# 🔊 Metro | Agenda

**REVISED** September 9, 2015

**Co-chair Stacey** 

Meeting:	SW Corridor Plan Steering Committee
Date:	September 14, 2015
Time:	9:00 a.m. to 11:00 a.m.
Place:	Tualatin Police Station (8650 SW Tualatin Rd.), Police Department Conference/Training room
Purpose:	General update on project analysis and refinement efforts, including PCC Sylvania investigation, alignment options in Tigard, and mode.

9:00 a.m. Welcome and introductions

#### **ACTION ITEM**

9:10 a.m.	Consideration of the Steering Committee meeting	Co-chair Stacey
	summary from July 13, 2015 <u>ACTION REQUESTED</u>	

#### **DISCUSSION ITEMS**

9:15 a.m. Engagement update Noelle Dobson, Metro Summary of recent and upcoming community relations events and public input opportunities. Discussion: Any questions or ideas about engaging youth, or engaging the public on mode decisions?

- 9:25 a.m. PCC Sylvania update Chris Ford, Metro and Dave Aulwes, TriMet Description of further technical work into direct and indirect connection options from light rail to the PCC Sylvania campus. Denise Frisbee from the PCC Board of Directors will make a statement on behalf of the College. Discussion: Does this work provide adequate information for the steering committee to make a decision in October on further study of a tunnel? What are the trade-offs between a direct and indirect connection?
- 9:45 a.m.Tigard Key IssuesBrian Harper, MetroOverview of tradeoffs between alignment options in the Tigard Triangle, downtown<br/>Tigard, and southeastern Tigard.Discussion: Which options provide the best outcomes, in light of potential<br/>benefits and community impacts?

- 10:10 a.m.Mode considerationsMatt Bihn, MetroPresentation on initial findings related to travel mode and interrelationship between<br/>considerations.Discussion: Any questions about how the information shared and its<br/>implications? What public input would aid your upcoming mode decision?
- 10:30 a.m.Shared Investment Strategy project updateChris Ford, MetroPreview of upcoming deliverables related to refining, prioritizing and funding SISprojects.Discussion: What information would the steering committee like to see forinclusion in the Southwest Corridor Preferred Package?
- 10:40 a.m.Upcoming materials and calendar overviewMalu Wilkinson, MetroShort review of upcoming reports, meetings, and decisions. Next meeting location.Discussion: Any questions regarding upcoming events?

#### PUBLIC COMMENT

- 10:45 a.m.Public CommentCo-Chair StaceyOpportunity for citizens to provide short testimony (<u>3 minute maximum</u>) and/or<br/>submit written comments to inform the Steering Committee.
- 11:00 a.m. Adjourn

#### Materials for 9/14/2015 meeting:

- 7/13/2015 meeting summary
- PCC Sylvania Light Rail Connection Options Technical Memo
- Tigard Key Issues memo

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	Summary of recent and upcoming community relations events and public input		
	opportunities. Discussion of upcoming ID Southwest meeting	ig in October.	
	Discussion: Any questions or ideas about upcoming and	d future engagement?	
	Desired agenda items for ID Southwest?		

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Southwest Corridor Plan Steering Committee Monday, July 13, 2015 9:00a.m. to 11:00a.m. Metro Regional Center, Council Chamber

Committee Members Present Bob Stacey, Co-chair Craig Dirksen, Co-chair John Cook Steve Novick Alan Snook Danny Doyle Roy Rogers Neil McFarlane Lou Ogden Gery Schirado

Metro Council Metro Council City of Tigard City of Portland ODOT City of Beaverton Washington County TriMet City of Tualatin City of Durham

Metro Staff

Malu Wilkinson, Elissa Gertler, Michaela Skiles, Brian Harper, Chris Ford, Anthony Buczek, Noelle Dobson, Yuliya Kharitonova

#### 1.0 Welcome and introductions

Co-chair Bob Stacey called the meeting to order at 9:01am and welcomed the committee members and guests to the meeting. Committee members introduced themselves. Co-chair Stacey gave a brief overview of the meeting agenda. He reminded the committee that public comments would be made before the vote on the High Capacity Transit alignment options.

#### 2.0 Consideration of the Steering Committee meeting summary from May 11, 2015.

Co-chair Stacey asked the committee for approval of the meeting summary from May 11, 2015. Hearing no objections, the meeting summary was accepted unanimously.

#### 3.0 Public Comment

Ms. Marcia Leslie, Chair of the Far Southwest Neighborhood Association (FSNA), expressed concern over the tunnel option along 53<sup>rd</sup> street. She urged the committee to reject the tunnel option due to negative impact on the surrounding neighborhoods. Ms. Leslie provided written statement, included as part of the meeting record.

Mr. John Gibbon, member of Southwest Neighborhoods Inc. (SWNI) and Portland Utility Review Board (PURB), noted concerns over the increased traffic volume and congestion on the 72<sup>nd</sup> street intersection. He endorsed Bus Rapid Transit (BRT) option as a way to counter negative impacts of traffic.

Mr. Morgan Thiers, a Southwest Portland resident, expressed strong support for Metropolitan Area Express (MAX) line from downtown Portland, Portland State University (PSU) area to Tualatin via Portland Community College (PCC) tunnel option. He emphasized that benefits from such a connection would outweigh the negative impact that tunnel location and construction might have. Mr. Thiers provided written statement, included as part of the meeting record.

Mr. R.A. Fontes, a Lake Oswego resident, expressed concern about increasing cost of transit and urged the committee to ensure that the cost of transportation does not outweigh its benefits. He provided supportive documents, included as part of the meeting record.

Ms. Emma Newman, Ms. Anna Kersey, and Mr. Thomas Tellis, representatives of Cascade Policy Institute, presented their research on transit use by students at PCC campuses. Ms. Newman asserted that based on their findings, a majority of students prefer and use personal transportation as a means to connect to the college campuses. Ms. Kersey supported Ms. Newman's statement by outlining benefits of using personal transportation and raised concerns over the negative impacts of transit or tunnel options. Mr. Tellis suggested alternate transit options be further explored in PCC campuses connection. Cascade Policy Institute representatives provided summary of the survey results, included as part of the meeting record.

Mr. Doug Allen, a member of the Association of Oregon Rail and Transit Advocates (AORTA), made a request to post all public records that were used in "Project memo: Public Comment on the Southwest Corridor draft staff recommendations" on the Southwest Corridor Plan website and Project Library. In addition, Mr. Allen requested documents analyzing any elements of the AORTA proposal. He provided written statement, included as part of the meeting record.

Co-chair Stacey responded that all documents pertaining to the Southwest Corridor Plan are part of the public record and available upon request.

Mr. Roger Averbeck, a member of SWNI, emphasized the importance of staying focused on the benefits to the communities served by the High Capacity Transit (HCT) in the Southwest Corridor Plan. He noted that there is additional work and public involvement needed regarding HCT designs and associated investment strategies. Mr. Averbeck provided written statement from SWNI, included as part of the meeting record.

Mr. Paul Thiers, an associate professor of Political Science and Program Leader for the Program in Public Affairs at Washington State University (WSU), expressed support for the cut-and-cover tunnel proposal to connect to PCC-Sylvania campus.

Mr. Sam Diaz, a community engagement coordinator at 1000 Friends of Oregon advocacy organization and currently representing Southwest Corridor Equity Coalition, requested that the Southwest Corridor Plan must include two core components - accessibility to all transportation options for residents and housing affordability. Mr. Diaz provided written statement, included as part of the meeting record.

#### 4.0 Project Staff recommendations regarding HCT alignments

Co-chair Stacey introduced Mr. Chris Ford and Mr. Matt Bihn, Metro staff, who provided the committee with an overview of project staff's recommendations regarding HCT alignment options. Their presentation included recommended technical modifications and recommendations based on further technical analysis.

The recommendations included:

- Remove the Marquam Hill-Hillsdale tunnel from further consideration
- Remove Hillsdale Loop tunnel from further consideration
- Postpone the decision regarding the PCC-Sylvania light rail cut-and-cover tunnel to October 2015
- Continue study Bus Rapid Transit (BRT) alignment option to PCC-Sylvania campus via Capitol Highway

Mr. Ford reminded the committee members that today, in light of the findings of staff research and recommendations, they would be asked to vote to recommend for public review to continue further study of the alignment options or to remove the options from further consideration.

Mr. Ford also requested the committee to consider adopting several HCT alignment modifications proposed in response to steering committee requests or based on further technical analysis, as published in the 'HCT alignment modifications based on technical analysis' document.

Co-chair Craig Dirksen addressed the committee members, to ensure there were no questions about presentation and everyone was comfortable with the presented information.

The committee members commented on the importance of improving traffic congestion, servicing OHSU and PCC-Sylvania campus transit riders thru better transit connections, and deliberated over the proposed recommendations.

#### 5.0 Engagement Update, Noelle Dobson

Co-chair Stacey introduced Ms. Noelle Dobson, Metro staff, who provided the committee with an overview of engagement activities.

Ms. Dobson started her presentation by introducing Ms. Linda Degman, Bond Program director at Portland Community College, who gave a brief overview of upcoming PCC leadership activities. In addition, Ms. Degman introduced Ms. Lisa Avery, a newly appointed president to the PCC - Sylvania Campus.

Ms. Dobson provided an update of engagement activities. The main outcomes of the engagement and outreach activities included:

- 69% support recommendation to remove the Marquam Hill tunnel from consideration
- 71% support recommendation to remove the Hillsdale tunnel from consideration
- 64% support recommendation to reschedule the decision regarding PCC tunnel to October
- 58% support recommendation to continue study of bus rapid transit on Capitol to PCC

The committee members inquired about future engagement and outreach activities. Concerns were raised regarding not reaching the average persons thru the current outreach efforts, and the importance of distinguishing home owners as opposed to renters on the surveys. Ms. Dobson responded that currently several future events are scheduled, and noted the concerns that were raised by the members of the committee.

# 6.0 Consideration of which HCT alignment options to study further and proposed HCT alignment modifications

**MOTION:** Co-chair Dirksen moved, seconded by Mayor Denny Doyle, to recommend for public review to continue further study of the four High Capacity Transit (HCT) alignments, based on the draft staff recommendations. The alignments and recommendations included:

- Remove the Marquam Hill-Hillsdale tunnel from further consideration
- Remove Hillsdale Loop tunnel from further consideration
- Postpone the decision regarding the PCC-Sylvania light rail cut-and-cover tunnel to October 2015
- Continue study Bus Rapid Transit (BRT) alignment option to PCC-Sylvania campus via Capitol Highway
- Adopt several HCT alignment modifications both in response to steering committee requests and based on further technical analysis, as published in the 'HCT alignment modifications based on technical analysis' document.

Co-chair Stacey expressed support for the recommendations, but also raised concerns over accessibility and ability to serve various populations without some of the options still on the table. Mr. Stacey noted negative tunnel construction impacts, however, voicing his concern that simply avoiding negative impacts of the tunnel construction might take away from the area's modernization and improvement of transit for the future generations. Mr. Stacey emphasized that a robust connect for pedestrians and bicyclists from an HCT station in South Portland.

Mr. Neil McFarlane emphasized the importance of establishing high quality connection to Oregon Health & Science University (OHSU) thru Light Rail Transit (LRT) or Bus Rapid Transit (BRT) options. He noted that TriMet is investigating ways to strengthen transit service between Hillsdale and downtown Portland even without a direct HCT connection, such as whether local buses can also run on the HCT transitway.

Commissioner Steve Novick stressed the importance of connecting the neighborhoods together, particularly relating to South Portland areas such as Lair Hill.

**<u>ACTION</u>**: Without further comments, the motion was <u>approved</u> unanimously.

#### 7.0 Shared Investment Strategy project update

Co-chair Craig Dirksen introduced Tom Mills, TriMet, to present on TriMet's Southwest Service Enhancement Plan. Mr. Mills gave an overview of the plan which included:

- New frequent service on lines 35, 44, 54, and 76
- Route changes/Additional trips on lines 1, 36, 37, 38, 39, 43, 44, 45, 51, 55, 56, 65, 67, 78, 92, 93, 154
- New bus lines Tualatin-Sherwood Rd/72<sup>nd</sup> Avenue and Pacific Highway/124<sup>th</sup> Avenue
- **Community/Job Connector Shuttles** Tualatin Shuttle expansion, Tualatin-West Linn-Oregon City, and Tigard-King City

The committee members commented about project's sustainability and welcomed new improvements and additions to the existing transit options.

#### 8.0 Upcoming materials and calendar overview, Chris Ford

Co-chair Dirksen introduced Mr. Chris Ford, Metro staff, who provided the committee with an overview of materials and update on Southwest Corridor Plan Timeline.

Mr. Ford reminded the committee that the next public meeting would be held on September 14, 2015 to discuss alignments in Tigard and Tualatin. The decision regarding the PCC-Sylvania light rail cut-and-cover tunnel will be made during the October Southwest Corridor Plan Steering Committee meeting. In December, decisions will be made on all of the alignment options, along with discussion on Shared Investment Strategy and its funding and Land Use Development Strategy.

#### 9.0 Adjourn

There being no further business, Co-chair Stacey adjourned the meeting at 11:05am.

Attachments to the Record:

		Document		
Item	Туре	Date	Description	Document Number
1	Agenda	07/13/15	Meeting agenda	071315SWCSC-01
2	Summary	05/11/15	05/11/15 meeting summary	071315SWCSC-02
3	Report	06/12/15	Draft Staff Recommendation	071315SWCSC-03
4	Report	06/12/15	Draft Staff Recommendation summary	071315SWCSC-04
5	Document	07/06/15	Memo on Phase II public comments	071315SWCSC-05
6	Report	July 2015	Public Engagement Summary	071315SWCSC-06
7	Document	07/06/15	SW Corridor Plan Timeline	071315SWCSC-07
8	Document	n/a	Written statements from public	071315SWCSC-08

**Southwest Corridor Plan** 

# PCC Sylvania Light Rail Connection Options

**Technical Memo** August 14, 2015



# **Overview**

This technical memo presents new information related to connecting high capacity transit to the Portland Community College (PCC) Sylvania campus as part of the Southwest Corridor Plan. This information is intended to inform and aid the Southwest Corridor Steering Committee in making a recommendation on whether to continue study of a direct light rail connection to the PCC Sylvania campus. The Steering Committee recommendation is scheduled for October 2015.

