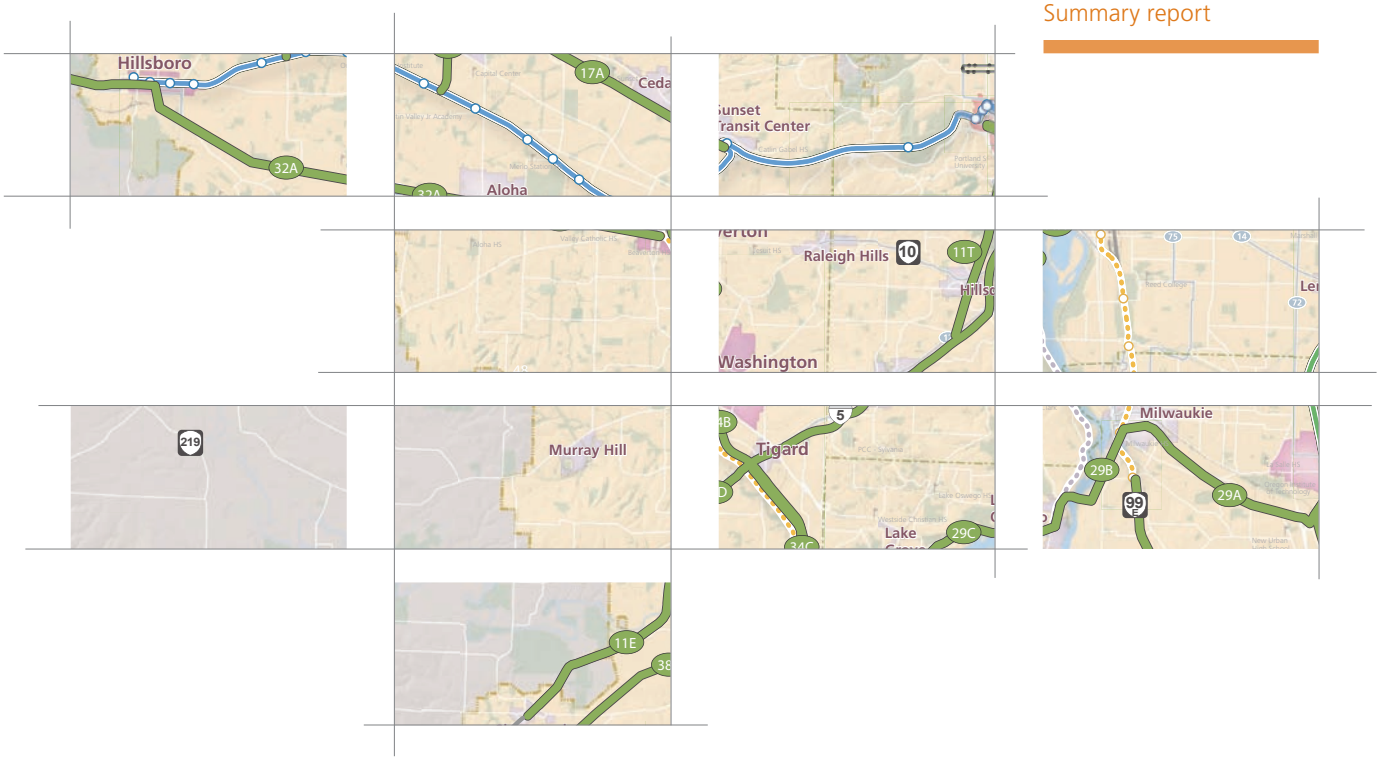

REGIONAL HIGH CAPACITY TRANSIT SYSTEM PLAN

2035

Summary report

June 2010

Metro | *Joint Policy Advisory Committee on Transportation*

Metro is the federally mandated metropolitan planning organization designated by the governor to develop an overall transportation plan and to allocate federal funds for the region.

The Joint Policy Advisory Committee on Transportation (JPACT) is a 17-member committee that provides a forum for elected officials and representatives of agencies involved in transportation to evaluate transportation needs in the region and to make recommendations to the Metro Council.

The established decision-making process assures a well-balanced regional transportation system and involves local elected officials directly in decisions that help the Metro Council develop regional transportation policies, including allocating transportation funds.

Project web site: www.oregonmetro.gov/goingplaces

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METRO COUNCILOR MESSAGE

The Metro Council is collaborating with our region's cities and counties to create vibrant, compact, connected communities in a distinctive fashion. In planning for future high capacity transit routes, we're building on a legacy of citizen involvement, elected leadership, and coordinated land use and transportation policy. Over 30 years ago, elected leaders and citizens rallied against the construction of freeways through developed neighborhoods and, instead, directed resources to a light rail project from Portland to Gresham along I-84. In 1995, the region adopted the 2040 Growth Concept to serve as a vision to guide growth and development over the coming decades. The existing and planned high capacity transit system functions to support the 2040 Growth Concept and the Regional Transportation Plan to protect the region's farm and forestland and to make great places.

The Portland metro region continues to lead the way in providing the region with a state-of-the-art transit system. The region has constructed over 50 miles of light rail and 14.7 miles of commuter rail. These high capacity lines connect the far reaches of the urban area from Hillsboro to Gresham and from north Portland to Clackamas – and many neighborhoods in between. In the wake of our success at building the first chapter of an exceptional high capacity transit system, the following document details the next phase of planning for high capacity transit to serve great places in the region over upcoming decades.

The Metro Council strives to create a region with sustained economic competitiveness and prosperity, transportation choices, minimized contributions to global warming, healthy ecosystems and equitably distributed benefits and burdens of growth. Therefore, the Metro Council adopted goals focusing on environment, communities and the economy to reflect that vision. Intensive public outreach and evaluation and analysis of high capacity transit options according to those goals and vision led to the Metro Council adopting Resolution No. 09-4052, which provides the region with high capacity transit projects and policy direction for the next decade.

We are thrilled to present you with following Regional High Capacity Transit System Plan summary report. The document encapsulates the planning process and results which led to the adoption of Resolution No. 09-4052 and the brilliant ideas captured from the public, scholars and experts, and elected officials on high capacity transit options in the region.

— Carlotta Collette, Metro Councilor

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1. INTRODUCTION

The Portland metropolitan area is an incredible place to live. Our region has vibrant communities, neighborhoods with distinctive personalities and a world class transit system. Residents value access to nature, trails, parks and wild places. The area is rich with lively community events and festivals, an active arts scene and a rich array of cultural activities. The communities that make up the Portland metro region have worked together tirelessly over the past decades to create one of the most livable regions of the county and consistently strive to be the greatest place to live, work and play.

> "Our region is a place that rewards those who commit themselves to keeping it a great place to live. It is a place where people act to meet the future, rather than wait to cope with its eccentricities. History teaches the often cruel lesson that a community that does not possess a clear vision of the kind of future it wants is not likely to be satisfied with the one it gets. Making the effort to identify what we want, and then acting purposefully and collectively to achieve it, is critical."—*Your Future Vision Commission, final report, Metro, 1993.*

As the Portland metro region aspires to be the greatest place, it must address 21st century challenges of energy independence, carbon neutrality, population growth, sustainable economic development and human health. Continued development of a world class, high capacity transit system is one part of an integrated strategy to accommodate the region's rapidly increasing population while reducing the negative impacts of that population on land, air and water quality. More than any single factor, regional land use policy has positioned the Portland metro area to take advantage of transit-supportive development policy and implementation. Dramatic future population growth and a renewed energy toward infill development will provide new opportunities to build upon this legacy. Furthermore, raw geometry and rising construction costs demand a focus on moving people efficiently and rapidly within existing corridors and rights of way. Economic growth in the region will depend on continued investment in a transit system that can move people efficiently. Achievement of other land use, financial and equity goals also rely heavily on a well formed high capacity transit system.

This High Capacity Transit System Plan report summarizes the results of outreach and data analysis intended to provide guidance for the region's long-term investments in high capacity transit. The prioritized high capacity transit corridors and discussion of improvements to the existing system are based on planned land uses, community values, environmental benefits, economic potential and deliverability. In addition, the report covers the main components addressed during the High Capacity Transit System Plan process, including public outreach, high capacity transit corridor evaluation, system considerations and best practices for high capacity transit in the United States and around the world. Further information about the technical evaluation of corridors and public outreach results are available in the technical documents Regional High Capacity Transit System Plan detailed evaluation (Nelson\Nygaard, July 2009) and Regional High Capacity Transit System Plan public involvement outreach summary (Metro, May 2009).

The Regional High Capacity Transit System Plan is a component of the Regional Transportation Plan. The RTP is the region's blueprint to guide projects, programs and policies related to all transportation modes, including bikes, pedestrians, autos, freight and transit. The Regional HCT System Plan is designed to focus on the frequent, fast and high capacity element of the public transit system; other transit system functions, including local bus, paratransit, streetcar and frequent bus are included in the RTP. High capacity transit is characterized by exclusive right of way and routes with fewer stops. The Regional HCT System Plan is not intended as a review of the regional transit structure or its management, or a complete service analysis of the existing HCT system. Rather, the plan aligns HCT project advancement in a way that supports and enhances the goals of the RTP and regional 2040 Growth Concept.

Transportation in the Portland metropolitan area

- ✓ Over 90 percent of the region's residents live within one-half mile of public transit. 9.2 million rides on bus and MAX were taken during July 2008, a 13.3 percent increase over July 2007, and there are 100 million rides on bus and MAX annually.[1]
- ✓ Twenty-two percent of Portland metro residents use alternative transportation,[2] and 11 percent of the region's workforce walks, bicycles or rides mass transit to work.[3]
- ✓ Portland-Vancouver area residents make an average of about 50 trips per year on transit. Only four of 40 regions in the United States had higher rates in 2004: San Francisco, Boston, Washington D.C. and Philadelphia.[4]
- ✓ Residents of the region drove about 19.5 miles per day in 2003. On average, city of Portland residents drive four miles less than the other 33 most populous U.S. metro areas. These extra miles saved translates into more money in the pockets of Portland residents and an extra $2.6 billion in spending money to invest in our local economy.[5]
- ✓ Transportation activities are the second largest source of greenhouse gases in Oregon, accounting for approximately 34 percent of the state's carbon dioxide emissions. Congestion on our region's freeways increased 20 percent between 2000 and 2005.[6]
- ✓ Trips on transit in the Portland metro region replace more than 205,000 car trips daily, eliminating more than four tons of smog producing pollutants and more than 540 tons of greenhouse gas emissions daily.
- ✓ The regional high capacity transit system has helped to leverage more than $6 billion of development in centers, corridors and station areas, and has been shown to create jobs through construction and long-term development.[7]

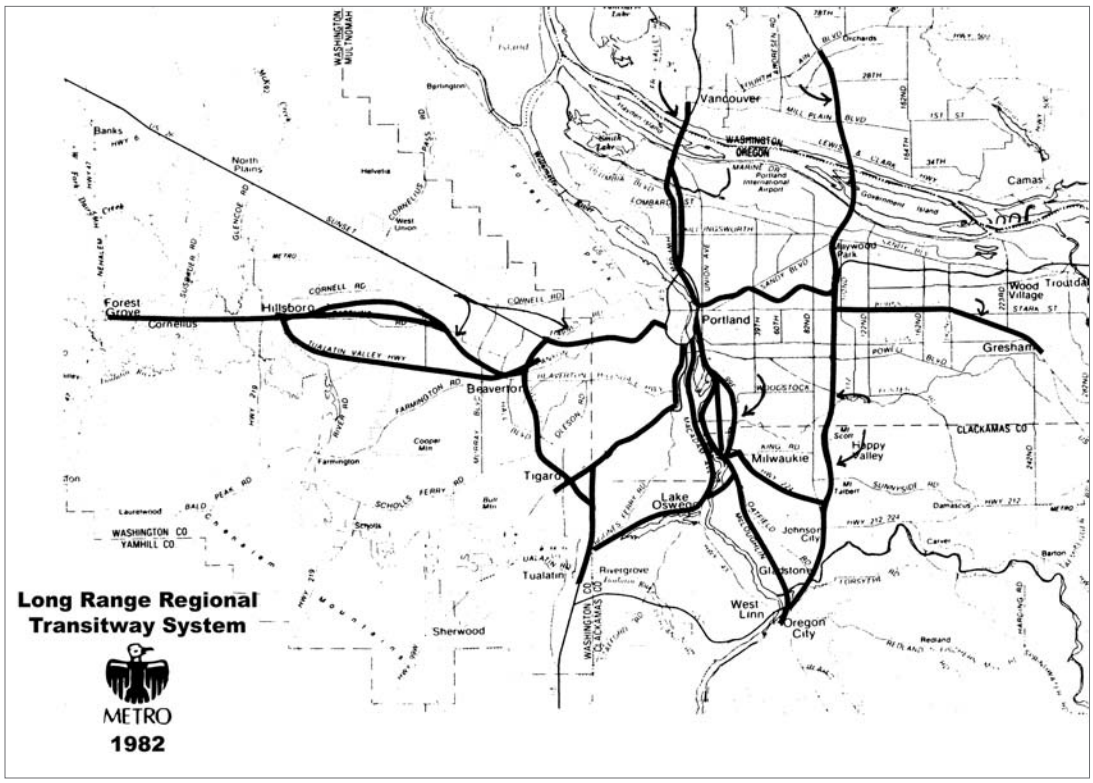
1 Our place in the world, Metro, 2009.
2 American Community Survey, U.S. Census Bureau, 2006.
3 Greater Portland prosperity: a regional outlook, Greenlight, 2008.
4 Metropolitan briefing book, Institute of Portland Metropolitan Studies, PSU, 2007.
5 Portland's green dividend, Joe Cortright, CEOS for Cities, July 2007.
6 Our place in the world, Metro, 2009.
7 Resolution No. 09-4025, Metro, February 2009.

THE CHOICE FOR HIGH CAPACITY TRANSIT IN THE REGION

The last comprehensive examination of regional high capacity transit system needs was the 1982 Light Rail System Plan. Impressively, the 1982 plan has resulted in 64 miles of light rail transit, commuter rail and streetcar being built and an additional 26 miles planned for construction by 2016.

In 1974, elected leaders rejected the so-called Mt. Hood Freeway project after public outcry over its expected cost and the destruction of neighborhoods required for its construction. Following this sea change in transportation policy, the region set aside plans for 54 new highway projects in favor of modest roadway projects and a network of transitways. These plans were codified in the 1975 Interim Transportation Plan and resulting refinements through the 1982 Light Rail System Plan. The 2040 Growth Concept, adopted in 1995 after an extensive public engagement process, calls for high capacity transit service to regional centers.

Figure 1.1: 1982 Light Rail System Plan map



REGIONAL TRANSPORTATION PLAN SCENARIO EVALUATION

As part of the RTP, in the fall of 2008, Metro and partner jurisdictions developed four transportation investment scenarios designed to measure improvements in mobility and access.[1] The scenarios were developed to provide a range of extreme investment decisions that would help illustrate trade-offs between investments. The four RTP scenarios were:

- investing in connectivity
- investing in high capacity transit and its supporting transit network
- investing in throughways
- investing in transportation demand management.

The high capacity transit scenario demonstrated the least increase in transportation-source greenhouse gases, created the least amount of housing growth outside the urban growth boundary and the highest effectiveness in concentrating housing growth in centers and corridors, and produced the greatest increase in transit use, walking and biking. While the high capacity transit scenario performed well, none of the scenarios by iteself would address the region's diverse needs.

When polled on the impact of the high capacity transit scenario in comparison to the other three scenarios, Joint Policy Advisory Committee on Transportation and Metro Policy Advisory Committee members stated that the HCT scenario will better address transportation issues and needs, have a positive ability to support job creation and goods movement, have a positive ability to support local, community aspirations, and have a positive ability to reduce the amount people drive.[2]

1 Transportation investment scenarios, Metro, November 2008.
2 Results of joint MPAC/JPACT meeting, Metro, November 2008.

THE HIGH CAPACITY TRANSIT SYSTEM TODAY

TriMet is the primary transit operator in the region; its district service area encompasses 575 square miles, serving 1.3 million people in the urban portions of Clackamas, Multnomah and Washington counties.[3] More than half the service area's population lives within one-half mile of TriMet service that operates every 15 minutes or better; 90 percent lives within one-half mile of TriMet service. In addition to those light rail lines listed in Figure 1.2, TriMet will open the green line in downtown Portland and to Clackamas Town Center in fall 2009 and the commuter rail line, WES, opened in February 2009. Wilsonville Smart provides service in the southwest corner of the region. Just outside of the Metro region, Sandy Area Metro and Canby Area Transit provide transit service for Sandy and Canby. Bus service in other surrounding areas, all with connections to TriMet, is also provided by C-TRAN (Clark County, WA); Cherriots (Salem, OR); Tillamook County Transportation District (Tillamook, OR); and Yamhill County Transit Area (Yamhill County, OR).

Figure 1.2: 2008 MAX light rail summary[4]

Line	Project/ construction Segment	Open	Length (miles)	Annual ridership opening year	Annual Ridership FY2008	Stations	Park and ride spaces
Blue Hillsboro to Gresham	Eastside- Portland to Gresham	Sept. 1986	15	6,600,000	35,100,000	30	2,898
Blue Hillsboro to Gresham	Westside- Hillsboro to Portland	Sept. 1998	18	5,900,000		20	3,613
Red Beaverton to Airpot	Airport- Gateway to Portland Airport	Sept. 2001	5.5	571,484		4	193
Yellow City Center to Expo	Interstate- Rose Quarter to Expo	May 2004	5.8	3,900,000		10	600
Green City Center to Clackamas Town Center	Downtown- PSU to Union Station Eastside- Gateway to Clackamas Town Center	Sept. 2009	14.5 (8.3 new)	TBD	n/a	20 (15 new)	2,300

3 A profile of the regional transit system in the Portland metropolitan region background paper, Metro, February 2007.

4 Transit Investment Plan, TriMet, 2007.

Portland Streetcar was constructed by the City of Portland. The streetcar is designed to provide local circulation in the central city; it operates in mixed traffic with frequent stops. Ridership has increased by an average of 17.4 percent per year since 2001.[5]

REGIONAL VALUES

Light rail became an important transportation choice for the region when faced with the destruction of established neighborhoods that a new freeway would cause, but it and other modes of high capacity transit continue to support regional values on many other levels. A 2006 survey of regional residents asked what they thought would be the three issues facing the region in 10 years; four of the top five issues mentioned benefit from high capacity transit: traffic congestion and transportation, the economy and jobs, population and growth, and environmental quality.[6]

PLACEMAKING AND REGIONMAKING

Six 2040 fundamentals were adopted as part of the 2040 Growth Concept by the region in 1997:

1. healthy economy
2. vibrant communities
3. environment health
4. transportation choices
5. equity
6. fiscal stewardship.[7]

This section addresses ways the regional HCT system supports these 2040 fundamentals.

Green economic boom

Dating back to 1979 when Metro was created by the voters, the region has been a national leader of the green and sustainable development movement. The Portland metro region often receives accolades for its transportation and land use planning and was recently ranked the top eco-friendly big city in the United States by SustainLane, a web-based guide to sustainable living. It is very possible that as the world transitions away from fossil fuels for most of its energy needs, the region could attract major employers in the fields of sustainability, green nanotechnology and renewable energies. The region should be prepared for rapid economic growth similar to the technology boom that occurred in the Seattle area and Silicon Valley.

Global migration

Climate change and volatile energy costs are likely to impact global migration patterns. Given the Portland region's moderate climate and supply of clear water, many have asked whether the region could accommodate another million residents beyond those already forecasted. If just 10 percent of California's 36 million people moved to the comparably wetter Pacific Northwest, and 30 percent of that wave moved to Portland, the region could gain 1 million residents within a short few years. Such a migration could create additional demand for transit and other forms of transportation.

5 Portland Streetcar Inc., 2009

6 Regional attitudes toward population growth and land use issues, Davis, Hibbits & Midghall, Inc., Metro, February 2006.

7 A profile of the regional transit system in the Portland metropolitan region background paper, Metro, February 2007.

Healthy economy

High capacity transit plays an important role in making the region affordable, attracting a well-educated work force, keeping freight and goods moving and supporting access to new jobs.

Transit supports a healthy economy by providing essential connections between where people live and work. Transit can help reduce the number of cars on the road, which reduces traffic congestion and improves the movement of freight.

The Department of Labor's Consumer Expenditure Survey shows that Portland has the second lowest rate of spending on transportation cost of the 28 largest U.S. metro areas.[8] Since residents spend less on driving, there is more money available to put back into the local economy, an extra $2.6 billion by some calculations.[9]

The emphasis on vibrant communities, reduction of congestion and transportation choices has attracted a passionate, well-educated workforce. During the 1990s, the number of college-educated 25 to 34 years olds increased 50 percent in the Portland metropolitan area, a rate five times faster than the nation as a whole.[10] Between 1995 and 2000, the city added 268 people in that demographic group for every 1,000 of the same group living there in 1995, according to the Census Bureau. Only four other metropolitan areas had a higher ratio.[11] As noted by the Wall Street Journal, transportation choices are part of the hard-to-quantify blend of attractions to the area.[12]

Transit capital investment also creates jobs and increases revenues for local businesses. A report by Cambridge Systematic, Inc. found that for every $10 million dollars invested in transit, 314 jobs are created in the year following investment, and businesses realize a gain in sales three times the

8 Portland's green dividend, Joe Cortright, CEOS for Cities, July 2007.
9 *Ibid*.
10 'Youth magnet' cities hit midlife crisis, Conor Dougherty, The Wall Street Journal, May 16, 2009.
11 American Community Survey, U.S. Census Bureau, 2006.
12 'Youth magnet' cities hit midlife crisis, Conor Dougherty, The Wall Street Journal, May 16, 2009.

Volatile energy costs and peak oil

No one can be sure, but most experts agree that we are approaching the "peak" in worldwide oil and natural gas production where demand exceeds supply, leading to rapid price increases. Fluctuating energy prices are creating pressure to reduce our consumption of fossil fuels and make rapid changes and investments in our transportation system. The sudden energy cost increases could dramatically shift how people travel.

Crude oil prices averaged about $15 per barrel from 1986 to 1999 and about $25 per barrel from 2000 to 2003. Prices climbed to almost $37 per barrel in 2004 and to $51 per barrel in 2005; from 2000 to 2005, crude oil prices rose an average of 14 percent annually.[1] The average price for 2008 was nearly $100 per barrel.[2]

Eighty-five percent of all petroleum is used for transportation, and 95 percent of energy used for transportation in Oregon is oil. Peak oil has direct, major implications for the movement of freight and people to, from and within our region. According to the City of Portland Peak Oil Task Force, automobile use will decline in favor of alternative transportation as oil prices increase in response to lack of supply. The region may have seen a preview of this with recent gas price spikes: between July 2007 and July 2008, the number of daily transit riders increased by more than 13 percent, likely in response to gasoline prices that topped $4 per gallon.[3]

1 *Descending the oil peak: navigating the transition from oil and natural gas, City of Portland Peak Oil Task Force, March 2007.*
2 *Short-term energy and summer fuels outlook, Energy Information Administration, U.S. Department of Energy, April 2009.*
3 *Choices: Transporation investment scenarios, Metro, November 2008.*

investment ($30 million).[13] Additionally, transit has been shown to produce a high net return on investment (4- or 5-to-1).[14] The Portland metro high capacity transit system has been shown to create jobs through construction and long-term development, including more than 50 new businesses that opened along the most recent line, Interstate MAX, since construction.

Vibrant communities

High capacity transit is an important tool for building vibrant, walkable and affordable communities. Transit-oriented developments are large- or small-scale developments organized to take advantage of high quality transit service. A survey of four transit-oriented developments in the Portland metro region, Orenco/Northwest 231st Avenue Station, Elmonica/Southwest 170th Avenue Station, Beaverton Central and The Merrick/Convention Center MAX, demonstrated the power of this development approach to increase transit ridership; 23 to 33 percent of residents take transit to work or school, and 15 percent of riders are 65 years old or older.[15] In the San Francisco Bay Area Rapid Transit discovered that transit-oriented development was one of the most cost-effective ways to reduce greenhouse gas emissions.[16]

A key component of the successful pairing of vibrant communities with high capacity transit is pedestrian connections. Nearly all transit riders are pedestrians at one end of their trip.

