



Southwest Corridor Plan
Key Issues: Hillsdale
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Key Issues: Hillsdale

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Hillsdale Key Issues: introduction and summary

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 (SIS) 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 refinements 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, then 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 studied, funded and implemented through other collective federal, state, regional and local efforts.

Desired outcome: Preferred Package

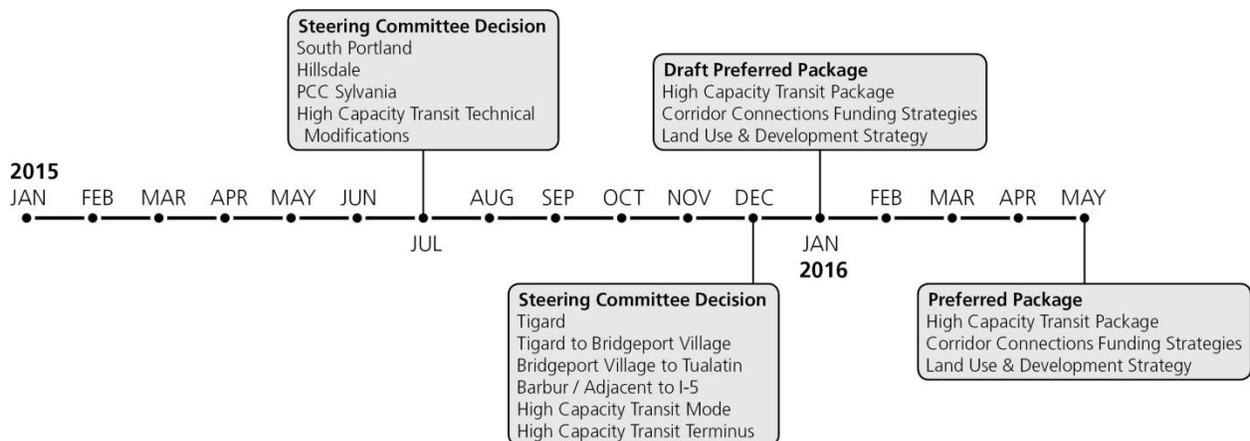
Project partners will work together to develop a Preferred Package by spring 2016 that addresses the needs and aspirations of Southwest Corridor residents and businesses. The Preferred Package will include the following components:

- **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 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.



How to use this Key Issues memo

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. The place-based key issues will be reviewed by the public and the Steering Committee in the context of their implications for achieving the multifaceted goals for the corridor as a whole. Decision makers and the public will have several months to discuss this report through public meetings and online engagement.

This document fits into a broader array of technical information that supports Steering Committee decision making during this phase of the Southwest Corridor Plan. **Appendix A** lists the anticipated major project documents and their estimated dates of completion.

In addition to this report and other Key Issues memos, a draft Evaluation Report expected in May 2015 will provide technical evaluation of the options in the South Portland, Hillsdale and PCC-Sylvania areas. A staff recommendation report focusing on HCT options in these areas will be available prior to the July 2015 Steering Committee meeting and will include a summary of stakeholder feedback. The remaining place-based evaluation and recommendation reports will be available before the December 2015 Steering Committee decision.

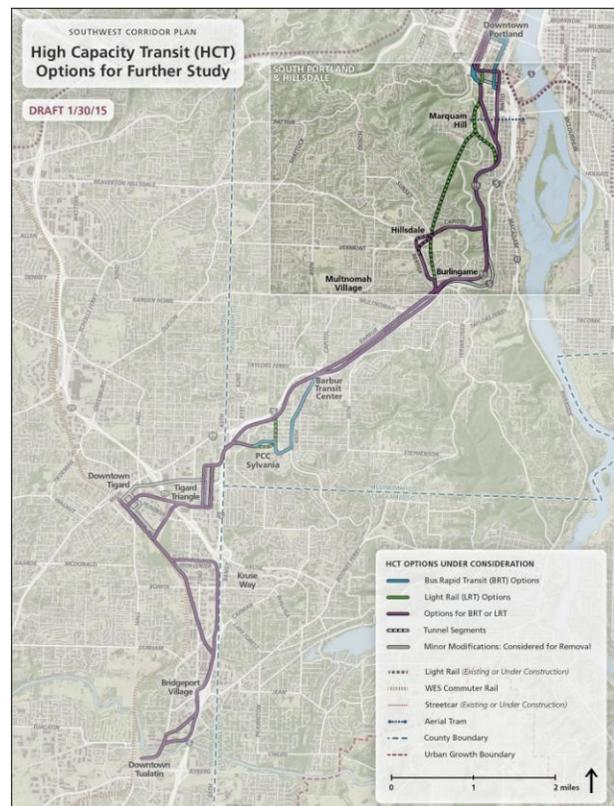
This document includes an overview of the decision making process as it relates to the key issues in South Portland, a description of the three proposed high capacity transit alignments to serve South Portland, a summary of technical information and a description of key issues for decision makers and the public to consider. Appendices contain supplemental information including maps and project lists of Shared Investment Strategy road, bicycle and pedestrian projects being considered for the South Portland area, a discussion of general transit mode considerations, and maps highlighting demographic factors in the study area.

Hillsdale Key Issues summary

The Hillsdale area encompasses the project area between Capitol Highway to the north and Burlingame to the south and includes three HCT options under consideration:

1. Barbur Boulevard between SW Hamilton Street and SW Bertha Boulevard (BRT or LRT) (does not provide direct HCT access to Hillsdale)
2. Hillsdale Loop using Barbur between Hamilton and looping through the Hillsdale town center via SW Capitol Highway and Bertha, including a cut-and-cover tunnel in or near the town center commercial area* (BRT or LRT)
3. Marquam Hill-Hillsdale deep-bored Tunnel between downtown Portland and Bertha (LRT only)

** In May 2014 the Southwest Corridor Steering Committee specified that LRT through Hillsdale should be studied only with a cut-and-cover tunnel to avoid property impacts and removal of traffic lanes in the congested commercial area. In June 2014 the Southwest Corridor Steering Committee specified that BRT through Hillsdale should be studied only with the cut-and-cover tunnel to avoid placing buses in mixed traffic where congestion is anticipated.*



Additional HCT options serving South Portland and Lair Hill are addressed separately in the South Portland Key Issues memo. The Marquam Hill-Hillsdale Tunnel alignment is addressed in both the South Portland and Hillsdale Key Issues memos.



Major decisions in Hillsdale

In July 2015 the Southwest Corridor Plan Steering Committee will be asked to make a recommendation on which of the proposed HCT alignment choices for serving the Hillsdale area will advance to further environmental review through a DEIS that could begin as early as late 2016. The Barbur Boulevard surface HCT alignment, as well as any associated local transit, roadway, bike, and pedestrian projects necessary to link Hillsdale to the HCT system, will continue to be studied beyond July 2015 and is anticipated to be included in the DEIS for detailed analysis. The Steering Committee will decide in July 2015 whether the tunnel alignments that would directly serve the Hillsdale town center will also proceed for further environmental review. This document focuses on the substantial tradeoffs between options so that the public and decision makers can be confident that all options that will enter the DEIS are viable and aligned with project goals.

Timeline of Major Decisions in Hillsdale

July 2015:

- Should the DEIS include study of an HCT alignment and station in the Hillsdale town center, or should the area continue to be served by a high level of local bus service with emphasis on connections to HCT stations near the town center?
- If HCT should be routed through the Hillsdale town center, should the Marquam Hill-Hillsdale Tunnel, the Capitol Highway cut-and-cover tunnel, or both be studied in the DEIS?
- Should the Barbur Boulevard surface HCT alignment and any associated local transit, roadway, bike and pedestrian projects necessary to link Hillsdale to the HCT system be studied further in the DEIS?

December 2015:

- Is BRT or LRT the preferred mode for the corridor to study in the DEIS?
- What is the timeframe for designing and implementing local transit service improvements to enhance connections to and through Hillsdale to the HCT project?
- What is the best implementation approach for corridor connection projects defined in the Shared Investment Strategy for Hillsdale?

Evaluation factors

Deliberation and decision making will be driven by how well each element of the proposed project meets the Southwest Corridor Plan overarching Purpose and Need, including improved mobility and safety for all users and modes of transportation, efficient and reliable transportation choices, wise use of public resources, improved access to key places, and equitable distribution of the benefits and burdens of transportation and land use development.

This Hillsdale Key Issues memo outlines data collected through technical analysis, local knowledge and partners discussions that will influence this decision including:

- Transit performance
- Community development
- Mobility
- Capital cost estimates
- Engineering complexity and risk
- Community impacts

Hillsdale summary

The following table summarizes evaluation factors, key considerations, and analysis results for consideration in the Hillsdale area.

Key considerations	Evaluation factors	Marquam Hill-Hillsdale Tunnel (LRT only)	Barbur	Hillsdale Loop
Transit Performance <ul style="list-style-type: none"> What are the tradeoffs to consider between transit performance of proposed tunnel alignments and other factors such as cost, construction complexity and risk, and community development impacts? 	2035 new transit trips	New Transit Trips: 16,900	New Transit Trips: <ul style="list-style-type: none"> 15,700 (LRT via Naito) 8,400 (BRT via Naito) 	New Transit Trips: <ul style="list-style-type: none"> 14,300 (LRT via Naito) 7,700 (BRT via Naito-estimated)
	2035 line riders	Line riders: 52,400 (High number of bus transfers to LRT in Hillsdale results in high line ridership relative to new transit trips)	Line riders: <ul style="list-style-type: none"> 43,500 (LRT via Naito) 30,800 (BRT via Naito - estimated) 	Line riders: <ul style="list-style-type: none"> 41,800 (LRT via Naito) 29,300 (BRT via Naito-estimated)
	Travel time (PSU to Tualatin)	Travel Time: 29 minutes	Travel Time: <ul style="list-style-type: none"> 31 minutes (LRT via Naito) 34 minutes (BRT via Naito) 	Travel Time: <ul style="list-style-type: none"> 34 minutes (LRT via Naito) 37 minutes (BRT via Naito - estimated)
Community Development <ul style="list-style-type: none"> Can local transit, road, bike and pedestrian improvements effectively connect Hillsdale to a surface alignment on Barbur? Are the positive and negative impacts of development growth that could occur with an HCT investment clearly defined? 	Access	<ul style="list-style-type: none"> Direct HCT service to Hillsdale with underground station Includes sidewalk/bike improvements along to access station 	<ul style="list-style-type: none"> Local bus service improvements to Hillsdale, Multnomah Village, and Crossroads provide connection to HCT Station at Burlingame Includes sidewalk/bike improvements along Barbur and to access station 	<ul style="list-style-type: none"> Direct HCT service to Hillsdale with underground station Includes sidewalk/bike improvements along Capitol and to access station
	Redevelopment potential	<ul style="list-style-type: none"> Promotes higher intensity mixed use development in Hillsdale center Likely to require consideration of a transit center in Hillsdale 		Promotes higher intensity mixed use development in Hillsdale center
Mobility <ul style="list-style-type: none"> Can a Hillsdale Loop be designed to mitigate traffic impacts for cars, bikes and pedestrians? How do alignment choices impact road, bike and pedestrian improvement projects that could serve Hillsdale? 	Accessibility	Includes sidewalk/bike improvements to access station	<ul style="list-style-type: none"> Includes sidewalk/bike improvements along Barbur and to access station Includes replacement of Barbur viaducts or provides new parallel pad/bike facility 	Includes sidewalk/bike improvements along Capitol and to access station
	Mode considerations		<ul style="list-style-type: none"> 23 BRT vehicles per hour in the peak in Hillsdale 10 LRT vehicles per hour in the peak 	Same as Barbur alignment option