## Contents

In July 2015, the Southwest Corridor Steering Committee directed project staff to further investigate options for a direct light rail tunnel to the Sylvania campus. This memo reports on the outcomes of this analysis, which aimed to identify ways to reduce impacts, costs and risks while maintaining or improving performance. The Steering Committee also directed project staff to explore alternative connections to the campus, in case the eventual Southwest Corridor alignment is routed on Barbur Boulevard (whether light rail or bus rapid transit) and not directly to PCC. This memo reports on the outcomes of research and design work related to mechanized and pedestrian connection options from a station on SW Barbur Boulevard to the campus. This memo also includes new transit modeling results, comparing projected ridership differences between previously considered alignment options.

Following this overview, this memo explains the context and background events leading up to this memo, explains the steps taken to identify and explore alternative tunnel options, describes the tunnel options and summarizes their relative costs and benefits, reports on the outcome of investigations into a mechanized connection and an enhanced pedestrian connection to campus, and reviews next steps.

## **Summary of findings**

The analysis found that, on the basis of cost and schedule, constructing a bored light rail tunnel connection to PCC Sylvania would provide a more efficient approach than the cut-and-cover tunnel considered by the Steering Committee in July 2015. In addition, a bored tunnel alignment may provide the most direct route connecting Barbur, PCC Sylvania and the Tigard Triangle, thus providing slightly improved travel times compared to a cut-and-cover tunnel. While a bored tunnel would result in property and traffic impacts, those impacts would be substantially less than from a cut-and-cover tunnel construction approach.

Given the challenges posed by a cut-and-cover tunnel—including difficulties with maintaining access and mitigating construction impacts to existing properties, the complex sequence of construction and engineering risk due to the depth of proposed tunnel—the analysis demonstrates that a bored tunnel connection PCC Sylvania is feasible and may be preferred.

## **Next steps**

This technical information will be considered by the Southwest Corridor Steering Committee at their October 2015 meeting, along with a status report from staff on other efforts related to PCC Sylvania, such as the college's progress on envisioning future campus development and community input.

# Background

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

## Southwest Corridor Plan process to date

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

Initial study of high capacity transit (HCT) in the Southwest Corridor began in 2009, with potential HCT destinations, routes and travel modes evaluated at a high level. Beginning in 2012, the Southwest Corridor partners worked to identify a set of collective investments that would help achieve local visions and link the Southwest Corridor communities with a more effective, reliable and safe regional transportation network. The project partners engaged the public on the investments that would make it easier, safer and more enjoyable to get around in their communities and studied the viability of different options for new transit to serve the whole Corridor. In 2013, the Southwest Corridor adopted a comprehensive Shared Investment Strategy that established a vision of investments in parks, trails, sidewalks, transit and roadways from Portland to Sherwood, Beaverton to Lake Oswego to support community goals. Some projects in the strategy are already underway; others require further study or funding for implementation.

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

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

## Analysis of PCC Sylvania area

The Southwest Corridor project partners are taking a place-based approach to understanding the key issues associated with potential HCT and transportation investments as they relate to local concerns and community aspirations. Key issues memos analyzing potential HCT alignment options in South Portland, Hillsdale, and the PCC Sylvania areas were released in March and April 2015. The PCC Sylvania Key Issues memo provided analysis of three HCT alignment options.

A Barbur alignment with improved connection to PCC (**Barbur option**) would remain on or parallel to Barbur and serve the campus with an improved pedestrian and bike connection from a station in the vicinity of Barbur and SW 53rd Avenue. This option is possible for either BRT or light rail.

PCC via SW Capitol Highway (**Capitol BRT option**) would create a direct connection to the campus, departing Barbur at the Crossroads intersection and using Capitol and SW 49th Avenue to reach the PCC-Sylvania campus. This segment would include stations on the PCC campus and in the vicinity of Capitol and SW Comus Street, near Holly Farm Park and the Capitol Hill Library. The alignment would head west through campus and then run on a new structure stretching from SW Lesser Road across I-5 to the Tigard Triangle. This option is only possible for BRT due to the steep slopes approaching and departing the campus that exceed light rail capability.

PCC via cut-and-cover tunnel (**light rail tunnel option**) would create a direct connection to the campus, departing Barbur at 53<sup>rd</sup> Avenue and running in a cut-and-cover tunnel underneath 53<sup>rd</sup> toward an underground station near the northern edge of campus. The alignment would then run westward and emerge from the cut-and-cover tunnel near Lesser Road, then run on a new structure stretching from Lesser Road across I-5 to the Tigard Triangle. This option is only being considered for light rail, as it would cost significantly more than BRT via Capitol.

A number of other HCT alignment options were removed from further consideration by the Steering Committee in April and June 2014. During that refinement process, it was determined that a direct connection to the PCC Sylvania campus with light rail could only be achieved using a tunnel. A tunnel is necessary because of the steep slope and substantial elevation difference between the campus and the Tigard Triangle. Light rail operations cannot operate on overly steep grades, and so a light rail alignment to PCC Sylvania must already be underground and descending at the campus in order to drop down to the elevation in Tigard. A cut-and-cover tunnel was initially assumed due to its lower construction costs compared to a bored tunnel. 53rd Avenue was chosen as the route for the tunnel because it provides the shortest connection between Barbur and the central campus and would impact the fewest residences, compared to other streets.

# July 2015 Steering Committee direction

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

To better inform the October decision, the Steering Committee requested that project staff expand on the options for connecting light rail to the PCC campus. Staff recommended actions that included:

- Continue to refine preliminary tunnel designs in order to better define tunnel impacts and potential mitigation.
- Continue to explore alternative mechanized connections between a Barbur station and the campus, such as a shuttle bus system or people mover, in the event that the option on Barbur is identified as the preferred alignment.

This memo reports on the findings of these actions, and provides transit modeling results analyzing projected ridership differences between the three alignment options (Barbur, Capitol BRT and light rail tunnel).

## **Tunnel refinement process**

After the July 2015 Steering Committee meeting, project staff held a tunnel design workshop to confirm the previous assumptions made for a cut-and-cover (C&C) tunnel and to determine whether a bored tunnel held potential to reduce impacts for a comparable cost to construct. Workshop participants included staff from the City of Portland, Metro and TriMet, as well as consultants from David Evans and Associates (DEA) and McMillen Jacobs and Associates (MJA). The goals of the workshop were to revisit assumptions for C&C and bored tunnel options, and to ensure that the most cost effective and least impactful tunnel concept for a light rail connection to PCC was identified for Steering Committee consideration in October.

The workshop began with a review of all potential tunnel and other PCC connection alignments explored to date, in order to identify design constraints and risks. Participants indentified three potentially feasible alignments for further exploration, including a long bored tunnel, a short bored tunnel, and a revised cut and cover tunnel, described below. Subsequently, DEA provided conceptual drawings for each alignment to MJA for further analysis of cost effectiveness, construction techniques, risks and feasibility.

# **Alternative Tunnel Options**

# **Cut-and-cover tunnel options**



#### Original light rail tunnel option

The light rail tunnel option originally considered by the Southwest Corridor Steering Committee in July 2015 utilized cut-and-cover construction, as it was believed this technique would be more cost effective than a tunnel constructed with a boring machine given its relatively short length. The tunnel portion of this alignment runs approximately 3,500 feet. The alignment begins at the north portal, located at 53rd Avenue and Barbur, and runs down the center of 53rd Avenue to the PCC campus. The south portal of the tunnel is located on PCC campus, east of Lesser Road, where the alignment would continue on a 1,400 foot long elevated structure over I-5 to the Tigard Triangle. The tunnel and a campus station would be constructed using the cut-and-cover technique.

This option would result in several substantial issues, most notably the likelihood of temporary or permanent displacements of residents, construction period traffic disruption, and complexities of the tunnel design and construction techniques resulting in longer and riskier construction.

Further investigation has determined that, beyond a certain depth, a C&C tunnel may be less cost effective than a bored tunnel. Also a C&C tunnel would likely be more impactful to the adjacent properties.

#### **Revised cut-and-cover tunnel option**

This option is largely consistent with the original option with an adjustment to construction technique. Unlike the original option, which would be constructed using a single open trench, the revised C&C tunnel would be constructed in eight total segments. Seven segments are located on 53rd Avenue between Barbur and PCC, each of which is a street block between intersections. The eighth segment is located on the PCC campus, between the light rail station and Lesser Road.

A mix of two construction techniques would be required to construct this option. One technique would utilize "open" C&C tunnel construction for each segment. Segments would be constructed one at a time, with secant pile bulkheads between each segment. The cut would remain open until the concrete box is constructed, then backfilled. Excavation would then proceed to the next segment.

The other construction technique would be employed where 53rd Avenue intersects a cross street. For the intersections, a "lidded" C&C construction approach would be used to maintain cross street traffic and minimize impacts to residential access. This approach uses a "top down" method, where a lid is first constructed over the future tunnel location. After the lid is complete, tunnel excavation is conducted below the lid.

Given the proximity of the residences along 53rd Avenue to the C&C tunnel construction, significant impacts still would occur with this revised approach. Temporary utility relocations and traffic control measures would be necessary. In addition, removal of spoils excavated from the trenches and addition of concrete would require an estimated 41,000 truck trips total, throughout construction. Trucks would use 53rd Avenue as well as Capitol Highway, SW Vacuna Street and SW 51<sup>st</sup> Avenue.

The overall duration of C&C tunnel construction is estimated at 59 months. Residential access would be severely limited during that time, allowing only pedestrian access via a sidewalk connection. Due to the limited width of the 53rd Avenue right-of-way, and the likelihood of rocky soil conditions, tunnel construction would block all vehicular access to driveways within each segment during construction. There is a high potential for displacement of multiple property owners, primarily as a result of loss of access.

In addition, temporary or permanent through-street connections to 51<sup>st</sup> Avenue would need to be established on Arnold, Buddington, and Coronado streets to maintain residential access for properties with driveways located on those roadways.

# Short bored tunnel option



The short bored tunnel alignment utilizes an approximately 2,900 foot long bored tunnel between the north portal near 53rd Avenue and Barbur and the south portal, located west of Lesser Road. The length of the tunnel is reduced through the use of retaining walls at the south portal. Then, the alignment travels on a 1,400 foot elevated structure across I-5 to the Tigard Triangle. A station is located approximately 120 feet below PCC campus in relative proximity to the long bored tunnel station.

The construction means and methods and sequencing of activities are the same for both the long and short bored tunnel options. The project construction would begin with the contractor mobilizing to the PCC station location to begin shaft construction of the station cavern, while the north and south portal locations would be developed, while the tunnel boring machine (TBM) refurbishment was completed offsite.

The TBM would be launched from the north portal location at 53<sup>rd</sup> Avenue, while the station excavation was occurring. Hauling activities from the portal would take place at the 53rd Avenue staging area located northwest of Barbur. The TBM would proceed to the station location and then to Lesser Road. Once the first tunnel is complete, the TBM would return to the north portal to begin boring the second tunnel. Overall construction duration is estimated to be 51 months for the short bored tunnel. Trucks are required to move the excavation materials and bring concrete to the site. It is estimated a total of

36,000 truck trips will be needed for the short bored tunnel. Trucks trips would primarily occur at the intersection of 53<sup>rd</sup> Avenue and Barbur. Significant traffic control measures would be needed to accommodate these truck trips. However, trucks would not need to travel along 53<sup>rd</sup> Avenue or adjacent residential streets, but may need to travel on Lesser Road. In addition, the location of the north portal could be relocated to the northwest, potentially passing under Barbur to minimize impacts to the intersection at 53<sup>rd</sup> Avenue. Additional exploration would be needed to compare potential costs and construction issues with bebefits of relocating the portal.

# Long bored tunnel option



The long bored tunnel alignment utilizes an approximately 5,200 foot long bored tunnel that travels from the north portal location at 53<sup>rd</sup> Avenue and Barbur, to a station located roughly 150 feet below the PCC campus, before proceeding directly to the Tigard Triangle. This tunnel alignment passes under I-5, locating the south portal to the west of I-5 near SW Atlanta Street, eliminating the need for the 1,400 foot long elevated structure used by the other options and its related property impacts.

Overall construction duration is estimated to be 54 months for the long bored tunnel. It is estimated a total of 42,000 truck trips will be needed for the long bored tunnel. Similar to the short bored tunnel, traffic control measures would be needed, and the relocation of the north portal can be explored to help mitigate the impacts at the intersection of 53rd Avenue and Barbur.

# **Comparative performance of options**



While travel time and ridership for each option has not yet been analyzed, it is believed the long bored tunnel would have the shortest travel time, as it is contains the fewest curves, and therefore would be the most direct route between 53<sup>rd</sup> Avenue/ Barbur, and the Tigard Triangle. Even with revised construction techniques, the C&C tunnel would have more significant impacts to adjacent properties due to the traffic control needs, access limitations, duration and sequence of construction, and increased need for noise and vibration mitigation due to proximity of homes to the 53rd Avenue right-of-way. In comparison, a bored tunnel would result in fewer impacts and would lessen residential displacement.

The long and short bored tunnel options are not without risk. A used and refurbished TBM may not be available, so it may be necessary to purchase a new machine at a higher cost. The portal locations would require additional review to address traffic control for hauling excavated spoils. The feasibility of boring under I-5 in the long bored tunnel option also requires further review.