Environmental health

Transit supports environmental health. Alternative transportation allows for more compact development that preserves the natural environment and agricultural land, reduces air pollution and is more energy efficient. Transportation activities are the second largest source of greenhouse gases in Oregon, accounting for approximately 34 percent of the state's carbon dioxide emissions. The Governor's

Climate change

Accordining to the University of Washington's Climate Impacts Group (2009), the Pacific Northwest will have average annual temperature increases of 2.2° F by the 2020s, 3.5° F by the 2040s and 5.9° F by the 2080s in comparison with the average annual temperatures from 1970 to 1999. In Oregon, the average snowpack has declined by 30 percent, and the spring runoff is happening sooner. Probable impacts of climate change in the Pacific Northwest include warmer temperatures, wetter winters and drier summers.[1]

Much of the change in the climate is attributed to greenhouse gas emissions, and as much as 35 percent of greenhouse gas emissions in Oregon are related to transportation. Many cities and regions around the world, including the Portland metro region, are actively working to minimize these emissions. As one of five states participating in the Western Climate Initiative, Oregon aims to reduce greenhouse gas emissions 15 percent below 2005 levels by 2020. Transit could play a key role in reducing regional greenhouse emissions, but the system has to have the capacity to meet these goals. (See the section on high capacity transit's role in reducing carbon emmissions, page 76).

1 A framework for addressing rapid climate change, final report to the governor, The Governor's Climate Change Integration Group, State of Oregon, January 2008.

13 Public Transportation and the nation's economy: a quantitative analysis of public transportation's economic impact, Cambridge Systematics, Inc., October 1999.

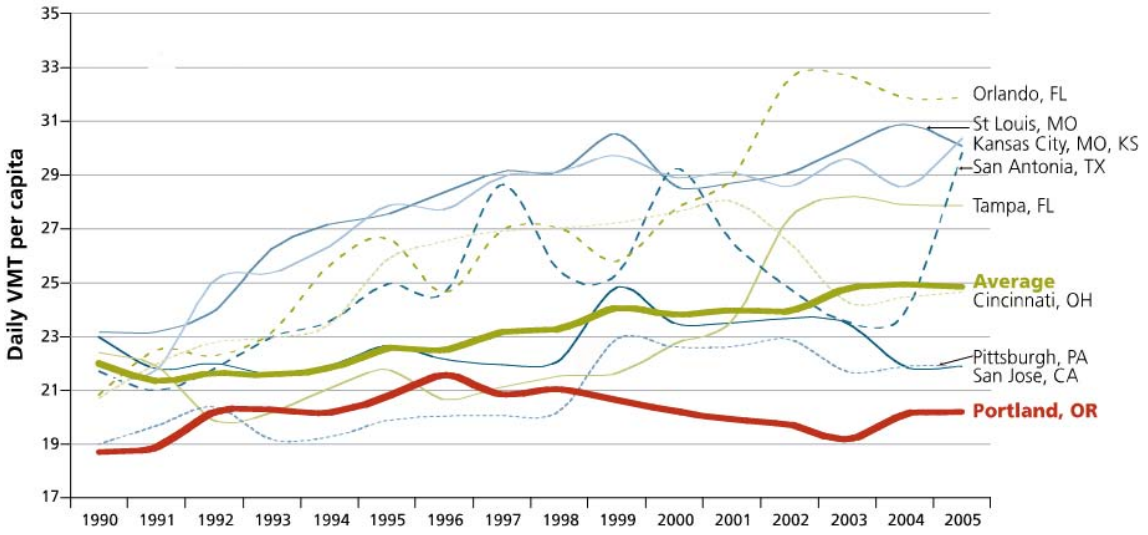
14 Dollars and sense: the economic case for public transportation in America, Donald H. Camph, July 1997.

15 Travel and transit use at Portland area TODs, Jennifer Dill, May 2006.

16 BART action to reduce greenhouse gas emissions: a cost-effectiveness analysis, Nelson\Nygaard Consulting Associates, December 2008.

Climate Change Integration Group stated that reducing vehicle miles traveled, the number of miles that residential vehicles are driven, is the "single most effective way to reduce greenhouse gas emissions."[17] As noted in Figure 1.3, the Portland area has fewer vehicle miles traveled compared to other metropolitan areas with similar populations.

Figure 1.3: Vehicle miles traveled comparison[18]



Transportation choices

A high capacity transit system that is fast, reliable and convenient provides individuals with transportation choices. The complete high capacity transit system facilitates access by bicycling, walking and transit to provide an integrated system of travel options. High quality transit in exclusive right of way helps ease congestion. Traffic congestion growth rates have actually been shown to decline in several U.S. cities after the establishment of light rail service.[19] Additionally, per capita congestion delay is significantly lower in cities with high quality rail transit systems than in otherwise comparable cities with little or no rail service.[20]

High capacity transit allows travelers a choice to avoid traffic congestion. TriMet calculates that the westside MAX Blue Line alone carries the equivalent of an additional 1.2 lanes of car traffic each direction on the Sunset Highway. In fact, MAX carries 26 percent of afternoon rush-hour commuters traveling on the Sunset Highway and Banfield Freeway corridors.[21]

Equity

High capacity transit offers access for individuals of all income levels and special needs residents of the region, including seniors and people with disabilities. Public transportation also serves the economically disadvantaged throughout the region by connecting low-income individuals to employment areas and related social services. The average cost of a public transit trip is substantially less than the average auto trip cost.

17 A framework for addressing rapid climate change, final report to the governor, The Governor's Climate Change Integration Group, State of Oregon, January 2008.

18 The average shown is for the 25 U.S. urban areas with the exception of Portland that have 2005 populations of one million to three million residents. Source: Highway Statistics, Table IM-72, Urban areas – selected characteristics, 1990-2005, U.S. Federal Highway Administration.

19 Comprehensive evaluation of rail transit benefits, Todd Litman, Victoria Transport Policy Institute, June 2006.

20 *Ibid.*

21 Facts about TriMet, TriMet, October 2008..

Fiscal stewardship

When paired with supportive land use, pedestrian connections and growth potential, high capacity transit capital investments can serve more people for fewer operating funds. Despite its high capital cost, high capacity transit can be more efficient and, therefore, fiscally responsible. In a recent exercise, projecting ridership to 2035 as part of the analyses supporting the development of the RTP, 26 miles of light rail transit was compared to 148 miles of new, expanded frequent bus. Although the two were allocated the same operating costs, the light rail transit was projected to have average weekday boardings of 37,000 and the frequent bus had average weekday boardings of 29,000.[22] Rail transit often attracts more choice riders than buses, in part due to its reliability, speed, comfort and integration with land use. When similar sized U.S. cities were compared, those with bus and rail systems and those with bus only systems fared differently over the period from 1996 to 2003. Over this period, bus and rail cities saw transit ridership grow 16 percent compared with 1.7 percent in bus only cities.[23] As of 2003, bus and rail cities experienced 74 percent less in operating and maintenance costs per passenger mile than bus only cities.[24]

Historically, high capacity transit projects have been built using a combination of capital funds from federal, state and local governments and some private sources. The federal support for capital development means that the region has historically paid only a minor share of capital projects out of local funds. This federal support would have otherwise gone to other transit projects in other parts of the country so these projects have offered a good value for local tax payers.

Figure 1.4: Historical regional light rail project funding shares[25]

	FTA *New Starts	TriMet	State of Oregon	FHWA Flex Funds	Local
Banfield light rail and Highway		33%	21%	45%	1%
Eastside light rail	65%	17%	14%	2%	1%
Airport light rail		22%		14%	64%
Interstate light rail	74%	11%		7%	9%
Clackamas light rail/Portland Mall	60%	5%	4%	11%	19%
WES commuter rail	37%	19%	22%	8%	14%
AVERAGE TOTAL	**53%**	**17%**	**9%**	**12%**	**10%**

22 Comprehensive evaluation of rail transit benefits, Todd Litman, Victoria Transport Policy Institute, June 2006.
23 *Ibid.*
24 *Ibid.*
25 TriMet, 2009.

PUBLIC INVOLVEMENT

The last broad-based, region-wide consideration of high capacity transit's role in regional planning dates back to 1982, with some adjustments in later RTP processes, notably the 2000 RTP update, though extensive planning, analysis, and public involvement have surrounded each project. The development of the Regional High Capacity Transit System Plan offered a valuable opportunity to gauge the public's vision for high capacity transit growth and development. Public input was requested during each phase of the process: the identification of corridors to evaluate, the development of evaluation framework and the evaluation and prioritization of corridors.

During the summer of 2008, feedback from residents, businesses, community organizations and elected officials identified 192 potential connections in about 55 corridors around the regions. The more than 50 stakeholders that participated included business and community leaders, transportation and transit providers, safety and security experts, developers, economic development professionals, social service and nonprofit organizations, environmental groups and elected officials. In addition, over 100 attendees contributed at the four workshops, farmers' markets and community events, and 200 people completed the online questionnaire.

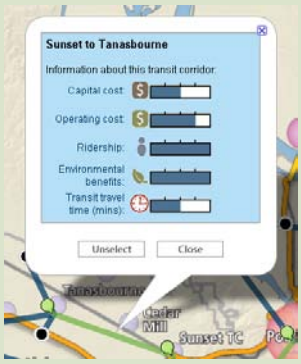
During the winter of 2009, the values collected during public involvement efforts were incorporated into the screening criteria. Staff presented the criteria to 31 existing community groups and to Metro advisory committees. In response, 115 community members, planning staff and elected officials completed a questionnaire about the evaluation framework.

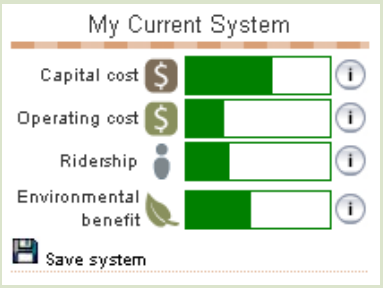
In spring 2009, Metro shared evaluation results with the public to begin discussing trade-offs, choices and priorities using an interactive web site build-a-system tool and online survey and public outreach events. The online survey was completed by 657 people, and the web site was viewed by 4,256 people.

Build-a-system tool

To understand community values related to prioritization of high capacity transit corridors, an online build-a-system tool allowed community members to explore trade-offs between corridors and build their own high capacity transit system.

With the build-a-system tool, community members learned about centers that could be served by high capacity transit and to compare corridors based on ridership, travel time, operations cost, capital cost and environmental benefits.





Participants were able to add corridors to their system until they reached a budget cap that approximated the funding that might be available for new high capacity transit in the next 25 to 30 years. Participants could see the total benefits and cost of their system and compare the benefits and costs between systems that they had created. Finally, participants could submit their favorite system to Metro and complete the online questionnaire. The tool and questionnaire were featured in several news articles.

The preparation of the HCT plan included a robust public involvement program that sought to:

- provide an open and transparent decision-making process conducted through equitable and constructive public discussion and input
- provide early and ongoing opportunities for stakeholders to raise issues and concerns
- proactively inform and engage a wide range of stakeholders in the decision-making process
- build widespread community understanding of findings and decisions
- encourage the participation of all stakeholders regardless of race, ethnicity, age, disability, income or primary language.

For detailed reports on these outreach efforts, see the Regional High Capacity Transit System Plan Public Involvement Outreach Summary (Metro, May 2009).

Themes resulting from outreach efforts

In addition to the specific input on the identification of corridors, the evaluation framework, and the evaluation and prioritization, staff collected overarching themes and policy level public comment. Some of the themes staff heard over the year-long process were access, service and speed, safety and security and connecting HCT to land use.

In general, the public expressed interest in:

- serving employment areas and major institutions, shopping areas and activity centers in addition to regional centers
- integrating stations into surrounding communities and linking stations to communities with bike facilities, pedestrian facilities and local transit service
- connecting land use to public transportation to create compact commercial, residential and mixed-use development to support transit ridership
- connecting suburbs to suburbs and faster service through downtown Portland
- improving access for transit-dependent groups such as low income or elderly populations
- increasing safety and security on transit vehicles, at stations and at crossings

Public outreach

The Regional High Capacity Transit System Plan gained valuable information about regional values through its robust public outreach process. The outreach included:

summer 2008

- ✓ interviews with 50 stakeholder groups
- ✓ four workshops with 100 attendees
- ✓ presentations at farmers' markets and events
- ✓ online questionnaire with 200 participants

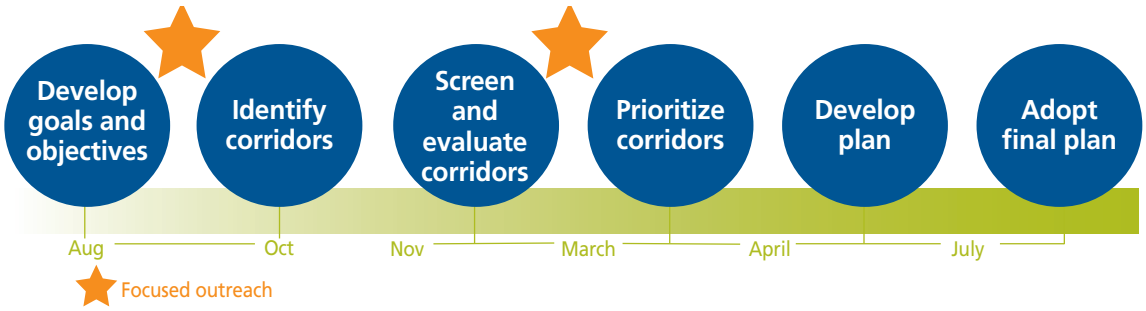
winter 2008 and spring 2009

- ✓ presentations to 31 groups
- ✓ a questionnaire with 115 participants of community members, planning staff and elected officials
- ✓ the build-a-system tool with 657 survey participants and 4,256 website visits.

- increasing budget and funding sources for high capacity transit
- filling in gaps and serving areas that are not served with high capacity transit today
- reducing congestion on roadways by reducing auto dependence and providing reliable transit with travel times that are competitive with driving
- supporting development or redevelopment in the region
- providing better transit service and existing system improvements in the city of Portland and other urbanized areas to reduce pressure to develop new areas.

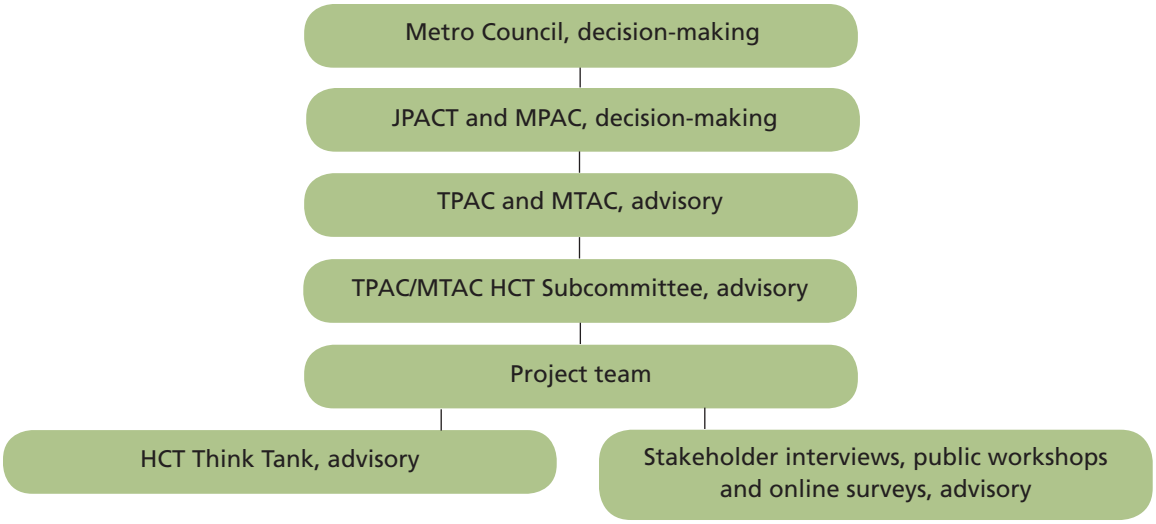
For individual reports on these outreach results, see the High Capacity Transit System Plan public involvement outreach summary (Metro, May 2009).

Figure 1.5: Project schedule of key decision points and focused outreach, August 2008 to July 2009



DECISION-MAKING

Figure 1.6: Decision-making process



The decision-making process for the High Capacity Transit System Plan was framed within existing Metro advisory committees. The High Capacity Transit Subcommittee was comprised of 18 representatives from the Metro Technical Advisory Committee and the Transportation Policy Alternatives Committee or the designees of the members. The subcommittee was charged with reviewing public input and technical analysis to provide guidance and consensus-based recommendations that reflected the interests and priorities of local jurisdictions through the High Capacity Transit System Plan process. The subcommittee provided ongoing guidance to the project and formal consensus-based recommendations to MTAC and TPAC at key decision points such as the identification of alternatives, development of an evaluation framework and prioritization of alternatives. MTAC and TPAC then made formal recommendations to the Metro Policy Advisory Committee, the Joint Policy Advisory Committee on Transportation and the Metro Council.

HCT Think Tank

The Portland area has historically been a center of activity for discussion of progressive approaches to land use, transportation and the integration of these in achieving quality communities with vibrant economies. As a result, the region has produced some of today's leading thinkers and practitioners on these subjects. The High Capacity Transit Think Tank was intended to bring together a cross section of these experts and activists at major milestones to ensure the Regional High Capacity Transit System Plan considered and benefited from this body of knowledge and experience. The group was not intended to embody a full representation of the community, but rather a cross section of specialized knowledge and interests.

The HCT Think Tank raised several crucial themes and questions to consider as part of the vision for high capacity transit within the region.

- ✓ Consider Portland's history in moving forward and be true to the region's values.
- ✓ Use high capacity transit as a tool for placemaking and regionmaking.
- ✓ Reinforce the concept of 20-minute neighborhoods within the region on a local level.
- ✓ Use high capacity transit to link residents to the global society.
- ✓ Balance the tension between the present in individual terms and the future in community and collective terms.
- ✓ Consider all existing rights of way as "land banking" for the transit system.
- ✓ Promote federal policy changes to level the playing field for federal transportation funding in favor of transit.
- ✓ Look beyond the norm and shift cultural expectations in order to serve and balance the needs of diverse constituencies.
- ✓ Create a complete, integrated system that includes pedestrians, bicycles and bus.
- ✓ Reinforce redundancies and diversity in the transit network for disasters.

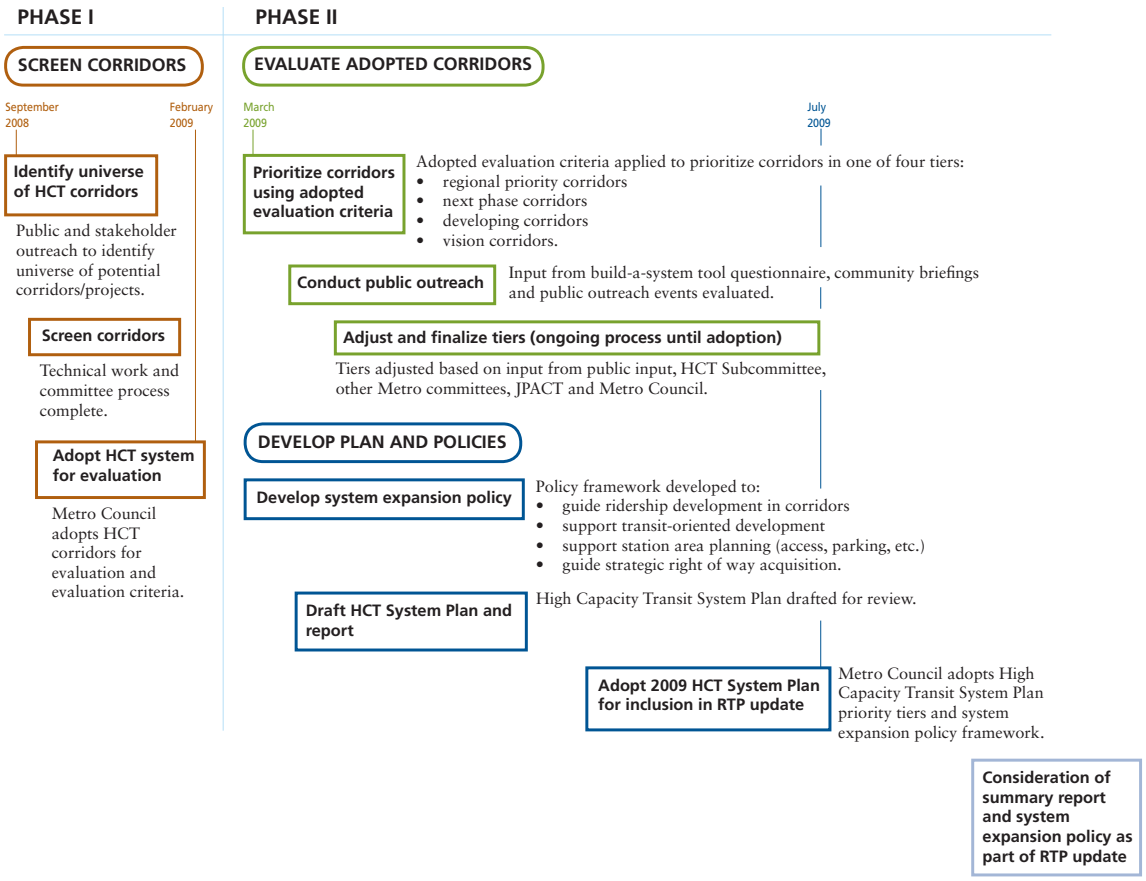
2. HIGH CAPACITY TRANSIT CORRIDOR PRIORITIZATION AND ADVANCEMENT

Metro is working with local partners to define how regional and local aspirations come together to create vibrant, healthy and sustainable communities. This effort is called, "Making the Greatest Place", and the HCT plan is one component of this effort. The challenges of climate change, rising energy costs, economic globalization, aging infrastructure and population growth require regional land use and transportation decisions to be supported by local decisions and actions. Much of the region remains auto dependent due to the relatively low level of transit supportive land use outside major urban centers. The Regional High Capacity Transit System Plan used an extensive evaluation process to identify regional priorities for high capacity transit investment over the long-term (30 years) and in the near-term (next 4 years).

SUPPORT OF METRO VISION AND RTP GOALS, PERFORMANCE MEASURES

HCT system capital investments must be recognized as an element of a much broader corridor strategy that includes supportive land use and transit-oriented development, comprehensive parking programs, well developed access systems for pedestrians and cyclists, park and rides and feeder bus networks.