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Key considerations	Evaluation factors	Marquam Hill-Hillsdale Tunnel (LRT only)	Barbur	Hillsdale Loop
Capital Costs <ul style="list-style-type: none"> Are the trade-offs between cost of a project and other factors such as reliability, safety, access and community development opportunities clear? How does cost impact the length of the final high capacity transit alignment? 	<i>Cost estimates in 2014 dollars</i>	Adds \$750M - \$900M compared to Barbur or Naito alignment	<ul style="list-style-type: none"> \$1.9B - \$2.4B (LRT) line cost \$680M - \$1.2B (BRT) line cost 	<ul style="list-style-type: none"> Adds \$226M (LRT) Adds \$137M (BRT)
Engineering complexity/risk <ul style="list-style-type: none"> Are the benefits and risks associated with construction of a deep-bored tunnel clear? What aspects of each alignment option present noteworthy risk? 	<i>Risk</i>	<ul style="list-style-type: none"> Large area needed for tunnel mining/access for heavy equipment and trucks at each portal Risk of complications with tunnel boring resulting in cost overruns Traffic and physical roadway impacts from hauling excavated materials 	<ul style="list-style-type: none"> Potential right-of-way impacts 	<ul style="list-style-type: none"> Potential right of way impacts Potential traffic and business disruptions during cut-and-cover tunnel construction Risk of complications with cut-and – cover tunnel
Community impacts <ul style="list-style-type: none"> Can the benefits and burdens of an HCT alignment be equally distributed among all population groups in the corridor? Do surface or tunnel alignments offer greater access to key places such as education, employment, health care and retail centers? 	<i>Distribution of impacts</i>	<ul style="list-style-type: none"> Most direct access to education, employment and health care services on Marquam Hill Limited access to education, health care, employment and retail services on Naito Parkway, South Waterfront, and local retail centers 	<ul style="list-style-type: none"> Potential right of way impacts 	<ul style="list-style-type: none"> Potential right of way impacts

Hillsdale Key Issues

There are three HCT alignments in the vicinity of Hillsdale: two underground and one surface. A number of other HCT alignment options were removed from further consideration by the Steering Committee in April and June 2014. More information on these options may be found on the Southwest Corridor Plan website: <http://www.oregonmetro.gov/public-projects/southwest-corridor-plan/project-library>.

Hillsdale HCT alignment option descriptions



Surface

Barbur Boulevard HCT alignment

The portion of the Barbur alignment discussed in this memo is between the Capitol Highway ramps and the Burlingame area. The Barbur alignment is a surface route that would continue along Barbur Boulevard from South Portland into the Burlingame area, with a station near Barbur Boulevard and 13th Avenue, approximately two-thirds of a mile from the Hillsdale town center. Either BRT or LRT would be center-running in exclusive right-of-way on this stretch of Barbur Boulevard. With this alignment local

bus service would be improved to ensure efficient transit connections between the Hillsdale town center area and HCT stations on Barbur Boulevard. This option would also improve bicycle and pedestrian facilities on Barbur Boulevard in this portion of the alignment. Opportunities for improving bicycle and pedestrian access between the town center and a Bertha Boulevard station would also be explored. Further north, a surface Barbur Boulevard or Naito Parkway alignment would include the Marquam Hill pedestrian/bike access project described below.

This alignment could include conversion of one of three northbound travel lanes north of the Capitol/Barbur on-ramp to transit-only use. This conversion would help minimize impacts to adjacent properties. The lane conversion would be approximately 3500' approaching Hamilton Street. At Hamilton Street about 400' of the third lane would be retained to accommodate right turns. All lane conversions considered will be analyzed at a higher level of detail in the DEIS phase to confirm road capacity is available to support conversion without unacceptably impacting traffic.

Tunnels

Hillsdale Loop with cut-and-cover tunnel: under Capitol Highway or fields

A surface alignment on Capitol Highway in Hillsdale would have major impacts to the main street in order to maintain vehicle lanes and run HCT in exclusive right-of-way. Therefore in July 2014 the Southwest Corridor Steering Committee recommended that only an alignment in a cut-and-cover tunnel should be considered further. A cut-and-cover tunnel entails excavating along the path of the tunnel, building the tunnel structure within this excavated trench, and then covering up the tunnel and rebuilding any disrupted roadways, structures, or fields above.

This option would depart from the Barbur alignment at the Capitol Highway southbound off-ramp. HCT would cross the southbound lanes of Barbur Boulevard on a new overpass structure and then run in the center of Capitol Highway. Due to steep slopes and the need to transition the center running alignment onto Capitol Highway, HCT would continue west on Capitol Highway on structure and retained fill until reaching Terwilliger Boulevard. Beyond Terwilliger, approaching Hillsdale, HCT would continue on the surface along Capitol Hwy. Near Sunset Boulevard, HCT would enter a portal to drop under Capitol Hwy in the cut-and-cover tunnel, and then could either continue under Capitol Highway to Bertha Boulevard or sweep to the south, passing behind the commercial buildings and under the sports fields next to Rieke Elementary School. HCT would emerge at a portal on Bertha Boulevard near the intersection with Vermont Street.

This alignment, similar to the surface alignment on Barbur Boulevard, could convert one of three northbound travel lanes north of the Capitol/Barbur on-ramp to transit-only use. This alignment may also be able to convert one of two westbound lanes between Barbur and Terwilliger Boulevards on Capitol Highway to minimize impacts to the park and adjacent properties. Approaching Terwilliger Boulevard, the second lane would be retained to accommodate turn movements at Terwilliger. All lane conversions considered will be analyzed at a higher level of detail in the DEIS phase to confirm road capacity is available to support conversion without unacceptably impacting traffic.

The Hillsdale HCT station would be located underground near the intersection of Capitol Highway and Sunset Boulevard. The Burlingame station on Barbur Boulevard would be located in the vicinity of Barbur, Custer Street, and 13th Avenue. For an LRT mode in this Hillsdale option, the Burlingame station location is particularly difficult due to the steep grades on 13th Avenue and could result in an elevated station above Custer Street near 13th Avenue. An elevated station would not be required for BRT.

Marquam Hill-Hillsdale Tunnel

This option would tie into the downtown Transit Mall via a new bridge at 4th Avenue connecting to the PMLR tracks at Lincoln Street. Access to the tunnel portal would be in the vicinity of Hooker Street. The tunnel would extend under Marquam Hill with a deep station to directly access Oregon Health & Science University (OHSU) and indirectly connect to the VA Medical Center and Casey Eye Institute through the OHSU campus. A second deep station would be located under the Hillsdale town center, near the intersection of Capitol Highway and Sunset Boulevard. The tunnel would exit the hillside in the vicinity of Bertha Boulevard where it meets Barbur Boulevard. A station in this location (near Custer Street and 13th Avenue) would likely need to be elevated above Barbur Boulevard to avoid traffic impacts and to provide a station area in the desired vicinity.

With this alignment option there would be no surface connections to inner southwest Portland except those north of I-405 described above. The Marquam Hill-Hillsdale Tunnel alignment would not assume a direct pedestrian and bicycle connection between Marquam Hill and Barbur Boulevard, since the area would be served by an underground station with an elevator.

Roadway, pedestrian and bicycle projects

All options include a range of roadway, pedestrian and bicycle improvements to better connect the corridor to the surrounding neighborhoods near stations and along surface portions of alignments. The specific improvements vary depending on the alignment and multimodal needs. Maps and lists of potential roadway, pedestrian and bicycle projects that would accompany HCT alignments in South Portland are included in Appendix B. Two major projects, Marquam Hill pedestrian/bike access and the Ross Island bridgehead project, are described in more detail below.

Marquam Hill pedestrian/bike access

This connection has been studied at a conceptual level through the Marquam Hill Design Challenge. Two firms were hired to conceptually render new connections from a Barbur or Naito transit stop up to Marquam Hill. Options studied included a sky bridge, several escalator options and a pedestrian tunnel. Connections on the hill were proposed at Terwilliger and/or within the OHSU campus. The project engaged the surrounding neighborhood groups, adjoining property owners and several health care providers. Those engaged included the Veterans Medical Center, NCM, and OHSU. It is clear that a well-designed connection from Barbur to the OHSU campus and beyond to the VA Medical Center is feasible, and it is assumed this connection would be constructed as part of a Barbur or Naito surface alignment.

Hillsdale analysis and findings

Transit performance

Key considerations:

- What are the tradeoffs to consider between transit performance of proposed tunnel alignments and other factors such as cost, construction complexity and risk, and community development impacts?

Key findings:

- Marquam Hill-Hillsdale Tunnel travel time would be one to two minutes faster than the Barbur option between Burlingame and downtown Portland.
- Using a Hillsdale Loop for this segment would be nearly three minutes slower than the Barbur option.
- A Marquam Hill – Hillsdale Tunnel would result in more line riders and new transit trips than a surface alignment on Barbur Boulevard between Burlingame and downtown Portland.
- The Hillsdale Loop with LRT would result in 1,700 fewer line riders and 1,400 fewer new system riders than LRT on Barbur.
- With a Marquam Hill-Hillsdale Tunnel there would be 3,900 daily on and offs at a Hillsdale station, including 2,700 transfers, which would require consideration of a transfer station in Hillsdale.

Transit performance analysis in the Hillsdale area focuses on differences between LRT operating through a tunnel under Marquam Hill and Hillsdale, LRT routed through Hillsdale via a cut-and-cover tunnel under Capitol Highway or the field behind Rieke Elementary School (Hillsdale Loop options), and an indirect Hillsdale connection with LRT remaining on Barbur Boulevard below Hillsdale, utilizing three travel demand model runs to reflect these alternatives. Model runs used LRT as the mode for comparison because a Marquam Hill-Hillsdale Tunnel is not under consideration for BRT. Some information about BRT ridership and travel time is included in the summary table on page 6. **All model results at this time should be considered preliminary as refinements of HCT options, traffic analyses and local bus service assumptions will necessitate updated modeling throughout the DEIS process.**

Travel time and reliability

The Marquam Hill-Hillsdale Tunnel would have a slightly shorter alignment than the Barbur alignment and would be completely separated from cars, pedestrians, and bikes. Therefore it would provide the fastest and most reliable travel times among HCT options, saving two minutes over a surface option that uses Naito Parkway in South Portland, and one minute over a surface option using Barbur Boulevard in South Portland, reducing total line time between Tualatin and Portland by three to six percent. The Hillsdale Loop options would be the slowest, with two minutes and 42 seconds additional travel time compared to the Barbur (via Naito) surface option, due to sharp curves and elevation changes. The Marquam Hill-Hillsdale Tunnel alignment would be four minutes and 42 seconds faster than a surface Barbur (via Naito) alignment that includes the Hillsdale Loop alternative.