The C&C tunnel option appears to have a longer construction duration, higher capital costs, and higher impacts to the community. In comparison, both the short and long bored tunnel options are more cost effective and reduce impacts to the community. A bored tunnel provides the most efficient approach to

providing a greater length of the LRT alignment, when compared to the C&C tunnel. A summary is provided in the following table.

ltem	Cut and Cover Tunnel Options	Short Bored Tunnel Option	Long Bored Tunnel Option
Total length (feet)	3,500	2,900	5,200
Cost effectiveness	Least	Better than C&C	Better than C&C
Total project duration	59 months	51 months	53 months
Est. # of dump trucks	33,000	35,000	40,000
Est. # of concrete trucks	8,000	1,200	2,100
Property impacts	Highest	Lower than C&C	Lower than C&C

### **Tunnel vs. Barbur**

Since the release of the PCC Sylvania Key Issues memo in April, project staff have modeled the number of future daily HCT boardings (ons and offs) on light rail at a PCC station. This information was projected for the year 2035. Total HCT line ridership and systemwide ridership were also modeled. Light rail on Barbur would result in 43,500 daily line riders and 15,700 new daily system riders in the year 2035. A direct light rail tunnel to PCC Sylvania with an on campus station would result in 46,200 daily line riders and 17,800 new daily system risers. The results are shown in the below figure.



As the figure shows, a light rail tunnel option would result in the most new riders and the biggest shift from bus to rail ridership. The figure also shows that a station on campus would result in significantly more new riders than a Barbur option, regardless of mode.

# **Alternative Mechanized Connections**

Other approaches to connect the PCC campus to a station at 53rd Avenue and Barbur were explored, to provide an alternative to a tunnel. By reviewing several precedents around the world, a range of potential "people mover" options were identified. These options will be further explored to determine feasibility, potential routes and destination. All options assume streetscape enhancements on 53<sup>rd</sup> Avenue, between the station and campus, as described below.

- Enhanced local bus service: As a component of TriMet's Southwest Service Enhancement Plan, Route 44 service, which links Barbur Transit Center and PCC Sylvania, will become frequent service, running every 15 minutes all day, every day. This service improvement could be further bolstered at key times. The plan also includes extending Route 44 south to Bridgeport Village.
- Moving sidewalks: This option would connect the station to campus via escalators. This option
  is not considered feasible due to the ½ mile distance to be traveled, would not fit the
  neighborhood character and would create conflicts with driveways and cross-street traffic. In
  addition, there are concerns with maintenance and operational reliability given the Pacific
  Northwest climate.
- **Bus shuttles:** This option would connect PCC Sylvania to the 53<sup>rd</sup> Avenue station, Barbur Transit Center and/or the Tigard Triangle. This option has relatively low capital costs, but requires additional operations and maintenance. Operations would be subject to schedule and may result in idle time in the off-peak hours.
- Autonomous vehicles/shuttle: This option would connect PCC to the 53<sup>rd</sup> Avenue station, Barbur Transit Center and/or the Tigard Triangle. This option has relatively low capital costs and operations and maintenance needs. The system would operate on the local street network, within mixed traffic, at low speeds. The system could be housed on-site and arrive on-demand. However, the technology is very new and is currently being tested, and changes in state and local laws may be necessary to allow for autonomous operation.



• **Personal Rapid Transit:** This option would provide a dedicated guideway shuttle between campus and the 53rd Avenue station, Barbur Transit Center and/or the Tigard Triangle. A guideway could utilize tracks similar to light rail (see picture of Metromover in Miami) or be constructed as a paved surface (such as Ultra PRT in London) that uses curbs to guide the vehicle. Autonomous features can provide on-demand service, both decreasing travel times and

limiting idle time in the off-peak hours, while lowering operations and maintenance expenses. While PRT is intriguing for longer distances, it requires a higher capital investment than other options. A tracked guideway would require signalized intersections at all crossings, while a paved guideway with curbs would require elevated structures to avoid intersection conflicts.



# **Alternative Pedestrian and Bicycle Connection**

If the Southwest Corridor Plan opts for a HCT alignment that remains on Barbur, a station near 53rd Avenue is likely. This local roadway provides the shortest access to the campus from Barbur and represents the most likely route for pedestrians and bicyclists to travel between HCT and PCC Sylvania. However, 53rd Avenue traverses a steep grade, only a portion is currently paved and it lacks sidewalks. Investment would be necessary to create a walk/bike connection that is usable to the general public.

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

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

- Discussion with PCC Sylvania staff to understand the unique issues that the campus has dealt with related to off-campus parking and thoughts around access from 53rd Avenue.
- Attended Far SW Neighborhood Association meeting to hear concerns and answer questions about potential HCT alignment options and the impacts of each on the neighborhood.
- Met with the City of Portland Bureau of Transportation and Bureau of Planning to respond to initial design concepts and highlight possible conflict points with City design standards and various engineering concerns.
- Met a second time with the City of Portland to highlight changes based on their initial input and verify that the concepts generated were viable for presentation to the public.

These refined concepts (see following page) were used for further discussions with PCC, the City and surrounding neighborhoods, including a second Far SW Neighborhood Association meeting to present the finalized design concepts and gather feedback on the ideas presented. The neighborhood members present asked several questions and seemed to be amenable to the concept, as proposed. Staff informed the neighborhood members that this was not a final design, merely a concept to utilize moving forward.

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



### Mayer-Reed Concepts for Enhanced SW 53rd Avenue

# Next steps

Project staff will release a second memo related to the October decision no later than September 11, 2015. That memo will report on the status of the further investigation into a light rail connection to PCC Sylvania, focusing on the recommended actions not covered in this technical memo:

- Development of campus visioning by PCC
- Sharing of student and staff travel data by PCC
- Engagement with the neighborhoods surrounding the campus as well as the college community
- Definition of a formal partnership with PCC

The Steering Committee will then make a recommendation for public review of whether to continue studying a light rail tunnel to PCC Sylvania and, if so, which alignment option. This decision will take place at the October Steering Committee meeting, scheduled for October 12, location TBD.

In December 2015, the steering committee will make recommendations for public review on continued study of HCT alignment options in Tigard and Tualatin, the preferred HCT terminus, and whether bus rapid transit or light rail is the preferred HCT travel mode.

Steering committee members and the public will have several months in early 2016 to discuss the draft Preferred Package resulting from these 2015 decisions. The final Preferred Package is anticipated to be adopted in spring 2016. Throughout 2016, the project partners will evolve details of the proposed HCT system from conceptual to preliminary design. Comprehensive environmental review of the Preferred Package would likely begin in 2017, which will encompass substantial advancement of HCT design, including details on roadway widening, lane conversions, property impacts and any tunnel construction. Construction of the HCT line could begin as early as 2021.



# Southwest Corridor Plan Key Issues: Tigard

Final Review Draft – September 4, 2015



Tigard Key Issues – September 4, 2015

# **Key Issues: Tigard**

# Contents

Tigard Key Issues: introduction and summary	1
Southwest Corridor Plan overview	1
Desired outcome: Preferred Package	1
Identifying the Preferred Package: 2015-2016 timeline overview	1
How to use this Key Issues memo	2
Evaluation factors	3
Downtown Tigard Key Issues	5
Major decisions in the downtown Tigard area	
Downtown Tigard summary	7
Downtown Tigard HCT alignment option descriptions	
Downtown Loop via Beveland Street crossina (BRT or LRT)	
Commercial Loop via Beveland Street crossing (BRT or LRT)	
Clinton Street Crossing (BRT or LRT)	13
Ash Avenue via Beveland Street crossing (BRT or LRT)	14
Branch Service via Beveland Street crossing (BRT or LRT)	15
Roadway, pedestrian and bicycle projects	16
OR-217 Crossing	16
Downtown Tigard analysis and findings	16
Transit performance	16
Community development	19
Mobility	21
Cost Estimates	23
Engineering complexity and risk	24
Community impacts	26
Southeast Tigard Key Issues	28
Major decisions in the Southeast Tigard area	
Southeast Tigard summary	29
Southeast Tigard alignment option descriptions	
Adjacent to freight rail (BRT or LRT)	
Adjacent to I-5 (BRT or LRT)	
Roadway, pedestrian and bicycle projects	
Southeast Tigard analysis and findings	
Transit performance	
Community development	35
Mobility	36
Cost Estimates	37
Engineering complexity and risk	38
Community impacts	38
Next steps	40
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 maps

# **Tigard Key Issues: introduction and summary**

## **Southwest Corridor Plan overview**

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

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

- In 2013, the committee recommended a Shared Investment Strategy that prioritizes key investments in transit, roadways, active transportation, parks, trails and natural areas.
- In 2014, the committee recommended a narrowed set of high capacity transit design options being considered and directed staff to develop a Preferred Package of transportation investments to support community land use goals.

## **Desired outcome: Preferred Package**

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

## **Identifying the Preferred Package: 2015-2016 timeline overview**

To reach a Preferred Package by spring 2016, three key steering committee decision-making points have been identified for July, October and December 2015. Technical analysis, place-based public outreach, and partner conversations will precede each steering committee decision. A draft recommendation

report will be available to the public before each decision-making point that will include public comment gathered during the place-based outreach period and any additional technical analysis compiled.



In July 2015, the steering committee took action on HCT alignment options in the South Portland, Hillsdale and Portland Community College (PCC) Sylvania areas of the corridor. The committee recommended continued study of a direct bus rapid transit connection to PCC Sylvania via SW Capitol Highway and removal of the Marquam Hill-Hillsdale tunnel and the Hillsdale Loop cut-and-cover tunnel from further consideration. The committee recommended rescheduling the decision regarding continued study of the PCC Sylvania direct cut-and-cover light rail tunnel decision to October 2015. The October 2015 decision will focus on whether to continue study of either a cut-and-cover or bored tunnel under the PCC Sylvania campus, which could include an exit portal in the Tigard Triangle.

In December 2015, the steering committee will make recommendations for public review on continued study of HCT alignment options in Tigard and Tualatin, the preferred HCT terminus, and whether bus rapid transit or light rail is the preferred HCT travel mode.

Steering committee members and the public will have several months in early 2016 to discuss the draft Preferred Package resulting from these 2015 decisions. The final Preferred Package is anticipated to be adopted in spring 2016. Comprehensive environmental review of the Preferred Package would likely begin in 2017; design and construction of the HCT line could begin as early as 2021.

## 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. This Tigard Key Issues memo is part of a series of memos and technical information on key places throughout the corridor that the public and steering committee can review before giving input and making recommendations on major project decisions.

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, in fall 2015 project staff will release a key issues memo on Tualatin, a draft Evaluation Report with technical evaluation of HCT alignment options in Tigard and Tualatin, a technical modifications memo on alignment options in Portland's Central Barbur area, and reports on travel mode and terminus. A staff recommendation report on these alignment options, terminus and travel mode will be available prior to the December 2015 Steering Committee meeting and will include a summary of stakeholder feedback.

The remainder of this document is divided into two sections for improved readability. The first section addresses key issues in downtown Tigard and the Tigard Triangle, while the second section addresses key issues in Southeast Tigard (the area between downtown and Bridgeport Village).

Both sections include:

- an overview of the decision making process as it relates to the key issues in Tigard,
- a description of the proposed high capacity transit alignments to serve Tigard,
- 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 projects involving roadway, bicycle and pedestrian investments being considered for Tigard, a discussion of general transit mode considerations, and maps highlighting demographic factors in the study area.

Additional options and alternative refinements are expected to materialize as the analysis, environmental and engineering efforts advance.

## **Evaluation factors**

This 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



# **Downtown Tigard Key Issues**

Downtown Tigard encompasses the project area between OR-99W to the east and north and Fanno Creek to the southwest. The Tigard Triangle is located between three major roadways: I-5, OR-99W and OR-217. Five options are under consideration to serve this area, all for both BRT and LRT:

- Downtown Loop
- Commercial Loop
- Clinton Crossing
- Ash Avenue
- Branch Service



## Major decisions in the downtown Tigard area

The HCT alignments in the Tigard Triangle were largely established in the document *HCT alignment modifications based on technical analysis* released on April 15, 2015. That memo proposed that the HCT alignment in the Tigard Triangle follow a 68th/70th Avenue couplet design. The Southwest Corridor Steering Committee adopted this recommendation for public review in July 2015.

In October 2015 the Southwest Corridor Steering Committee will be asked whether to continue study of either a cut-and-cover or bored tunnel to serve the PCC Sylvania campus.

In December 2015 the steering committee will be asked to make a recommendation on which of the proposed HCT alignment choices for serving downtown Tigard will advance to further environmental review through a Draft Environmental Impact Statement (DEIS), which could begin in late 2016. This Key Issues memo focuses on the tradeoffs between the five options currently under consideration so that the public and decision makers can refine the options to be considered in the DEIS based on project goals.

Major decisions in October 2015:

• Will a high capacity transit tunnel to serve PCC Sylvania continue to be studied, which could include a tunnel exit portal in the Tigard Triangle?

Major decisions in December 2015:

- Which HCT alignment options in downtown Tigard should be advanced for further study?
- 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 downtown Tigard to link to the HCT project?
- What is the best implementation approach for corridor connection projects defined in the Shared Investment Strategy for downtown Tigard?

Deliberation and decision making regarding the alignment options will be driven by how well they meet the Southwest Corridor Plan's stated 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. The alignments currently under consideration could adjust in the future as a result of refinements that materialize as the analysis, environmental and engineering efforts advance.
## **Downtown Tigard summary**

The following table summarizes evaluation factors, key considerations, and analysis results for the downtown Tigard area.