Figure 2.1: Regional HCT System Plan process diagram

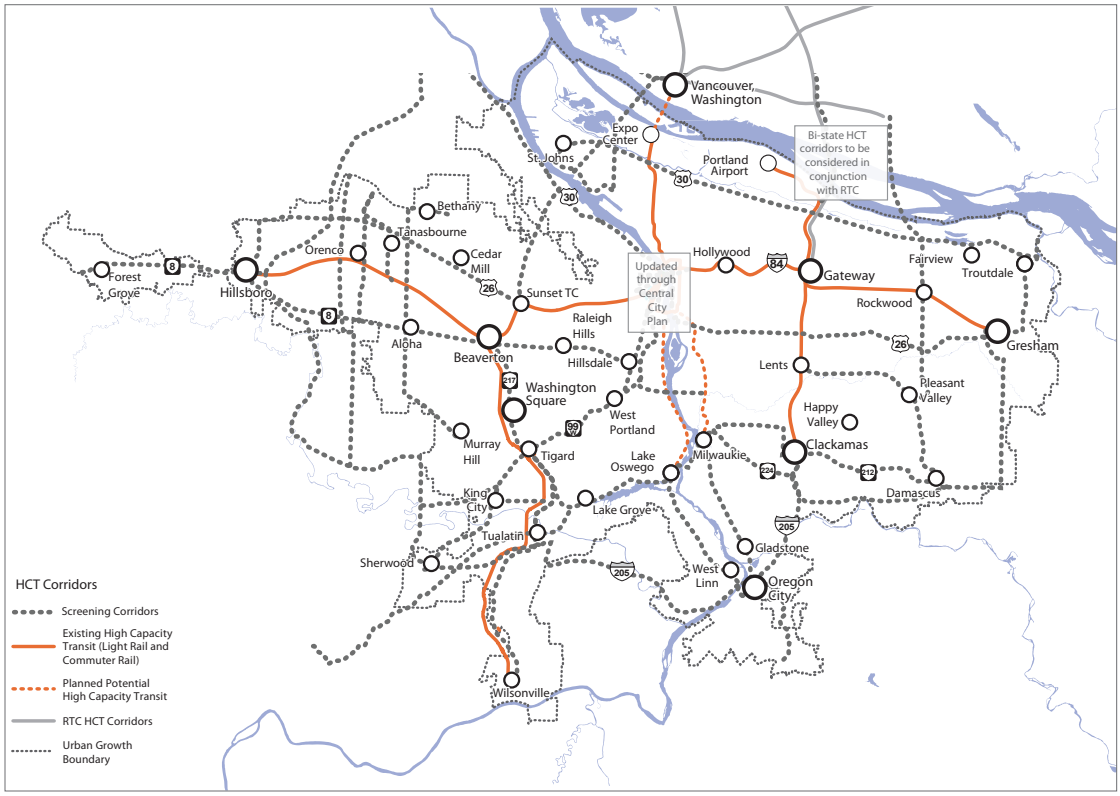


EVALUATION METHODOLOGY

Phase one: Identification of corridors and development of screening criteria

Public workshops, stakeholder interviews and review of numerous past regional transit planning efforts were considered in developing a "long list" of potential regional HCT corridors to be studied. At the completion of this work, the universe of potential corridors totaled 55, as shown in Figure 2.2.

Figure 2.2: Universe of corridors for screening evaluation



The intent of the screening was to eliminate corridors that could not reasonably support an HCT investment in the next 30 years; however, some corridors where projected 2035 land uses are not supportive of HCT were retained for other reasons, such as demonstrated local aspirations to meet transit-supportive land use requirements. An early phase evaluation was applied to reduce the list of potential corridors, so more intensive evaluation of the best candidate corridors could be completed.

Eight criteria were used to screen the corridors:

- ridership
- corridor availability and cost
- environmental constraints
- equity
- connectivity and system benefit
- congestion
- 2040 Growth Concept land use
- origins and destinations transit demand.

A set of 18 high capacity transit corridors was identified and adopted for evaluation and prioritization by the Metro Council on Feb. 12, 2009 (Figure 2.3). Additionally, two central city service improvement projects, a tunnel through downtown Portland and an eastside connector, were evaluated separately from the other corridors. Potential corridor extension to neighboring cities were also evaluated separately, as discussed later in this report.

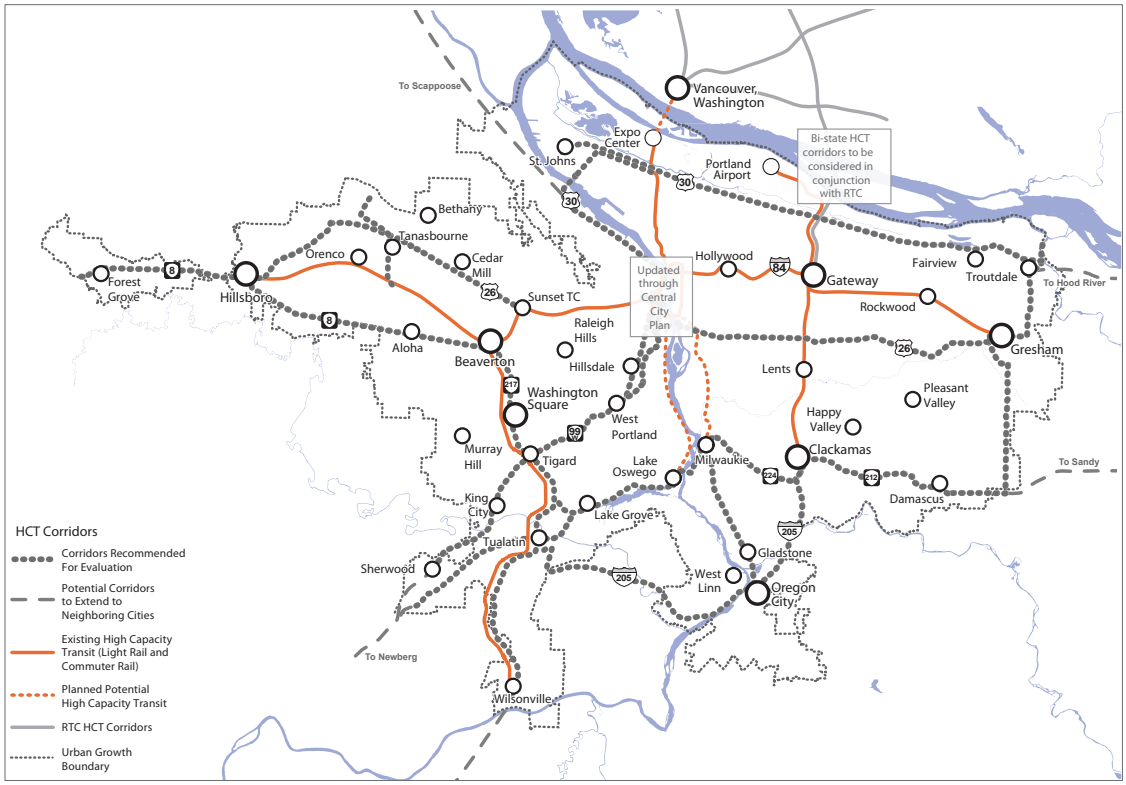


Figure 2.3: Corridors advanced for detailed evaluation and prioritization

For details on the screening process, see the Regional High Capacity Transit System Plan final screening results memo (Nelson\Nygaard, February 2009).

Phase two: Detailed evaluation of adopted corridors

In the fall of 2008 and early 2009, Metro worked with local jurisdictions and regional partners, including TriMet, to develop and refine a set of evaluation criteria to be used to evaluate and prioritize the screened HCT corridors. The evaluation criteria were organized using a multiple account evaluation approach.

This approach is consistent with the Regional Transportation Plan outcomes-based evaluation approach, in which three areas of benefit are stressed: community, environment and economy. Additionally, a deliverability account was added to determine a corridor's near-term readiness.

Within each category, several measures were used to assess near-term and long-term benefits and impacts of implemented HCT investments. Figure 2.4 presents how the process was aligned with the RTP evaluation approach.

Multiple account evaluation

The multiple account evaluation approach was adapted and refined from a standardized methodology employed in the United Kingdom for evaluation of major transportation projects. This approach, called the new approach to appraisal, is a multi-criteria decision analysis based tool that builds on already well established cost-benefit analysis and environmental impact assessment techniques.

The multiple account evaluation approach was chosen for the HCT System Plan because of its ability to provide decision-makers with data in a number of key areas, allowing them to assess the cost and benefits of proposed HCT investments. The process also aligned closely with the Regional Transportation Plan framework, which ensured consensus among regional partners.

Figure 2.4: 2035 RTP evaluation approach and deliverability

The evaluation approach aligns specific HCT plan recommendations with the hierarchy of regional planning objectives.

- 2040 Growth Concept (vision)
- 2035 Regional Transportation Plan (implementing the 2040 Growth Concept)
- Regional High Capacity Transit Plan (supporting RTP Goals)

Figure 2.5 summarizes the specific criteria under each account: community, environment, economy and deliverability. For more detailed descriptions of these criteria, see the Regional High Capacity Transit System Plan detailed evaluation report (Nelson\Nygaard, third draft, April 2009).

Figure 2.5: High Capacity Transity System Plan evaluation criteria

	Community
C1	Supportiveness of existing land uses
C2	Local aspirations
C3	Placemaking and urban form
C4	Ridership generators
C5	Support of regional 2040 Growth Concept
C6	Integration with regional transit system
C7	Integration with other land uses*
C8	Congestion avoidance benefit**
C9	Equity benefit
C10	Health (promotion of physical activity)**
C11	Safety and security***
C12	Housing and transportation benefit
C13	Transportation efficiency or travel time benefit to individual user**
C14	Transportation efficiency or travel time benefit to all corridor users**
	Environment
EN1	Reduction in emmissions and disturbance**
EN2	Risk of natural resources disturbance
EN3	Risk of 4(f) resource disturbance***
	Economy
EC1	Transportation efficiency (operating cost per rider)**
EC2	Transportation efficiency annual capital and operating cost per rider)**
EC3	Employment served
EC4	Vacant and rebuilding/redevelopment land
	Deliverability
D1	Total project capital cost (exclusive and nonexclusive right of way options)
D2	Capital cost per mile (exclusive and nonexclusive right of way options)
D3	Operating and maintenance cost**
D4	Total corridor ridership**
D5	Funding potential**

** Addressed through the mobility corridors work in coordination with Oregon Department of Transportation*
*** Criteria which are evaluated, at least in part, using regional travel demand outputs*
****Discussed later in this report*

It should be noted that two criteria, safety & security and risk of 4(f) resource disturbance, were not evaluated at the corridor level because the results would not show a difference between the corridors at this level of analysis. Issues related to these two criteria would be addressed through alignment alternatives studies and design solutions. Another criterion, integration with other road uses, was deferred to the regional mobility corridor process being undertaken by Metro in support of the RTP update. A discussion of issues relating to these criteria is provided in the best practices for building great communities with transit at the center section of this report (page 49).

Using the adopted evaluation criteria, a detailed evaluation was conducted on the 18 corridors. For each corridor, the criteria were either quantitatively or qualitatively applied or given an assessment using a scale between significant benefit to significant constraint or adverse impact.

Where quantitative data was available as part of a criterion evaluation, natural data breaks were employed in the scoring process. Where possible, criteria were rated against a baseline or reference case (in this case, the RTP 2035 reference case) and criteria scoring for all corridors were shown as either having a beneficial or adverse impact, as shown in Figure 2.6.

Figure 2.6: Criteria scoring method

Assessment	Natural data break	Rating
Significant benefit	4th	3
Moderate benefit	3rd	2
Slight benefit	2nd	1
Neutral	1st	0
Slight constraint/adverse impact	2nd	-1
Moderate constraint/adverse impact	3rd	-2
Significant constraint/adverse impact	4th	-3

Note: For most criteria with quantitative evaluation outputs, four natural data breaks were applied indicating the level of benefit or constraint – from neutral to significant benefit. In all cases, the first break was considered to fall close to neutral and was indicated as such. For several of the criteria, it was determined that the corridors needed to be scored using the full range of impacts – from significantly adverse to significant benefit – in which case seven natural breaks were used.

The technical evaluation was documented and presented to the HCT Subcommittee for review and consideration. After considering several options for balancing evaluation criteria, the subcommittee determined that an equal weighting of all adopted criteria was the best determinant of project prioritization and was most reflective of public input, RTP goals and the 2040 Growth Concept vision.

Local aspirations workshops

Making a vision a reality is not a simple task. Metro initiated a local aspirations process to help each community establish its own voice as the region prepares for regional growth management and transportation systems decisions in 2009 and 2010.

These decisions include the identification of transportation investment priorities and how to best accommodate the next 20 to 50 years of population and employment growth. Over the long term, the aspirations of local communities to accommodate that growth will inform the deployment of Metro's technical and financial assistance to support communities in implementation of the 2040 Growth Concept, the region's blueprint for managing growth.

To inform these decisions and use regional investments wisely, Metro held four workshops to understand the aspirations of each unique community and engage in an ongoing dialogue with local partners to document community aspirations as related to high capacity transit.

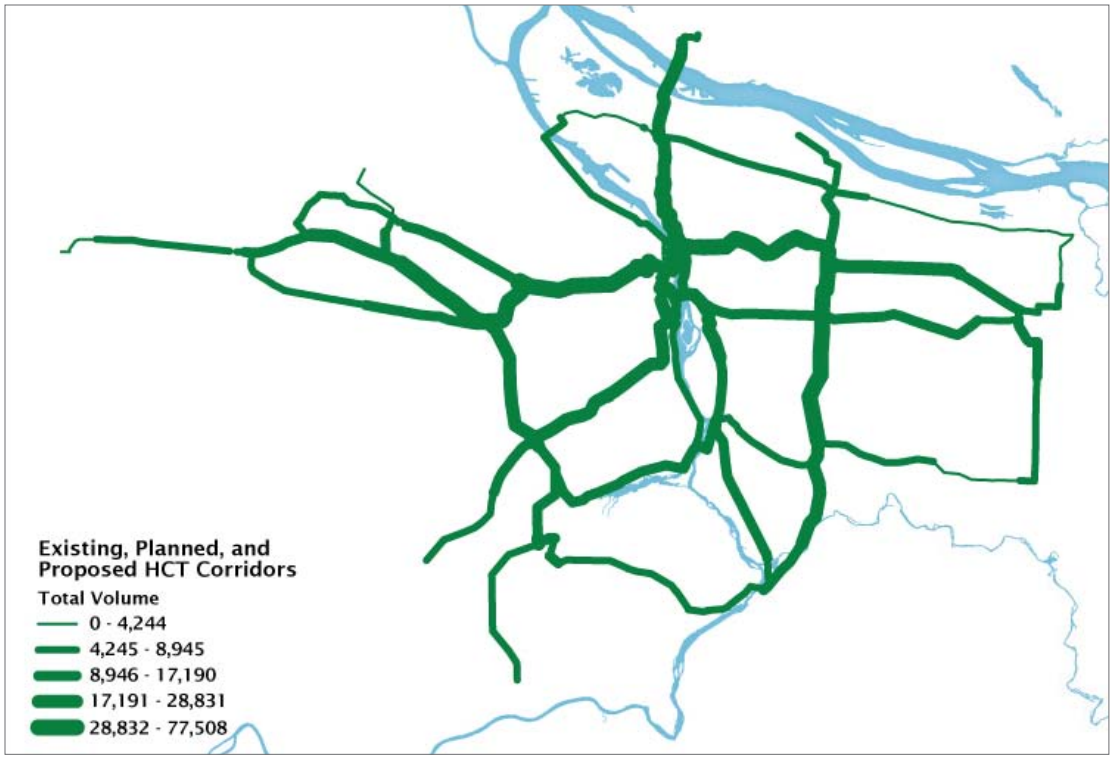
EVALUATION RESULTS AND ADVANCEMENT PROCESS

The Regional High Capacity Transit System Plan identifies near- and long-term regional HCT priorities. The system expansion policy component of the HCT plan provides a framework to advance future regional HCT corridors by setting targets and defining regional and local actions that will guide the selection and advancement of those projects.

All corridors were evaluated assuming light rail transit as the primary investment mode. This decision was made to simplify evaluation requirements and to ensure that all corridors were evaluated evenly. A more detailed analysis of each corridor is included in the Regional High Capacity Transit System Plan detailed evaluation report (Nelson\Nygaard, July 2009), including a discussion of other viable HCT modes. Ultimately, mode decisions will be made as corridors enter into the Federal Transit Administration Alternatives Analysis process. Corridor communities that wish to consider lower cost transit modes can use system expansion policy targets to assess whether a different mode could improve the priority ranking of their project (see system expansion policy framework section, page 25).

The full detail of the screening and corridor evaluation are included in technical reports available on Metro's web site at www.oregonmetro.gov. Highlights from these reports are summarized below.

Figure 2.7: Future transit ridership volumes for evaluated corridors



High capacity transit priority tiers

All corridors that were evaluated in detail are priority regional transportation corridors in which future high capacity transit could serve an important function. Certain corridors are much more viable in the near term. To distinguish near-term regional priorities from corridors that will need time to develop, a simple set of priority tiers was established. The set of near-term projects was constrained to two or three based on the region's history of project implementation. In the past 25 years, Metro and TriMet have taken on a major investment analysis about every three years. If regional policy makers were to choose to dedicate more resources toward HCT corridor evaluation and development, it could influence the number of HCT projects the region takes on over time and the speed of HCT system expansion. Metro and TriMet are constrained when it comes to working with the federal government to obtain funding for capital development. For example, obtaining funding through the Federal Transit Administration's New Starts grant process takes seven or eight years on average from initiation of a federal alternatives analysis to completion of a full funding grant agreement.

The Regional HCT System Plan recommends near-term regional priority corridors receive top priority for advancement to a federal alternatives analysis, federal funding and implementation. However, no corridor is guaranteed advancement, and every corridor has the opportunity for rapid advancement by meeting system expansion policy targets to be defined in the 2010 Regional Transportation Plan update.

Figure 2.8 summarizes the priority tiers and (with figures 2.9 to 12) shows which projects were ranked in each tier. Priority tiers will be updated each time the Regional Transportation Plan is updated or by amendment to the RTP.

Figure 2.8: Summary of HCT priority tiers

Tier	Tier description	Corridors* (not listed in order of performance)
Near-term regional priority corridors	Corridors that are most viable for implementation in next four years.	10 – Portland to Gresham in the vicinity of Powell corridor 11 – Portland to Sherwood in the vicinity of Barbur/Highway 99W corridor 34 – Beaverton to Wilsonville in the vicinity of WES**
Next phase regional priority corridors	Corridors where future HCT investment may be viable if recommended planning and policy actions are implemented.	8 – Clackamas Town Center to Oregon City in the vicinity of I-205 corridor 9 – Park Avenue to Oregon City in the vicinity of McLoughlin corridor (extension) 17 – Sunset Transit Center to Hillsboro in the vicinity Highway 26 corridor/ Evergreen 17D – Tanasbourne (extension) 28 – Clackamas Town Center to Washington Square in the vicinity of I-205/ Highway 217 corridors 29 – Clackamas Town Center to Washington Square in the vicinity of railroad right of way 32 – Beaverton to Hillsboro in the vicinity of TV Highway 55 – Gateway to Salmon Creek in the vicinity of I-205 corridor***
Developing regional priority corridors	Corridors where projected 2035 land use and commensurate ridership potential are not supportive of HCT implementation, but which have long-term potential due to political aspirations to create HCT supportive built form.	12 – Hillsboro to Forest Grove (extension) 13 – Gresham to Troutdale (extension)
Regional vision corridors	Corridors where projected 2035 land use and commensurate ridership potential are not supportive of HCT implementation.	13D – Troutdale to Damascus 16 – Clackamas Town Center to Damascus 38S – Sherwood to Tualatin

**Corridors presented in each tier are sorted by numeric order only; corridor numbers refer to identifications used in the scoring and evaluation processes.*

***Corridor 34: WES frequency improvements to 15-minute all day service are currently included in the state RTP financially constrained list of projects. The project as included in the RTP represents this level of improvement phased in over time, not construction as light rail as evaluated in the Regional HCT Plan technical evaluation.*

****Corridor 55 (Gateway to Salmon Creek) was selected as part of the Southwest Washington Regional Transportation Council HCT System Plan and was not ranked based on evaluation criteria used in this plan.*