Corridor line and system ridership

Future transit ridership forecasts are largely determined by the speed of the service relative to competing modes and by the numbers of households and jobs it serves. Ridership is expressed in two ways: **line ridership** measures the number of daily riders on the specific HCT line (between the terminus and downtown Portland)—this includes both new transit riders and those who rode buses in a no-build scenario (without the HCT project). **Change in system transit trips** measures the growth of total system ridership with implementation of the proposed project compared to a no-build alternative—this isolates new transit riders only. While shifts from buses to HCT in the model reflect riders who mostly benefit from improved accessibility with a project, new riders represent shifts in mode, usually from autos to transit, that are more likely to benefit the transit system as a whole. All measures are for forecast year 2035.

The Marquam Hill-Hillsdale Tunnel option would result in 8,900 more line riders compared to LRT on Barbur (via Naito), a 20 percent increase, but only 1,200 more new system transit trips, a 8 percent increase. This disparity results from the difference in access to Marquam Hill between the Tunnel alternative and the surface alternatives. With HCT on either Barbur or Naito, a direct pedestrian and bicycle connection between Barbur Boulevard and Marquam Hill is assumed to be built as part of the HCT project. This connection, whether it is an elevator, escalator, walkway, or other design, would be accessible to HCT riders and to local bus riders at Barbur Boulevard near Gibbs Street. Approximately half of the projected users of the pedestrian/bicycle connection would be local bus riders. For the Marquam Hill-Hillsdale Tunnel alternative, without the direct connection between Barbur Boulevard and Marquam Hill, local bus riders instead would transfer to LRT in either Hillsdale or downtown Portland and travel one stop to the tunnel station under Marquam Hill. These transfers result in higher line ridership for LRT in a tunnel, but a much smaller difference in net new transit trips compared to the surface alternatives.

The LRT Hillsdale Loop option would result in 1,700 fewer line riders compared to surface LRT on Barbur, a four percent decrease, and 1,400 fewer new system trips, a nine percent decrease. While a station in Hillsdale would add riders, the slower travel time relative to a Barbur alignment would reduce demand at other stations along the line and result in a net loss in line ridership.

Transfers in Hillsdale

As described earlier, a Marquam Hill-Hillsdale Tunnel option would result in a significant number of transfers between local buses and LRT in Hillsdale, many by riders destined to or from Marquam Hill, one stop away. Under both the LRT on Barbur option and the Hillsdale Loop option, these local bus riders would continue through Hillsdale on their local bus, using the pedestrian/bicycle connection from Barbur at Gibbs to access Marquam Hill. Under the LRT tunnel alternative, Marquam Hill-bound riders of six bus lines (lines 44, 45, 54, 55, 56, 92) would transfer between local bus and LRT at the Hillsdale station. There would be nearly 3,900 daily ons and offs at the station, representing a 71 percent increase in usage compared to the Hillsdale Loop option. Of the 3,900 ons and offs in Hillsdale with the Marquam Hill-Hillsdale Tunnel, 2,700, or 69 percent, would be transfers, requiring consideration of a transit center in the town center. Changes to the local bus network resulting from the addition of the HCT project would affect these projections.

Hillsdale mode considerations

Appendix C includes a general discussion of differences between BRT and LRT modes and their corridor-wide impacts; this section addresses issues particular to Hillsdale.

With the Hillsdale Loop alignment, consideration should be made for the number of transit vehicles travelling through the town center. Today eight local bus routes travel through the town center, with over 20 buses on Capitol Highway in the peak hour on weekdays, and service will increase as future demand grows. Introduction of HCT, regardless of mode, could reduce the number of local buses operating through Hillsdale as riders would shift to the HCT. However, because of differences in carrying capacities, more BRT vehicles than LRT vehicles would be needed to carry an equivalent passenger load (see Appendix C). The projected 2035 demand would require 23 BRT vehicles per hour in the peak through Hillsdale or along Barbur, while LRT would require 10 vehicles per hour. As detailed in the Engineering Complexity and Risk section, an LRT or BRT project could impact the park adjacent to Capitol Highway if both westbound travel lanes are required for autos. With BRT, park impacts could be avoided by operating in mixed traffic; however, this would likely affect BRT travel time and reliability.

Community development

The information presented in this section is meant to highlight the trade-offs between serving Hillsdale directly with a tunnel alignment or indirectly via a surface alignment on Barbur Boulevard. Hillsdale currently has eight bus lines that run through it during normal weekly service hours, and experiences high levels of automobile traffic at peak hours. There is a challenge in determining the investments that will alleviate current concerns at a reasonable cost to the Southwest Corridor project.

Key considerations:

- Can local transit, road, bike and pedestrian improvements effectively connect Hillsdale to an indirect surface alignment on Barbur?
- Are the positive and negative impacts of development growth that could occur with an HCT investment clearly defined?
- Would construction of a cut-and-cover tunnel cause significant disruption to traffic flow and business access?

Key findings:

- An HCT investment in Hillsdale could spur higher intensity mixed use development due to a possible increase in markets rents.
- The Marquam Hill-Hillsdale Tunnel and Hillsdale Loop options would require an underground station near the commercial corridor along Capitol Highway. A surface entry point (e.g. elevator) would provide access to the station.

The Barbur Boulevard alignment between Burlingame and downtown Portland would have stations at Hamilton Street and Gibbs Street (and Lincoln Street for the Naito alignment) in South Portland and at Bertha Boulevard/13th Avenue, and would likely include improved local bus service to connect Hillsdale to downtown Portland and other destinations.

Access

Both alignment options providing direct service to Hillsdale would include a tunnel station located in the commercial corridor of Capitol Highway. This location would offer best access to the heart of the commercial service district, Wilson High School, Multnomah County Library, and the surrounding single-family neighborhoods. The station for any alignment through Hillsdale would be underground and would necessitate construction of a surface entry point, with an elevator system. As detailed in the Transit Performance section, the volume of existing riders on local transit that are forecasted to transfer between Hillsdale and Marquam Hill would likely require the addition of a transit center serving bus transfers. The location of a transit/transfer station relative to the existing transportation system has not been explored in detail.

Surface HCT on Barbur Boulevard would not directly serve the Hillsdale town center, but local bus service, along with bike and pedestrian facilities, could be improved to ensure efficient connections to this regional system.

Redevelopment potential

The center of Hillsdale along Capitol Highway is almost exclusively one-story retail, consisting mainly of low-intensity linear developments set back from the roadway with street fronting parking lots. Only a few of the retail uses front the street. There are redevelopment opportunities along Capitol Highway on properties that are underutilized. Current zoning would allow existing properties to be redeveloped to a higher density, if market rents were positively impacted by an HCT line. It is unclear if BRT would have the same impact on redevelopment as LRT, thus lowering the possible return from redevelopment in the town center. Initial efforts to understand the impact that an HCT investment might have on market rents show that the majority of the redevelopment opportunities in Hillsdale would be found on the north side of Capitol Highway. Most likely, these opportunities would be higher-density multifamily with ground floor retail or some form of 3-4 story office use.

Parcels further from the core retail area could experience some increased medium-density multifamily housing opportunities along Bertha Boulevard and Beaverton-Hillsdale Highway. There is also the possibility of scattered townhome development within some of the existing neighborhoods, depending on how land values respond to the investment of a new HCT line in the area.

Support of local land use plans

Hillsdale is identified as a 2040 town center on the Metro Growth Concept Map. Town centers serve local populations with everyday needs and on occasion have specialty and destination retail. Town centers are usually connected to regional centers via major road networks and transit, although the development of town centers varies greatly.

Forecasts project low to moderate growth in Hillsdale over the next 20 years. Regardless of any HCT investment, households are expected to grow by about 850 units, while employment forecasts only show a net increase of 350 jobs. While both figures are significant in terms of Hillsdale's size, the totals are not large when compared to some other area forecasts in South Portland or along long stretches of Barbur Boulevard to the south. The Hillsdale Town Center Plan does not expressly state a desire for HCT

service, but it does call out the need for better bus service to the town center. Additionally, the plan does identify commercial properties in the core as opportunity sites for new, mixed-use development.

Mobility

Key considerations:

- Can high capacity transit be designed to minimize negative impacts to auto, freight, bicycle and pedestrian mobility and access?
- How do alignment choices impact road, bike and pedestrian improvement projects that could serve Hillsdale?

Key findings:

- None of the alignments options overlap with regional or statewide freight routes.
- The Barbur Boulevard surface alignment would include design treatments that could improve road safety for all users on Barbur.
- The Hillsdale Loop alignment would include design treatments that could improve road safety for all users on Capitol Highway.
- The Tunnel alignment avoids interaction with traffic, and does not include opportunities to improve access or safety along Barbur or Capitol.

Motor vehicle and freight mobility

The Barbur alignment would pass through the intersection of Barbur and Terwilliger Boulevards. This is a key vehicle capacity constraint on Barbur Boulevard, necessitating a design that would mitigate HCT impact on traffic operations, such as an exclusive transitway or grade separation.

With the Hillsdale Loop alignment, the route through Hillsdale along Capitol Highway would require grade separation, envisioned as a cut-and-cover tunnel, to avoid traffic impacts in the Hillsdale town center. HCT in the Hillsdale Loop alignment would operate in-street on Capitol Highway east of the town center and along Bertha Boulevard south of the town center. With the cut-and-cover tunnel the effect on traffic would be limited. The Hillsdale Loop alignment would avoid the of Barbur/Terwilliger intersection. Barbur and Bertha Boulevards are both designated Major Truck Streets by the City, while Capitol Highway is designated a Truck Access Street. Freight stakeholders have expressed interested in avoiding overlap between HCT and freight routes. None of the alignment options overlap with regional or statewide freight routes. Transit designs would be required to accommodate freight trucks including vertical and horizontal clearances for all alignment options.

Initial traffic analysis considered traffic operations on the Hillsdale alignments. The following table summarizes the intersections analyzed and the initial findings.

	Meets motor vehicle performance target?*	
	2035 No-Build	2035 Build
Barbur Blvd & 3rd Ave/2nd Ave	No	Yes
Terwilliger Blvd & Barbur Blvd	No	No
I-5 Ramps/Bertha Blvd & Barbur Blvd	Yes	Yes

* Within permitted margin of accuracy

Source: Final SW Corridor Traffic Analysis and Operations Memorandum, DKS, July 29, 2014

During the DEIS phase, more detailed traffic analysis will be performed including queuing analysis, and mitigation would be developed for intersections not expected to meet the 2035 motor vehicle performance target. This could include changes in lane configurations, traffic signals, or other mitigation options. If the Hillsdale Loop alignment is included in the DEIS, detailed traffic analysis of this route would be needed to determine traffic impacts.