Key considerations	Evaluation factors	DOWNTOWN LOOP	COMMERCIAL LOOP	CLINTON CROSSING	ASH AVENUE	BRANCH SERVICE
Transit Performance What are the tradeoffs to consider between transit performance of the downtown Tigard alignments and other factors such as cost, travel time, property impacts, auto access impacts and connectivity?	2035 new transit trips	– 14,500 (LRT) – 7,800* (BRT)	— 14,500* (LRT) — 7,800* (BRT)	- 15,600 (LRT) - 8,400* (BRT)	– 15,700 (LRT) – 8,400 (BRT)	- 16,700 (LRT) - 9,000* (BRT)
	2035 line riders	- 41,800 (LRT) - 29,600* (BRT)	- 41,800 (LRT) - 29,600* (BRT)	- 43,600 (LRT) - 30,900* (BRT)	- 43,500 (LRT) - 30,800 (BRT)	- 44,400 (LRT) - 31,400* (BRT)
	Travel time in minutes (from PSU)	LRT: – 24 to Tigard – 34 to Tualatin BRT: – TBD – TBD	LRT: – 24 to Tigard – 34 to Tualatin BRT: – TBD – TBD	LRT: – 21 to Tigard – 30 to Tualatin BRT: – TBD – TBD	LRT: – 22 to Tigard – 31 to Tualatin BRT: – 25 to Tigard – 34 to Tualatin	LRT: – 24 to Tigard – 30 to Tualatin BRT: – TBD – TBD
Community Development Do any of the alignment choices offer significantly different redevelopment opportunities? Are local plans supportive of an HCT investment?	Access	<ul> <li>2 stations in Tigard Triangle</li> <li>1 or 2 stations west of OR-217</li> </ul>	<ul> <li>2 stations in Tigard Triangle</li> <li>1 or 2 stations west of OR-217</li> </ul>	<ul> <li>Only 1 station in Tigard Triangle (north)</li> <li>1 station west of OR-217</li> </ul>	<ul> <li>2 stations in Tigard Triangle</li> <li>1 or 2 stations west of OR-217</li> </ul>	<ul> <li>2 stations in Tigard Triangle</li> <li>2 stations west of OR-217</li> </ul>
		Downtown access comparable across alignment choices. All options access the Tigard TC and WES.				
	Redevelopment potential			Least redevelopment potential for the Tigard Triangle		
		Downtown redevelopment potential similar across all alignments				

Key considerations	Evaluation factors	DOWNTOWN LOOP	COMMERCIAL LOOP	CLINTON CROSSING	ASH AVENUE	BRANCH SERVICE
Mobility Can high capacity transit be designed to minimize negative impacts to auto, freight, bicycle and pedestrian mobility and access? Do the alignments that including a roadway crossing of OR-217 provide a traffic benefit? Do the alignment options result in	Accessibility	Transit bridge over OR-217 could accommodate all modes. Business access impacts along Commercial, Hall, and Scoffins.	Transit bridge over OR-217 could accommodate all modes. Business access impacts along Commercial, Hall, and Scoffins.	Transit bridge over OR-217 could accommodate bikes and pedestrians, but not autos. Would not alter lanes on 68 <sup>th</sup> Ave. Would not develop 70 <sup>th</sup> Ave.	Transit bridge over OR-217 could accommodate bikes and pedestrians, but not autos.	Transit bridge over OR-217 could accommodate all modes.
noteworthy differences for pedestrians, bicyclists, freight, or safety?	Mode considerations	In one-way loop through downtown Tigard: - Up to 52 BRT vehicles per hour in the peak* - Up to 20 LRT vehicles per hour in the peak	In one-way loop along Commercial Street and WES: - Up to 52 BRT vehicles per hour in the peak* - Up to 20 LRT vehicles per hour in the peak*	In each direction: – Up to 26 BRT vehicles per hour in the peak* – Up to 10 LRT vehicles per hour in the peak	In each direction: – Up to 26 BRT vehicles per hour in the peak – Up to 10 LRT vehicles per hour in the peak	At Tigard TC station: – Up to 13 BRT vehicles per hour in the peak* – Up to 5 LRT vehicles per hour in the peak
<b>Costs</b> Are the trade-offs clear between cost and other factors such as reliability, safety, access and community development opportunities?	Segment capital cost estimates in 2014 dollars	LRT: – \$442 million BRT: – TBD	LRT: – \$442 million BRT: – TBD	LRT: – \$353 million BRT: – TBD	LRT: – \$399 million BRT: – TBD	LRT: – \$388 million BRT: – TBD
How does cost impact the length of the final HCT alignment? How do operating costs compare between options?	Operating cost	Slightly higher operating cost than Clinton and Ash options due to slower travel time	Slightly higher operating cost than Clinton and Ash options due to slower travel time	Lowest operating cost due to shortest travel time	Slightly higher operating cost than Clinton option due to slower travel time	Highest operating cost due to increased service north of Tigard; up to 50% more vehicle operating hours than other options

Key considerations	Evaluation factors	DOWNTOWN LOOP	COMMERCIAL LOOP	CLINTON CROSSING	ASH AVENUE	BRANCH SERVICE
Engineering complexity/risk Complexity and risk add cost to the project and could result in the cost and schedule overruns. What aspects of each alignment add complexity to the project? What aspects of each alignment option present noteworthy risk?	Risk	<ul> <li>Restricts left turn access to commercial businesses</li> <li>Requires reconstruction of Tigard Transit Center</li> </ul>	<ul> <li>Restricts left turn access to commercial businesses</li> <li>Requires reconstruction of Tigard Transit Center</li> <li>Assumed setback from freight rail could be problematic</li> </ul>	<ul> <li>Long ¾-mile structure to cross OR-217</li> <li>OR-217 bridge would not accommodate autos</li> <li>Could impact a wetland area</li> </ul>	<ul> <li>Beveland Crossing would not accommodate autos</li> <li>New adjacent auto bridge might not be eligible for New Starts funding</li> </ul>	<ul> <li>Requires         reconstruction of         Tigard Transit         Center</li> <li>Challenges in         including         bike/ped facilities         along most of HCT         alignment in         Tigard.</li> </ul>
<b>Community impacts</b> Can the benefits and burdens of a high capacity transit alignment be equally distributed among all population groups in the corridor?	Distribution of impacts	<ul> <li>Bisects large tracts in industrial area</li> <li>Commercial property impacts in downtown</li> <li>Restricts turning movements of vehicles in downtown</li> </ul>	<ul> <li>Bisects large tracts in industrial area</li> <li>Restricts turning movements of vehicles in downtown</li> </ul>	<ul> <li>Visual impact of long structure flying over properties and roadways</li> <li>Commercial property impacts in downtown</li> </ul>	Considerable impacts to residential and commercial properties	Some access impacts and commercial property impacts, but less than other options

\*estimated based on related model runs

Tigard Key Issues – September 4, 2015

## **Downtown Tigard HCT alignment option descriptions**

There are five HCT alignments in the downtown Tigard area. A number of other HCT alignment options were removed from further consideration by the Steering Committee in April and June 2014. More information on the options removed may be found on the Southwest Corridor Plan website: <a href="http://www.oregonmetro.gov/public-projects/southwest-corridor-plan/project-library">http://www.oregonmetro.gov/public-projects/southwest-corridor-plan/project-library</a>.



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

HCT would cross OR-217 at a new bridge curving from Beveland Street to Wall Street, which would also include facilities for cars, bikes, and pedestrians. HCT would continue southwest on Wall Street, then turn towards downtown Tigard along a new street extending southeast from Commercial Street. In downtown Tigard, HCT vehicles would run in a one-way counter-clockwise transit loop (in two-way streets) from the new alignment along Hall Boulevard, Scoffins Street and a new road south of Main Street, then return on Commercial Street Southbound vehicles would then shift over to parallel the WES tracks near Wall Street to head toward the Bonita station. This option would include a station near the Tigard Transit Center, and could include a station on Wall Street near Hunziker Street as well.



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

As with the Downtown Loop option, HCT would cross OR-217 at a new bridge between Beveland Street and Wall Street, which would include facilities for cars, bikes, and pedestrians. HCT would continue south on Wall Street, then turn towards downtown Tigard in a one-way transit loop along a new twoway street extending from Commercial Street. This alignment would run in a one-way counter-clockwise loop along Commercial and parallel to the WES tracks, with a sharp turn near the existing Tigard Transit Center. The downtown Tigard station would be located near this turn. This option could include a station on Wall Street near Hunziker Street as well.



## **Clinton Street Crossing (BRT or LRT)**

HCT would run three quarters of a mile on a transit-only elevated structure from 70<sup>th</sup> Avenue and Clinton Street across OR-217 to Hall Boulevard. At Hall Boulevard, the alignment would transition to center running in a new street connecting Hall Boulevard to Commercial Street. The alignment would then turn southeast to parallel the WES alignment heading toward Tualatin. A station would be located near the existing Tigard Transit Center on the new street. Unlike the other options, this alignment would not include a station in the southern portion of the Tigard Triangle (the Beveland station).



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

HCT would cross OR-217 on a new bridge extending westward from Beveland Street, passing behind the industrial properties fronting Hunziker Street and crossing Hall Boulevard at Knoll Drive. This new OR-217 crossing would be open to bicyclists and pedestrians in addition to transit. From Hall Boulevard, the alignment would connect to Ash Avenue, with a station between Scoffins and Commercial, and then turn southeast to parallel the WES tracks. This alignment would not include a Hunziker station.

A new auto, bike, and pedestrian bridge (not shown on the map above) could connect Beveland Street to Hunziker Street near its intersection with Wall Street, similar to the link in the Downtown Loop and Commercial Loop alignments.

This alignment may also provide an opportunity to extend Ash Avenue across the WES and freight rail tracks with a new roadway crossing, pending negotiations with the regulating authorities of the rail corridor.



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

As with the Downtown Loop option, HCT would cross OR-217 on a new bridge between Beveland Street and Wall Street, which would include facilities for cars, bikes, and pedestrians. The alignment would include a station near Hunziker Street and Wall Street. From there, transit vehicles would continue along Wall Street, connecting to the WES corridor; Wall Street would continue to be a dead end street for other modes.

At the Hunziker station, every other HCT vehicle would continue to a terminus in Tualatin while the other HCT vehicles would continue to a downtown Tigard terminus. Tigard-bound vehicles would reverse direction at the downtown Tigard station, and then return to the Hunziker station heading northbound to Portland. Tualatin-bound vehicles would turn southeast to parallel the WES tracks, bypassing the downtown Tigard station and continue to Tualatin. This arrangement would mean a transfer at the Hunziker Station to travel between Tigard Transit Center and Tualatin via HCT.

## 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. The specific improvements vary depending on the alignment and multi-modal needs. Maps and lists of potential roadway, pedestrian and bicycle projects that would accompany HCT alignments in downtown Tigard are included in **Appendix B**. One major project, the OR-217 crossing, is described in more detail below.

## **OR-217 Crossing**

This project is a new auto, bicycle and pedestrian crossing over Highway 217 between Beveland Street and Hunziker Street. The bridge would provide a new connection between the Tigard Triangle area and downtown Tigard to supplement the two existing crossing opportunities at OR-99W and 72<sup>nd</sup> Avenue.

For some of the HCT alignment options under consideration, the OR-217 crossing could be included within the HCT project design. The Downtown Loop, Commercial Loop and Branch Service options all include a transit crossing from Beveland Street to Wall Street, which is the preferred location for an auto crossing as well. For these three alignments, an auto crossing is assumed to be included in the design of the bridge. For the Clinton Crossing and Ash Avenue alignment options, however, it would be challenging to incorporate an auto crossing into the transit bridge due to the proximity to OR-99W. For these alignments, bicyclists and pedestrians could be accommodated on the transit crossing, but a new auto crossing would require a separate bridge farther south.

## Downtown Tigard analysis and findings

## **Transit performance**

Key considerations:

• What are the tradeoffs to consider between travel time, access, ridership, cost and impacts?

Key findings:

- The Branch Service option would have the highest ridership overall, but also the least station ons and offs in downtown Tigard.
- The Clinton to Tigard Transit Center option would provide the fastest travel time to Tualatin while connecting through downtown Tigard, but would have ridership comparable to the Ash Avenue option due to the lack of a station in the southern portion of the Tigard Triangle.
- The two loop options would have the lowest ridership due to their slower travel times compared to the other three options.

All travel demand model results at this time should be considered preliminary. Refinements of HCT options, traffic analyses and local bus service assumptions will necessitate updated modeling throughout the DEIS process. Model runs were completed for four of the five downtown Tigard options. The Commercial Loop option was not modeled because it is very similar to the Downtown Loop option and would perform comparably. Model runs for the loop options assume a single station in downtown Tigard, without a Hunziker station. BRT design options are identical to LRT options in downtown Tigard; relative differences in travel times and ridership between these options for BRT would be similar to LRT,

so some options were modeled for LRT only for the purpose of comparison. Estimated BRT ridership for these options has been calculated by applying the relative differences between the LRT options to the ridership for the one BRT option that has been modeled, Ash Avenue.

## Travel time and reliability

The Downtown Loop option was the first concept developed for downtown Tigard. Due to the looping in downtown it would be the slowest option, resulting in a 24-minute trip from downtown Portland to downtown Tigard and 34 minutes to downtown Tualatin. Because of the loop, northbound travel would be slightly slower. The Commercial Loop option would have similar travel times. Inclusion of a Hunziker station would increase travel times on these options.

The two loop options could provide unreliable travel times with BRT because up to 26 vehicles would be required in each direction in order to meet 2035ridership demand. For the two loop options, both directions would run in a one-way loop to access the downtown Tigard station, resulting in up to 52 vehicles per hour running along the one-way busway through multiple intersections downtown. More detailed traffic analysis would be necessary to assess the feasibility of a loop alignment with BRT.

The Clinton Crossing option was developed in an effort to improve on travel times. It would provide a 21-minute trip from downtown Portland to downtown Tigard and a 30-minute trip to downtown Tualatin, an improvement of several minutes over the original design. Part of the time saving is a result of not serving the southern portion of the Tigard Triangle and not including a Hunziker station, however.

The Ash Avenue option would be only one minute slower than the Clinton Crossing option, at 22 minutes to downtown Tigard and 31 minutes to downtown Tualatin, while retaining the Beveland station in the Tigard Triangle.

The Branch Service option would provide a 24-minute trip to downtown Tigard and a 30-minute trip to downtown Tualatin. The travel time to downtown Tigard would be slightly slower compared to the Ash Avenue option because it would include the Hunziker station. The travel time to downtown Tualatin would be faster than the Ash Avenue option because the Tualatin branch would skip the downtown Tigard station. As a result, however, a trip between Tigard and Tualatin would require a transfer at the Hunziker station, adding transfer wait time to that trip.