Figure 2.9: Near-term regional priority corridors

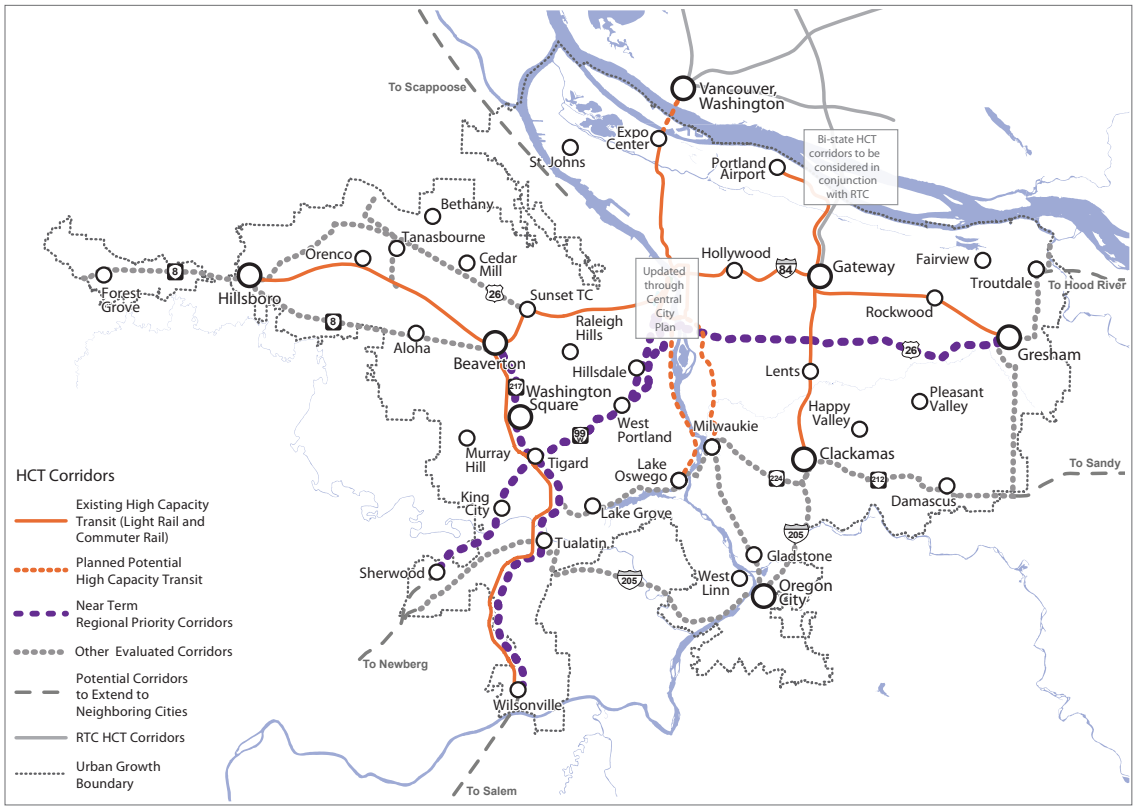


Figure 2.10: Next phase regional priority corridors

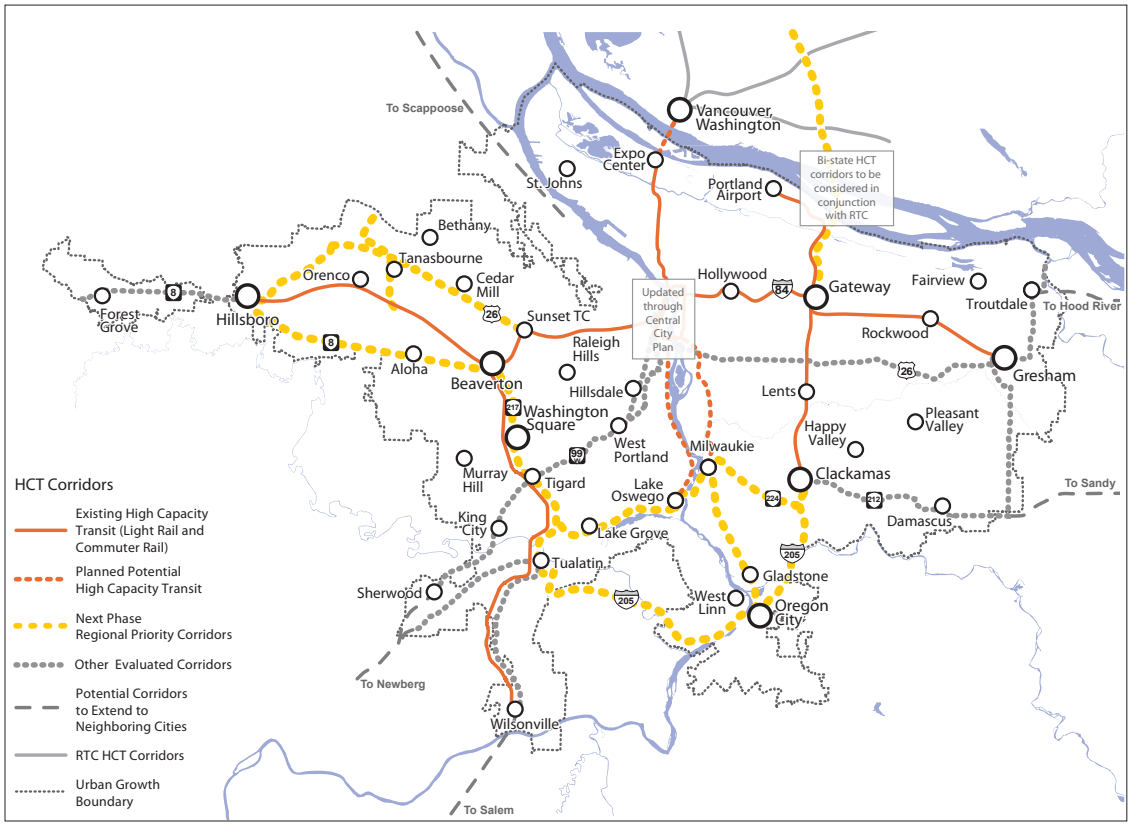


Figure 2.11: Developing regional priority corridors

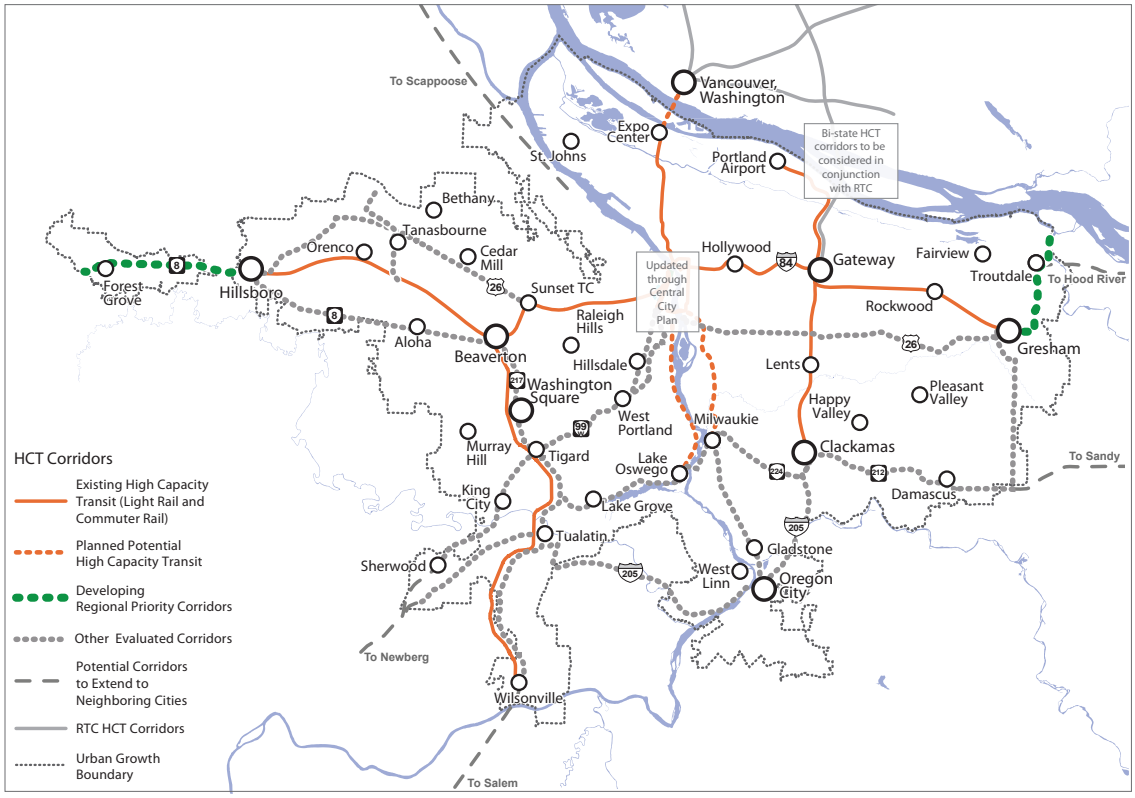
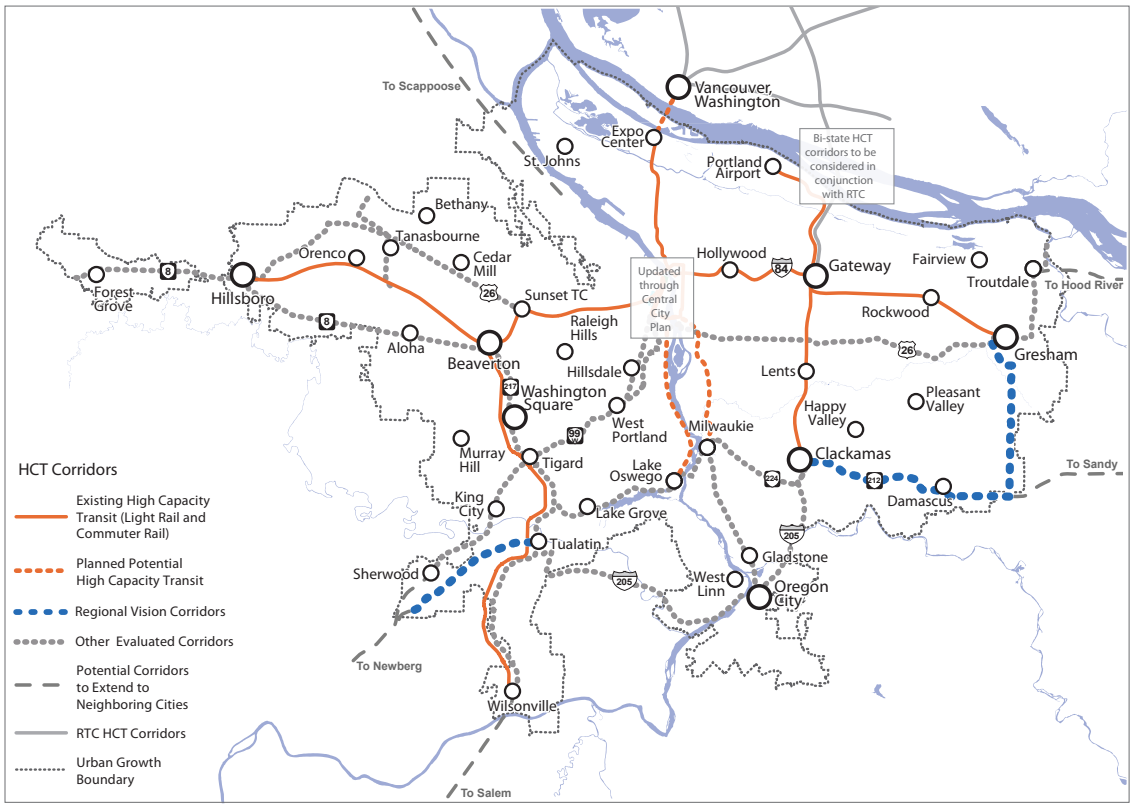


Figure 2.12: Regional vision corridors



"The Portland region is more fortunate than most. It has already defined a future vision by adopting the 2040 Growth Concept of compact, mixed-use development designed for walking and bicycling. Now it needs to support this ambitious vision with a transportation system that will make it work: a regional framework of light rail transit connected by frequent and reliable bus and streetcar service to smaller centers and neighborhoods, supported by safe and convenient facilities for pedestrians and bicyclists of all ages.

"The criteria for implementing this system needs to be not increased mobility or even reduced congestion, but the social and economic vitality of all of the region's communities. Therefore, the public's investment in transportation must further other regional goals. Light rail stations and transit centers must be located and designed to attract the stores, businesses, and housing that revitalizes and sustains neighborhoods. Public transit must connect residential areas and employment centers."—*Myron Orfield, "Portland Metropolitics," Coalition for a Livable Future, July 1998.*

SYSTEM EXPANSION POLICY FRAMEWORK

The system expansion policy framework is designed to provide a transparent process agreed to by Metro and local jurisdictions to advance high capacity transit projects through the tiers. The framework is based on a set of targets designed to measure corridor readiness to support a high capacity transit project.

The system expansion policy framework:

1. identifies which near-term regional priority corridors perform best in the analysis and therefore appear to be the best candidates to move into the federal project development process toward implementation
2. delineates a process by which potential HCT corridors can move closer to implementation, advancing from one tier to the next through a set of coordinated Metro and local jurisdiction actions.

Based on the tiered category, regional actions would be aligned with concurrent work in each corridor while local actions would focus on meeting HCT system expansion targets. In near-term corridors, formal corridor working groups would be established. Other corridors would coordinate work through existing processes.

Figure 2.13 illustrates the process for project advancement under the system expansion policy.

System expansion policy framework concepts

This section elaborates on terms used in Figure 2.13 to describe local actions, regional actions and targets proposed for HCT project advancement. The process for advancing projects and specific targets for project advancement will be refined as part of the Regional Transportation Plan update.

Figure 2.13: Local actions matrix

Tiers	Potential local actions	Potential regional support	Potential system expansion targets	Potential strategies
Near-term regional priority corridors	Develop corridor problem statement. Define corridor extent. Assess corridor against system expansion targets. Create ridership development, land use and TOD plans for centers and stations. Assess mode and function of HCT. Create multimodal station access and parking plans. Assess financial feasibility.	Create land use and TOD plans for centers and stations. Analyze station siting alternatives. Coordinate with MTIP priorities. Perform multi-modal transportation analysis. Create multimodal station access and parking plans. Start potential alternatives analysis.	Transit supportive land use/station context Community support Partnership/political leadership Regional transit network connectivity Housing needs supportiveness Financial capacity – capital and operating finance plans Integrated transportation system development	Corridor working group Existing land use and transportation working groups
Next phase regional priority corridors	Develop corridor problem statement. Define corridor extent. Assess corridor against system expansion targets. Create ridership development, land use and TOD plans for centers and stations. Assess mode and function of HCT.	Create land use and TOD plans for centers and stations. Analyze station siting alternatives. Coordinate with MTIP priorities.	Transit supportive land use/station context Community support Partnership/political leadership Regional transit network connectivity Housing needs supportiveness Financial capacity – capital and operating finance plans	Existing land use and transportation working groups
Developing regional priority corridors	Develop corridor problem statement. Define corridor extent. Assess corridor against expansion targets. Create ridership development, land use and TOD plans for centers and stations.	Create land use and TOD plans for centers and stations. Analyze station siting alternatives.	Transit supportive land use/station context Community support Partnership/political leadership Regional transit network connectivity	Existing land use and transportation working groups
Regional vision corridors	Develop corridor problem statement. Define corridor extent. Assess corridor against system expansion targets. Create ridership development, land use and TOD plans for centers and stations.	Create land use and TOD plans for centers and stations.	Transit supportive land use/station context Community support	Existing land use and transportation working groups

Local action descriptions

Local actions would be structured to help local jurisdictions move their project toward targets set for project advancement. Some or all of the following actions could be taken to advance a project, depending on the tier placement.

Develop corridor problem statement: The corridor problem statement defines the purpose of and establishes goals for the proposed HCT investment (i.e., congestion mitigation, economic development, etc.). It assesses the role of the project in addressing other regional transportation priorities and identifies opportunities for integration with other transportation system improvements in the corridor.

Define corridor extent: As in a federal alternatives analysis, the definition of corridor extent could encompass multiple alignment corridors or options.

Assess corridor against system expansion targets: Progress toward all system expansion targets for the current priority tier is identified.

Create ridership development, land use and transit-oriented development plans for centers and stations: Assessment of potential future ridership based on current land use projections, identified station areas and local zoning. This might involve demand modeling, but could effectively use Transit Orientation Index (TOI) scores within one-half mile of identified station areas. A ridership development plan could include assessment of TOI score, residential density, employment density, potential cost-effectiveness and transit supportive land uses (zoning and station typology aspirations).

Assess mode and function of HCT: The HCT modes that are most relevant for meeting the primary function of a corridor's problem statement are defined. Selection of a lower cost mode could improve the corridor's ability to meet targets.

Create multimodal station access and parking plan: The station access plan would ensure that station designs optimize opportunities for intermodal connections and transit-oriented development by planning for an urban block pattern. The parking management plan would help local jurisdictions develop transit-supportive parking policies that include development of potential parking districts. It could also establish maximum parking requirements, pay-for-parking, park and ride development and management plans, and other parking code changes such as unbundling parking for new development.

Assess financial feasibility: Financial feasibility of the region to advance an HCT project is examined. The analysis would consider and propose incentives to finance existing and future infrastructure improvements, using tools such as system development charge credits, tax abatement, improvement districts and tax increment financing.

Regional support descriptions

Regional support will be necessary to advance any corridor. Regional actions may already be in place, such as work coordinated through the transportation system plans; however, specific regional actions to support HCT project advancement would vary based on the tier.

Create land use and transit-oriented development plans for station areas: Land use and transit-oriented development plans for corridors would be reviewed for local areas to ensure that station areas within a defined corridor extent can meet defined targets for ridership and transit supportive land use.

Analyze station siting alternatives: Locations of stations are critical to the success of the HCT system. Metro has advanced tools to work in tandem with locals to assess the trade-offs between potential station areas.

Coordinate with Metropolitan Transportation Improvement Program priorities: HCT investments should align with regional priorities for transportation and land use investments. MTIP prioritization would support development or preparation of a corridor as an HCT project.

Perform multi-modal transportation analysis: Metro will assist with the preparation and production of transportation modeling for near-term regional priority corridors. Metro will assist corridors in other tiers as well; however, methods may vary.

Create station access and parking plans: Parking availability is one of the strongest determinants of transit ridership and has the potential to add significant value to leverage regional HCT investment. Metro has tools for the region to review parking plans for all land use types; regional support action will coordinate with and aid local action.

Start potential alternatives analysis: The region can begin the process to help projects advance into federal alternatives analysis process.

Proposed system expansion target descriptions

A small set of system expansion targets will be identified to measure project readiness and contribution to regional goals. These targets will provide clear direction to local jurisdictions that desire to advance projects. System expansion targets would vary based on the tier.

Transit supportive land use/station context: Under this target, each station along a proposed alignment should be evaluated for ridership potential based on the jurisdiction's demonstrated willingness to promote transit supportive development. Specific targets could be set for residential, commercial and employment density in station areas. Additionally, each station should undergo an evaluation to determine: (1) the capacity for station area development, (2) ability to create good station access for all modes and (3) any issues with station capacity or functionality.

Community support: This measure would be qualitative, based on expressed support for HCT service in the corridor.

Partnership/political leadership: This measure would be qualitative based on demonstrated political leadership, development of strategic partnerships and demonstrated advancement of local aspirations.

Regional transit network connectivity: This measure would assess the role the project plays in filling key regional transit system gaps, connectivity with the existing and planned systems and ability for existing system facilities to support the investment. It would also measure a project's impact on the regional HCT system's ability to increase system capacity to deal with malfunction, incident or construction/maintenance, and the ability for existing station and track infrastructure to support the investment.

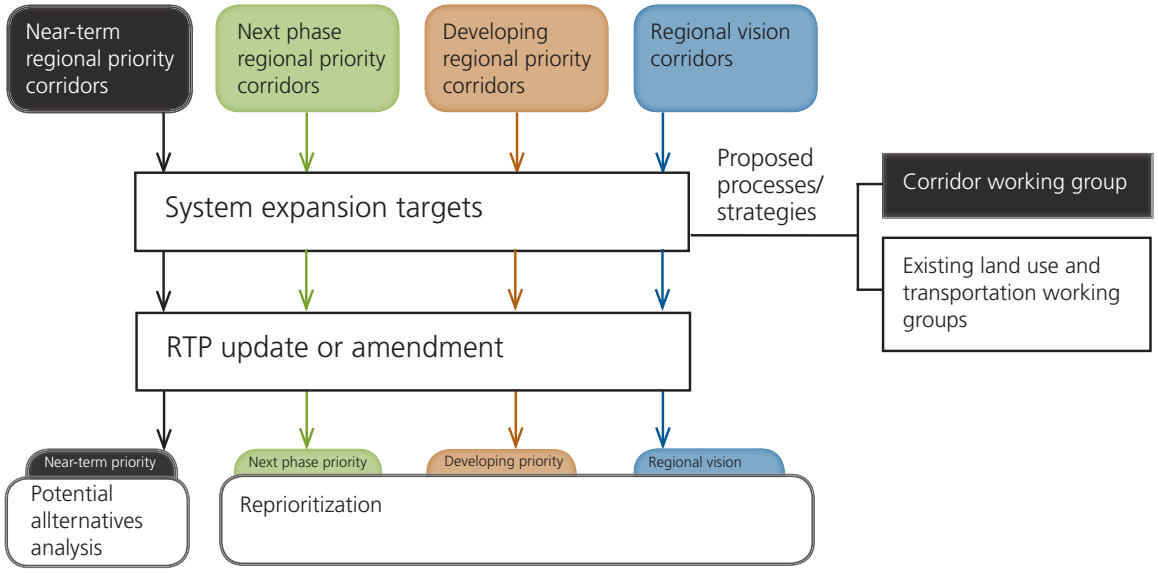
Housing needs supportiveness: This measure would assess the contribution of the project to improve overall housing and transportation affordability for populations of concern.

Financial capacity (capital and operating finance plans): This measure would assess the capacity to fund capital and operations with no significant negative consequences on existing infrastructure or transit system operations. This evaluation could include:

> **Capital finance plan:** A qualitative rating based on whether a project is partially or fully funded, the availability of local capital funds and competition for funding that is needed for core system capacity enhancements or maintenance.
>
> **Operating finance plan:** A preliminary analysis of the financial capacity to operate using measures such as estimated farebox recovery, cost-effectiveness (total annualized operating and capital cost per passenger), and the stability, reliability and availability of proposed operating subsidy.

Integrated transportation system development: This measure would quantitatively assess the role each project would play in addressing a broad range of regional transportation priorities, particularly those priorities for the mobility corridor in which the corridor is located.

Figure 2.14: System expansion policy process



3. HIGH CAPACITY TRANSIT SYSTEM DEVELOPMENT

This plan reviews and prioritizes future regional high capacity transit corridors for the Portland metro region. A critical consideration when prioritizing a HCT investment is how well the corridor integrates into the entire transit system, including the conventional bus and streetcar system. The region's transit system should be designed to be responsive to a wide range of travel needs and diverse customer markets while also furthering key transportation and land use policy objectives. As corridors advance and are studied more carefully, there are a number of system considerations that should be evaluated. This section frames the context in which the regional system has developed to date and identifies key system design considerations for future system expansion and enhancement.

"One of the basic principles of urban planning is that the distribution and intensity of land use should be coordinated and balanced with a transportation system that will accommodate the movement of people and goods within the community of region. The transportation system can be utilized as a principal tool in developing proper land use patterns, thus allowing land-use planning and transportation planning to reinforce on another. An effective regional policy to integrate land use development planning and transportation planning will intensify rapid transit's catalyst effect upon the distribution of future land use developments."—*National League of Cities & US Conference of Mayors, 1973*[1]

1 *Banfield Transitway Project, technical report, light rail transit land use considerations, TriMet, 1977*

DEFINING HIGH CAPACITY TRANSIT

High capacity transit is defined by its function: to carry high volumes of passengers quickly and efficiently from one place to another. Other defining characteristics of HCT service include the ability to bypass traffic and avoid delay by operating in exclusive or semi-exclusive rights of way, faster overall travel speeds due to wide station spacing, frequent service, transit priority street and signal treatments, and premium station and passenger amenities.

The transit modes most commonly associated with high capacity transit include:

- light rail transit, light rail trains operating in exclusive or semi-exclusive right of way[1]
- bus rapid transit, regular or advanced bus vehicles operating primarily in exclusive or semi-exclusive right of way
- rapid streetcar, streetcar trains operating primarily in exclusive or semi-exclusive right of way
- commuter rail, heavy rail passenger trains operating on exclusive, semi-exclusive or nonexclusive (with freight) railroad tracks.

Other transit modes, such as exclusive track heavy rail or monorail, could be applied in Portland but have generally not been considered due to high costs.

SYSTEM DESIGN CONSIDERATIONS

While individual proposed high capacity transit corridors will need to have independent value to merit future investment, it is also critical to consider the role each new line or extension plays in developing the region's transit and broader transportation system. This section discusses some considerations in system design that will be important as new lines are studied in more detail.

1 Exclusive right of way, as defined by Transportation Research Board TCRP report 17, includes fully grade separated right of way. Semi-exclusive right of way includes separate and shared rights of way as well light rail and pedestrian malls adjacent to a parallel roadway. Nonexclusive right of way includes operations in mixed traffic, transit mall and a light rail/pedestrian mall.

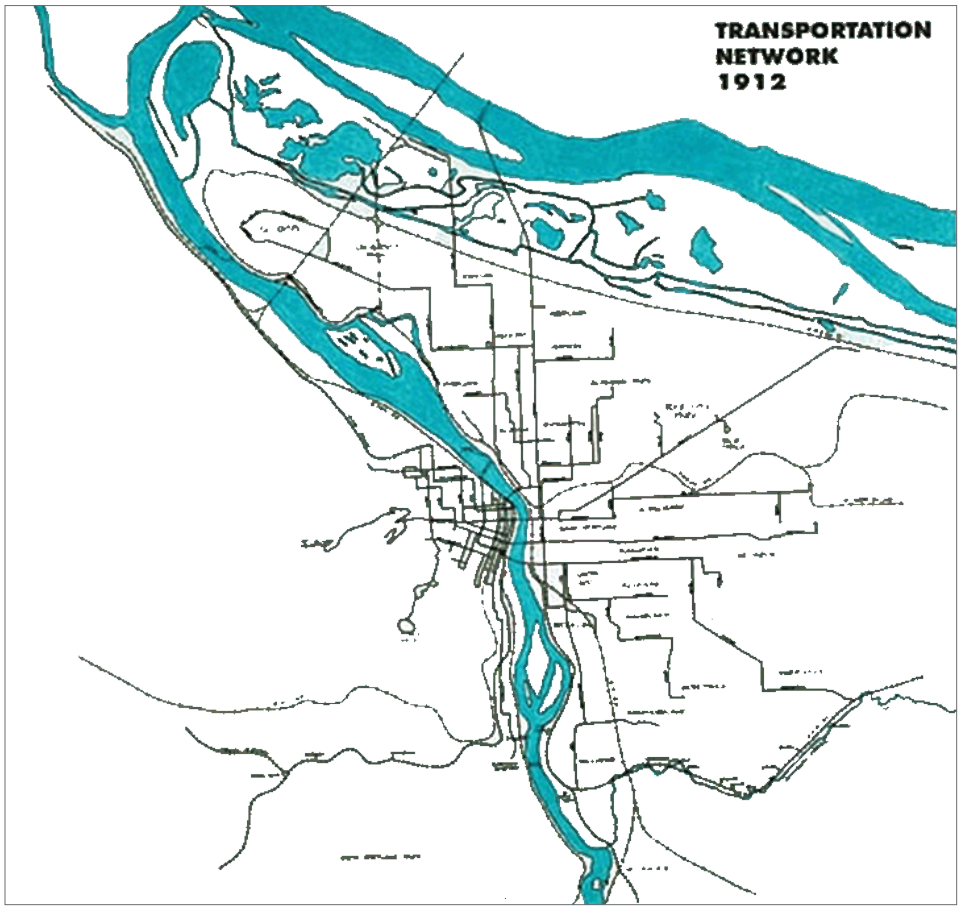
Grid versus radial system

The historic urban form of the Portland area was influenced by developers who organized new neighborhoods around streetcar and interurban rail transport. By the early 1900s, Portland and surrounding developed areas were organized around a dense series of radial rail corridors operated by Portland Railway Light and Power Company and the City and Suburban Railway Company. By 1904, there were over 100 miles of operating rail service; this amount increased as new lines were added into the 1920s.