Pedestrians and bicycles

The Barbur surface alignment and Hillsdale Loop alignment would both improve pedestrian and bicycle facilities along their respective routes. The Barbur Boulevard route would directly address segments without sidewalks and bike lane gaps at the Newbury and Vermont structures. The Hillsdale Loop alignment would improve segments lacking sidewalks and bike lanes just east of the town center. The tunnel alignment would not preclude these improvements in the future, but is not anticipated to implement them.

Safety

Use of the Barbur or Hillsdale Loop alignment would also bring opportunities to improve the roadway for safety of all modes of travel. Barbur Boulevard is a designated high-crash corridor, and has been the location of six fatal crashes between South Portland and Burlingame (adjacent to Hillsdale) between 2007 and 2013. The segment of Capitol Highway in Hillsdale is the location of several high-severity crashes including one fatal crash between 2007 and 2013. Design treatments to address observed crash types and improve pedestrian and bicycle facilities could improve safety, with a particular opportunity on Barbur to address a high-crash location. The tunnel alignment would not preclude improvements on Barbur Boulevard or Capitol Highway in the future, but would not implement them as part of an HCT project.

Access

Presuming use of center-running transit for the in-street segments, the Barbur and Hillsdale Loop alignment options would both result in minor changes to motor vehicle access, where there are few destination and access points. Both options would likely involve elimination of some left-turn accesses, but changes to circulation patterns to continue to provide access would be evaluated.

Lane conversions

The only places in the corridor under consideration for lane conversion are sections of roadways that currently appear to have excess capacity based on early traffic analysis. One of these locations is on Barbur Boulevard between Hamilton Street and Capitol Highway in “the woods.” This segment of Barbur

Boulevard currently has three northbound travel lanes and two southbound travel lanes, so the project team is looking at the potential to convert one of the northbound travel lanes for LRT in order to reduce cost and minimize impacts to adjacent properties. If decisions are made to exclude lane conversions, designs can be modified to maintain existing lane configurations, with the tradeoff of more property impacts. For BRT, the project team is looking at running the BRT vehicles in mixed traffic in this segment of Barbur Boulevard.

As the project progresses, further traffic analysis will look in detail at traffic flows at intersections as well as in the broader network to confirm whether lane conversions could work and whether additional mitigations might be needed to allow conversion, such as new turn lanes or signals. Additionally, more detailed consideration of the property impacts of different lane configurations will allow for a discussion about the trade-offs between minimizing impacts and maintaining existing auto capacity.

Cost Estimates

Key considerations:

- Are the trade-offs between cost of a project and other factors such as reliability, safety, access and community development opportunities clear?
- How does cost impact the length of the final high capacity transit alignment?

Key findings:

- BRT estimates range from \$680M to \$1.2B.
- LRT estimates that include a cut-and-cover tunnel in Hillsdale and PCC-Sylvania range from \$1.9B to \$2.4B. This does not include the cost of a Marquam Hill-Hillsdale bored Tunnel.
- A Marquam Hill-Hillsdale bored Tunnel would add an estimated \$732M to \$900M to the cost of an LRT project.

Current cost estimates for corridor HCT alignments are based on conceptual designs. Estimates will continue to be refined during the DEIS process as options are narrowed and designs progress, but are useful now in demonstrating the relative differences between current options. **All figures are in year 2014 dollars, and exclude escalation and finance costs.** Cost estimates are not yet complete for all modes, options, and segments; estimates will be updated and reported as the project progresses.

Corridor-wide costs

Current estimates for a BRT alignment from downtown Portland to Tualatin range from \$680M to \$1.2B. The range reflects options for cut-and-cover tunneling and for infrastructure improvements to allow BRT to operate in dedicated transit lanes.

Costs for an LRT alignment extending from downtown Portland to Tualatin would range from \$1.9B to \$2.4B. The range is inclusive of surface and shallow cut-and-cover tunnel options in Hillsdale and at PCC but excludes the deep-bored tunnel option under Marquam Hill. The region's funding capacity will impact the final inclusion of expensive HCT alignment choices that provide direct service to important destinations versus serving more communities to the south.

Hillsdale area costs

BRT or LRT running south from downtown Portland could follow Barbur Boulevard to the Custer Street and 13th Avenue intersection, or could loop up through Hillsdale via Capitol Highway returning on Bertha Boulevard to Barbur Boulevard at Custer Street and 13th Avenue. BRT staying on Barbur Boulevard in this segment is estimated at \$140M if using Barbur in South Portland, and \$327M if using Naito Parkway in South Portland (including Ross Island Bridgehead project costs). This estimate assumes that BRT operates in mixed traffic through “the woods” and that the Vermont and Newbury viaducts are not removed, but does include new pedestrian and bicycle facilities on separate structures parallel to the viaducts. An option for BRT that routes through the Hillsdale town center would include a structure beginning on Barbur Boulevard and elevates the guideway to pass over Barbur and meet grade at Terwilliger Boulevard. BRT would operate through a cut-and-cover tunnel under Capitol Highway between Sunset Boulevard and through the Hillsdale town center. This BRT option is estimated add \$137M to the cost of those alignments that remain on Barbur Boulevard below Hillsdale.

LRT from downtown Portland to Custer Street and 13th Avenue without a Hillsdale Loop and cut-and-cover tunnel is estimated to cost \$441M if using Barbur Boulevard in South Portland, and \$609M if using Naito Parkway (including Ross Island Bridgehead project costs). The Hillsdale Loop is estimated to add \$226M to the cost of those alignments that remain on Barbur Boulevard below Hillsdale. Major cost considerations for the Barbur LRT alignment include replacement of the existing Vermont and Newbury Viaducts with new structures for autos, transit, pedestrians and cyclists. Similar to BRT, the Hillsdale Loop LRT alignment would include a structure beginning on Barbur Boulevard and elevating the guideway to pass over Barbur and meet grade at Terwilliger Boulevard. Short of the Hillsdale town center, the LRT option would enter a portal and slip underground passing south of the town center under existing playfields, reemerging near Vermont Street at Bertha Boulevard. The option would also require an elevated station above Custer Street before continuing south in a center running condition in Barbur Boulevard.

Engineering complexity and risk

Key considerations:

- Are the benefits and risks associated with construction of deep-bored or cut-and-cover tunnels clear?
- What aspects of each alignment option present noteworthy risk?

Key findings:

- The primary risks of an alignment on Barbur Boulevard would be balancing traffic operations with right-of-way impacts to adjacent properties, and the complex engineering required to build retaining walls on steep slopes.
- The primary risks of a Hillsdale Loop alignment would be balancing traffic operations with right-of-way impacts to adjacent properties, the complex engineering required to build retaining walls on steep slopes, and the risks inherent to tunneling.
- A Marquam Hill-Hillsdale bored Tunnel would have the highest level of engineering complexity and risk of the three proposed alignments.

Complexity and risk analysis in the Hillsdale segment focuses on differences between LRT operating through a tunnel under Marquam Hill and Hillsdale, LRT or BRT routed on the surface of Barbur Boulevard, and LRT or BRT options which connect through Hillsdale via Capitol Highway and Bertha Boulevard. Complexity and risk analysis comparisons of these options are at this time a mix of quantitative and qualitative factors. Additional analysis will be developed in the coming months to further define geotechnical/structural complexity and risk for tunnels, as well as to identify the potential for impacts to major utilities.

Marquam Hill-Hillsdale Tunnel

Of the options under consideration the deep-bored tunnel under Marquam Hill has the highest level of complexity and risk. Tunnels are inherently risky given the unexpected subsurface conditions to be encountered and overcome. The West Hills, formed by basalt flows, are geologically complex including numerous faults, resulting in a high degree of risk. Many tunnels constructed for transportation worldwide exceed their estimated costs by substantial amounts. For example, the Robertson Tunnel, which provides transit access to the Oregon Zoo, ultimately cost 80 percent more than the original construction bid due to unforeseen complications and related schedule delays.

In the case of a bored tunnel particular consideration must be given to the impacts to the portal areas near Hooker Street and near the intersection of Barbur and Bertha Boulevards. These include the large footprint required for the mining operation staging areas, access to these locations for heavy equipment and trucks, complex sequencing of work and materials delivery, as well as materials to be hauled off site. A considerable amount of construction traffic would be generated by hauling off excavated soil and rock. This would add complexity to the transportation system surrounding the site and the need to mitigate impacts along the haul route, which would likely include phasing reconstruction of roadways damaged by very heavy trucks continually travelling through. In addition, the northern portal's proximity to Duniway Park could have Section 4(f) implications and the southern portal's proximity to a busy commercial area in Burlingame would be likely to impact businesses. Section 4(f) is a federal provision that prevents the use of land from publicly owned areas such as parks unless specific conditions are met, including there being no prudent alternative.

A technical tunneling memo expected in May 2015 will more fully describe the geotechnical issues associated with tunnel construction.

Barbur

The LRT in this segment would operate in continuous dedicated guideway and, as a result, would have greater levels of risk due to the need for large retaining walls to accommodate the necessary widening of roadways and possible geotechnical complications. Due to the added weight of the LRT system, both viaduct structures on Barbur Boulevard would need to be replaced, or instead new combined LRT/Pedestrian and Bicycle structures would be necessary parallel to the existing viaducts which would continue to be used for auto traffic. This choice includes some risk and complexity related to the potential for phased replacement of the existing viaducts or construction of new structures nearby, in addition to the challenges of maintaining traffic movements through the construction zone. The viaduct

replacement option would be a more complicated construction effort with a higher cost and level of risk.

This segment of Barbur Boulevard has known geotechnical factors, which could complicate widening Barbur for HCT north of the viaducts. Widening would be necessary to provide an exclusive operating guideway for HCT while maintaining existing lanes for vehicular traffic. These would require large retaining walls along the hillside. The topography would also complicate the construction of new parallel pedestrian and bicycle structures. Much of this segment has relatively free-flowing traffic, even during peak periods, which would allow the BRT vehicle to not be delayed much when in mixed traffic. Widening between Miles Street and Terwilliger Boulevard could be necessary to accommodate a southbound dedicated lane to reduce congestion that queues back to Miles Street during peak periods. If this is necessary, there is the potential for adjacent property impacts and an impact at Fulton Park.

Hillsdale Loop with cut-and-cover tunnel

With either mode, the Hillsdale Loop alignment would require a new structure on Capitol Highway to address the steep slope between Barbur Boulevard and Terwilliger Boulevard and to transition the center running HCT to and from Capitol Highway. This structure would begin on Barbur Boulevard and would slope up above Barbur and cross over the lanes below into Capitol Highway. The topography and potential complexity with large retaining walls on the steep slope would involve considerable engineering complexity and risk.