## Corridor line ridership, system transit ridership, and station activity

Future HCT ridership projections are largely determined by the speed of the service relative to competing modes and by the numbers of people and jobs the HCT line serves. Ridership is expressed in three 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 would ride local buses in a no-build scenario (without the HCT project).
- **Change in system transit trips** measures the growth of total transit system ridership in the entire transit service area with implementation of the proposed project compared to a no-build alternative—this isolates new transit riders only. While shifts of modeled riders from local buses

to HCT service indicate benefits from improved accessibility gained with a project, new riders represent shifts in mode, usually from autos to transit, that are more likely to benefit the transportation system as a whole.

• Station ons and offs measures daily activity at specific transit stops.

## All measures are for forecast year 2035.

The Branch Service option would have the highest ridership overall, with 44,400 daily line riders and 16,700 new transit trips for LRT. This high ridership, though, is a result of the higher off-peak frequencies assumed for the line because of the branched service. The other alignment options assumed service frequencies of every 7.5 minutes in the peak, and 15 minutes in the off-peak. Since each branch is served by every alternating vehicle, the service frequencies between Tigard and the Hunziker station and between Tualatin and the Hunziker station would be 15 minutes in the peak and 30 minutes in the off-peak. TriMet's service policy does not allow such infrequent service in the off-peak, so both branches were assumed to have 15-minute all-day service. As a result, the combined frequency north of Tigard would be 7.5 minutes, not 15 minutes, during the off-peak. While the Branch Service option would generate higher ridership, it would also result in much higher operating costs—vehicle revenue hours would be nearly 50% greater than the other options.

Although the Branch Service option has the highest overall ridership, it also has the lowest number of station ons and offs in downtown Tigard because only every other vehicle would serve the downtown station. The Branch Service would have 5,500 ons and offs at the downtown Tigard station for LRT, which is a drop of 40 to 47 percent compared to the other alignment options. While some of these lost riders may be choosing to board the HCT line at a different station in the branch service scenario, others may be choosing a different mode of transportation due to the reduction in HCT service downtown compared to other alignment options.

The Ash Avenue and Clinton Crossing options would perform similarly to one another, with around 43,500 line riders and 15,600 new transit riders for LRT. While the Clinton Crossing option would be slightly faster, and thereby attract more riders throughout its alignment, it would not include the Beveland station, which results in effectively the same ridership as the Ash Avenue option. The Clinton Crossing option would have 10,300 daily ons and offs at the downtown Tigard station, compared to 9,900 for the Ash Avenue option.

The Downtown Loop and Commercial Loop options, which are the slowest alignments, would attract approximately 41,800 line riders, 14,500 new transit trips and 9,200 downtown Tigard station ons and offs for LRT.

#### Downtown Tigard mode considerations

**Appendix C** includes a general discussion of differences between BRT and LRT modes and their corridorwide impacts. This section addresses issues particular to the downtown Tigard area.

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 in the northern

section of the alignment would require up to 26 BRT vehicles per hour in the peak, while LRT would require up to 10 vehicles per hour. This difference in frequencies could affect the amount of signal priority permitted to the HCT service, and result in slower travel times for BRT than initially assumed. Impacts to local traffic would also be more likely with BRT, as BRT vehicles would be traveling through downtown Tigard at least every 3 minutes in each direction in peak periods compared to every 6 minutes for LRT. The high frequency of BRT vehicles would be particularly concerning for the two loop options because the vehicles from both directions would run in a one-way loop to access the downtown Tigard station, resulting in up to 52 vehicles per hour on the busway in the one-way portions.

## **Community development**

Key considerations:

- Do any of the alignment choices offer significantly different redevelopment opportunities?
- Are local plans supportive of an HCT investment?

Key findings:

- Based on the location of each alignment and their associated downtown stations, there does not appear to be a significant difference in redevelopment opportunities for downtown Tigard.
- The absence of a station in the southern portion of the Tigard Triangle with the Clinton Crossing option will likely impact redevelopment opportunities.
- The Tigard Triangle Strategic Plan builds off of the work done on the Tigard HCT Land Use plan to actively support the investment of HCT in the area.

## Access

The Tigard Triangle has historically had limited access opportunities, due to the confluence of the major roadways that surround and define the area (I-5, OR-99W and OR-217). There are no access points to the west, one to the south (72<sup>nd</sup> Avenue) and one across I-5 to the east (Haines Street). Of the four access points to the north, only two extend beyond Highway 99W. The area is also limited in terms of bicycle and pedestrian accessibility, mainly due to limited street connectivity and lack of sidewalks.

The opportunity for HCT two stations within the Triangle offers the most direct transit access to the area while also assisting in the closing of several gaps in the bike/pedestrian network. There are two distinct sub-districts within the Triangle, with the northern area focusing on retail and possible future housing/office, while the southern portion focuses on employment, institutional, and educational land uses. Having two stations in the Triangle will offer the ability to access and grow those existing and future uses to the benefit of the area. Additionally, the southern station will offer a possible connection for bikes and pedestrians seeking to access employment lands southeast of the Triangle in the Kruse Way area.

Access to downtown Tigard is not as constrained as the Tigard Triangle, but it faces some similar challenges. Highway 99W acts as a barrier to access from the north, as this high-traffic facility discourages walking or biking to the downtown. This barrier will pose challenges to getting potential HCT riders from northern Tigard to downtown except by car. Enhancing pedestrian and bike crossing opportunities along OR-99W will be necessary to support access to a new HCT stop in downtown. Access

to downtown Tigard from the south is largely via Hall Boulevard, which features a bike lane and has a consistent sidewalk along its west side. Access from the west into downtown is limited by the heavy rail line. An additional crossing of the rail line is desirable, but may be difficult to secure. The City is interested in extending Ash Avenue across the rail line in particular.

## Redevelopment potential

The City of Tigard has a unique opportunity to work with vacant parcels in the Triangle, unlike most other possible station locations along the HCT alignment. Redevelopment opportunities in the Tigard Triangle have been recently identified through the Tigard Triangle Strategic Plan process. Many early opportunity redevelopment sites are located within the northern portion of the Triangle, offering the uncommon chance for new development served by transit in a moderately urban setting. Vacant parcels exist on both northern corners of the Clinton Street/ 69<sup>th</sup> Avenue intersection and along Atlanta Street at 68<sup>th</sup> and 69<sup>th</sup> avenues. The proposed Beveland station in the southern portion of the Triangle would serve employment and commuter student populations and take advantage of development opportunities along Beveland Street and surrounding local streets.

These opportunity sites could be purchased or planned as a phased development by either the City or an individual developer. Policy changes and investment in pedestrian and bicycle infrastructure could enhance future development capacity of those parcels. The City plans and current activity will help support redevelopment potential by taking an active role in early Shared Investment Strategy projects and ensuring that near-term construction is designed to take advantage of future HCT.

The Clinton Crossing option would not include a Beveland station, which would likely limit the redevelopment potential in the southern portion of the Triangle. Although redevelopment will likely occur anyway due to increased land values associated with the HCT investment, those opportunities may happen further in the future. An HCT station in the southern portion of the Triangle would have a more immediate impact on land values there, thus promoting new development opportunities sooner.

Within downtown Tigard, previous station area planning has identified multiple parcels that are viable candidates for redevelopment. HCT investment in the area would likely have a positive market influence on early opportunity sites near the existing transit center. Although there are few vacant parcels in downtown, targeted acquisition and redevelopment of existing uses is a viable option already under way. This approach has already been taken with the upcoming Burnham/Ash Mixed-Use Housing Project. Additional housing projects in downtown are expected to spur the retail uses outlined in the City's local plans.

The downtown also includes a number of identified brownfield properties. Some of these brownfields may not require further cleanup for their current uses, but future redevelopment for residential purposes would likely require additional assessment and remediation efforts. The City has successfully acquired an EPA Assessment Grant and should continue to pursue funding efforts that will address the impact of contamination on redevelopment costs. This type of assistance to private developers and land owners will be key to catalyze early development opportunities in downtown.

## Support of local land use plans

The *Tigard HCT Land Use Plan* laid the groundwork for supporting the investment of Light Rail or Bus Rapid Transit in the Triangle and throughout Tigard. The plan acknowledges that the Triangle offers the greatest opportunity in Tigard to build viable station communities, but also poses significant challenges. This planning effort led to the City's *Tigard Triangle Strategic Plan*. Although the Strategic Plan does not rely solely on HCT investment, the work was done with a future HCT alignment through the area in mind. The use of the 68<sup>th</sup>/70<sup>th</sup> Avenue couplet allows the City to focus on 69<sup>th</sup> Avenue as a pedestrian-oriented street, as envisioned in the strategic plan, supported by HCT one block away.

Although no local plans call for HCT service into downtown Tigard, the City's existing plans are supported by the Southwest Corridor Plan. The *City Center Urban Renewal Plan* focuses on implementing street improvements that will increase multimodal access and connectivity, reduce congestion at major intersections and increase safety for pedestrians, bicyclists and motor vehicles. The Shared Investment Strategy projects identified in the SW Corridor Plan are supportive of this effort. The *Tigard HCT Land Use Plan* ensures that downtown has the zoning in place to support a HCT investment, such as development standards that ensure active ground-floor uses, provide robust street connectivity, and orient buildings towards the street, promoting the vision described in the concept. The *HCT Land Use Plan* also encourages continued efforts to address off-street parking, as the City should be seeking to maximize development potential around the ultimate downtown station location.

## Mobility

Key considerations:

- Can high capacity transit be designed to minimize negative impacts to auto, freight, bicycle and pedestrian mobility and access?
- Do the alignments that including a roadway crossing of OR-217 provide a traffic benefit?
- Do the alignment options result in noteworthy differences for pedestrians, bicyclists, freight, or safety?

Key findings:

- All of the options would improve connectivity of the circulation system for all modes within downtown Tigard and would improve bike and pedestrian safety.
- All of the options would likely provide a new bike and pedestrian connection over OR-217 between downtown and the Triangle. The loop options and Branch Service option could create a new auto connection over OR-217 as well, but the Ash Avenue and Clinton Crossing options would not.
- The loop options would impact business access in multiple locations.
- All options except the Clinton Crossing would run in a couplet in the Triangle, which would alter traffic flow but result in more north-south through lanes due to development of 70<sup>th</sup> Avenue.

## Motor vehicle and freight mobility

The Downtown Loop option would follow a segment of Hall Boulevard, which is a local truck route although not a regional or state freight route. None of the other alignment options would follow

designated freight routes. All the options under consideration would include an at-grade crossing of either Hunziker Street, a regional freight connector, or Hall Boulevard, a local truck route. Potential impacts to freight mobility and mitigating actions will be evaluated in the DEIS.

The below table summarizes the intersections analyzed and the initial findings. All the alignments would result in minimal impacts to motor vehicle traffic at all study intersections with the exception of 72<sup>nd</sup> Avenue/Beveland Street. The proposed new overcrossing of OR-217 at Beveland would attract traffic from the congested OR-217 interchanges at Highway 99W and 72<sup>nd</sup> Avenue, increasing traffic at 72<sup>nd</sup> and Beveland. However, the City of Tigard has planned a future widening of 72<sup>nd</sup> Avenue to four lanes, which would address this potential issue under both Build and No-Build conditions.

	Meets motor vehicle performance target?*		
Intersection	2035 No-Build	2035 Build	
68 <sup>th</sup> & Dartmouth (I-5 SB ramps)	Yes	Yes	
72 <sup>nd</sup> & Beveland (links to new OR-217 crossing)	No	No	
Hunziker & Hall	Yes	Yes	
Hall & Scoffins	Yes	Yes	
Hall & Commercial	Yes	Yes	

\* Within permitted margin of accuracy

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

## Pedestrians and bicyclists

All of the options would result in new street connections and complete gaps in pedestrian and bicycle facilities, including a new crossing of OR-217. The Downtown Loop option would result in the greatest connectivity improvement. The Commercial Loop, Clinton Crossing and Ash Avenue options would produce moderate improvements. The Branch Service option provides the relatively least (but still noteworthy) benefits to the walking and bicycling environment.

## Safety

The primary improvement to safety is the proposed connection over OR-217, included in all of the options, which would include bicycle and pedestrian facilities, providing a safer route than currently exist. All existing connections between the Triangle and downtown require pedestrians and bicyclists to cross a freeway interchange.

The DEIS will evaluate if there are any queuing issues on the local system and exit ramps.

## Access

The two loop options would both impact access to businesses along Commercial Street and the proposed extension of Commercial to Wall Street. The Downtown Loop could additionally have access impacts along Hall Boulevard and Scoffins Street, with left turns restricted to signalized intersections. The Clinton Crossing, Ash Avenue and Branch Service alignments would have fewer access impacts in the downtown area because they would run primarily in new right-of-way or adjacent to the WES tracks rather than within the existing street network.

## Lane conversions

Within the Triangle, apart from the Clinton Crossing option, the options under consideration would include a couplet for transit and general purpose traffic in the Tigard Triangle along 68th and 70th Avenues. 68th is currently the primary north-south street in that area, with one through travel lane in each direction, left and right turn pockets at the intersection with Dartmouth and a continuous center turn lane to the north of Dartmouth. The couplet would convert the southbound travel lane on 68th to northbound transit use, changing 68th into a one-way northbound street for both transit and general traffic; the center turn lane would likely become a through travel lane, thereby maintaining two lanes for vehicle traffic. This approach would develop 70th, which is largely an undeveloped right-of-way today, into the southbound leg of the couplet, with one or two southbound through lanes for vehicle traffic.

Within the downtown Tigard area, none of the options currently under consideration would convert auto travel lanes to transit right-of-way. Rather, several of the options propose construction of new streets or bridges to improve connectivity in the area, including a crossing over OR-217 between downtown and the Tigard Triangle, an extension of Commercial Street and a new street connection parallel to Main Street.

#### **Cost Estimates**

Key considerations:

- Are the tradeoffs clear between cost and other factors such as reliability, safety, access and community development opportunities?
- How does cost impact the length of the final HCT alignment?
- How do operating costs compare between options?