The radial streetcar and interurban network brought workers to downtown Portland, creating a strong business district, and returned workers to neighborhood centers such as Irvington, Richmond, St. Johns, Council Crest and Lake Oswego. Today, many of TriMet's frequent service bus lines follow the historic streetcar network, and Portland's most vital neighborhood centers and main streets are on former streetcar corridors. As the region has grown, downtown Portland has continued to serve as the regional employment and entertainment center. As in the past, the region's modern rail system plays an important role in maintaining a strong, region-serving central city district.

Given the historic development of the region, a radial high capacity transit structure continues to serve current and projected travel patterns in the Portland region well. Strong linkages remain between key regional markets and the Portland central city. Development of the near-term regional priority corridors identified in this report (Portland to Sherwood and Portland to Gresham via

Figure 3.1: 1912 Portland streetcar system



European Street Trams

The distinction between urban streetcars – smaller trains operating in mixed-traffic with limited priority – and light rail transit, which is typically developed using exclusive rights of way, has been blurred in many European cities which have taken an integrated approach, combining the best attributes of each.

These European street tram systems, which have been constructed in places like Lyon, Dublin, Hanover, and Nantes over the past few decades, use larger vehicles with sleek styling of a modern streetcar but with capacities comparable to a light rail train. They operate in dedicated rights of way with traffic priority on urban streets, comparable to Portland's downtown light rail operations, but also stress urban integration and the placemaking value of rail investments. As the Portland metro region continues to lead the nation in building great communities, rail mode integration will be a critical consideration.

Nantes, France

Dublin, Ireland

Southeast Powell Boulevard) along with planned MAX service to Milwaukie and Vancouver, Wash. and a rapid streetcar extension to Lake Oswego will create a robust radial high capacity transit network. An extension of the Interstate Highway 205 MAX line or Milwaukie MAX line to Oregon City would further enhance this radial system. New cross-region or circumferential routes, which create grid connections between key regional markets, may become priorities for the region once the radial system is fully realized and regional markets can generate enough riders to justify the HCT investment.

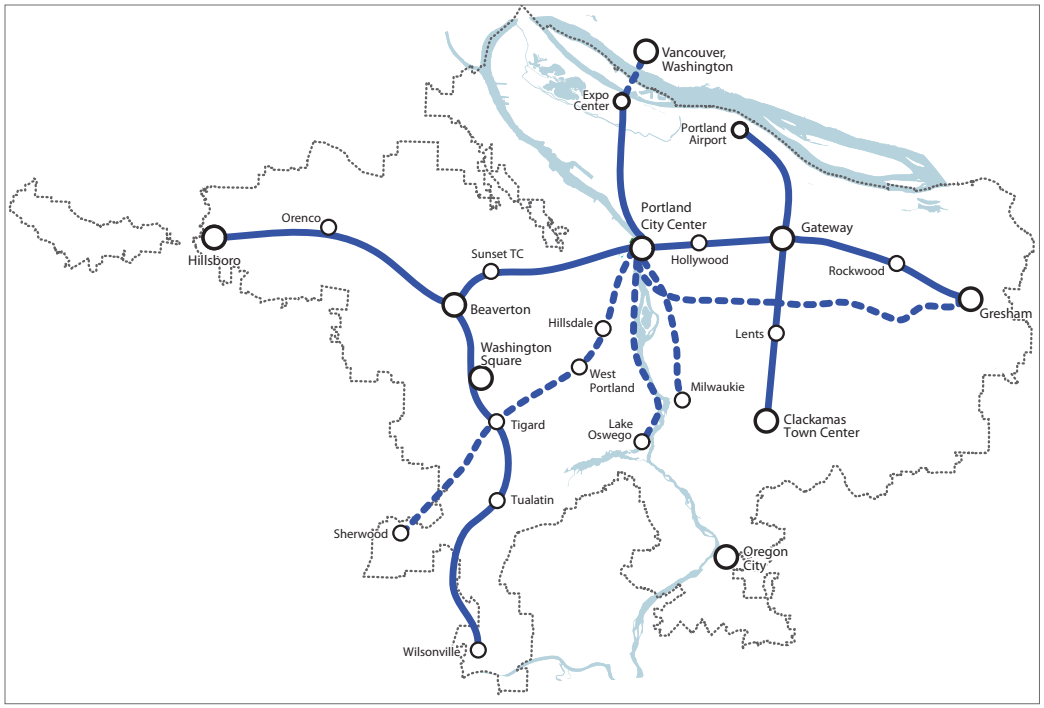
Much like a grid street network, which uses perpendicular streets crossing at regular intervals, a HCT grid network provides service in a series of linear corridors crossing frequently across a city or region. Grid systems provide additional person carrying capacity and travel choices but are only feasible if there are enough riders to support parallel lines. Consistent, high frequencies are required for a grid system to work well, so transfer time between lines is minimized. Once the radial HCT system illustrated in Figure 3.2 is complete, new cross-region investments in HCT may be more viable. Some of the most heavily used TriMet bus lines in the region are cross town routes that connect neighborhoods and centers outside of downtown. Future benefits of a grid HCT system include:

- strengthened regional and town centers
- increased travel options to, from and within regional and town centers
- reduced travel times for cross-region trips.

This plan determines that near-term regional priority investments in the HCT system are best aimed at extending the radial network and increasing the person carrying capacity of services to the central city. The additions of the planned Milwaukie and Vancouver extensions of the Yellow Line and Lake Oswego rapid streetcar will dramatically improve the radial network south and north of downtown Portland. This study suggests the next regional priorities are two new radial lines to Southeast Portland/Gresham and Southwest Portland/

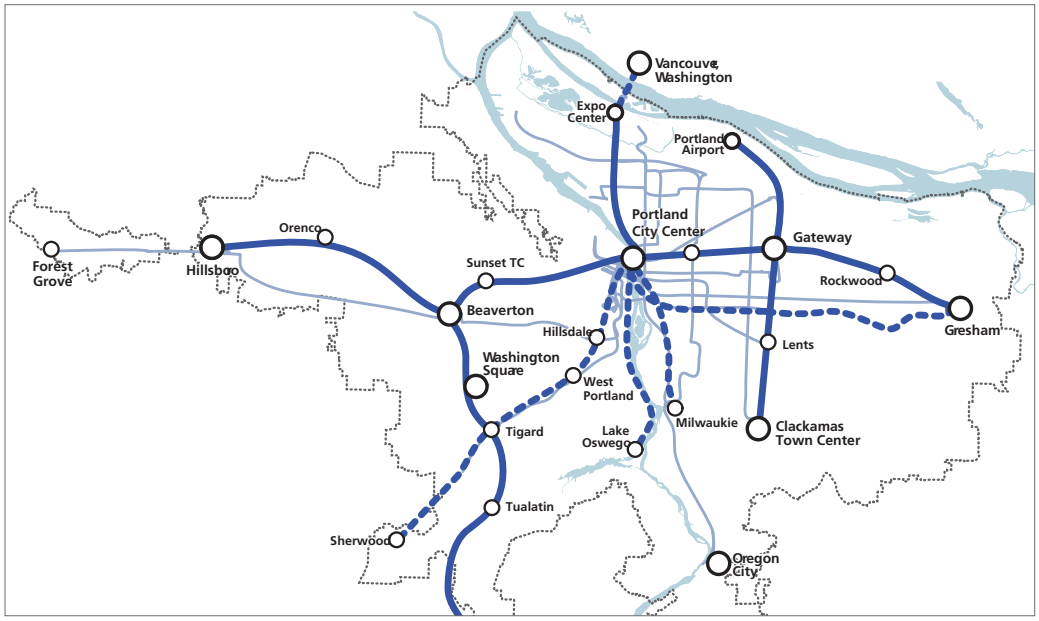
Tigard (possibly continuing to Sherwood). Furthermore, system analysis shows that the highest value investments in terms of riders gained per dollar of capital and operating investment would be the inner portions of these two regional priority corridors. Indeed, two short radial lines may provide a much greater transportation benefit than a single long corridor. This is an important consideration as the region evaluates future high capacity transit investments. Well within the timeframe of this 30-year plan, cross-region investments in HCT are likely to advance as regional priorities. In particular, an east-west alignment south of Portland connecting the I-205 corridor with Milwaukie, Lake Oswego, Tigard and Washington Square appears to be a strong candidate for a cross-region HCT line. With the Westside Express Service (WES), the Green Line, the Milwaukie extension of the Yellow Line, the Lake Oswego streetcar and a future Barbur Boulevard HCT investment in place, this new line crossing the southern metro region would increase transit connectivity to downtown via connections to multiple high capacity lines as well as provide an important connection between growing 2040 Growth Concept-identified regional and town centers.

Figure 3.2: Existing and near-term regional priority HCT corridors



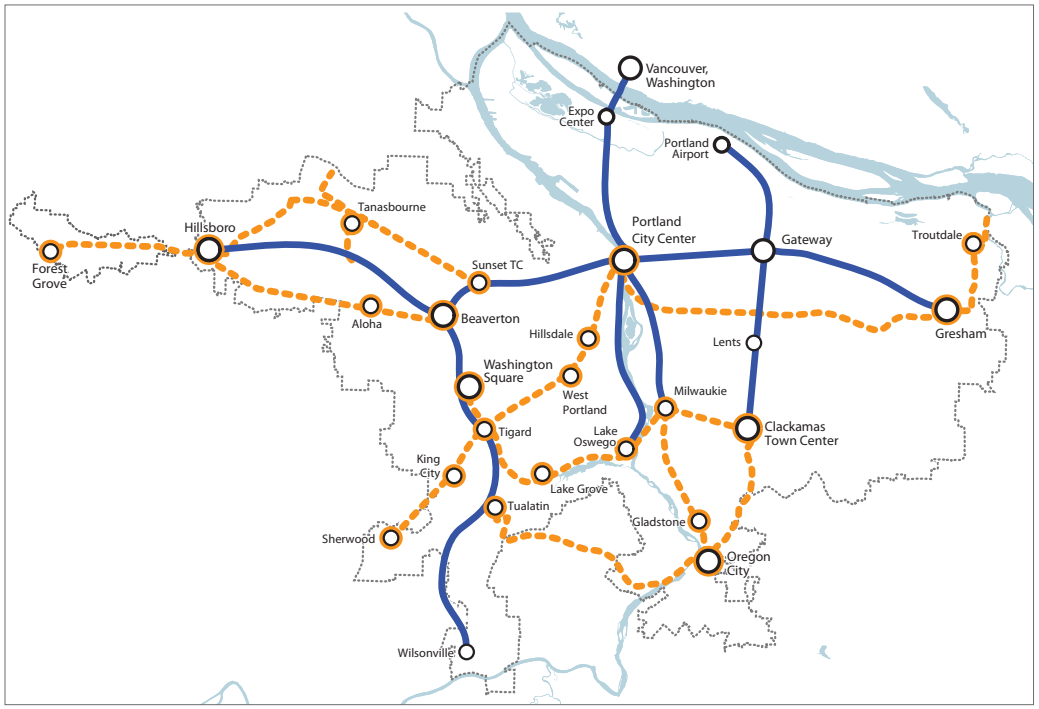
This map shows the existing high capacity transit network (solid lines) along with the planned and near-term HCT corridors (dashed lines). The existing and planned HCT network is largely radial in nature with service oriented to the central city.

Figure 3.3: Existing, planned and near-term regional priority HCT corridors and frequent bus network



This map shows the existing, planned and near-term HCT corridors (solid and dashed dark blue lines) with the frequent service network (in light blue). The frequent service network provides extensive cross-regional connections to the radial HCT system, forming the basis of a grid transit network with service oriented to the central city.

Figure 3.4: Existing, planned and regional priority HCT corridors



This map shows the existing and planned HCT corridors (solid blue) along with all of the near-term, next phase and developing regional priority HCT corridors. This HCT network more closely resembles a grid network with several new cross-region connections.

Network density (versus system coverage)

The region's light rail system was developed to fit the unique characteristics of the region, including downtown Portland's 200-foot blocks, which limit MAX light rail trains to two cars (many light rail systems can operate three- or four-car trains). As the region grows and demand for high capacity transit increases, particularly to downtown Portland, the system will need to increase its capacity to carry passengers. There are a few viable options to increase HCT person carrying capacity over time:

- increase service frequency (number of trains per hour) on existing lines
- add new lines to the system that serve parallel radial markets, preferably with at least 1-mile spacing between lines
- construct a tunnel under downtown that would allow some trains to operate with more than two cars and to travel faster through downtown Portland. However, the analysis for the HCT showed that, though a tunnel would increase travel speeds, the losses in direct walk access outweigh the benefits in the planning horizon.

The person carrying capacity of the region's transit system is anticipated to increase over time as new lines open and/or service frequency is increased to deal with increased demand. For example, the Green Line will add passenger capacity in the Banfield corridor where it will operate with Blue Line and Red Line service.

Branching

Branching uses the strategy of allowing high capacity transit lines with different terminus locations to use the same route for the bulk of their run. In the current MAX system, the Green, Red and Blue lines branch at the Gateway Transit Center (after sharing tracks and stops through the Banfield corridor). As the Portland metro region expands its rail system, the strategy of branching lines should be considered in more cases. This is particularly effective where a strong inner line segment exists, but there are multiple options for a line terminus. Branching can eliminate the need to make difficult decisions between relatively equal outer termini markets and can help deliver higher frequency service on inner line segments.

As the system evolves and new corridors are studied in detail, there will be other opportunities for branching light rail or other high capacity services. It is important to recognize that lines radiating from the central city have the opportunity to serve a triangular area, expanding as the corridor moves away from the central city. Corridor 11, which is described as a general corridor from Portland to Tigard and on to Sherwood in the vicinity of the Southwest Barbur Boulevard, is one of the corridors given top regional priority in this study and provides a good example of a corridor where branching opportunities should be evaluated. In this case, the three strongest terminus markets are Tigard, Washington Square and Tualatin. It would be difficult to serve all directly with a single line. A Tigard line that branched at Hillsdale Highway to serve Washington Square or Tualatin could provide service to both destinations on equal headways and deliver service at half the headway to Hillsdale and Oregon Health Science University.

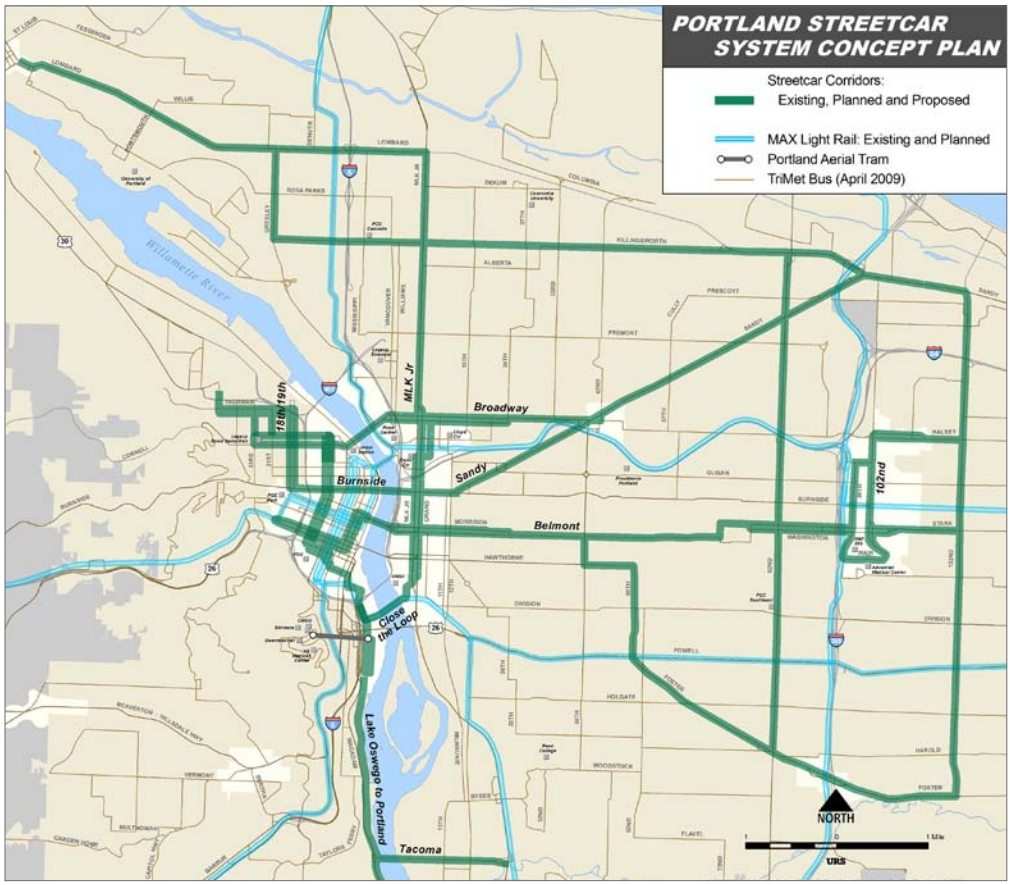
Portland Streetcar System Concept Plan and rail interoperability

The City of Portland Bureau of Transportation and Bureau of Planning are conducting a Streetcar System Plan in coordination with the TriMet and Metro. The Streetcar System Plan is a long-range study that will identify transit corridors in Portland with the highest potential for more detailed analysis in future years. Key goals of the plan are to:

- reinforce walkable and economically diverse neighborhoods and vibrant main streets
- encourage sustainable and equitable development and infrastructure
- support reduction of vehicle trips
- support greater accessibility, housing options, employment and economic development.

Figure 3.5 illustrates draft corridors identified in the system plan. These may change as the plan is finalized.

Figure 3.5: Draft Streetcar System Plan map



Draft Streetcar System Concept Plan map from the public review draft of the Portland Streetcar System Concept Plan, July 2009. This draft map is subject to revisions.

Certain corridors identified as potential long-range streetcar lines were excluded from consideration in the Regional High Capacity Transit System Plan. However, an important future consideration is the interoperability of MAX light rail and Portland streetcar systems. Currently, each system uses slightly different design standards that do not allow MAX trains to operate on streetcar tracks. Because streetcar trains are lighter, a shallower track bed can be used that can save significant cost and cut down on construction time. Careful consideration should be given to future investments to determine whether there may be value in developing segments of streetcar track to support light rail technology. This may have particular value where streetcar tracks could provide alternative routings for MAX, providing system redundancy and protecting the regional transportation system in the case of a major facility failure. For example, streetcar tracks could provide an eastside connection between the Rose Quarter and the Broadway Bridge or the new light rail bridge (to be constructed as part of the Milwaukie line), which would allow MAX trains access to downtown Portland if it were necessary to close the Steel Bridge.

Corridor 43 as initially studied includes a connection between St. Johns and the MAX Yellow Line on North Interstate Avenue but focuses on the Highway 30 corridor as the primary connection between downtown and St. Johns. A more cost-effective way serve St. Johns with light rail may be to branch the Yellow Line at North Lombard Street. Lombard Street is being considered as a streetcar corridor in this area; however, constructing the line to be compatible with both technologies could create the opportunity to serve this area as a MAX extension. Delivering streetcar to St. Johns will require construction of new north-south trackage from the central city, whereas branching the MAX Yellow Line could significantly reduce the total track miles to be constructed. Additionally, the Southeast Foster Boulevard corridor may be a viable alternate to share streetcar and light rail.[2]

Vehicles

Along with predictable departures and efficient travel times, ensuring adequate vehicle capacity greatly impacts passenger comfort and system reliability. Block lengths in downtown Portland constrain the length of MAX light rail trains, but TriMet is adding capacity by purchasing vehicles that are slightly longer than previous vehicles and have more passenger space by eliminating redundant operator space. This additional capacity comes with a loss of service flexibility so it is still uncertain whether this strategy will continue into the future..

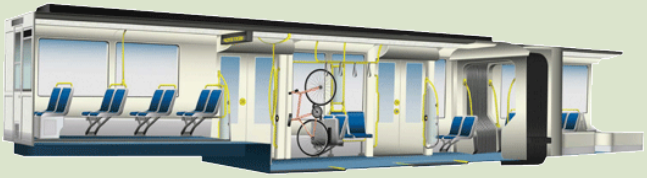
Typical HCT vehicles have low floors and wide doorways that streamline boarding and alighting. These characteristics are important to universal access and should be combined with providing vehicle seating available at various heights, using nonslip fabrics and surface materials, and providing highly visible and tactile yellow warning strips and handles. Choosing vehicle amenities that serve older adults, passengers who use mobility devices and people with strollers and large packages creates a system that is more comfortable and attractive for everyone. Current TriMet procurement practice and guidelines prioritize these features.

In addition to selecting vehicles with adequate capacity and passenger comforts, agencies brand their systems by choosing highly recognizable vehicle designs. Developing an innovative HCT system offers a special opportunity to choose vehicles that will become a vibrant symbol of the new service, the agency and the region. Sleek, modern designs, unique colors and even "green" fuel propulsion systems can create an iconic vehicle, and may draw upon elements of existing fleet vehicle designs. For example TriMet light rail vehicles, including the new "Type IV" have

2 In the June 2009 Streetcar System Plan materials, the Lombard Street and Foster Boulevard lines are categorized as eventual streetcar corridors. The Southeast Belmont Street line leading to Foster Boulevard is categorized as a planned and/or priority corridor.

New TriMet MAX vehicles in Portland

In preparation for the new Green Line service rollout in September 2009, TriMet has ordered 22 new Siemens Avanto S70 light rail vehicles. These 70 percent low-floor trains have more passenger capacity than the existing fleet, with eight more seats per train and more room for standees with only 7 feet of additional length. This is due to the parlor cab configuration, a seat layout and interior design that leaves more open space. These vehicles also have an updated exterior, with rounded corners and smooth sloping fronts, but retain MAX's emblematic blue and gold circles in the paint design.



regenerative braking, which recaptures some of the energy from braking and puts it back into the overhead wires for use by other trains on the alignment.

Service quality

Successful transit services consider the total transit system; this means delivering safe, comfortable, reliable service to passengers in a manner that pleases existing customers and attracts new customers. Key components of service quality stressed in the functional design of HCT are addressed below.

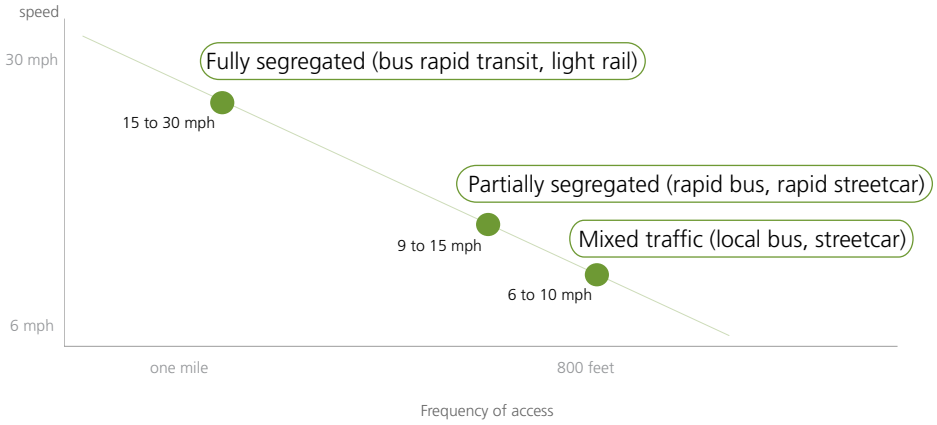
Service frequency and hours of service. Frequent service, or service with headways of 15 minutes or less, are generally considered the point at which a person no longer needs to use a schedule. Passengers can rely on a bus or train arriving within a short time frame. Frequent service also makes transfers easier, since the wait time between trip segments is minimal. Transit customers consider wait time at stops doubly punitive compared with in-vehicle delay. Transit agencies often choose their headways based on the demand for transit service in an area. Where there is weak demand, headways are typically longer. Long headways do not offer the same amount of convenience as short headways. As a result, riders must carefully plan their trips, so not to miss any crucial transfers.

