parallel bike and pedestrian structures along Barbur.	low to moderate <i>degree of change</i>
Barbur + Barbur	BRT would be operating within Barbur. Some widening would be required. Few instances where vegetation between road and neighborhoods is removed. Includes new pedestrian and bicycle connection to Marquam Hill and parallel bike and pedestrian structures along Barbur.	low to moderate <i>degree of change</i>
Naito + Hillsdale	Includes some changes to the street network around the Ross Island Bridge. BRT would operate in Naito and Barbur with a new structure from Barbur to Capital Hwy and two tunnel portals within Hillsdale. Includes new pedestrian and bicycle connection to Marquam Hill and parallel bike and pedestrian structures along Barbur. Includes a new structure from Barbur to Capital Hwy and two portal entrances in Hillsdale.	moderate to high <i>degree of change</i>
Barbur + Hillsdale	BRT would operate in Barbur with a new structure from Barbur to Capital Hwy and two tunnel portals within Hillsdale. Includes new pedestrian and bicycle connection to Marquam Hill and parallel bike and pedestrian structures along Barbur.	moderate to high <i>degree of change</i>

LRT: PCC-Sylvania area		
	<i>Visual impacts</i>	<i>Rating</i>
Barbur	Existing roadway would be expanded for light rail operations. Few instances where vegetation between road and neighborhoods is removed. Includes a new surface park and ride facility at the 53 rd Avenue station and new structure from approximately SW 55 th Ave to the Multnomah/Washington County line. Includes a new pedestrian and bike connection to PCC.	moderate <i>degree of change</i>
PCC via tunnel	Light rail would operate along Barbur to a tunnel at SW 53 rd Avenue which includes two portals to tunnel. The alignment crosses I-5 on a structure from SW Lesser Rd to the Multnomah/Washington County line.	moderate <i>degree of change</i>

BRT: PCC-Sylvania area		
	<i>Visual impacts</i>	<i>Rating</i>
Barbur	BRT would be operating within Barbur. Some widening would be required. Few instances where vegetation between road and neighborhoods is removed. Includes a smaller structure over I-5 (compared to the light rail alignment). Also includes pedestrian and bike connection on SW 53 rd Avenue and a new surface park and ride along Barbur.	low to moderate <i>degree of change</i>
PCC via Capitol	BRT would be operating within Capitol Hwy. Some widening would be required. Includes a new transportation mode through campus. Few instances where vegetation between road and neighborhoods is removed. Also includes a new structure over I-5 from SW Lesser Rd to the Multnomah/Washington County line.	moderate <i>degree of change</i>

Natural areas and historic properties

Methodology

For this measure, parks, wetlands and historic properties were identified along each alignment. A low to high impact rating was assigned to each option based on the number, duration and severity of potential impacts. Though some impacts may potentially be avoided or mitigated, changes to the alignment design could result in an increase in other property impacts or add cost to the project. Potential impacts to natural areas and historic properties will be evaluated in more detail in the DEIS, including avoidance or mitigation strategies.



Results

LRT: South Portland and Hillsdale		
	<i>Potential impacts to natural areas and historic properties</i>	<i>Rating</i>
Naito + Barbur	Potential partial impacts to Water & Gibbs Community Garden, Terwilliger Boulevard Parkway and George Himes Park. Potential for a historic property impact.	moderate impact
Barbur + Barbur	Potential partial impacts to Lair Hill Park, Terwilliger Boulevard Parkway and George Himes Park. Potential for a historic property impact.	moderate impact
Naito + Hillsdale	Potential partial impacts to Water & Gibbs Community Garden, Terwilliger Boulevard Parkway, George Himes Park and Stephens Creek Natural Area. Impacts to Terwilliger Boulevard Parkway or George Himes Park along Capitol Highway would be challenging to avoid due to the constrained space between the two parks. Potential for a historic property impact.	moderate to high impact
Barbur + Hillsdale	Potential partial impacts to Lair Hill Park, Terwilliger Boulevard Parkway, George Himes Park and Stephens Creek Natural Area. Impacts to Terwilliger Boulevard Parkway or George Himes Park along Capitol Highway would be challenging to avoid due to the constrained space between the two parks. Potential for a historic property impact.	moderate to high impact
MH-H tunnel	Potential major temporary impacts to Duniway Park for construction staging. Potential partial impacts to Terwilliger Boulevard Parkway between Terwilliger and Barbur at the northern tunnel portal.	high impact