## Key findings:

- The Branch Service, Ash Avenue and Clinton Crossing alignments have the lowest capital cost.
- The segment cost is affected by which couplet is used in the Tigard Triangle.
- The Branch Service option would have the highest operating cost due to the increased service frequency required north of the Hunziker Street station, where the two branch lines would converge.

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 capital costs

Current estimates for an LRT alignment from downtown Portland to downtown Tualatin range from \$1.7 billion to \$2.2 billion. BRT cost estimates are under development, and should be available in the Evaluation Report to be released in mid-autumn. The ranges reflect the lowest and highest cost

combination of alignment options for each mode. The region's funding capacity will impact the final HCT alignment choices and associated projects.

## Downtown Tigard area costs

Currently for the downtown Tigard area, cost estimates are available for LRT options only. BRT cost estimates are under development, and should be available in the Evaluation Report to be released in mid-autumn.

The current estimated capital costs for LRT through the Tigard Triangle and downtown Tigard range from \$353 million to \$442 million. The major cost element for each option is the crossing over OR-217.

Despite having the longest structure to cross over 217, the Clinton Crossing option would have the lowest total capital cost, in part by avoiding construction of the couplet and a second station in the Triangle.<sup>1</sup> Of the options that include a couplet through the Triangle, the lowest cost is the Branch Service, followed by the Ash Avenue option. The Downtown Loop and Commercial Loop options would have the highest cost, largely due to their greater segment length—27% longer than the Ash Avenue option and 31% longer than the Branch Service Option. The cost estimates for the loop options assume inclusion of a Hunziker station.

## **Operating cost**

Operating costs are influenced in large part by the total travel time along an alignment and the frequency of service provided. Within the Tigard area, the Branch Service option would have the highest operating cost because of the increased service frequency that would be provided north of the Hunziker Street station, where the two branch lines would converge, in order to provide adequate service along each individual branch line. The total daily vehicle operating hours for the branch service could be up to 50% higher than for the other Tigard options.

Among the other options, the Clinton Crossing would have the lowest operating costs because it has the fastest travel times, followed by the Ash Avenue option and then the two loop options. Compared to the Branch Service, however, the differences between these other options are relatively minor.

## **Engineering complexity and risk**

Key considerations:

- Complexity and risk add cost to the project and could result in the cost and schedule overruns.
- What aspects of each alignment add complexity to the project?
- What aspects of each alignment option present noteworthy risk?

Key findings:

- The Branch Service option would add the least complexity and risk to the project.
- The Clinton Crossing option would add the most complexity.

<sup>&</sup>lt;sup>1</sup> Building a couplet on 68th and 70th avenues in the Triangle would cost more than a couplet on 68th and 69th avenues.

## Downtown Loop

The Downtown Loop option would introduce project risks by impacting access to industrial businesses along Commercial Street, which abut the WES/freight tracks to the southwest and would border the HCT alignment to the northeast.

## Commercial Loop

The Commercial Loop option would impact access to businesses along Commercial Street as well, and also require reconstruction of the Tigard Transit Center in order to provide space for the HCT turnaround. The alignment design assumes a 25-foot setback from the existing freight rail, whereas the railroad may require a larger distance. Negotiations with the railroad over setback distances would introduce additional risk to the project.

## Clinton Crossing

This option would include a ¾-mile structure to cross OR-217 and to negotiate the grade changes between the Tigard Triangle and downtown Tigard. The structure would be relatively high and would create visual impacts in addition to engineering complexity. Auto traffic would not be permitted on the crossing because that would exacerbate traffic congestion in the Hall Boulevard and OR-99W landing area. In addition, this option would cross over a wetland area to the east of OR-217 and could result in environmental impacts requiring mitigation.

## Ash Avenue

This option would include a structure crossing OR-217 at Beveland Street, which would veer northwest away from Hunziker Street and toward Ash Avenue. A separate auto bridge could be constructed to connect to Hunziker, but funding for this connection would likely not be part of the federal funding for a transit project. Bicycle and pedestrian facilities could be included on the HCT structure. The structure would cross over wetlands and creeks.

There is a desire to add a new at-grade crossing of the existing WES/freight tracks at Ash Avenue that would provide a new link to downtown for autos and a good connection to the HCT station for all modes. Approval of this crossing ultimately lies with the Oregon Department of Transportation (ODOT).

## Branch Service

This option would require the reconstruction of the Tigard Transit Center to allow for a third track for LRT or a turnaround location for BRT. West of the OR-217 crossing, the alignment would travel on Wall Street, which is a dead end street that does not intersect other roads, and adjacent to WES/freight rail tracks. This routing creates difficulties incorporating bike and pedestrian features into the HCT design because there would be no connection to a through roadway west of Hunziker Street. The need for quiet zones at the alignment's intersection with Hall Boulevard would be investigated.

## **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?

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, low-income or senior populations.
- Based on spatial analysis of demographic maps, there are slight differences in how each alignment option runs through areas of non-English speaking 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**). Future discussions with residents, employees and visitors to these areas will help expand understanding of 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 demographic maps, the majority of the alignment options would run through higher than average populations of non-white populations. Disaggregation by race shows that the Clinton Crossing and Ash Avenue options would run through higher concentrations of Native Hawaiian or Pacific Islander and Asian populations than the other alignment options.

#### Low-income and senior populations

Based on spatial analysis of demographic maps, all of the options would run through areas with higher than average concentrations of low-income populations. None of the options runs through areas with higher than average concentrations of senior populations, although the Commercial Loop and Branch Service options border upon areas of higher than average senior populations to the south.

#### Access to services

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

## Property impacts

The options under consideration have varying levels of impact to adjacent private properties. In many cases, property impacts are limited to a narrow strip needed to widen the roadway and sidewalks. In other cases, temporary construction easements may be necessary with no permanent impacts. In extreme cases, large or complete acquisitions may be necessary when impacts to buildings or other major infrastructure are unavoidable.

Project staff is currently quantifying the areas of potential impact for each option and will present this information in the future. 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.

In general, the Ash Avenue option would result in the highest number of property impacts, some of which would occur in the central downtown area. The Branch Service option would result in the fewest impacts to developed properties, but would affect access to some businesses.

# **Southeast Tigard Key Issues**

Between downtown Tigard and Bridgeport Village, two options are under consideration for both BRT and LRT modes:

- Adjacent to freight rail
- Adjacent to I-5: Tech Center Drive to Bridgeport Village



## Major decisions in the Southeast Tigard area

In December 2015 the Southwest Corridor Plan Steering Committee will be asked to make a recommendation on which of the proposed HCT alignment choices between downtown Tigard and Bridgeport Village will advance to further environmental review through a DEIS.

## Southeast Tigard summary

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

Key considerations	Evaluation factors	Adjacent to freight rail	Adjacent to I-5	
Transit Performance What are the tradeoffs to	2035 new transit trips	— 15,700 (LRT) — 8,400 (BRT)	– 16,000 (LRT) – 8,600* (BRT)	
performance of the alignments and other	2035 line riders	– 43,500 (LRT) – 30,800 (BRT)	– 43,600 (LRT) – 30,900* (BRT)	
factors such as cost, travel time, property impacts, auto access impacts and connectivity?	Travel time (PSU to Tualatin)	LRT: – 31 minutes BRT: – 34 minutes	LRT: – 34 minutes BRT: – 37 minutes*	
<b>Community Development</b> What are the main access issues in the area? Are there significant land use implications between alignment choices?	Access	<ul> <li>Better access for neighborhoods</li> <li>Need for improved connections</li> <li>Better access to 72nd Avenue employment area</li> </ul>	<ul> <li>Too far from existing neighborhoods for walk/bike access</li> <li>Better access to Kruse Way employment area</li> </ul>	
	Redevelopment potential	No major difference between options		
Mobility Can high capacity transit be designed to minimize negative impacts to auto,	Accessibility	No major difference between options or modes Future traffic operations in this area will perform better with the HCT project than without it		
Do the alignment options result in noteworthy differences for pedestrians, bicyclists, freight, or safety?	Mode considerations	In each direction: – Up to 26 BRT vehicles per hour in the peak – Up to 10 LRT vehicles per hour in the peak		
Capital Costs Are the trade-offs clear between cost and other factors such as reliability, safety, access and community development opportunities? How does cost impact the	Segment cost estimates in 2014 dollars	LRT: – \$233 million BRT: – TBD	LRT: – \$238 million BRT: – TBD	
length of the final HCT alignment?				

## Tigard Key Issues – September 4, 2015

Key considerations	Evaluation factors	Adjacent to freight rail	Adjacent to I-5
Engineering complexity/risk Complexity and risk add cost to the project and could result in the cost and schedule overruns. What aspects of each alignment add complexity to the project? What aspects of each alignment option present	Risk	Both options require negotiations with right-of-way owners and comparable risks related to alignment adjustments to avoid impacts to I-5 access.	
noteworthy risk?			
<b>Community impacts</b> Can the benefits and burdens of a high capacity transit alignment be equally distributed among all population groups in the corridor?	Distribution of impacts	<ul> <li>Few business access impacts</li> <li>No residential property impacts</li> <li>Fewer commercial property impacts</li> </ul>	<ul> <li>Few business access impacts</li> <li>No residential property impacts</li> <li>More commercial property impacts</li> </ul>

\*estimated based on related model runs

## Southeast Tigard alignment option descriptions

There are two HCT alignments in the Tigard to Bridgeport Village area. A number of other HCT alignment options were removed from further consideration by the Steering Committee in April and June 2014. More information on the options removed may be found on the Southwest Corridor Plan website: <a href="http://www.oregonmetro.gov/public-projects/southwest-corridor-plan/project-library">http://www.oregonmetro.gov/public-projects/southwest-corridor-plan/project-library</a>.

![](_page_60_Figure_3.jpeg)

![](_page_61_Figure_1.jpeg)

## Adjacent to freight rail (BRT or LRT)

HCT would run alongside the WES commuter rail tracks between downtown Tigard and Bonita Road. South of Bonita Road, the alignment would split off from WES to run alongside the Union Pacific Railroad (UPRR) tracks. Where the UPRR tracks run under I-5, the HCT alignment would turn south to parallel the freeway approaching a Bridgeport Village station and park-and-ride lot. There would be two stations along the alignment between downtown Tigard and Bridgeport Village—one located near Bonita Road and the other near Upper Boones Ferry Road.

![](_page_62_Picture_1.jpeg)

## Adjacent to I-5 (BRT or LRT)

HCT would run alongside the WES tracks between downtown Tigard and just south of SW Tech Center Drive, where it would turn east and run between industrial businesses. HCT would run along the west side of I-5 between the OR-217 interchange and a Bridgeport Village station and park-and-ride lot. There would be two stations along the alignment between downtown Tigard and Bridgeport Village—one located near Bonita Road and the other near Carman Drive/ Upper Boones Ferry Road.

## Roadway, pedestrian and bicycle projects

Both options include a range of roadway, pedestrian and bicycle improvements to better connect the corridor to the surrounding neighborhoods. The specific improvements vary depending on the alignment and multi-modal needs. Maps and lists of potential roadway, pedestrian and bicycle projects that would accompany HCT alignments in the Southeast Tigard area are included in **Appendix B**.

## Southeast Tigard analysis and findings

## **Transit performance**

Key considerations:

• What are the tradeoffs to consider between transit performance of the alignments and other factors such as cost, travel time, property impacts, auto access impacts and connectivity?

Key findings:

- Adjacent to I-5 would add one minute of travel time compared to the Adjacent to Freight Rail option.
- Overall line and system ridership would be comparable between the two options.
- The Adjacent to I-5 option would have more ons and offs at the Bonita Road station, while the Adjacent to Freight Rail option would have more ons and offs at the Upper Boones Ferry Road station.

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

Due to its added length, the Adjacent to I-5 option would be one minute slower than the Adjacent to Freight Rail option, with most of the extra time occurring between the Bonita Road station and the downtown Tigard station (or the Hunziker Street station in the Branch Service option).

Both options would provide highly reliable travel times. HCT would run in an exclusive guideway for both options for BRT and LRT, and both options would pass through relatively few signalized intersections. The Adjacent to Freight Rail option would traverse three intersections, while the Adjacent to I-5 option would pass through only one.

## *Corridor line ridership, system transit ridership, and station activity*

Line ridership and system transit ridership would be comparable between the two options due to tradeoffs in station location. While the Adjacent to I-5 option would have approximately 2,000 more ons and offs at a Bonita Road station compared to the equivalent Adjacent to Freight Rail station, it would have around 2,000 fewer ons and offs at an Upper Boones Ferry Road station. These differences are due to the high concentration of employment in the Kruse Way area, which would be better served by the Adjacent to I-5 Bonita Station, and in the 72<sup>nd</sup>/Upper Boones Ferry area, which would be better served by the Adjacent to Freight Rail option.

## Southeast Tigard mode considerations

Please see the discussion related to downtown Tigard.

## **Community development**

Key considerations:

- What are the main access issues in the area?
- Are there significant land use implications between alignment choices?

Key findings:

- Existing sidewalk gaps and a lack of bicycle infrastructure, coupled with the existence of a utilized rail corridor, limit access from the residential neighborhoods to the west.
- Future plans call for the land uses in this stretch of the alignment to change very little. The area will continue to focus on providing employment uses.

#### Access

The majority of existing employment uses between downtown Tigard and Bridgeport Village would have a high level of access to the HCT system under either alignment option and regardless of station locations. Sidewalk gaps and bicycle infrastructure would need to be addressed along 72<sup>nd</sup> Avenue and in the Carman Drive area to make that access consistent.

Existing residential uses in southeastern Tigard would have a modest level of access to the HCT system, due to the barriers posed by Fanno Creek and the WES/freight rail line. An alignment along the existing WES rail corridor with a station at 74<sup>th</sup> Avenue and Bonita Road would offer the best access for the residential neighborhoods, although the absence of a walkable street grid and the presence of the rail crossing create less-than-ideal access conditions at this location. Pedestrian and bike crossings over the rail line and additional connections between residential streets and collectors and arterials could substantially improve access.