The cut-and-cover tunnel, like the bored tunnel described earlier, is inherently risky given the likelihood for unexpected subsurface complications to be encountered and overcome. The cut-and-cover tunnel must navigate and relocate utilities and has potential to encounter sites with archaeological value. Additionally, a cut-and-cover tunnel would require a complex sequencing plan to maintain traffic on Capitol Highway and Bertha Boulevard where the portal and tunnel transition to roadway.

Community impacts

Key considerations:

- Can the benefits and burdens of a high capacity transit alignment be equally distributed among all population groups in the corridor?
- Do surface or tunnel alignments offer the greatest access to key places such as education, employment, health care and retail centers?

Key findings:

- Based on spatial analysis of demographic maps, there is no significant difference in how each alignment option runs through areas of non-white or non-English speaking populations.
- Based on spatial analysis of demographic maps, there are slight differences in how each alignment option runs through areas of low-income and senior populations.
- Subsequent analysis and conversations with residents, employees and visitors to the corridor will further detail the potential for unequal distribution of benefits and burdens of high capacity transit construction and service.

Demographic maps for non-white, non-English speaking, low-income and senior populations were overlaid with maps of the proposed HCT alignments (see Appendix D). Subsequent discussions with residents, employees and visitors to these areas will help us to further understand how different racial, ethnic and language groups may be impacted by the proposed alignments.

Non-white and non-English speaking populations

Based on spatial analysis of the maps, none of the alignment options would run through areas with more than average non-white populations; however, disaggregation by ethnicity shows that a Marquam Hill tunnel alignment would pass under one area of higher than average concentration of Asian population south of Marquam Hill. Each alignment would run primarily through areas with very low percentages of non-English-speaking populations, with one exception of a higher than average parcel of non-English speaking population west of Marquam Hill.

Low-income and senior populations

Based on spatial analysis of the maps, the Barbur Boulevard and Naito Parkway alignments would run primarily through areas with higher than average low-income populations; the Marquam Hill alignment would run under a portion of higher than average low-income population and also under below average areas. Each of the three alignment choices would run through areas with significantly higher than average populations of seniors 65 years and older. The Hillsdale Loop option would run through areas with somewhat higher than average populations of seniors.

Access to services

Improvements to the transportation systems throughout the Southwest Corridor aim to improve access to important community services such as education, health care, retail and employment centers for all residents.

Education centers identified in the Hillsdale study area include OHSU's Marquam Hill campus, Wilson High School, Rieke and Hayhurst Elementary schools and Hillsdale public library. A Marquam Hill-Hillsdale tunnel would provide the most direct service to OHSU's Marquam Hill campus via an underground elevator, but would provide limited access improvements to K-12 schools. K-1 schools could be served directly by a Hillsdale Loop option, or from a station 2/3 mile away on a Barbur alignment. Rieke Elementary could potentially be impacted during construction of a Hillsdale Loop alignment but would benefit from long term improvements to the site.

Health care services identified in the Hillsdale study area OHSU's Marquam Hill campus and the VA Medical Center. A Marquam Hill-Hillsdale tunnel would provide the most direct service to Marquam Hill via an underground elevator. With a Barbur Boulevard alignment, riders could access Marquam Hill via local transit, bicycle and pedestrian connections.

Key retail and employment centers in Hillsdale include the town center along Capitol Highway and areas along Barbur Boulevard south of Terwilliger Boulevard. The Hillsdale town center would be most directly served by HCT with a Marquam Hill-Hillsdale tunnel or Hillsdale Loop tunnel. One of the Hillsdale Loop alignment options would result in major impacts to retail and employment along Capitol Highway during cut-and-cover tunnel construction. For HCT riders coming from north or south on the alignment, the

additional 2.8 minutes of travel time for a Hillsdale Loop alignment would increase the travel time needed to access retail and employment centers north and south of Hillsdale.

Property impacts

The options under consideration all have varying levels of impact to adjacent private properties. In many cases, property impacts are limited to only a narrow strip of area needed to widen the roadway and sidewalks. In other cases, temporary construction easements may be all that is needed to allow for construction of new roadway and sidewalks. In extreme cases, large or complete acquisitions may be necessary when impacts to buildings or other major infrastructure are unavoidable. The project team is currently quantifying the areas of potential impact on each of the options and will be presenting the level of impact of the various options relative to one another once the data is assembled. In areas where converting an auto travel lane to a transit lane is under consideration, property impacts will be evaluated for scenarios both with and without the lane conversion in order to facilitate discussion about the trade-offs of minimizing impacts and maintaining auto capacity.

Next steps

This Key Issues Memo formally introduces to decision-makers and the public information relevant to a decision on high capacity transit alignments in South Portland. Between March and July 2015, project staff will present information on Hillsdale and other Southwest Corridor Plan issues and invite public comment at numerous public meetings, including a Community Planning Forum and a Community Technical workshop. An updated calendar can be found on our website:

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

May 2015: Staff will produce a technical evaluation report that will include assessments of options accessing South Portland, Hillsdale and Portland Community College, followed by staff recommendations to the Steering Committee in June.

July 13, 2015: The Steering Committee will be asked to consider making decisions on what options in these three areas should continue to be studied in a DEIS.

December 2015: The Steering Committee will be asked to consider making a recommendation on the mode, terminus and remaining HCT alignments to be studied further in a DEIS, along with an implementation strategy for the corridor connection projects defined in the Shared Investment Strategy.

Appendices

Appendix A: Anticipated major project documents and estimated dates of completion

Appendix B: Shared Investment Strategy roadway and active transportation projects

Appendix C: Corridor-wide mode considerations

Appendix D: Demographic map

Appendix A: Anticipated major project documents and estimated dates of completion

July Steering Committee decision: direct vs. indirect service to Marquam Hill, Hillsdale and PCC-Sylvania

- Key Issue Memos:
 - South Portland – March
 - Hillsdale – March
 - PCC-Sylvania – May
- Draft Evaluation Report – May
- Evaluation Report and Recommendation – June
- Supplementary documents:
 - Tunnel fact sheet – March
 - Modeling report – May
 - Cost estimate report – May
 - Tunnel technical memo – May

December Steering Committee decision: remaining HCT alignments, mode, and terminus and SIS funding strategy

- Key Issue Memos:
 - Tigard – June
 - Tigard to Bridgeport Village – September
 - Bridgeport Village to Tualatin – September
 - Barbur / Adjacent to I-5 – October
 - HCT mode – October
 - HCT terminus – October
- Draft Evaluation Report – October
- Evaluation Report and Recommendation – November
- Supplementary documents:
 - Modeling report – October
 - Cost estimate report – October
 - Traffic report - October
- Funding strategy for Shared Investment Strategy roadway, bike and pedestrian projects – December

Appendix B: Shared Investment Strategy roadway and active transportation projects

The information in this appendix will be further developed and presented as a stand-alone document.

The Shared Investment Strategy (SIS) Roadway and Active Transportation Project List includes projects that improve access to both key places in the corridor and to the high capacity transit (HCT) alignments currently under consideration:

- **HCT-aligned projects** are roadway, bikeway and pedestrian projects that were initially identified in the SIS in July 2013, and then were further refined in July 2014 as the HCT alignments were narrowed. These projects either run along the HCT alignment (and would be incorporated into HCT designs and cost estimates) or improve access to station areas.
- **Corridor Connections** are roadway, bikeway and pedestrian projects that improve connectivity and mobility across the corridor, beyond the immediate geographic area of a potential HCT line. These were identified in the SIS in July 2013 as critical for the support of land use goals in essential and priority places.

Some of the projects identified as HCT-supportive are also critical land use supportive projects, and will remain on the SIS Roadway and Active Transportation Project List as Corridor Connections projects if their associated HCT station or alignments are removed from consideration. Other HCT-supportive projects that do not support key land uses will be removed from the SIS project list as their associated HCT alignments or stations are removed from consideration.

For all projects on the SIS Roadway and Active Transportation Project List, potential funding sources will be identified. For HCT-supportive projects, one potential funding approach will be as part of the HCT package, but other potential funding sources will be identified for each project to support their implementation whether as part of a transit project or as a standalone project. Some of the projects will require traffic analysis and evaluation of other impacts prior to project partner support for implementation.

The following map and list show both the HCT-supportive and corridor connections projects in the South Portland and Hillsdale areas.

Project # Location/ Ownership	Title Description	Cost	Primary Mode	Primary Project Type	Time- frame	Potential Funding Sources	Notes
1019 Portland ODOT	Barbur Lane Diet - Capitol to Hamilton (reduce northbound lanes from three to two with multimodal improvements) Reduce number of northbound lanes from three to two from Capitol Hwy (north) to 1/4 mile south of Hamilton to reduce speeds and improve safety, improve ped/bike crossing safety and add protected bike lanes	¢	Bicycle	Corridor Connections			
1044 Portland ODOT	South Portland Circulation and Connectivity (Ross Island Bridge ramp connections) Adds a new ramp connection between I-405 and the Ross Island Bridge from Kelly Avenue. Restore at-grade intersections along Naito Parkway, with new signalized intersections at Ross Island Bridge access and at Hooker Street. Removes several existing roadways and ramp connections.	\$\$\$\$	Multimodal	HCT Supportive		HCT Package	With HCT on Naito Parkway: Include
2999 Portland	Pedestrian connection from Barbur to Terwilliger at Gibbs Construct a new pedestrian walkway under the tram within the Gibbs right-of-way through the Terwilliger Parkway. The steep grade and forested area will require lighting and stairs.	\$	Pedestrian	HCT Supportive		HCT Package	With HCT station at Barbur/Naito & Gibbs: Include
3028 Portland	Inner Hamilton bikeway -from SW Terwilliger Blvd to SW Corbett Ave. Enhanced shared roadway. Includes connection to Terwilliger on SW Hamilton Terrace	¢	Bicycle	HCT Supportive		HCT Package	With HCT station at Barbur & Hamilton: Include

Multimodal
Auto/Freight
Bicycle
Pedestrian
Bike/Ped

Cost: ¢ - up to \$500,000; \$ - up to \$5 M; \$\$ - up to \$10 M; \$\$\$ - up to \$20 M; \$\$\$\$ - More than \$20 M