Services with an 18-hour span of service provide customers with the security that transit is available to them almost any time they need it. In combination, 15-minute or better frequency and long service spans create a predictable, reliable, livable system, where people can feel comfortable relying on transit for their daily transportation needs. TriMet has expanded frequent service seven days a week from three bus lines in 1999 to 16 bus lines by 2008, and all MAX lines offer frequent service every 15 minutes or more often.

Speed and reliability. Urban transit users often have many travel options, including driving, bicycling, walking or taking transit. Each mode offers advantages to people, depending on their circumstances. Most transit users do not expect transit to get them to their destination faster than driving, but they find other benefits that make transit a desirable option.

In order for transit service to be effective, transit speed and access must be balanced. In the case of high capacity transit, access is typically concentrated in select areas in exchange for faster travel speeds, shorter travel times and better on-time performance. Access to only a few station areas emphasizes the need for a good access to these sites by bike, foot, conventional transit service or automobile. Figure 3.6 depicts the direct tradeoff between access and operating speed. Lines with fewer stops have less delay.

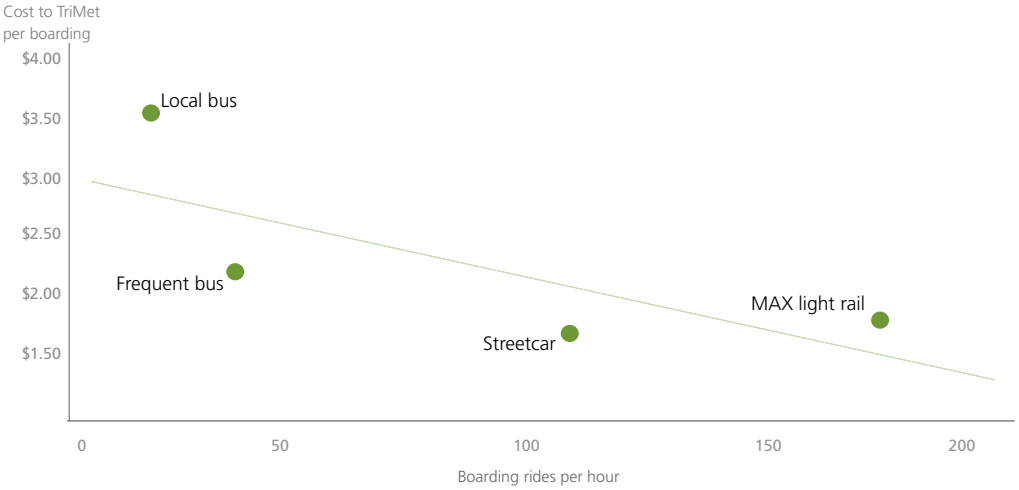
Figure 3.6: Average speeds relative to stop spacing



Capacity

Two key factors determine person carrying capacity in a corridor (assuming the right of way design is established): vehicle type and frequency. Sizing transit service to meet demand is an ongoing challenge. One of the advantages of HCT is, if demand for transit service is high, that it can move a large number of people efficiently at a low operating cost. The Figure 3.7 shows that Portland's regional light rail system, which provides the most passenger capacity per hour of service, is also the most cost-effective way to transport transit passengers in high demand corridors.

Figure 3.7: Cost per passenger trip for transit modes in the Portland metro region



Customer experience

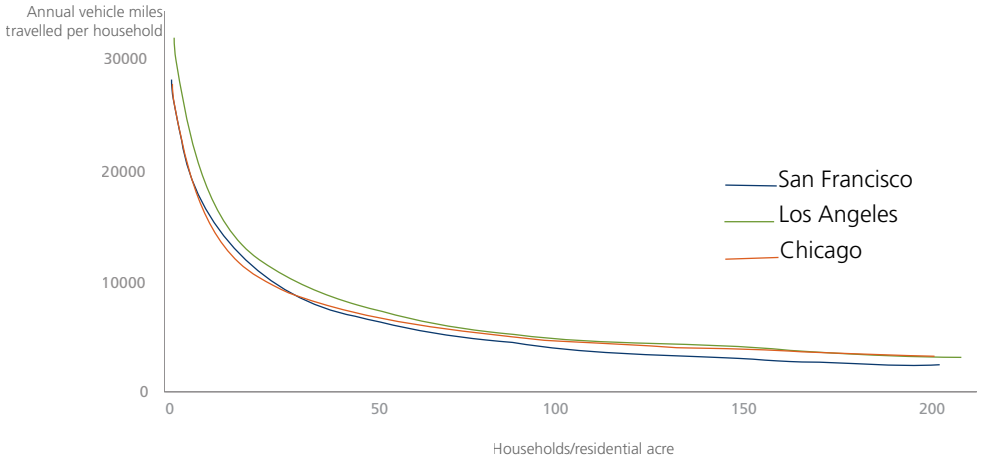
Since their wheels run on tracks rather than pavement and turning movements are more gradual and less frequent, rail vehicles typically deliver a smoother ride than buses, thus making it easier to read or work on board. Seating configurations on rail vehicles are also typically more spacious, although advanced bus rapid transit vehicle configurations are often similar to a small rail car. Modern bus rapid transit vehicles provide comparable level of amenities to rail but are often challenged to provide an equal ride quality. From a purely aesthetic standpoint, transit customers and developers often prefer rail modes and bus rapid transit over local bus, because these modes signify a more permanent and important component of the transportation network. Other factors that can improve customer experience include: large windows, tall ceilings and a clean environment on vehicles, and real-time information, clean environments and covered waiting areas at station areas. Issues related to the customer's experience with transit are further discussed in the system design and usability section later in this report (page 64).

Land use and urban form

Mixed land uses concentrated within walking distance of HCT stations are critical to fostering walkable communities where transit is the most convenient mode available for longer trips. A detailed regression analysis conducted in the Portland metro region shows that population and employment density can predict 80 percent of transit demand in an area. In other words, where concentrations of residents, jobs and activities are high, so too is the demand for transit.

Denser mixed-use communities also reduce demand for driving, which in turn can satisfy multiple policy goals such as reductions in greenhouse gas emissions, improved roadway operations and reduced capital construction. Figure 3.8 shows residential density's impact on annual vehicle miles travelled (VMT) per household in San Francisco, Los Angeles and Chicago. To achieve the dramatic drop in per capita VMT that occurs as urban neighborhoods transition from 10 to 50 households per acre, high quality transit service and quality pedestrian access must be in place. The most dramatic shift happens between 10 and 30 households per acre. In the Portland metro area, downtown and the Pearl District have an average 24 households per acre and Nob Hill has 28 households per acre. The Lloyd and Hillsdale districts and the Westmoreland and Clinton neighborhoods have an average of between eight and 11 households per acre.

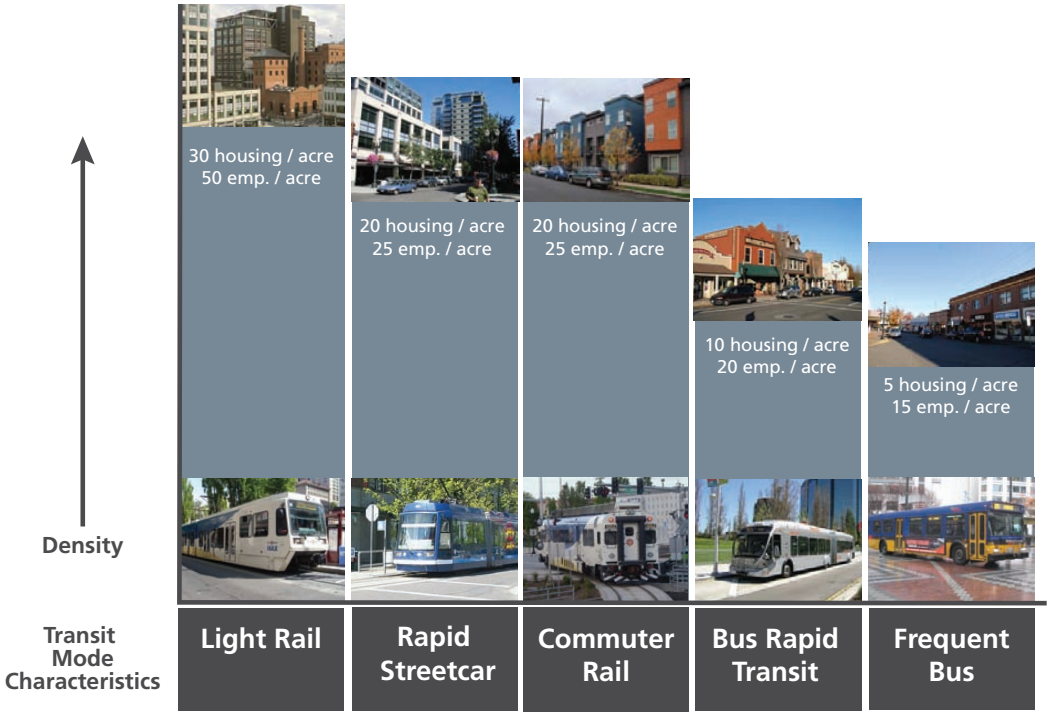
Figure 3.8: Impact of residential density on driving[3]



3 Location efficiency: neighborhood and socioeconomic characteristics determine auto ownership and use – studies in Chicago, Los Angeles and San Francisco, Holtzclaw, J. et al., Transportation Planning and Technology, vol. 25, 2002.

Figure 3.9 provides a guide for the average land use densities (within one-half mile of stations) that support various transit mode investments.

Figure 3.9: Station area density targets for high capacity transit modes



The transit systems that support the great cities of the world (London, New York, Tokyo, etc.) are emblematic and were essential to the evolution of each city's urban fabric and pedestrian-friendly streets. It is important to note that HCT systems tend to organize development differently than locally serving modes.

- Linear development. Local bus and streetcar typically have a linear impact on density and overall mix of land uses in a corridor since these modes have close stop spacing and provide consistent pedestrian access along the entire line.
- Nodal development. Light rail and bus rapid transit typically provide regional service with wider stop spacing and more developed stations. These modes typically have an impact on density and land use types within a one-third to one-half mile radius of the station.
- Mixed. Rapid bus (on-street bus rapid transit) or modes that mix right of way treatments and/or stop spacing may spur both types of development in different segments of the line.

Figure 3.10: Mode capacity

Local bus, streetcar	Frequent bus	Bus rapid transit, light rail
Less capacity		*More capacity*
Streetscape doubles as station		*High investment in station access*
Supports linear development		*Supports nodal development*

HCT SYSTEM STATUS

Population growth must be considered first when planning for transportation and economic opportunity. The world's population is growing, and here at home our population is also expanding rapidly. The population of the Portland-Vancouver area grew 26.6 percent between 1990 and 2000, from 1.5 million to 1.9 million.[4] Seventy-five percent of this population lives in the three counties of the Portland metro region, Multnomah County (34 percent), Washington County (23 percent) and Clackamas County (nearly 18 percent). The area's population grows at a rate of 500 people per week, and Metro projects that by 2030 the Portland-Vancouver area will house one million additional residents, raising the population to between 2.9 and 3.2 million – about double what it was in 1990. New forecasts show that by 2030, the population of the Portland metro region and adjacent cities will increase from 1.9 million people to between 2.9 and 3.2 million.[5] By 2060, the Portland region could have between 3.6 and 4.4 million residents and as many as 2.4 million jobs.[6]

Regional transit ridership grew at twice the rate of population growth between 1990 and 2000.[7] TriMet states that though Portland's population has grown 27 percent in the last 10 years, transit ridership has grown 46 percent.[8] The region's 2040 Growth Concept seeks to prepare for the increase in growth in the Portland metro region by encouraging growth and transportation access in seven regional centers and downtown Portland as the central city. Transportation options, including pedestrian and bike access as well as transit, play a large role in facilitating growth within our current capacity. While this growth brings opportunity, it also creates new challenges. Assuming these growth forecasts are correct, the region needs to prepare itself to be able to accommodate new demand with the existing and planned high capacity transit services.

Using regional travel demand model data, an analysis was conducted to assess the ability of the existing and future HCT system to meet demand. In 2005, the existing system consisted of three lines: the Red, Blue and Yellow lines. It has been estimated that in 2005 the existing system, had adequate capacity to accommodate demand (using between 26 to 76 percent of available capacity). For the future model year of 2035, several recently completed corridors and planned transit corridors were modeled to determine how well the system can handle future demand. As shown in Figure 3.11, most of the existing and future capacity will be utilized, but demand can be accommodated with more frequent trains.

4 Statistics for regional population are drawn from the Census Bureau's designation of the "Portland-Vancouver Primary Metropolitan Statistical Area" and include Multnomah, Washington and Clackamas counties as well as Clark, Columbia and Yamhill counties. This Portland-Vancouver area differs from the Metro's service area of the Portland metro region which includes Multnomah County and parts of Washington and Clackamas counties and is the focus for Metro's transportation and land use planning.

5 20 and 50 year Regional population and employment range forecasts – draft, Metro, March 2009.

6 *Ibid.*

7 Transportation Investment Scenarios, Metro, November 2008.

8 Dirty Words, TriMet, April 2009.

Figure 3.11: Transit demand

Route or corridor	Modeled peak-hour headway (minutes)	Percent utilized (evening peak 2-hour period)	Necessary headway to meet demand (minutes)
Existing corridors (2005)			
Blue Line (Gresham to Hillsboro) and Red Line (Portland Airport to Beaverton) – combined	5	62%	16.2
Yellow Line (Portland central city to Expo Center)	10	26%	38
Existing and planned corridors (2035)			
Blue Line (Gresham to Hillsboro) and Red Line (Portland Airport to Beaverton) – combined	4.3	126%	4.1
Yellow Line (Portland Central City to Expo Center)	7.5	123%	6.1
WES commuter rail (Beaverton to Wilsonville)	30	142%	21.1
Green Line (Portland Central City to Clackamas Town Center)	7.5	134%	5
Near-term priority high capacity transit corridors (2035)			
Corridor 10 (downtown Portland to Gresham)	10	83%	12.1
Corridor 11 (downtown Portland to Sherwood)	10	110%	9.1
Corridor 34 (upgrades to WES commuter rail corridor)	10	89%	11.2

Capacity on the entire MAX system is constrained by the need to operate two car trains, meaning future capacity increases require adding headways or building new lines. The current HCT system can accommodate headways of about 2 minutes per direction (30 trains per hour, per direction) over prolonged periods. With the Portland Mall in operation, the Yellow and Green lines operate on Southwest 5th and 6th avenues, which increases system capacity to expand train service through downtown. Although passenger capacity will be over utilized assuming modeled headways, existing light rail infrastructure is sufficient to accommodate projected 30-year increases in passenger demand. In short, this analysis shows that the current and planned HCT major track infrastructure does have the capacity to accommodate demand at least until the year 2035, assuming operating funds become available to improve headways.[9]

The public, jurisdictional staff and elected officials requested that the Regional HCT System Plan evaluate options for improving operating speed of MAX through downtown Portland. The plan conducted an analysis of two options for improving travel speeds through downtown:

9 A number of minor track upgrades will be needed to accommodate more trains on the existing system, particularly at key merge points such as Gateway Transit Center, Rose Quarter Transit Center and the Steel Bridge.

1. An east-west tunnel from Lloyd Center/Northeast 11th Avenue station to Goose Hollow/ Southwest Jefferson station with a single station located in the vicinity of Pioneer Courthouse Square. The tunnel would save approximately 12 minutes of travel time for passengers traveling from the Lloyd Center to Goose Hollow or beyond and allow for longer train sets not constrained by downtown block widths.
2. An eastside bypass from the future OMSI station to Interstate Rose Quarter station. This bypass would save approximately 10 minutes for approximately 4 percent of passengers traveling north-south past the central city.

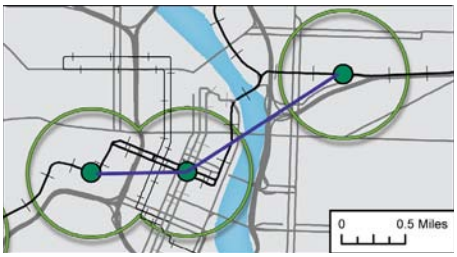
The analysis concluded that construction of a downtown bypass or tunnel does improve travel speed but at the expense of superior access to employment and households in downtown provided by an at-grade, convenient alignment. This analysis also concluded that the operational need to meet projected demand can be met with the existing surface alignments on Southwest Morrison and Yamhill streets and on the Portland Mall. Downtown employment constitutes a high enough percentage of regional employment that diminished accessibility due to a single station is not outweighed by optimizing transit travel speed through the downtown. Direct service is measured by walk access of a half mile. The total estimated capital cost to construct the downtown tunnel as described is $2.2 billion in 2009 dollars. More stations could be built, but the travel time savings would be correspondingly less, diminishing returns for what would be one of the most expensive projects ever built in the region.

Figure 3.12: Analysis of tunnel or connector through downtown Portland

Tunnel versus downtown	Current alignment	Tunnel
Households served in 2005	19,300	14,400
Households served in 2035	40,600	28,100
Employment served in 2005	121,000	98,700
Employment served in 2035	173,900	140,800

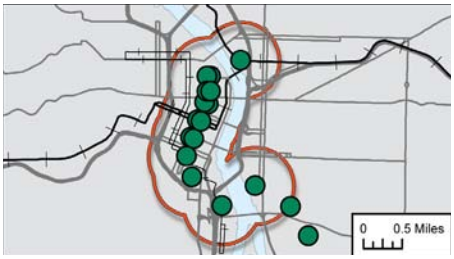
Current downtown light rail stations

Proposed tunnel light rail stations

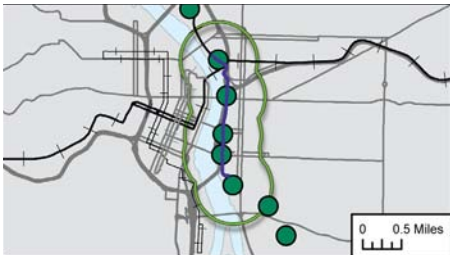


Connector versus Portland Mall	Current alignment	Connector
Households served in 2005	15,900	3,800
Households served in 2035	42,700	13,000
Employment served in 2005	129,600	49,900
Employment served in 2035	192,900	75,300

Current Portland Mall light rail stations



Proposed connector light rail stations



Other surface running options for enhancing MAX travel speed through downtown will be considered by the City of Portland in the Central City Plan; these may prove to be the most cost-effective improvements and to best match regional land use and growth management goals. Simply eliminating one or two tightly spaced stations, providing bypass tracks for express trains on Southwest Morrison and Yamhill streets, or adding a separate express alignment on another couplet in downtown could all improve travel speed through the central city at a minimal cost when compared with tunneling.

Other system constraints

There are several merge locations in the system that impact operating speed and overall system capacity:

- Steel Bridge. The Green, Red, Yellow and Blue lines will utilize the Steel Bridge. There are capacity constraints at the junctions on the east and west ends leading to the bridge.
- Rose Quarter Transit Center. The Rose Quarter Transit Center is also constrained due to the high number of light rail, bus, pedestrian, bicycle, and auto movements sharing limited space.
- Non-preempted at-grade light rail/auto crossings in the system. Wherever a non-preempted at-grade crossing with a roadway occurs, light rail must either preempt or yield to traffic creating some operational constraints.
- At-grade light rail/light rail crossings at Steel Bridge, Gateway, and the Portland Mall.

PASSENGER RAIL BEYOND THE PORTLAND METRO REGION

Preliminary demand estimates to Neighboring Cities

A high level assessment of potential demand for commuter rail outside of the Portland urban growth boundary was conducted for this plan. The demand estimates of ridership potential are highly conceptual and were developed only to determine the order of magnitude differences between corridors, not as actual predictions of ridership. The estimates are not based on detailed alignment, station location or service concepts. Rather, they estimate potential to attract riders based on comparable commuter rail services in operation in the United States and the overall demand for work travel between the major corridor markets. Five potential corridors were evaluated:

- Salem/Keizer to Beaverton. This line would be an extension of the WES commuter rail, terminating at the Beaverton Transit Center and serving to downtown Salem..
- Hood River to Gresham. This line would generally travel along I-84 and connect Hood River to the MAX Red Line at the Parkrose/Sumner Transit Center.
- Newberg to Beaverton. This line would generally travel along Highway 99 from Newberg to the existing WES commuter rail corridor, terminating at the Beaverton Transit Center.
- Scappoose to Portland. This line would generally follow Highway 30 and connect to downtown Portland at Union Station.
- Sandy to Clackamas Town Center. This line would generally follow Highway 212 and connect to the Green Line at Clackamas Town Center.

Estimates of ridership potential were developed using two different approaches:

- Journey-to-work flows and adjusted mode split. This method uses worker flows from the 2000 U.S. Census and applies an adjusted mode share based on different factors that influence ridership in the corridors.

- Ridership per capita based on peer commuter rail systems. This method utilizes actual ridership data from several peer commuter rail systems in the country and estimates ridership on a per capita basis.

These two methods were then compared and blended to develop a single high-level estimate of ridership, as shown in Figure 3.13. Ridership numbers assigned to each corridor should be considered an order-of-magnitude estimate for purpose of comparing corridors and prioritizing future study.

Figure 3.13: Estimated ridership potential methods and average annual ridership

Commuter rail corridor	Estimated corridor population*	Peer review		Journey-to-work analysis	
		Estimated weekday ridership	Estimated annual ridership	Estimated weekday ridership	Estimated annual ridership
Hood River	22,100	130	34,000	50	12,000
Salem/Keizer	519,800	3,200	807,000	2,500	637,000
Scappoose	11,000	70	17,000	40	9,000
Newberg	111,500	700	173,000	1,000	257,000
Sandy**	33,200	400	103,000	n/a	n/a

** Very rough estimate of population within a 5-mile buffer of the commuter rail corridor.*
*** Ridership on the Sandy line was not estimated using the journey-to-work because this corridor is entirely within Clackamas County.*

Key findings from this analysis

Nonviable corridors. Hood River, Scappoose and Sandy are not viable commuter rail markets given current and projected conditions. Even considering a very low capital cost to construct these corridors, any metric of cost per passenger served would be very high.

Potential corridor. A potential future commuter rail line to Newberg may be feasible in the long term. Even though the riders per mile analysis looks favorable due to the relatively short distance of the line, the overall population in the rail shed is very low compared to other corridors, and overall ridership is relatively low. Metro, regional partners and corridor communities should consider right of way preservation planning for this corridor and consider land use planning activities that focus on transit supportive development around potential future commuter rail station areas.

Promising corridor. Salem/Kaiser is the most promising of the corridors evaluated. In addition to the highest market potential, this corridor has a number of favorable aspects: there is existing Amtrak passenger rail service in the corridor, this is a lightly used freight corridor that was evaluated in the 2001 Oregon Rail Study as a potential commuter rail corridor, and an alignment could easily tie into the WES commuter rail service now operating to Wilsonville. If the region or state chose to focus on the development of inter-regional rail service, this alignment should take priority. After coming to a similar conclusion about this corridor, the Oregon State Legislature recently passed HB 2408, which directs ODOT to study the possible extension of commuter rail service from Wilsonville to Salem.

4. GOOD PRACTICES FOR BUILDING GREAT COMMUNITIES WITH TRANSIT AT THE CENTER

PLANNING CONTEXT AND SYSTEM CONCEPTS

During the development of the High Capacity Transit Plan, a number of questions and concepts were raised in communication with the public and with partner jurisdictions. This section attempts to address the range of issues raised and provide guidance for future policy discussions, guidance, and implementation of practices related to the High Capacity Transit.

The Portland metro region uses a collaborative regional approach to planning and economic development. Most importantly, the approach recognizes the tight interrelation of land use, economic development and transportation decisions in creating great communities and building a region ready to address the greatest challenges of the 21st century. High capacity transit is an important tool to this end. The Regional HCT System Plan provides a framework by which HCT investments support urban growth, housing, regional affordability, environmental protection and livability goals. Like any element of community development, the plan is not static. Rather it sets a dynamic course where holistic system development is a priority and future investments are measured against targets that advance a broad set of regional goals.