An alignment adjacent to I-5 would move a Bonita station more than ½ mile from the residential neighborhoods. That distance, along with the existing creek and rail barriers, would likely limit use of the station by nearby residents, but the station would provide improved access to the Kruse Way employment area on the east side of I-5.

#### Redevelopment potential

Employment is expected to grow in this area, particularly within the 72<sup>nd</sup> Avenue corridor. Previous land use analysis done for the Southwest Corridor, under the guidance of City of Tigard staff, showed the 72<sup>nd</sup> Avenue Employment Corridor experiencing significant growth in the coming two decades. How that growth is managed and how access to the housing developments to the west occurs need to be explored further if multiple stations are being considered in this area.

Most of this growth will likely occur through expansions onsite with some coming through full site redevelopment. Surface parking is in good supply in the area, allowing for expansion in the near term that could incorporate transit-oriented design. As the area becomes more active, development within deep setbacks or parking lots along the frontage of major roads may provide another opportunity to increase investment and bring additional retail and services to the employees and residents of the area.

Several sites in the area are currently identified by the City as having mid-term redevelopment potential, with scattered infill lots available in the residential neighborhoods to the west.

## Support of local land use plans

The *Tigard HCT Land Use Plan* largely focuses on locations within downtown, the Tigard Triangle, and further west along 99W, but also analyzes the intersection of Carman/ Upper Boones Ferry Road and SW 72<sup>nd</sup> Avenue. The plan calls for this intersection, which it names Upper Bridgeport Village, to develop predominantly with employment and retail. The area is already characterized by employment uses, made up of a mix of light industrial and office. Any future retail uses in the area would be meant to serve existing employees only, not regional shoppers.

## Mobility

Key considerations:

- Can high capacity transit be designed to minimize negative impacts to auto, freight, bicycle and pedestrian mobility and access?
- Do the different alignment choices have differences in the level of benefit or impact?

Key findings:

- None of the alignment options overlap with regional or statewide freight routes between Bridgeport Village and downtown Tigard.
- Because the alignments are separated from motor vehicle traffic, there are minimal changes for motor vehicles, pedestrians, bicyclists, safety, or property access.

## *Motor vehicle and freight mobility*

Neither alignment runs along a designated freight route, whether state, regional, or local. Both alignments cross 72<sup>nd</sup> Avenue—which is a regional freight connector and local truck route—at grade, resulting in minimal impact on operations.

Both alignments are completely separated from traffic except for at-grade street crossings. The DEIS will evaluate how the at-grade street crossings affect motor vehicle traffic. The following table summarizes the intersections analyzed and the initial findings. The results show that traffic operations in this area will perform better with the HCT project than without it.

	meets motor venicle performance target.		
Intersection	2035 No-Build	2035 Build	
72 <sup>nd</sup> & Bonita	Yes	Yes	
72 <sup>nd</sup> & Upper Boones Ferry (North)	No	Yes	
72 <sup>nd</sup> & Upper Boones Ferry (South)	Yes	Yes	
Upper Boones Ferry & Durham	No	Yes	
72 <sup>nd</sup> & Durham	Yes	Yes	

## Meets motor vehicle performance target?\*

\* Within permitted margin of accuracy

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

## Pedestrians and bicyclists

Both alignments are completely separated from traffic except for at-grade street crossings, resulting in minimal impact to the walking and bicycling environment.

## Safety

Both alignments are completely separated from traffic except for at-grade street crossings, resulting in minimal differences in roadway safety. The DEIS will evaluate if there are any queuing issues on the local system and exit ramps.

## Access

Both alignments are completely separated from traffic except for at-grade street crossings, resulting in minimal impacts to property access.

## Lane conversions

Neither alignment option would require travel in or along an existing roadway. No lane conversions would occur in this area.

## **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:

• The Adjacent to I-5 option would cost \$5M more than the Adjacent to freight rail option.

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.

## Southeast Tigard segment costs

Cost estimates are available for LRT options only. BRT cost estimates are under development, and should be available in the Evaluation Report to be released in mid-autumn.

The Adjacent to I-5 option would cost \$5M more than the Adjacent to freight rail option. The higher cost is due to more property acquisitions and construction of underpasses to avoid I-5 ramp conflicts. The cost of the Adjacent to freight rail option could increase depending on the outcome of negotiations with UPRR over right of way considerations

## **Engineering complexity and risk**

Key considerations:

- Complexity and risk add cost to the project and could result in the cost and schedule overruns.
- What aspects of each alignment add complexity to the project?
- What aspects of each alignment option present noteworthy risk?

Key findings:

• Both options require negotiations with right-of-way owners and comparable risks related to alignment adjustments to avoid impacts to I-5 access.

While the Adjacent to freight rail alignment would be the more direct and faster option, negotiations would be required with UPRR, which owns the right of way, to allow HCT operations. These negotiations could complicate the project timeline and result in additional expense. This option could require grade separation of the transit alignment at Upper Boones Ferry Road if the DEIS analysis shows queuing impacts of an at-grade crossing on nearby I-5 exit ramps.

The Adjacent to I-5 option would avoid the UPRR right of way and the need for negotiations with the railroad. This alignment would be more expensive to construct due to commercial property acquisitions and required underpasses of I-5 ramps. This option will also require conversations with ODOT and FHWA. There is a risk that these conversations may require the transit alignment to be located west of the interchange that may have some right-of-way impacts.

#### **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?

Key findings:

- Based on spatial analysis of demographic maps, both alignment option runs through areas of non-white, low-income, senior, and non-English speaking 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**). Future discussions with residents, employees and visitors to these areas will help expand understanding of how different racial, ethnic and language groups may be impacted by the proposed alignments.

Based on spatial analysis of demographic maps, both alignment options would run through higher than average populations of non-white, low-income and senior populations. The Evaluation Report, which will be released in October 2015, will include a more detailed analysis to compare the number of new

transit trips in areas with higher than average low income, people of color, and limited English proficiency populations.

#### Access to services

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

## Property impacts

The options under consideration have varying levels of impact to adjacent private properties. In many cases, property impacts are limited to a narrow strip needed to widen the roadway and sidewalks. In other cases, temporary construction easements may be necessary with no permanent impacts. In extreme cases, large or complete acquisitions may be necessary when impacts to buildings or other major infrastructure are unavoidable. Project staff is currently quantifying the areas of potential impact for each option and will present this information in the future.

Based on current estimates, the Adjacent to I-5 option would have slightly more property impacts than the Adjacent to Freight Rail option. Neither option in the Southeast Tigard area would have residential property impacts.

# **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 Tigard. Between July and December 2015, project staff will present information on alignments in Tigard and other Southwest Corridor Plan issues and invite public comment at meetings and online. An updated calendar can be found on our website:

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

Upcoming staff reports and Steering Committee review of Southwest Corridor issues that affect Tigard include:

**September 2015:** This Key Issues memo will be presented to the Southwest Corridor Steering Committee for review and discussion. A technical evaluation report will be released in October with an in-depth assessment of options for accessing Tigard and Tualatin.

**December 2015:** The Steering Committee will make recommendations for public review on which HCT alignments in Tigard to continue studying, as well as the preferred travel mode and terminus. The Steering Committee will also review and discuss the list of Shared Investment Strategy projects and the funding strategy for those projects.

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

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

- Key Issue Memos:
  - Tigard September
  - Bridgeport Village to Tualatin September
  - HCT mode October
  - HCT terminus October
- Technical modifications memo: Central Barbur area October
- Draft Evaluation Report, Part 2 October
- Draft Recommendation Report November
- 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 table show both the HCT-supportive and Corridor Connections projects in the downtown Tigard, Tigard Triangle and Kruse Way areas.

#### HCT-supportive projects in the downtown Tigard, Tigard Triangle and Kruse Way areas

The HCT-supportive projects in this area would focus on improving bike and pedestrian access to the potential HCT stations and along the HCT alignment.

## Corridor Connections projects in the downtown Tigard, Tigard Triangle and Kruse Way areas

The Shared Investment Strategy includes several additional bike and pedestrian projects in this area that would not be directly linked to the HCT alignments.


Project # Location/ Ownership	<b>Title</b> Description	Cost	Primary Mode	Primary Project Type	Notes
<b>1100</b> Tigard WashCo.	Hall/Hunziker/Scoffins Intersection Realignment Realign offset intersection to cross intersection to alleviate congestion and safety issues	\$	Auto/Freight	Corridor Connections	
<b>2077</b> Tigard ODOT	<b>Tigard Transit Center crossing improvements.</b> Shorten crossing distances, make crosswalks more visible, and provide more time for pedestrians to cross at the intersections of 99W and SW Greenburg Rd., 99W & SW Hall Blvd., and 99W & SW Dartmouth St.	\$	Pedestrian	HCT Supportive	With all HCT options: Include crosswalk visibility and timing elements at Greenburg, Hall, Dartmouth, 72nd, and 68th (50%)
<b>2079</b> Tigard	<b>Tigard Transit Center pedestrian path</b> Formalize the informal path running from Center Street Connection from SW Commercial St. to SW Hall Blvd., by paving it, making it ADA accessible, providing lighting, and wayfinding signage.	¢	Pedestrian	HCT Supportive	
<b>2080</b> Tigard	<b>Tigard Transit Center sidewalk infill.</b> Build sidewalks, where there are none, along SW Scoffins St. & SW Ash St. These streets are near the Tigard Transit Center and provide access to it. Ensure there is a landscaped buffer between pedestrians and motor vehicles.	¢	Pedestrian	HCT Supportive	
<b>1107</b> Tigard WashCo.	<b>Hwy. 217 Over-crossing - Hunziker Hampton Connection</b> Build new connection of Hunziker Road to 72nd Avenue at Hampton St., requires over-crossing over Hwy 217, removes or revises existing 72nd Avenue/Hunziker intersection/ connection.	\$\$\$\$	Auto/Freight	HCT Supportive	With HCT crossing from Beveland to Wall in Tigard: Include
<b>5024</b> Tigard	<b>68th Avenue (widen to 3 lanes)</b> Widen to 3 lanes or for transitway including sidewalks and bike lanes between Dartmouth/I-5 Ramps and south end	\$\$\$	Multimodal	HCT Supportive	With all HCT options: Include sidewalk on one side from Atlanta to south of Baylor With HCT on 68th Avenue: Include
<b>1078</b> Tigard	Atlanta Street Extension (new roadway) Extend Atlanta Street west to Dartmouth Street	\$	Auto/Freight	HCT Supportive	
<b>5037</b> Tigard WashCo. ODOT	Hall Boulevard Widening, Oleson to 99W Widen to 3 lanes; build sidewalks and bike lanes; safety improvements	\$	Multimodal	Corridor Connections	

Project # Location/ Ownership	<b>Title</b> Description	Cost	Primary Mode	Primary Project Type	Notes
<b>1077</b> Tigard	Ash Avenue railroad crossing (new roadway) Extend Ash Avenue across the railroad tracks from Burnham to Commercial Street.	\$	Auto/Freight	HCT Supportive	Requires closure of another crossing by the city of Tigard
<b>5004</b> Lake Oswego	Boones Ferry Road Boulevard improvements (turn lanes with bike/ped Madrona to Kruse Way) Widen to include bike lanes, sidewalks, and turn lanes. This project is Phase 2, Oakridge/Reese to Kruse Way. Phase 1 (\$23 Million) is in Low Build.	\$\$	Multimodal	Corridor Connections	
6002 Lake Oswego	Carman Dr. sidewalks and bike lanes Add bike lanes and pedestrian pathway	\$	Bike/Ped	Corridor Connections	
<b>3121</b> Tigard Lake Oswego	Bonita Road bike lanes: 72nd to I-5 Install bike lanes in eastbound direction from 72nd Avenue to I-5 Bridge	¢	Bicycle	HCT Supportive	With HCT station at Bonita & 74th: Include as re-striping only
<b>3117</b> Tigard Tualatin	<b>72nd Avenue bikeway: 99W to city limits</b> Install bike facilities on both sides of the street from Highway 99W to South City Limits	\$	Bicycle	HCT Supportive	With all HCT options: Include if done through re-striping (conversion from 3-lane to 2- lane with bike lanes
<b>3129</b> Tigard	Tigard Transit Center Bicycle Hub Provide bicycle hub at Tigard Transit Center	¢	Bicycle	HCT Supportive	With all HCT options: Include as bike 'n ride
<b>2058</b> Tigard	Hunziker Street Sidewalks: 72nd to Hall Install sidewalk on both sides of the street from 72nd Avenue to Hall Boulevard	\$	Pedestrian	HCT Supportive	With HCT station at Hunziker & Wall: Include one side from Wall/Beveland overcrossing to 72nd
2054Tigard	<b>Commercial Street sidewalks: Main to Lincoln</b> Install sidewalks on both sides of the street from Main Street to Lincoln Street	¢	Pedestrian	HCT Supportive	Include on one side of street (50%)

Project # Location/ Ownership	<b>Title</b> Description	Cost	Primary Mode	Primary Project Type	Notes
<b>2045</b> Tigard	<b>72nd Avenue sidewalks: 99W to Bonita</b> Complete gaps in sidewalk on both sides of street from Highway 99W to Bonita Road	\$	Pedestrian	HCT Supportive	With all HCT options: Include one side from 99W to Dartmouth (25%) With HCT station at Beveland: Include one side from Dartmouth to Hunziker (25%) With HCT station at 72nd & Tech Center Drive: Include west side from Tech Center Drive to south of Landmark Lane (20%) With HCT station at WES & Bonita: Include east side from Bonita to Landmark Lane (10%)
<b>2046</b> Tigard	<b>72nd Avenue sidewalks: Upper Boones Ferry to Durham</b> Install sidewalk on both sides of street from Upper Boones Ferry Road to Durham Road	\$	Pedestrian	HCT Supportive	With HCT to Bridgeport Village: Include

# **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**





















# Southwest Corridor Plan Key Issues: Tigard Executive Summary, September 4, 2015

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

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

- In 2013, the committee recommended a Shared Investment Strategy that prioritizes key investments in transit, roadways, active transportation, parks, trails and natural areas.
- In 2014, the committee recommended a narrowed set of high capacity transit design options being considered and directed staff to develop a Preferred Package of transportation investments to support community land use goals.