Project # Location/ Ownership	Title Description	Cost	Primary Mode	Primary Project Type	Time- frame	Potential Funding Sources	Notes
3038 Portland	Lower SW 1st bikeway -from SW Barbur Blvd to SW Arthur St. Multiple bicycle facility types: separated in-roadway (Corbett: Gibbs - Grover); bicycle boulevard (all other segments). Includes connection to SW Kelly Ave on SW Grover St and SW Corbett Ave	¢	Bicycle	HCT Supportive		HCT Package	With HCT station at Barbur/Naito & Gibbs: Include
3044 Portland ODOT	Middle Barbur bikeway -from SW 23rd Ave to SW Capitol Hwy-Barbur Blvd Ramp. Separated bicycle route in-roadway. Listed as a Regional Bicycle Parkway in the Regional Active Transportation Plan (5/9/13).	\$	Bicycle	HCT Supportive		HCT Package	With HCT adjacent to I-5: Include within 1/2 mile of stations With HCT on Barbur: Include
3093A Portland	Terwilliger bikeway gaps Separated bicycle route in-roadway. Eliminate key gaps in the Terwilliger Blvd bikeway	¢	Bicycle	HCT Supportive		HCT Package	With HCT station at Barbur & Terwilliger: Include lower section near Barbur (50%)
3101 Portland	Vermont-Chestnut bikeway -from SW Capitol Hwy to SW Terwilliger Blvd. Bicycle boulevard	¢	Bicycle	HCT Supportive		HCT Package	With HCT station at Barbur & Terwilliger: Include Include with HCT station at 13th instead of Terwilliger?
4002 Portland ODOT	Barbur Blvd, SW (3rd - Terwilliger): Multimodal Improvements Construct Improvements for transit, bikes and pedestrians. Transit improvements include preferential signals, pullouts, shelters, left turn lanes, sidewalks, and crossing improvements.	\$\$	Multimodal	HCT Supportive		HCT Package	With HCT on Barbur Boulevard: Include

Project # Location/ Ownership	Title Description	Cost	Primary Mode	Primary Project Type	Time- frame	Potential Funding Sources	Notes
5005 Portland ODOT	Barbur Blvd, SW (Terwilliger - City Limits): Multimodal Improvements Complete boulevard design improvements including sidewalks and street trees, safe pedestrian crossings, enhance transit access and stop locations, and bike lanes (Terwilliger - SW 64th or Portland City Limits).	\$\$\$\$	Multimodal	HCT Supportive		HCT Package	With HCT adjacent to I-5: Include within 1/2 mile of stations (20%) With HCT on Barbur Boulevard: Include
5006 Portland ODOT	Barbur Lane Diet: Miles to Capitol Reduce number of northbound travel lanes on Barbur from Miles to Capitol Highway (north) from two to one to reduce speed and improve safety. Adds bike lanes over Newberry and Vermont bridges.	¢	Bicycle	Corridor Connections			
5013 Portland ODOT	Naito/South Portland Improvements (left turn pockets with ped/bike and remove tunnel, ramps and viaduct) Reconstruct Naito Pkwy as two-lane road w/bike lanes, sidewalks, left turn pockets, & on-street parking. Remove grade separation along Naito at Barbur Blvd. (tunnel), the Ross Island Bridge, Arthur/Kelly (viaduct), and the Grover pedestrian bridge.	\$\$\$\$	Multimodal	HCT Supportive		HCT Package	With HCT station at Barbur & Gibbs: Include signaled pedestrian crossing(s) of Naito near station (1%) With Naito alignment: Include
6004 Portland ODOT	Newbury viaduct bicycle and pedestrian facilities Construct new bicycle and pedestrian facilities at/parallel to Newbury St. viaduct	\$	Bike/Ped	Corridor Connections			

Project # Location/ Ownership	Title Description	Cost	Primary Mode	Primary Project Type	Time- frame	Potential Funding Sources	Notes
6005 Portland ODOT	Vermont viaduct bicycle and pedestrian facilities Construct new bicycle and pedestrian facilities at/parallel to Vermont St. viaduct	\$\$	Bike/Ped	Corridor Connections			
6022 Portland ODOT	I-405 Bike/Ped Crossing Improvements Improve opportunities for bicycles and pedestrians to cross over/under I-405 on Harbor Drive, Naito Parkway, 1st, 4th, 5th, 6th and Broadway.	\$	Bike/Ped	HCT Supportive		HCT Package	Consider opportunity to address with HCT crossing of I-405
9005A Portland	Red Electric Trail: Fanno Creek Trail to Willamette Park - Hillsdale to Shattuk Provide east-west route for pedestrians and cyclists in SW Portland that connects and extends the existing Fanno Creek Greenway Trail to Willamette Park. Listed as a Regional Bicycle Parkway and Regional Pedestrian Parkway in the Regional Active Transportation Plan (5/9/13).	\$	Bike/Ped	HCT Supportive		HCT Package	With HCT station in Hillsdale: Include
9005B Portland	Red Electric Trail: Fanno Creek Trail to Willamette Park - to Hillsdale Provide east-west route for pedestrians and cyclists in SW Portland that connects and extends the existing Fanno Creek Greenway Trail to Willamette Park. Listed as a Regional Bicycle Parkway and Regional Pedestrian Parkway in the Regional Active Transportation Plan (5/9/13).	\$\$\$	Bike/Ped	Corridor Connections			

Project # Location/ Ownership	Title Description	Cost	Primary Mode	Primary Project Type	Time- frame	Potential Funding Sources	Notes
9007 Portland	Slavin Road to Red Electric Trail: Barbur to Corbett Build Multi use trail on Slavin Road from Barbur to Corbett. The Red Electric Trail is listed as a Regional Bicycle Parkway and Regional Pedestrian Parkway in the Regional Active Transportation Plan (5/9/13).	\$	Bike/Ped	Corridor Connections			

HCT-supportive projects in Hillsdale

The HCT-supportive projects in the Hillsdale area would focus on improving bike and pedestrian access to the Hillsdale HCT station and along the Barbur Boulevard alignment.

The Hillsdale HCT alignment options would have implications for the HCT-supportive projects in South Portland because the Marquam Hill-Hillsdale tunnel spans both the South Portland and Hillsdale areas. With the Marquam Hill-Hillsdale tunnel, bike and pedestrian improvements in South Portland on 1st Avenue and Hamilton, a new pedestrian connection between Barbur and Terwilliger, and Naito/Ross Island Bridgehead multimodal improvements would not be included with HCT.

#	Title	% of project included with each HCT alignment option				
		Barbur LRT	Barbur BRT	Hillsdale Tunnel LRT	Hillsdale Tunnel BRT	Marquam Hill-Hillsdale tunnel LRT
1044	South Portland Circulation and Connectivity	0 to 100	0 to 100	0 to 100	0 to 100	0
2999	Pedestrian connection from Barbur to Terwilliger	100	100	100	100	0
3028	Inner Hamilton bikeway	100	100	100	100	0
3038	Lower SW 1st bikeway	100	100	100	100	0
3093A	Terwilliger bikeway gaps	50	50	50	50	50
4002	Barbur Blvd Multimodal Improvements	100	100	30	30	5
5013	Naito/South Portland Improvements	1 to 100	1 to 100	1 to 100	1 to 100	0
9005A	Red Electric Trail: Hillsdale to Shattuck	0	0	100	100	100

0	not included with HCT alignment
% to %	potentially included with HCT alignment, depending on options in other areas
%	1 to 33% of project included with HCT alignment
%	34 to 66% of project included with HCT alignment
%	67 to 100% of project included with HCT alignment

Corridor Connections projects in Hillsdale

The Shared Investment Strategy includes several additional bike and pedestrian projects in the Hillsdale and Burlingame area that would not be directly linked to the HCT alignments, including two different approaches to improving bike and pedestrian safety along Barbur Boulevard.

The first approach, used by projects 1019 and 5006, would remove one northbound vehicle lane on Barbur Boulevard to improve safety by reducing traffic speeds and adding protected bike lanes. The other approach, used by projects 6004 and 6005, is to add bike and pedestrian facilities parallel to the Newbury and Vermont viaducts on Barbur Boulevard, which currently have no bike lanes and a narrow sidewalk. The lane reductions would cost less than the parallel structures while providing enhanced bicycle and pedestrian facilities along a longer stretch of Barbur.

In addition to the Barbur improvements, the Corridor Connections list includes the portion of the Red Electric Trail that would not be included with an HCT station at Hillsdale and the Slavin Road multi-use trail that connects the Red Electric Trail to South Portland.

Appendix C: Corridor-wide mode considerations

The information in this appendix will be further developed and presented as a stand-alone document.

Two high capacity transit (HCT) modes are under consideration for the corridor:

- Light rail transit (LRT)
- Bus rapid transit (BRT)

Bus Rapid Transit description

There are currently four operating LRT (or MAX) lines and one under construction in the Portland area. In 2014, BRT was selected as the preferred mode for the under-development Powell-Division Transit Development Project, but to date BRT does not operate in the region. Typically, BRT is differentiated from standard bus service by several characteristics:

- Fifty percent or more of the alignment operate in dedicated transitway lanes to increase speed and reliability.
- Portions of the alignment may have queue bypass lanes, signal priority, or other design elements to speed travel.
- Vehicles are larger capacity and have multiple doors for entry and exit.
- Fare payment is made off-board to reduce dwell times.
- Stations are similar to LRT or streetcar stations, and are spaced further apart than local service bus stops for faster service.

Capital costs

Depending on the percentage of dedicated transitway for a BRT alternative, capital costs to construct physical infrastructure are more expensive for LRT, which operates in fully dedicated transitway, in large part due to right-of-way acquisition of property required for construction. It is important that BRT planning consider the risks of “watering down” a project by deciding to operate BRT in congested roadways to avoid high capital costs or engineering complexity. This can diminish the effectiveness of BRT service as the most difficult places to attain exclusive right of way are often the places it is most needed.

Capital costs are a one-time cost shared by many partners including the federal government, which usually contributes 50% of a project’s capital cost, as well as state and local governments, municipal planning organizations, transit agencies, and other private partners.

Operating and maintenance costs

The vehicle operator accounts for the largest share of operating costs regardless of mode. Since an LRT vehicle has greater capacity compared to a BRT vehicle (266 versus approximately 86), fewer LRT vehicles are required to carry an equivalent passenger load, making LRT less expensive to operate than BRT. SW Corridor model runs indicate that in the year 2035 the 7.5 minutes assumed peak headway (number of minutes between vehicle arrivals) for LRT is sufficient to accommodate peak-hour, peak-direction demand. For BRT, however, the peak frequencies would need to be increased to 3 minute

headways to accommodate demand. This would result in higher operating costs for BRT for the lifetime of the service. On-going operating and maintenance costs are largely locally funded.

Speed, service and ridership

LRT attracts more riders than BRT. Because LRT always operates in exclusive transit lanes and because it is more likely to be granted signal priority at intersections, light rail is faster and more reliable than BRT. Stated preference surveys also show that LRT attracts more discretionary riders than BRT, due to speed advantages but also to better perceived ride quality compared to BRT.