This section is intended to provide background for further future policy discussions using examples and research from great transit-oriented communities and neighborhoods in the Portland metro region, around the country and in other parts of the world. This section describes in more detail the mutually supportive relationship between land use, transit service quality, transit accessibility and integration of the complete multimodal transportation system. Two additional considerations are discussed separately, safety and security, and carbon/greenhouse gases reduction strategies. Station safety and security is discussed under the system design and usability section (page 66), while carbon/greenhouse gases reduction strategies are presented in the final section, high capacity's role in reducing carbon emissions (page 76), since these strategies are a culmination of all of these factors.

In this section:

- Integrating transit and land use
- Access and system integration
- System design and usability
- Multimodal corridors
- High capacity transit's role in reducing carbon emissions

The practices discussed in this section are not prescriptive for the Portland metro region and do not have consensus among jurisdictional partners. Rather, the ideas brought forth in this section reflect the interests, concerns, and thoughts heard and discussed in meetings and stakeholder interviews with members of the public, committees of jurisdictional staff and elected officials, and the Think Tank that warrant further investigation.

INTEGRATING TRANSIT AND LAND USE

Metro's Regional High Capacity Transit System Plan presents a significant opportunity to implement the regional 2040 Growth Concept by further integrating land use and transportation in the region. By extending the transit network, the HCT plan will increase regional accessibility, thereby enhancing the viability of transit-oriented development in new and existing station areas. Designed properly, the future corridors will open up new opportunities for residents to choose lifestyles where they can live, work and play without the daily use of a private automobile.

Capturing the full value of future regional transit investments will require coordinated land use planning along corridors and within station areas. Given the maturation of Portland's light rail

transit system and others like it throughout the country, there is a growing body of tested best practices that can help inform land use policy in the region. The section below describes some of these key practices under the headings of guiding transit-oriented development principles including the "three D's" of transit-oriented development: density, diversity and design.

Start with development-oriented transit

The realization of integrated land use and transit planning is commonly referred to as transit-oriented development. The connotation is, however, that land use follows and reacts to transit. A truly synergistic relationship begins with development-oriented transit (transit projects that are intentionally designed with existing and future development in mind). HCT alignments and stations should provide direct access to compact mixed-use districts while also opening up new development and redevelopment opportunities.

The long-term potential value of development oriented transit is illustrated by the Rosslyn-Ballston Corridor in the Washington, D.C. area. Despite the added upfront costs, Arlington County, Va. was successful in its bid to move the proposed Metrorail Orange Line alignment from the median of Interstate Highway 66 to a subway beneath the struggling Wilson Boulevard commercial corridor. This prescient move helped the corridor's five station areas attract over 45 million square feet of commercial space and 20,000 residential units while diverting growth from nearby stable single family neighborhoods. To mimic this success, transit-oriented development potential should be considered and incorporated into alignment and station location decisions.

In order to be successful, the region must establish a corridor vision and stick with it. Far from operating in a vacuum, each station is part of a corridor and the greater transit system. As such, its land use planning should be tied to broader corridor analysis and visioning. This can be difficult because transit lines cross neighborhood and political boundaries, so corridor-wide land use planning takes additional effort and coordination not found in every region or every project. The successful efforts of other regions to coordinate corridor planning efforts should inform the corridor working groups envisioned by the HCT system expansion policy.

Much of Arlington County's success with implementing transit-oriented development has been attributed to its corridor approach to planning. Well before the term transit-oriented development was coined, the county's elected officials, planners and citizenry understood the transit and land use connection and were willing to advocate for it. With a development friendly Rosslyn-Ballston corridor to work with, the county was able to develop and adopt a general land use plan for the new stations. Successfully branded as the bull's-eye approach to development, the public and private sectors rallied behind this vision. Supported by more targeted station sector plans, the county's General Land Use Plan guided all development decisions for the corridor over the last 40 years.

It is this steady strategic planning and implementation over multiple development cycles that has helped each station area thrive in its own right and as part of the corridor. Rather than effectively

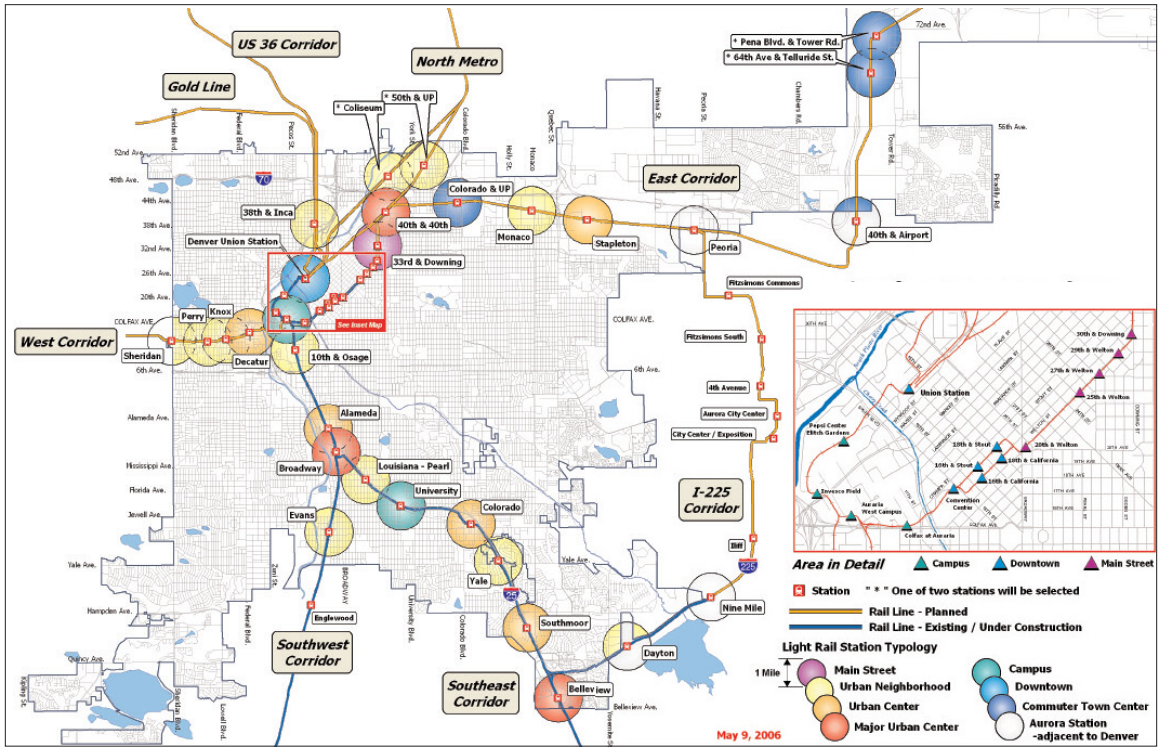
The relationship of density, diversity and design

As density increases, more potential riders are given access to transit, if transit is available. Assuming nicely designed streets and stops that invite passengers, increased density will drive ridership higher. As the level of transit patronage increases in a corridor, transit providers will look to offer more frequent service and to improve the speed and reliability of service for passengers. High quality, permanent transit service makes an area attractive to more residents, signaling to developers that the market is good for more dense, diverse and designed housing and amenities. This relationship builds over time as long as transit is able to respond to growing demand.

cannibalizing one another by pursuing similar aspirations, the stations fulfill distinct roles or market niches and are often referred to as a "string of pearls." For instance, some stations areas are primarily employment centers, while others are small scale urban villages with an eclectic mix of shops and restaurants.

Other jurisdictions have used corridor and system planning to establish a hierarchy of station areas. The City and County of Denver developed a transit-oriented development typology system for existing and future transit stations as part of its Transit-Oriented Development Strategic Plan. In anticipation and advance of actual zoning changes, the typologies helped "clarify expectations for new development, alleviate concerns about inappropriately scaled development at transit stations and guide incremental decisions on infrastructure and project approvals."[1] Station area classifications outside of the central business district range from high density major urban centers to smaller scale urban neighborhoods and include unique types such as campus (e.g. University of Denver) and main street (e.g. historic streetcar corridors) typologies. This place-based approach enhances predictability for the development community while easing the fears of single family neighborhoods. From a corridor perspective, it helps create vibrant lines by stringing together a series of differentiated, but compatible, station areas.

Figure 4.1: City and County of Denver's station area typology map



Promote and test new density concepts

Household and employment density is the primary determinant of transit ridership. Here in the Portland region, a 1995 study by Nelson\Nygaard Consulting Associates found that 93 percent of the variation of transit demand is explained by employment and housing density, after controlling for 40 land use and sociodemographic variables.[2] The degree to which density impacts ridership

1 Transit-Oriented Development Strategic Plan, City and County of Denver, 2006.

2 Land use and transit demand: the transit orientation index, Nelson\Nygaard Consulting Associates, 1995.

is also significant. A study of 129 San Francisco Bay Area rail stations found that the commute mode split was 24.3 percent in neighborhoods with densities of 10 housing units per gross acre.[3] This figure jumps to 43.4 percent and 66.6 percent, respectively, in station areas with densities of 20 and 40 housing units per gross acre. In terms of employment density, significant commuter modal shifts to transit occur as employment destinations reach 50 to 75 employees per gross acre.[4] Consistent with this body of research, a recent national review of transit-oriented development design guidelines found that most agencies recommend a minimum of 20 to 30 housing units per gross acre to create highly transit-supportive housing areas.[5] Minimum employment thresholds are sought by requiring minimum floor area ratios of 5:1 for commercial or mixed-use development.[6]

One strategy to best encourage transit oriented densities in HCT station areas over the short- and mid-terms, would for local jurisdictions to test the market feasibility of land use requirements through an audit of their development codes. Thresholds for minimum densities should be transit oriented, but they should also be achievable within the planning horizon of the station area. An audit could determine whether minimum densities can be achieved. An audit should also ensure that maximum densities can be achieved in light of parking requirements, height restrictions, floor area ratio maximums and other bulk restrictions. The audit should assess public financial resources available for transit-oriented development and related infrastructure such as urban renewal, tax abatements and adjusted system development charges or other

Development-oriented transit promotes the seamless integration of land use and transit.

Mixed-use development at North Main Village in Milwaukie.

The Center Commons transit-oriented development project in Northeast Portland includes a mix of renter and owner-occupied housing types.

Pedestrian-oriented design and blocks help bring people (density) and activities (diversity) to the transit system.

3 Influence of density, diversity, and design on proportion of commutes by transit for Bay Area station area residents, Bay Area Rapid Transit, 2000.

4 Relationships between land use and travel behavior in the Puget Sound region, L.D. Frank and G. Pivo, WSDOT, 1994.

5 Transportation and land use innovations, Reid Ewing, 1997.

6 Station area planning: how to make great transit oriented places, Reconnecting America and the Center for Transit-Oriented Development, 2008.

programs.[7] This process would reconcile land use regulations with market realities while demonstrating the potential need for local financial tools in facilitating higher density mixed-use development.

"Transportation is one of the key factors in shaping our cities. As our communities increasingly undertake deliberate measures to guide their development and renewal, we must be sure that transportation planning and construction are integral parts of general development planning and programming. One of our main recommendations is that Federal aid for urban transportation should be made available only when urban communities have prepared or are actively preparing up-to-date general plans for the entire urban area which relate transportation plans to land-use and development plans."
— March 1962 joint report on urban mass transportation submitted to President Kennedy at his request by the Secretary of Commerce and the Housing and Home Finance Administrator.[1]

1 *Urban transportation planning in the U.S.: an historical overview, U.S. Department of Transportation, August 1983.*

Diversify uses and housing types

The second of the "three Ds" of transit-oriented development is diversity, or a mix of land uses. By providing retail, services and employment opportunities, a diverse transit-oriented development enhances the viability of a transit lifestyle. This is consistent with the City of Portland's concept of the 20-minute neighborhood, a place where people can reach most of their routine destinations within a 20-minute walk from home. Mixing uses also enhances the efficiency of a transit system by inducing more counter-flow trips to stations outside the central business district. More mature transit systems in the United States are often characterized by this more balanced multidirectional ridership. Again demonstrating the long-term benefits of concerted transit-oriented development efforts, Arlington County Metrorail stations exhibit a nearly equal number of boardings and alightings during the morning and evening peak periods, optimizing the system by serving as origins (residential) and destinations (employment, entertainment) and filling outbound and inbound trains throughout the course of a day.

Encouraging and in some cases requiring mixed-use development should be done strategically for the entire corridor. In strong markets with high visibility and a large critical mass of residents and/or employees, ground floor commercial can be very successful. In less intense and more peripheral station areas, the viability of retail and services may be more challenging. With the exception of specialty neighborhood destination retail, commercial uses usually require vehicle access, visibility and traffic to survive. Whereas a busy light rail station might have 2,000 boardings and alightings per day, even a modest retail node typically will have at least 15,000 cars passing per day. For these reasons, requiring mixed-use in inappropriate locations may result in empty storefronts or preclude new development altogether.

Rather than stretching retail beyond its limits, jurisdictions are increasingly targeting specific areas for active ground floor uses. The City of Vancouver, B.C. has adopted a downtown retail uses map that designates specific streets and corners that are best suited for commercial uses. Generally speaking, these areas are historic streetcar corridors where retail has grown and prospered organically over time. So as not to over saturate supply and dilute demand, the map also prohibits ground floor commercial uses on many of its downtown residential streets.

To optimize diversity in HCT corridors, stations and mixed-use zoning should be targeted in areas that are already attracting diversity rather than forcing the market elsewhere. Regionally and nationally, stations that conjure images of places (e.g., Hollywood District in Portland, Mockingbird Station in Dallas, Texas, Gaslamp Quarter in San Diego, Calif., and Dupont Circle in Washington,

7 For more information and programs, see Community investment toolkit, vol. 1: Financial incentives, Metro, 2007.

D.C.) rather than simply transportation nodes have been successful in this regard. To this end, HCT alignments and stations should be oriented towards existing "branded" areas with strong urban amenity packages. Urban amenities such as shops, restaurants and theaters in these districts have the ability to attract future mixed-use development and promote destination ridership.

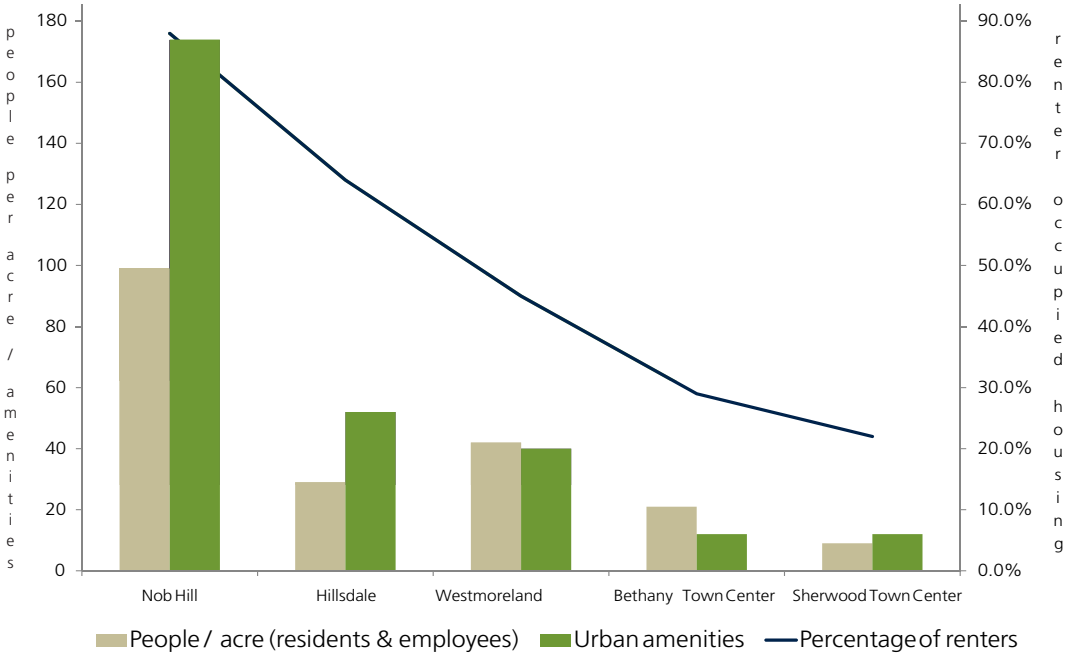
A second best practice is to adopt a more holistic view of transit-oriented development diversity. Recent analysis of a selected number of the region's successful neighborhood centers such as Nob Hill and Sellwood-Westmoreland compared to regional town centers found that, in addition to residential and employment density, urban amenities were related with a strong supply of rental housing, a good proxy for an active youthful population.[8] Local jurisdictions should design land use regulations in station areas to help capture diversity in terms of housing types, thereby attracting a better mix of generations and income groups.

Design urban form both vertically and horizontally

The third of the "three Ds" of transit-oriented development is design, the urban form and character of a station area. Pedestrian friendly design is what separates transit-oriented development from transit-adjacent development. A dense mix of uses may be near a transit station, but if the uses are not functionally linked to the station via pleasant and comfortable pedestrian connections, they are not likely to fulfill their full ridership potential.

The density and configuration of street blocks dictates urban form and connectivity, both of which impact travel behavior. Research suggests that the single most important urban design determinant of transit ridership is the underlying block pattern of an area. In the Bay Area, residents in neighborhoods with an average block size of 6 acres (approximately 900 feet by 300 feet) had a transit mode split of approximately 11 percent. Neighborhoods with blocks averaging 3 acres (approximately 600 feet by 200 feet) exhibited an impressive 48 percent mode split.[9]

Figure 4.2: Density, housing urban amenities



8 State of the centers: investing in our communities, Metro, 2009.

9 Influence of density, diversity, and design on proportion of commutes by transit for Bay Area station area residents, Bay Area Rapid Transit, 2000.

Whereas smaller blocks warrant more urban style development and provides greater connectivity, large blocks will likely attract fewer transportation routing options. The large blocks along the MAX Blue Line east of I-205 demonstrate this difficulty. Platted originally within unincorporated Multnomah County, individual lots reaching 300 feet in depth pull development away from the street. To avoid this problem, land division regulations should set the table for transit-oriented development by establishing maximum block lengths (e.g., 400 feet) and/or block perimeters (e.g., 1,200 feet). Big blocks make walking seem to take longer, stifling pedestrian activity. To implement this provision, local jurisdictions should have local funding mechanisms and incentives in place to help finance land assembly and existing and future infrastructure improvements.

Transit-oriented design is also controlled by design guidelines and/or design review processes. Seeking to enhance the pedestrian experience walking to and from transit, guidelines may control building size, materials, fenestration (openings and windows) and building articulation. Standards should avoid requiring costly materials and features and focus on the key elements of strong urban form to limit added costs, increase affordability and promote architectural diversity. Minimum building heights and maximum setbacks, for instance, can be employed together to foster a sense of safety and enclosure for pedestrians, thereby creating an "outdoor room" effect. It also simply ensures the walk from sidewalk to building is not prohibitively long. Massachusetts's *Model Transit-Oriented Development Overlay District* suggests a minimum allowable building height of 28 feet and a maximum building setback of 5 feet. Exceptions to these standards may be granted if, respectively, a building is at least two stories or if an outdoor seating area, plaza or courtyard is incorporated into a development. To add visual interest and to provide more visibility, design standards may include requirements for transparency (e.g., see-through windows, openings onto the sidewalk) and/or active ground floor uses. For key pedestrian streets, Sacramento Regional Transit recommends 75 percent of ground floor building facades be transparent. As mentioned earlier, active ground floor retail or commercial uses can be required along market viable streets and/or strategic corners. This continuous pedestrian friendly street edge is preserved by the regulation of access and vehicle parking. Design standards should limit or prohibit curb cuts along pedestrian streets and tuck surface parking to the side or, ideally, behind buildings. More so than with other modes, every transit rider is also a pedestrian. If it isn't pleasant and safe to walk (or roll a wheelchair) to and from a station, then transit cannot perform to its potential. Similar standards are implemented in some jurisdictions in this region. Those that do will compete better for future HCT investments.

ACCESS AND SYSTEM INTEGRATION

A successful transit system must allow people to travel where they want and when they want with assurance that they won't be met with unreasonable delays or breaks in service. This necessitates an approach to system design which places priority on multimodal access.

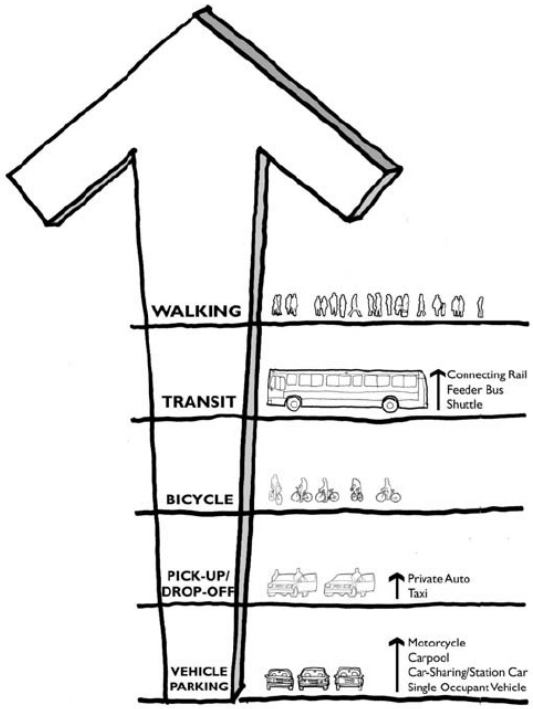
No matter how frequent, comfortable and well planned an HCT line is, passenger experience and ridership will suffer if it is difficult, time-consuming or uncomfortable to get to and from stations. Ultimately, jurisdictions' decisions to support different modes of access also determine the success of common goals such as easing traffic congestion, reducing emissions and supporting sustainable development.

Jurisdictions could consider developing a formal hierarchy of access to guide decision-making along HCT corridors and to evaluate disparate HCT station designs, infrastructure investments and area planning in light of these community goals . Figure 4.3, taken from the 2003 Bay Area Rapid Transit Access Guidelines, illustrates that low cost and high capacity modes, such as walking and transit, can produce the most cost-effective benefits and have less of an impact on the environment

and neighborhoods. This hierarchy helps decision makers combine incentives for priority modes with disincentives for low priority modes in mutually reinforcing land use, infrastructure and urban design decisions. In the Portland region, bicycles might likely take higher priority than transit in the hierarchy of access.

Urban form around many current MAX stations is transit, bike and pedestrian supportive, but some current stations and many future station locations will be challenged to provide excellent access for bicyclists and pedestrians. How passengers get to their origin station also determines their access choices at the destination end. Investments in multi-modal infrastructure and services are needed in regional and town centers and smaller station areas alike. Coordinated planning between jurisdictions in a corridor, design guidelines tailored to station typologies and targeted policies for parking management and infrastructure investment are all best practice strategies for creating environments that support multiple modes of HCT system access.

Figure 4.3: Muti-modal hierarchy



Source: BART Station Access Guidelines, April 2003.

Corridor thresholds and station area plans

In the San Francisco Bay Area, the Metropolitan Transportation Commission adopted a transit-oriented development policy in 2005 to promote "the development of vibrant, mixed-use neighborhoods around new stations."[10] The policy guides coordinated transit-oriented development planning at different scales in order to make sure regional goals and site specific development work together. Elements of the Bay Area plan should be considered in creating land use plans in HCT corridors and station areas.

Residential density thresholds around proposed HCT corridors. Setting these thresholds on a corridor level allows jurisdictions to meet density requirements even if intensification is not feasible at every station along the line.

Station area plans. Created in collaboration with the community, these plans specify future land use goals, parking strategies and transportation network designs around local stations. In addition to supporting corridor level density targets, these plans are detailed enough to guide walkable street designs, such as limiting blank walls and curb cuts, and promoting active storefronts, retail and employment.