The project partners are working together to develop a Preferred Package by spring



# What is a Southwest Corridor Key Issues memo?

The Southwest Corridor project partners are taking a place-based approach to understanding the key issues as they relate to local concerns and community aspirations. The Tigard Key Issues memo is part of a series of memos and technical information on key places throughout the corridor that the public and steering committee can review before giving input and making recommendations on major project decisions.

The full Tigard Key Issues memo is available at www.swcorridorplan.org and includes an overview of the decision-making process, description of the proposed high capacity transit alignments to serve Tigard, summary of technical information and 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 roadway, bike and pedestrian projects being considered for the Tigard area, a discussion of general transit mode considerations and maps highlighting demographic factors in the study area.

A summary of stakeholder feedback and findings from additional technical analysis will be incorporated into a draft recommendation document that will be available prior to the December 2015 steering committee decision.



2016 that addresses the needs and aspirations of Southwest Corridor residents and businesses. The Preferred Package will include the following components:

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

# **Defining a Preferred Package**

In December 2015, the steering committee will make recommendations for public review on continued study of high capacity transit alignment options in Tigard and Tualatin, the preferred high capacity transit terminus, and whether bus rapid transit or light rail is the preferred high capacity transit travel mode.

Steering committee members and the public will have several months in early 2016 to discuss the draft Preferred Package resulting from these 2015 decisions. The final Preferred Package is anticipated to be adopted in spring 2016. Comprehensive environmental review of the Preferred Package would likely begin in 2017; design and construction of the high capacity transit line could begin as early as 2021.

# October 2015: Major decisions for Tigard

• Will a high capacity transit tunnel to serve PCC Sylvania continue to be studied, which could include a tunnel exit portal in the Tigard Triangle?

# **Steering Committee decisions**



# December 2015: Major decisions for Tigard

- Which high capacity transit alignment options in downtown Tigard should be advanced for further study?
- Is bus rapid transit or light rail the preferred mode to be studied in the Draft Environmental Impact Statement?
- What is the timeframe for designing and implementing local transit service improvements to enhance connections to and through downtown Tigard to link to the high capacity transit project?
- What is the best implementation approach for roadway, bike and pedestrian projects that are not included as part of the high capacity transit project but are defined in the Shared Investment Strategy for Tigard?

# **Tigard findings**

Deliberation and decision-making will be driven by how well each element of the proposed project meets the Southwest Corridor Plan's overarching goals, 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.

Information in the Tigard Key Issues memo highlights data collected through technical analysis, community knowledge and discussions with partners that will influence this decision, including:

- **transit performance** ridership, travel time, reliability
- community development station access, redevelopment opportunities
- **mobility** connectivity, freight movement, safety, traffic, bike and pedestrian access
- **cost:** initial capital cost estimates
- **engineering complexity and risk** construction impacts, engineering risks
- **community impacts** distribution of benefits and burdens, property impacts.

A full copy of the Tigard Key Issues memo and appendices is available at www.swcorridorplan.org.

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The downtown Tigard and Tigard Triangle areas include five high capacity transit options under consideration. Four options for the downtown Tigard area would include a couplet on 68th or 70th Aves. through the Tigard Triangle area and new crossings over OR-217 from Beveland St.

- Downtown Loop runs along Wall St. and in a one-way loop on streets through downtown Tigard
- **Commercial Loop** runs along Wall St. and in a one-way loop through downtown on a new street extending from and parallel to WES tracks
- Ash Avenue connects to Ash Ave., then runs southeast parallel to WES tracks
- **Branch Service** runs along Wall St., then alternating transit vehicles would continue parallel to WES tracks either north to downtown Tigard or south to Tualatin

Additionally there is one downtown Tigard option that bypasses the southern part of the Tigard Triangle.

• **Clinton Crossing** runs on a transit-only structure over OR-217 from Clinton St. in the Triangle to a new street downtown, then turns southeast to parallel the WES tracks



# **Downtown Tigard summary**

The following table summarizes evaluation factors, key considerations, and analysis results for the downtown Tigard area.

Key considerations	Evaluation factors	DOWNTOWN LOOP	COMMERCIAL LOOP	CLINTON CROSSING	ASH AVENUE	<b>BRANCH SERVICE</b>
<b>Transit Performance</b> What are the tradeoffs to consider	2035 new transit trips	– 14,500 (LRT) – 7,800* (BRT)	– 14,500* (LRT) – 7,800* (BRT)	– 15,600 (LRT) – 8,400* (BRT)	– 15,700 (LRT) – 8,400 (BRT)	– 16,700 (LRT) – 9,000* (BRT)
between transit performance of the downtown Tigard alignments and other factors such as cost, travel time, property	2035 line riders	- 41,800 (LRT) - 29,600* (BRT)	- 41,800 (LRT) - 29,600* (BRT)	- 43,600 (LRT) - 30,900* (BRT)	– 43,500 (LRT) – 30,800 (BRT)	– 44,400 (LRT) – 31,400* (BRT)
impacts, auto access impacts and connectivity?	Travel time in minutes (from PSU)	LRT: – 24 to Tigard	LRT: - 24 to Tigard	LRT: - 21 to Tigard	LRT: - 22 to Tigard	LRT: - 24 to Tigard
		<ul> <li>— 34 to Tualatin</li> <li>BRT:</li> </ul>	<ul> <li>– 34 to Tualatin</li> <li>BRT:</li> </ul>	<ul> <li>– 30 to Tualatin</li> <li>BRT:</li> </ul>	<ul> <li>— 31 to Tualatin</li> <li>BRT:</li> </ul>	– 30 to Tualatin BRT:
		– TBD – TBD	– TBD – TBD	– TBD – TBD	<ul> <li>25 to Tigard</li> <li>34 to Tualatin</li> </ul>	– TBD – TBD
<b>Community Development</b> Do any of the alignment choices offer significantly different redevelopment opportunities? Are local plans supportive of an HCT	Access	<ul> <li>2 stations in Tigard Triangle</li> <li>1 or 2 stations west of OR-217</li> </ul>	<ul> <li>2 stations in Tigard Triangle</li> <li>1 or 2 stations west of OR-217</li> </ul>	<ul> <li>Only 1 station in Tigard Triangle (north)</li> <li>1 station west of OR-217</li> </ul>	<ul> <li>2 stations in Tigard Triangle</li> <li>1 or 2 stations west of OR-217</li> </ul>	<ul> <li>2 stations in Tigard Triangle</li> <li>2 stations west of OR-217</li> </ul>
investment?		Downtown a	ccess comparable acro	ss alignment choices. All c	options access the Tigarc	d TC and WES.
	Redevelopment potential			Least redevelopment potential for the Tigard Triangle		
			Downtown redevel	opment potential similar	across all alignments	

Key considerations	Evaluation factors	DOWNTOWN LOOP	COMMERCIAL LOOP	CLINTON CROSSING	ASH AVENUE	<b>BRANCH SERVICE</b>
Mobility Can high capacity transit be designed to minimize negative impacts to auto, freight, bicycle and pedestrian mobility and access? Do the alignments that including a roadway crossing of OR-217 provide a traffic benefit? Do the alignment options result in	Accessibility	Transit bridge over OR-217 could accommodate all modes. Business access impacts along Commercial, Hall, and Scoffins.	Transit bridge over OR-217 could accommodate all modes. Business access impacts along Commercial, Hall, and Scoffins.	Transit bridge over OR-217 could accommodate bikes and pedestrians, but not autos. Would not alter lanes on 68 <sup>th</sup> Ave. Would not develop 70 <sup>th</sup> Ave.	Transit bridge over OR-217 could accommodate bikes and pedestrians, but not autos.	Transit bridge over OR-217 could accommodate all modes.
noteworthy differences for pedestrians, bicyclists, freight, or safety?	Mode considerations	In one-way loop through downtown Tigard: - Up to 52 BRT vehicles per hour in the peak* - Up to 20 LRT vehicles per hour in the peak	In one-way loop along Commercial Street and WES: - Up to 52 BRT vehicles per hour in the peak* - Up to 20 LRT vehicles per hour in the peak*	In each direction: - Up to 26 BRT vehicles per hour in the peak* - Up to 10 LRT vehicles per hour in the peak	In each direction: - Up to 26 BRT vehicles per hour in the peak - Up to 10 LRT vehicles per hour in the peak	At Tigard TC station: - Up to 13 BRT vehicles per hour in the peak* - Up to 5 LRT vehicles per hour in the peak
<b>Costs</b> Are the trade-offs clear between cost and other factors such as reliability, safety, access and community development opportunities?	Segment capital cost estimates in 2014 dollars	LRT: – \$442 million BRT: – TBD	LRT: – \$442 million BRT: – TBD	LRT: – \$353 million BRT: – TBD	LRT: – \$399 million BRT: – TBD	LRT: – \$388 million BRT: – TBD
How does cost impact the length of the final HCT alignment? How do operating costs compare between options?	Operating cost	Slightly higher operating cost than Clinton and Ash options due to slower travel time	Slightly higher operating cost than Clinton and Ash options due to slower travel time	Lowest operating cost due to shortest travel time	Slightly higher operating cost than Clinton option due to slower travel time	Highest operating cost due to increased service north of Tigard; up to 50% more vehicle operating hours than other options

Key considerations	Evaluation factors	DOWNTOWN LOOP	COMMERCIAL LOOP	CLINTON CROSSING	ASH AVENUE	BRANCH SERVICE
Engineering complexity/risk Complexity and risk add cost to the project and could result in the cost and schedule overruns. What aspects of each alignment add complexity to the project? What aspects of each alignment option present noteworthy risk?	Risk	<ul> <li>Restricts left turn access to commercial businesses</li> <li>Requires reconstruction of Tigard Transit Center</li> </ul>	<ul> <li>Restricts left turn access to commercial businesses</li> <li>Requires reconstruction of Tigard Transit Center</li> <li>Assumed setback from freight rail could be problematic</li> </ul>	<ul> <li>Long ¾-mile structure to cross OR-217 bridge would not accommodate autos</li> <li>Could impact a wetland area</li> </ul>	<ul> <li>Beveland Crossing would not accommodate autos</li> <li>New adjacent auto bridge might not be eligible for New Starts funding</li> </ul>	<ul> <li>Requires</li> <li>reconstruction of Tigard Transit</li> <li>Center</li> <li>Challenges in including bike/ped facilities along most of HCT alignment in Tigard.</li> </ul>
<b>Community impacts</b> Can the benefits and burdens of a high capacity transit alignment be equally distributed among all population groups in the corridor?	Distribution of impacts	<ul> <li>Bisects large tracts in tracts in industrial area</li> <li>Commercial property impacts in downtown</li> <li>Restricts turning movements of vehicles in downtown</li> </ul>	<ul> <li>Bisects large tracts in industrial area</li> <li>Restricts turning movements of vehicles in downtown</li> </ul>	<ul> <li>Visual impact of long structure flying over properties and roadways</li> <li>Commercial property impacts in downtown</li> </ul>	Considerable impacts to residential and commercial properties	Some access impacts and commercial property impacts, but less than other options

\*estimated based on related model runs

# Southeast Tigard summary

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

Key considerations	Evaluation factors	Adjacent to freight rail	Adjacent to I-5
Transit Performance What are the tradeoffs to	2035 new transit trips	- 15,700 (LRT) - 8,400 (BRT)	— 16,000 (LRT) — 8,600* (BRT)
performance of the alignments and other	2035 line riders	– 43,500 (LRT) – 30,800 (BRT)	- 43,600 (LRT) - 30,900* (BRT)
factors such as cost, travel time, property impacts, auto access impacts and connectivity?	Travel time (PSU to Tualatin)	LRT: – 31 minutes BRT: – 34 minutes	LRT: – 34 minutes BRT: – 37 minutes*
<b>Community Development</b> What are the main access issues in the area? Are there significant land use implications between	Access	<ul> <li>Better access for neighborhoods</li> <li>Need for improved connections</li> <li>Better access to 72nd</li> </ul>	<ul> <li>Too far from existing neighborhoods for walk/bike access</li> <li>Better access to Kruse Way employment area</li> </ul>
alignment choices?	Redevelopment potential	Avenue employment area No major difference between op	otions
<b>Mobility</b> Can high capacity transit be designed to minimize negative impacts to auto,	Accessibility	No major difference between op Future traffic operations in this a HCT project than without it	otions or modes area will perform better with the
pedestrian mobility and access? Do the alignment options result in noteworthy differences for pedestrians, bicyclists, freight, or safety?	<i>Mode</i> considerations	In each direction: – Up to 26 BRT vehicles per hour in the peak – Up to 10 LRT vehicles per hour in the peak	
Capital Costs Are the trade-offs clear between cost and other factors such as reliability, safety, access and community development opportunities?	Segment cost estimates in 2014 dollars	LRT: – \$233 million BRT: – TBD	LRT: – \$238 million BRT: – TBD
How does cost impact the length of the final HCT alignment?			



Key considerations	Evaluation factors	Adjacent to freight rail	Adjacent to I-5
Engineering complexity/risk Complexity and risk add cost to the project and could result in the cost and schedule overruns. What aspects of each alignment add complexity to the project? What aspects of each	Risk	Both options require negotiation comparable risks related to align impacts to I-5 access.	ns with right-of-way owners and onment adjustments to avoid
alignment option present noteworthy risk?			
<b>Community impacts</b> Can the benefits and burdens of a high capacity transit alignment be equally distributed among all population groups in the corridor?	Distribution of impacts	<ul> <li>Few business access impacts</li> <li>No residential property impacts</li> <li>Fewer commercial property impacts</li> </ul>	<ul> <li>Few business access impacts</li> <li>No residential property impacts</li> <li>More commercial property impacts</li> </ul>

\*estimated based on related model runs