BRT: South Portland and Hillsdale		
	<i>Potential impacts to natural areas and historic properties</i>	<i>Rating</i>
Naito + Barbur	Potential partial impacts to Water & Gibbs Community Garden, Terwilliger Boulevard Parkway and George Himes Park. Potential for a historic property impact.	moderate impact
Barbur + Barbur	Potential partial impacts to Lair Hill Park, Terwilliger Boulevard Parkway and George Himes Park. Potential for a historic property impact.	moderate impact
Naito + Hillsdale	Potential partial impacts to Water & Gibbs Community Garden, Terwilliger Boulevard Parkway, George Himes Park and Stephens Creek Natural Area. Impacts to Terwilliger Boulevard Parkway or George Himes Park along Capitol Highway would be challenging to avoid due to the constrained space between the two parks. Potential for a historic property impact.	moderate to high impact
Barbur + Hillsdale	Potential partial impacts to Lair Hill Park, Terwilliger Boulevard Parkway, George Himes Park and Stephens Creek Natural Area. Impacts to Terwilliger Boulevard Parkway or George Himes Park along Capitol Highway would be challenging to avoid due to the constrained space between the two parks. Potential for a historic property impact.	moderate to high impact

LRT: PCC-Sylvania area		
	<i>Potential impacts to natural areas and historic properties</i>	<i>Rating</i>
Barbur	Potential for a partial historic impact.	low to moderate impact
PCC via tunnel	Potential temporary partial impacts to Sylvania Park during tunnel construction.	low to moderate impact

BRT: PCC-Sylvania area		
	<i>Potential impacts to natural areas and historic properties</i>	<i>Rating</i>
Barbur	Potential for a temporary partial historic impact during construction.	low to moderate impact
PCC via Capitol	Potential for a partial historic impact.	low to moderate impact

Appendix A: Project Goals in Relation to Evaluation Criteria

This appendix shows how the evaluation criteria employed in the High Capacity Transit Technical Evaluation Results and Methodology, Part 1, relate to the established goals of the Southwest Corridor project.

Project Goals

The purpose of the Southwest Corridor project is to interconnect Tualatin, Tigard, Southwest Portland and the region's central city through a high capacity transit project and appropriate community investments in a congested corridor to improve mobility and create the conditions that will allow communities in the corridor to achieve their land use vision.

The thirteen goals of the project are:

- 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 business in growing communities
- Improve potential for housing and commercial development in the corridor and encourage development in centers and transit-oriented development at stations along the corridor
- Ensure benefits and impacts promote community equity
- 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
- Provide transit service that is cost effective to build and operate with limited local resources
- Advance transportation project that are sensitive to the environment, improve water and air quality and help reduce carbon emissions
- Catalyze improvements to natural resources, habitat and parks in the corridor

Evaluation Criteria

Potential alignments and other variable components of the HCT line will be evaluated across a variety of criteria, including transit performance, access and development, mobility, cost, engineering complexity, and community and environmental impacts. This document, along with the Key Issue memos, attempts to evaluate the relative performance of the South Portland alignment options against these criteria, using a number of objective measures.

The following table shows how these criteria and measures relate to the project goals. Note that some goals apply to multiple criteria.

Goals	Criteria	Measures
<ul style="list-style-type: none"> ▪ Serve the existing and projected transit demand in the corridor ▪ Improve transit service reliability in the corridor ▪ Improve transit frequency and travel times 	Transit performance	<ul style="list-style-type: none"> New system transit trips Line ridership Travel time Mixed traffic Signalized intersections crossed
<ul style="list-style-type: none"> ▪ Provide options that reduce overall transportation costs ▪ Improve multimodal access to a range of housing types and business in growing communities ▪ Improve potential for housing and commercial development in the corridor and encourage development in centers and transit-oriented development at stations along the corridor ▪ Ensure benefits and impacts promote community equity 	Access and development	<ul style="list-style-type: none"> Equitable access to transit Redevelopment potential Support for existing plans
<ul style="list-style-type: none"> ▪ 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 	Mobility	<ul style="list-style-type: none"> Freight Traffic Transportation safety Street connectivity Bike improvements Pedestrian improvements
<ul style="list-style-type: none"> ▪ Provide transit service that is cost effective to build and operate with limited local resources ▪ Provide options that reduce overall transportation costs 	Cost	<ul style="list-style-type: none"> Capital cost Operations and maintenance costs
<ul style="list-style-type: none"> ▪ Provide transit service that is cost effective to build and operate with limited local resources ▪ Ensure benefits and impacts promote community equity 	Engineering complexity	<ul style="list-style-type: none"> Construction impacts Engineering risk
<ul style="list-style-type: none"> ▪ Advance transportation project that are sensitive to the environment, improve water and air quality and help reduce carbon emissions ▪ Catalyze improvements to natural resources, habitat and parks in the corridor ▪ Ensure benefits and impacts promote community equity 	Community & environmental impacts	<ul style="list-style-type: none"> Property impacts Property access impacts Property impacts to historically under-represented populations Visual impacts Impacts to natural areas and historic properties

Note that the purpose, goals, objectives and measures may be refined through the Draft Environmental Impact Statement (DEIS) process.