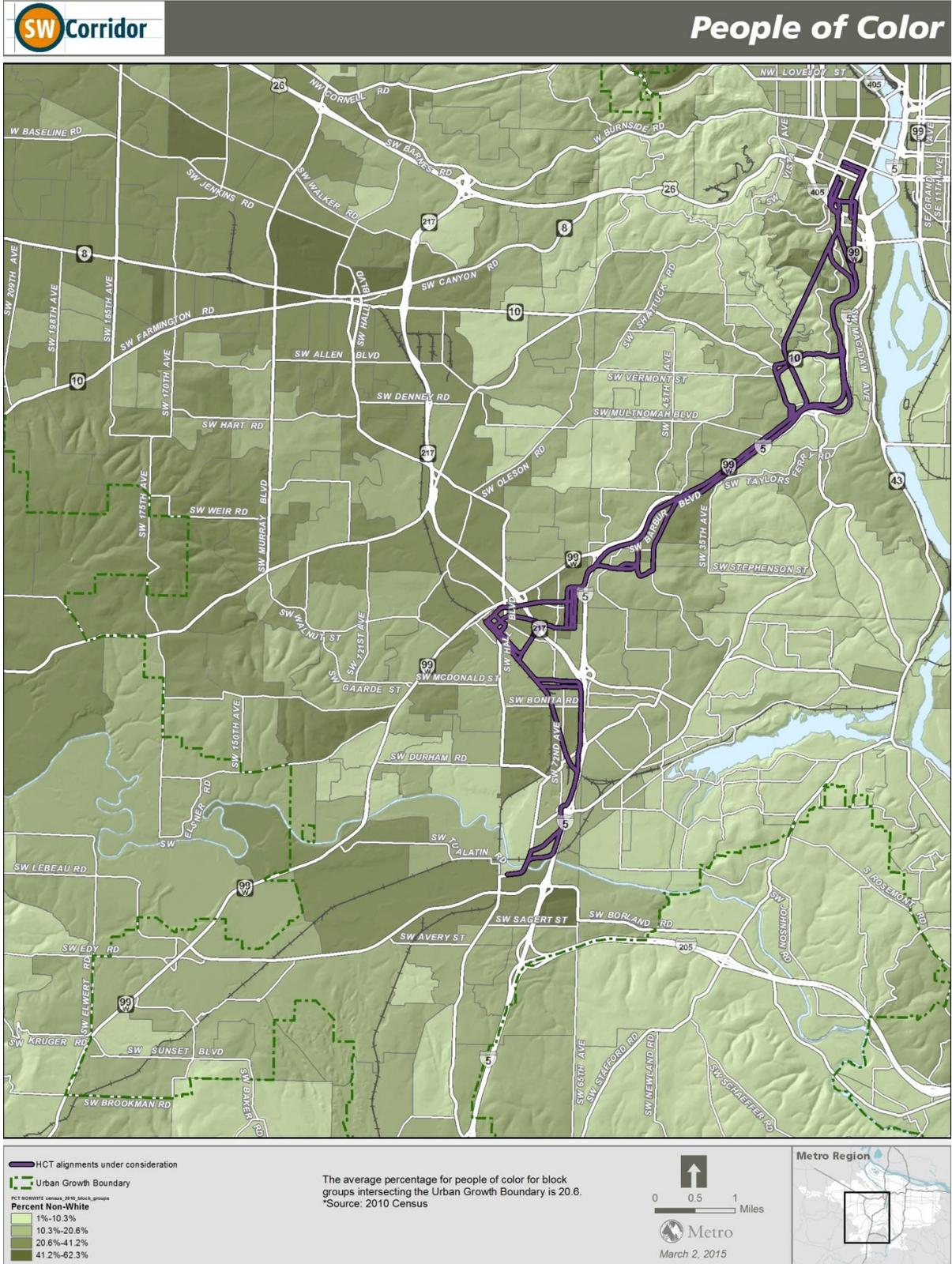
Models indicate that in 2035 the demand for HCT in the Southwest Corridor would require 20 BRT vehicles per hour in the peak, while LRT is assumed to operate with eight vehicles per hour in the peak with enough capacity still available to accommodate ridership growth beyond 2035. For BRT, growth above the projected 2035 demand would require yet more increases in service.

HCT service provides travel time advantages over local buses because of exclusive right of way but also because of longer distances between stations and signal priority at intersections. The high number of hourly vehicles required for BRT can be expected to diminish some of the travel time benefit from signal priority. The more frequently HCT vehicles pass through an intersection, the less likely signal priority can be given to the transit vehicles over autos. When the frequency of signal priority requests interferes with auto movement, priority for HCT vehicles is limited. It's expected that traffic would be largely unaffected by the eight LRT vehicles per hour assumed in the peak in 2035; however, the frequency required for BRT would likely prohibit full priority.

Development

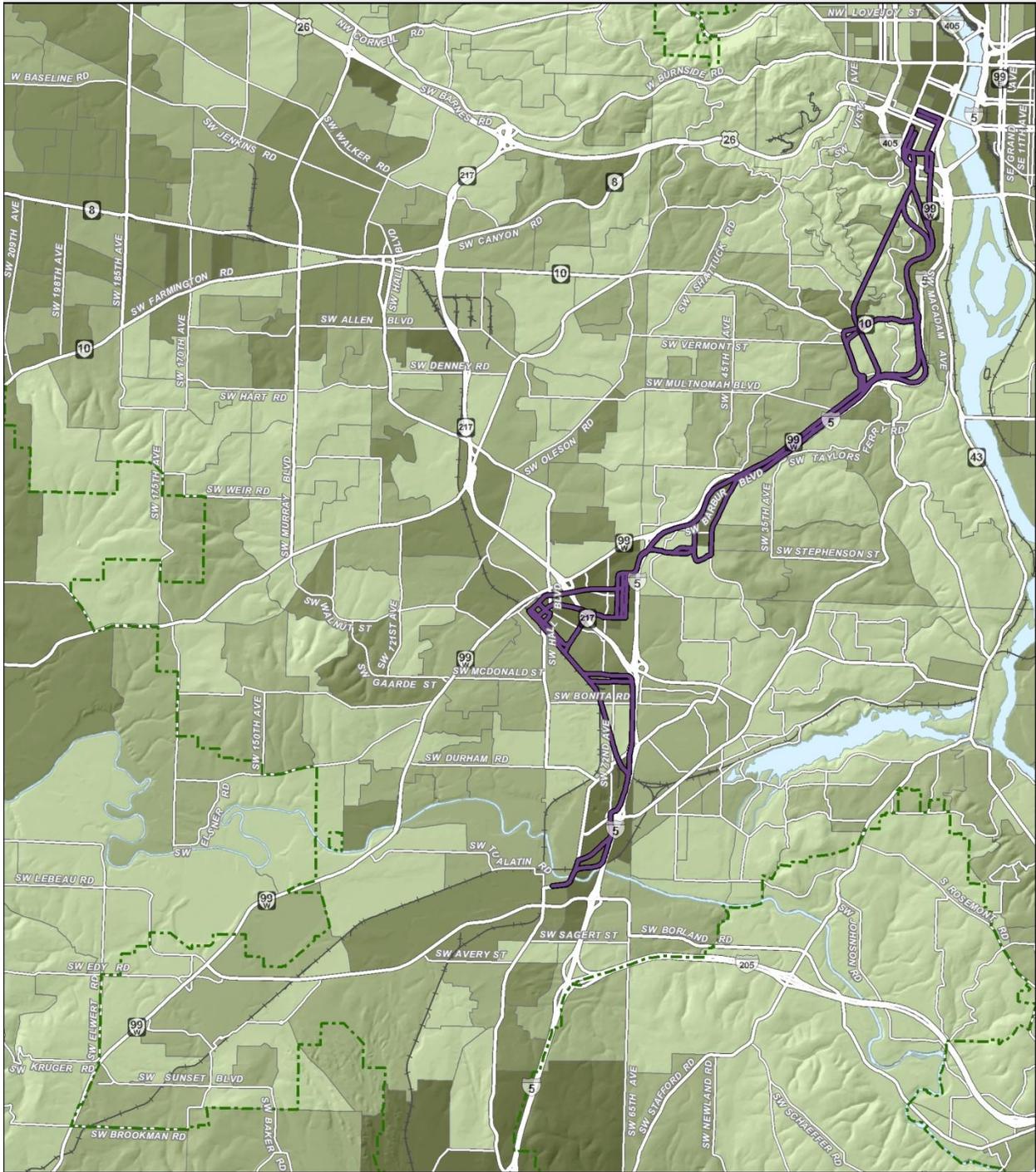
Both BRT and LRT would leverage private development investment at station areas. Available research assessing the difference in scale of development by mode is inconsistent and contradictory. Staff will address development by mode over the course of the next year.

Appendix D: Demographic maps





American Indian or Alaskan Native Population

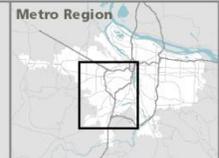


— HCT alignments under consideration
- - - Urban Growth Boundary
PCT AIAN census_2010_block_groups
Percent AIAN
 0% - 46%
 46% - 91%
 91% - 1.8%
 1.8% - 5.3%

The average percentage for AIAN population for block groups intersecting the Urban Growth Boundary is 0.91.
 *Source: 2010 Census

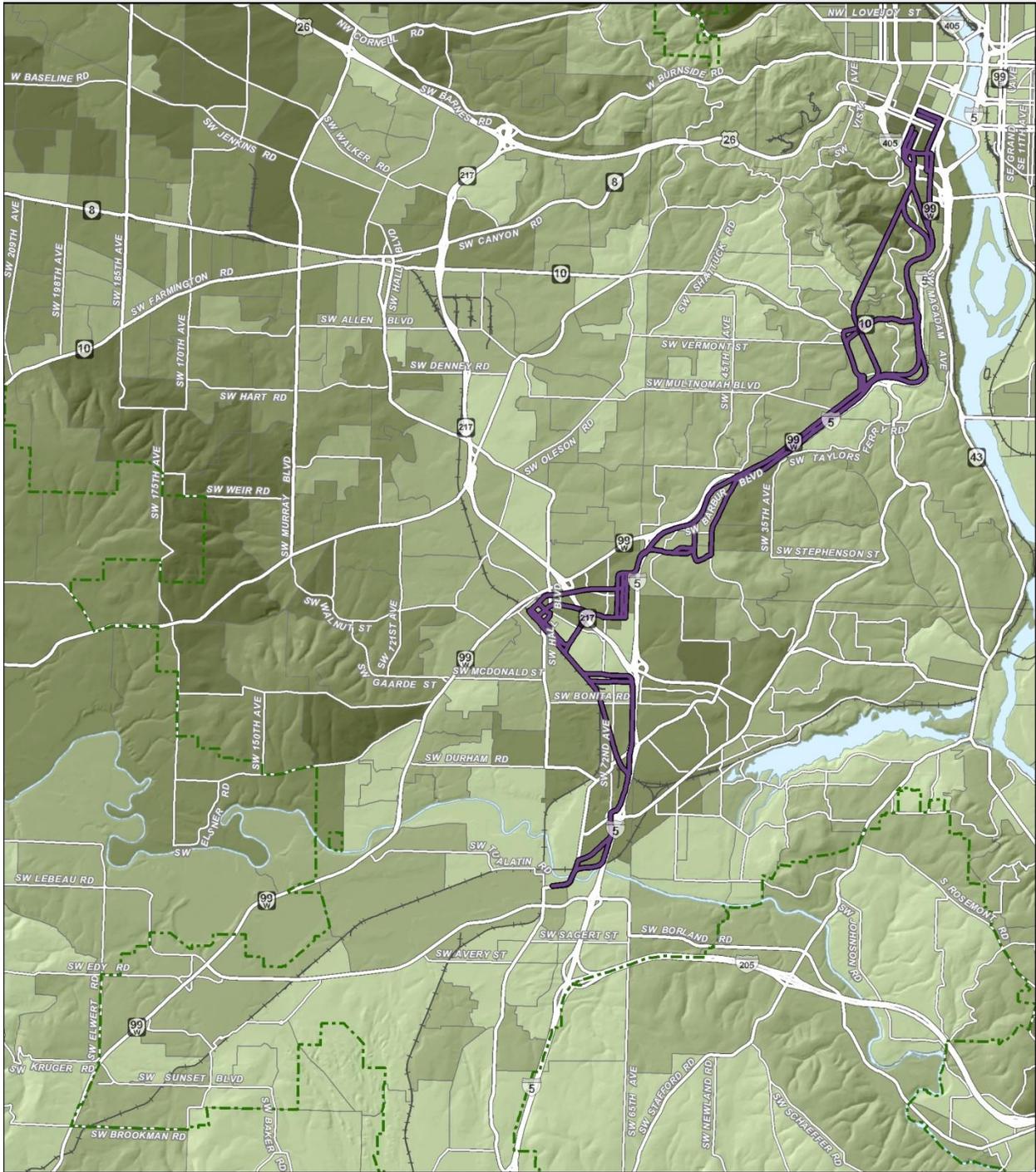
0 0.5 1 Miles

 March 2, 2015





Asian Population



— HCT alignments under consideration
- - - Urban Growth Boundary
PCT AS10A census_2010_block_groups
Percent Asian
 0% - 3.1%
 3.1% - 6.2%
 6.2% - 12.3%
 12.3% - 45.1%

The average percentage for Asian population for block groups intersecting the Urban Growth Boundary is 6.17.
 *Source: 2010 Census

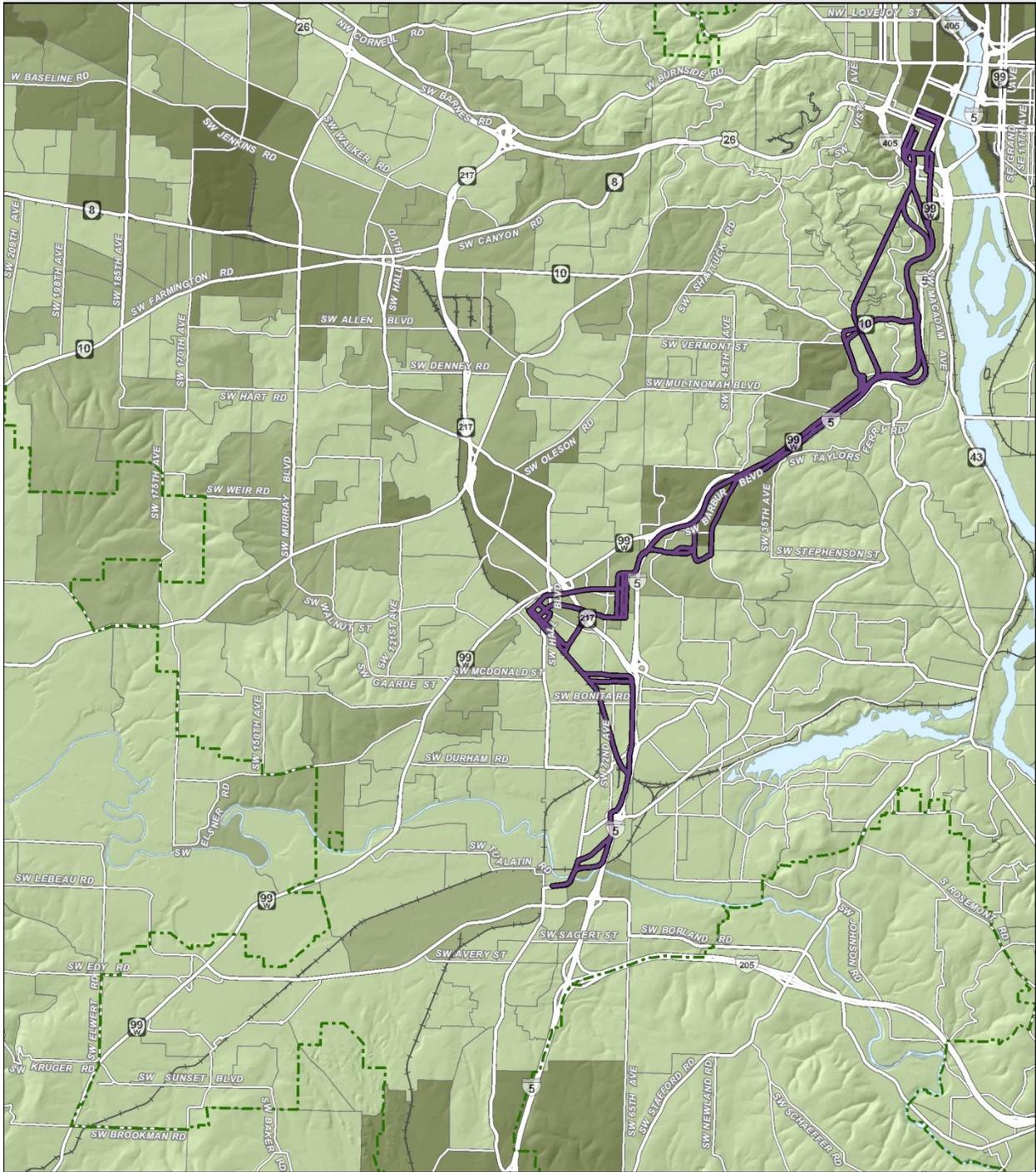
0 0.5 1 Miles

 March 2, 2015





Black Population

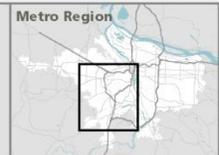


- HCT alignments under consideration
- Urban Growth Boundary
- PCT BLACK census_2010_black_groups
- Percent Black**
- 0% - 1.9%
- 1.9% - 3.7%
- 3.7% - 7.14%
- 7.14% - 39.8%

The average percentage for Black population for block groups intersecting the Urban Growth Boundary is 3.7.
*Source: 2010 Census

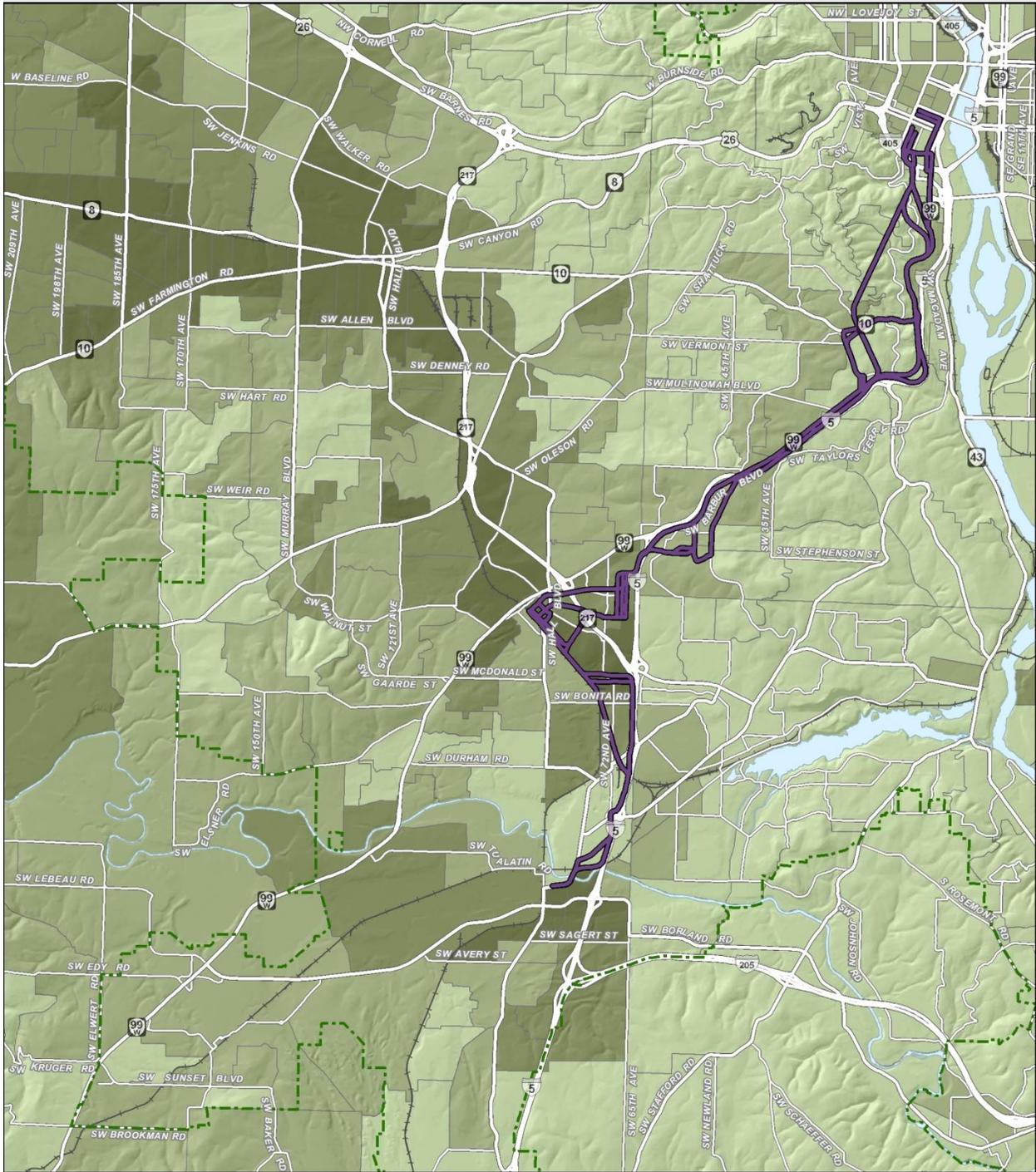
0 0.5 1 Miles

Metro
March 2, 2015





Hispanic Population



HCT alignments under consideration
 Urban Growth Boundary
PCT Hispanic: census_2010_block_groups
Percent Hispanic
 0% - 5.6%
 5.6% - 11.1%
 11.1% - 22.3%
 22.3% - 83%

The average percentage for Hispanic population for block groups intersecting the Urban Growth Boundary is 11.13.
 *Source: 2010 Census

March 2, 2015