Access circulation diagrams. These diagrams direct all new development to support preferred travel patterns for each access mode in the station area.

The commission has also implemented a grant program to fund plans in key locations and has determined that these small planning grants (most $100,000 or less) are among the most cost-

10 Transit-Oreiente Development (TOD) Policy for Regional Transit Expansion Projects, Resolution 3434, Metropolitan Transportation Commission, 2005.

effective ways to improve station access, draw new passengers to the system and reduce regional greenhouse gas emissions.

As with the corridor level density thresholds, the Bay Area recognizes that not all areas are appropriate locations for intense transit-oriented development growth. During planning, stakeholders employ station classification based on existing land uses, street networks, parking supply, proximity to highways and the quality of existing and proposed transit service and non-motorized infrastructure. Classification identifies the access modes most appropriate for each station in order to prioritize supportive infrastructure investments and consider the cost per new rider of making a given improvement. Based on a station's classification, plans focus on bolstering the non-motorized network, strengthening transit connectivity or improving park and ride access in the immediate term. Best practices for supporting each access mode are described below.

Walking and biking networks

Non-motorized modes are primary in the access hierarchy because they consume little land, have the least impact on the environment, reduce demand on motorized systems and are available to all people without the need to own or drive a car. With good pedestrian and bicycle networks in place, the catchment area for walking access to transit is considered to be within a one-half mile radius for pedestrians (a 10-minute walk) and a 3- to 5-mile radius for bicycling. Bike and walk networks within these HCT catchment areas should be among top local priorities. Accordingly, the draft

Creating a walk- and bike-friendly environment

- ✓ Mixed-use development offers conveniences like cafés, day care, dry-cleaning, and shopping.
- ✓ Human-scale urban design features add comfort and interest, such as transparent frontages, small setbacks, street trees, furniture, and awnings.
- ✓ Traffic calming slows vehicles and prioritizes people on bicycle and on foot.
- ✓ A complete network of walkways with continuous sidewalks, well-marked signalized crossings and green buffers or parking separates the walkway and traffic.
- ✓ A complete network of off- and on-street bikeways with prominent intersection treatments offers convenience and safety to bicyclists.
- ✓ Universal design recognizes the needs of people of all ages with a wide range of physical and cognitive abilities.
- ✓ Good wayfinding includes consistent signage, maps and online trip planners combining biking, walking and transit.

recommended policy language for the Regional Transportation Plan update specifically describes an integrated mobility strategy "to guide the development of a region-wide network of on- and off-street bikeways and walkways integrated with transit… [which] cannot achieve their full potential if they are treated as stand-alone." Portland's dramatic success increasing bicycle travel to the central city could be replicated around key HCT stations through the region. Critical non-motorized elements for station access are addressed below.

Comprehensive walking and biking networks. HCT corridor and station construction present special opportunities to build new walking and cycling amenities, such as parallel paths along the right of way, and station area plans can compel specific radial (feeder) improvements within the expected one-half mile and 3- to 5-mile catchment areas. Walk and bike pathways to stations should be continued onto the property and into station buildings.

Prominent bike and pedestrian station entrances. Entrances should be separated from vehicle traffic, leading directly to ticketing and boarding platforms or to bike parking.

Concentrated passenger amenities. Amenities at terminals and transfer points, including weather protection, seating and nearby or integrated services and dining options.

Bicycles at the station

In addition to complete, comfortable and clear bicycle networks through the 3- to 5-mile catchment area, cyclists must be assured that they will have a secure place to keep their bicycles at the HCT station. A survey of Portland cyclists found that a major deterrent to combining cycling with transit was a limited capacity for bikes on board and not wanting to leave expensive bicycles parked unattended.[11]

Refinements for the RTP from the bike policy and transit-bike parking working groups include consistent guidelines for bike parking, concentrated at stations identified as regional bike-transit facilities. Such identified transit centers would have dense residential development or major destinations located in the area but outside of walking distance, especially with bikeway connections to the station. Station areas with high expected walking or feeder transit access would not receive as much bike

Bicycle accommodations

This bike lane in Portland leads cyclists safely behind a streetcar stop, out of the way of both vehicles and waiting pedestrians.

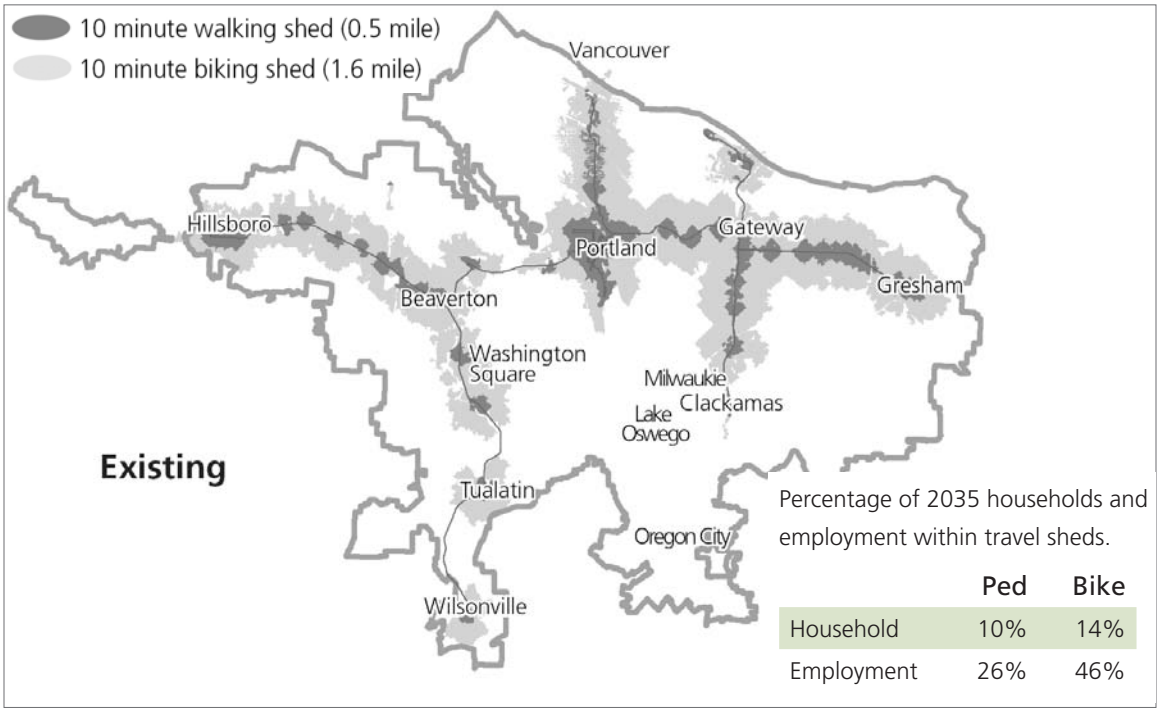
A bike box in Portland allows cyclists to be more visible at intersections.

Covered bicycle parking creates a safe, dry and convenient place for bicyclists to park.

11 Bicycle parking guidelines – draft, TriMet, 2009.

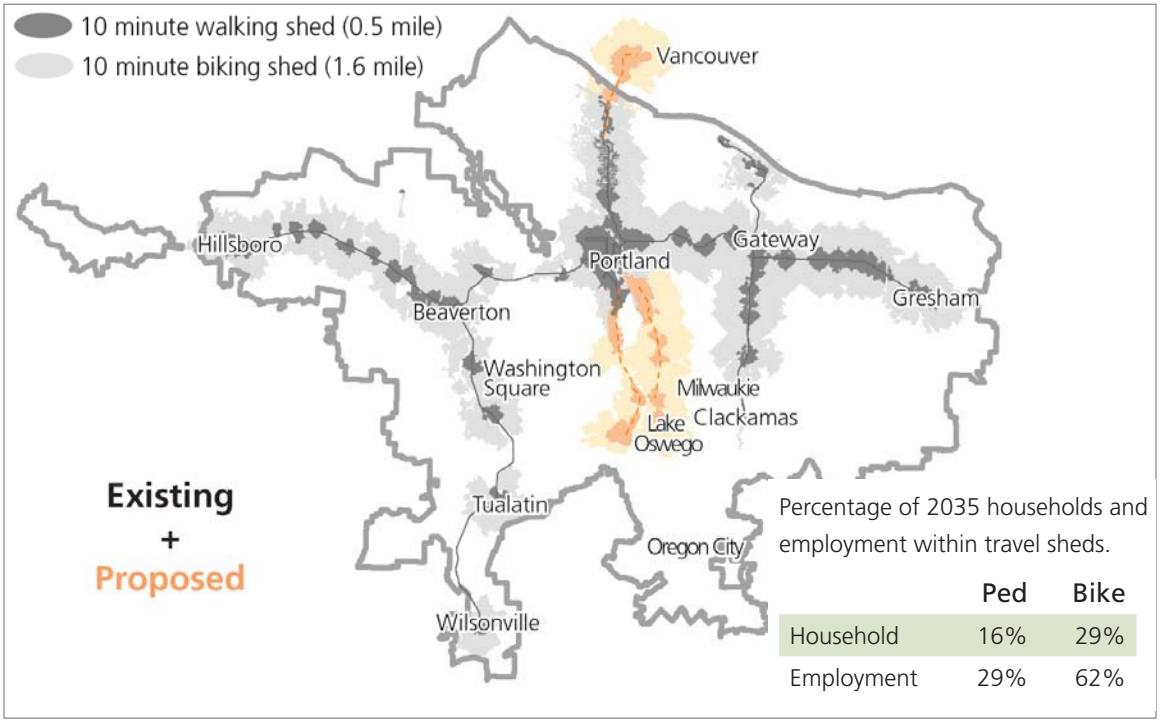
Figures 4.4 to 4.7 show how walking and bike access would increase throughout the region as the high capacity transit network expands. The analysis was conducted using a network analysis tool that measures walking and biking distances based on existing road networks. These figures are calculated on households and employement within the urban growth boundary only; Clark County is not calculated, but estimated.

Figure 4.4: 10-minute walking and biking travel shed, existing HCT corridors



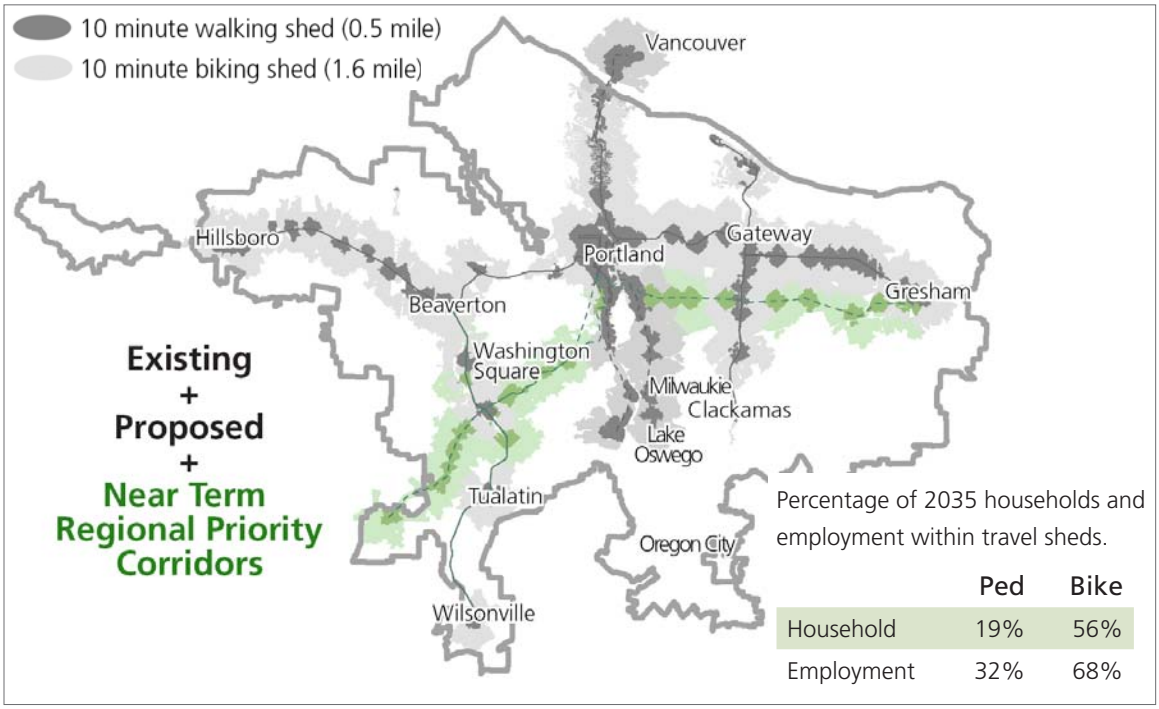
	Ped	Bike
Household	10%	14%
Employment	26%	46%

Figure 4.5: 10-minute walking and biking travel shed, existing and planned HCT corridors



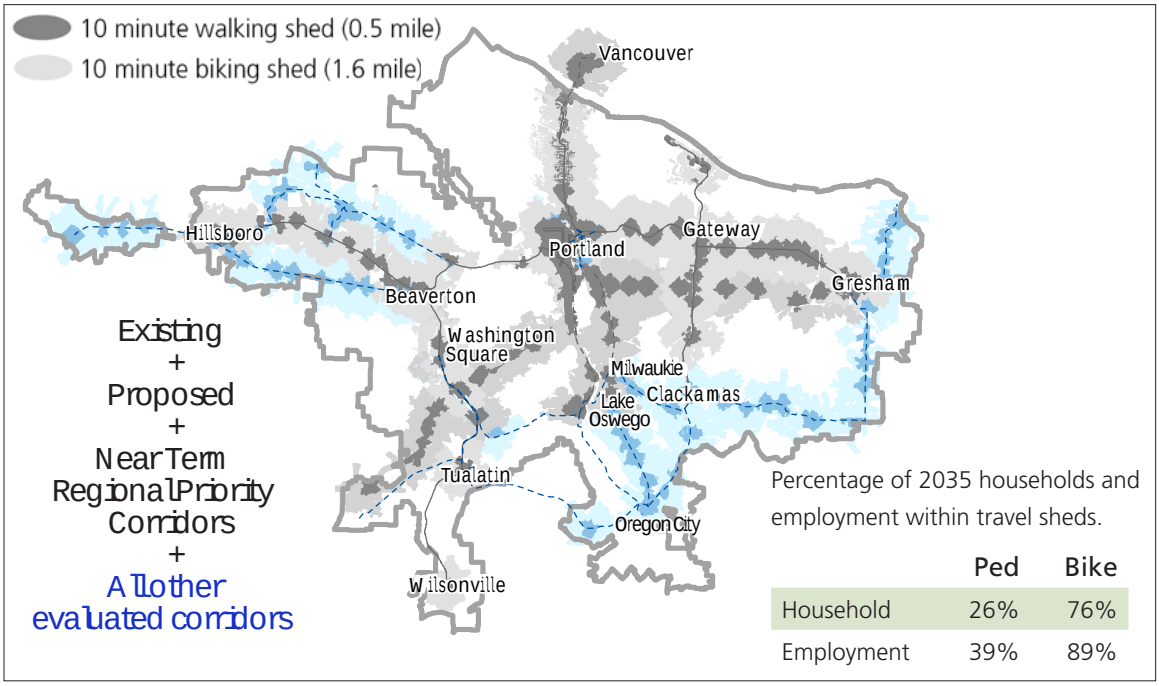
	Ped	Bike
Household	16%	29%
Employment	29%	62%

Figure 4.6: 10-minute walking and biking travel shed, existing, planned and near-term priority HCT corridors



	Ped	Bike
Household	19%	56%
Employment	32%	68%

Figure 4.7: 10-minute walking and biking travel shed, existing, planned and evaluated HCT corridors



	Ped	Bike
Household	26%	76%
Employment	39%	89%

parking. The guidelines suggest evaluating daily boarding data, existing bicycle facilities and household densities to determine the amount and placement of parking. For stations identified as regional bike-transit facilities, the guidelines recommend bike parking capacity for 10 to 30 percent of peak hour bike-walk boardings, with a mix of sheltered racks, bike lockers and enclosed racks within attended or card access areas.[12]

The RTP transit-bike parking working group recommendations for Portland draw on examples of extensive, high quality, high priority bicycle parking at train stations throughout Europe, especially in the Netherlands, Denmark and Germany. In cities such as Copenhagen, Amsterdam and Münster, main train stations overflow with parked bicycles. In order to accommodate and prioritize cycling access, bike racks have been installed near station entrances en route to ticketing areas and on desire lines from major bikeways. Stations offer a range of parking types, from open outdoor U-racks to sheltered parking with direct access to the platforms, staffed bike stations with clothes lockers, restrooms, repairs and rentals and even piped-in music. Bike parking in full view of station attendants, or at the least with optional cages and rentable bike lockers, are preferred for added security. Because capacity issues will always constrain the number of bicycles that can be transported on board HCT vehicles, opportunities should exist for cyclists to rent overnight, long-term storage for personal bikes at destination stations to complete the trip to their final destination.

Motorized access

Peninsula Traffic Congestion Relief Alliance

Parking at Portland's Beaverton Transit Center

Paid BART Park and Ride

Connecting transit service

Among motorized access modes, connections to transit are of highest priority. Feeder service significantly extends HCT catchment areas without creating additional traffic from private vehicles. Today, TriMet connects bus routes to MAX light rail and WES commuter rail, providing convenient transfers between modes and maintaining predictable wait times. Real-time information such as Transit Tracker displays improves passenger experience by providing information about vehicle arrivals. Riders perceive time spent waiting much more negatively than time spent riding, particularly when no information about vehicle arrival is available. Vehicle location and departure estimates can be displayed inside stations and at

12 *Ibid.*.

HCT around the world

Bogota, Columbia's world-renowned TransMilenio bus rapid transit system was designed with the goal to stimulate urban renewal through improvements to public spaces and restricted reliance on private vehicles. Instead of building a planned citywide multilevel highway system, Mayor Enrique Peñalosa refocused policy on creating a ubiquitous HCT bus network coupled with innovative urban design features that support access to the network without the need to drive.

Stations are located every 500 meters (one-third mile) on average. In addition to funding bike facilities, sidewalks, pedestrian avenues and signalized intersections through station catchment areas, public plazas and open spaces were built or improved, making areas inviting for pedestrian and bicycle trips and creating community amenities.

Since TransMilenio opened, transit mode share has increased from 64 to 70 percent. Notably, in light of the deliberate bike and pedestrian improvements, non-motorized mode share also increased, from 8 to 15 percent. In Bogota's bus rapid transit corridors, bikes are critical for TransMilenio ridership and cost-efficient service. Officials estimate that for every 20 people who bike to a station, one fewer feeder bus is needed. Bike parking facilities are integrated within terminals at key locations, where cyclists receive a bike parking sticker free of charge.

bus stops as well as online and on mobile devices. As new HCT stations are constructed, bus stops should be located to minimize the walking distance, avoid street crossings and offer sufficient curb space for peak demand with a preference for on-street stops. Developing supporting bus networks can be particularly important in suburban jurisdictions where pedestrian and bicycle access is more challenging, but these additional bus networks also add significant operating cost to support a new HCT line.

Feeder service for transit

A common barrier to shifting people away from long regional trips by private vehicle is the "last mile" connections to trunk line transit service like light rail or commuter rail. Shuttle services are often the most viable option in suburban environments where pedestrian and bicycle options are limited and locations are distant and/or on a disconnected street network.

Private vehicles

In station areas where automobile access will remain the dominant mode for the near term, agencies can choose parking management tools that enable passengers to use private cars but still demonstrate a priority for non-motorized and transit access.

- Allow passenger drop-offs as a low-cost means of extending the HCT catchment area without requiring parking; however, these zones still consume valuable curb space and generate vehicle congestion that can dissuade bicycle, pedestrian and transit access.
- Carefully size and locate park and rides based on the feasibility of other access modes (i.e., not locating park and rides in areas with good feeder transit access).
- Set parking maximums instead of parking minimums or allow shared parking arrangements among varied uses.
- Reserve spaces for high occupancy vehicles in priority locations near entrances and weather protection.
- Charge for parking on a monthly, daily or hourly basis, with surcharges at popular stations or variable prices throughout the day based on changing demand.

The Portland metro region's parking management policy establishes parking maximums at developments based on proximity to frequent transit service. TriMet park and ride lots are sited outside of the Portland central city to extend transit access to locations not otherwise well served by transit routes and where transit-oriented development is unlikely. Twenty percent of these park and rides are shared arrangements with churches, movie theaters and retail, many of which are not at light rail stations. Priority spaces may also be reserved for carpools and motorcycles, modes that consume less space per passenger for vehicle storage.

In the San Francisco Bay Area, Bay Area Rapid Transit has begun offering different types of paid parking, setting rates and the number of reserved spots based on demand patterns at different stations. Between 25 to 45 percent of stalls are reserved for monthly permit holders, with these spaces opening to anyone for use after 10 a.m. Other spaces can be reserved online on a daily basis before driving to the station. In addition, stations where parking regularly reaches capacity have begun to charge a $1 fee for parking in any spot, not just reserved spaces. While BART found that there was no drop in ridership as parking charges were implemented, and many lots continue to be filled to capacity before the morning peak period ends, lower-income passengers tend to respond more strongly to changes in parking prices than higher income passengers.[13] TriMet has begun to implement similar programs in the Portland metro region. At Sunset and Gateway Transit Centers, TriMet has reserved some spots for short-term, metered parking to address demand and increase availability of spaces at these over-subscribed park and ride lots.

At many stations, BART is also pursuing mixed-use housing redevelopment projects on old surface parking lots and constructing new structured garages with smaller footprints for the same or even greater capacity. This is a primary BART regional strategy to reduce vehicle miles traveled per capita by creating walkable, transit-oriented communities and to reduce the combined cost of housing and transportation for area residents. Similarily, TriMet entered into an agreement with the Portland Development Commission(PDC) to replace several acres of surface park and ride at the Gateway Transit Center with spaces in a parking garage. PDC partnered with a local developer on a multi-phase transit oriented development of the former park-and-ride site. Phase 1 is a medical clinic.

Parking management in station area communities

Above and beyond these direct treatments at stations, jurisdictions can also adopt regionwide policies that reduce incentives to drive. Parking policy can be a key determinant of a jurisdiction's readiness to support high capacity transit. Some of the most important policies are explored below.

13 Parking pricing and fees – traveler response to transportation system changes, TCRP report 95, Transportation Research Board, February 2005.

Widespread parking pricing. To ensure high ridership and reduce the many negatives of excessive driving, most public parking should be priced, and most employee parking should be either cashed out or priced. Cash out policies require employers who provide subsidized parking for their employees to offer a cash allowance in lieu of a parking space. Revealing the true cost of parking to those who drive typically decreases driving by 20 to 25 percent and increases transit ridership accordingly. Municipalities can put policies in place to require employer parking cash out, like Bellevue, Wash., and ensure adequate parking availability at all times by pricing public parking, like Redwood City, Calif.

Residential parking unbundling. Households looking for transit-oriented lifestyles are more likely to self-select into transit-oriented developments when they do not have to buy more parking than they need. Municipalities should require that developers unbundle the cost of parking from the cost of housing, particularly in rental units and multifamily condos For example, the City of Portland allows the unbundling of parking.

Residential parking ratios. Families living near high capacity transit demand less parking than those in auto dependent neighborhoods. Municipalities should eliminate minimum parking requirements in station areas and substitute parking maximums, ideally no more than 1.5 spaces per unit and often less. For example, San Francisco, Calif. sets residential parking maximums in transit-oriented neighborhoods at 0.25 to 0.75 spaces per unit.

Commercial parking ratios. Minimum parking ratios should be eliminated and replaced by maximums to ensure that development is truly transit-oriented and not just transit-adjacent. San Mateo, Calif., allows up to 2.0 spaces per 1,000 square feet of transit-oriented development. Commercial parking in San Francisco is limited to 7 percent of gross floor area and typically must be wrapped in active uses or built underground.

Transit pass programs. Many municipalities require that all new developments in station areas fund universal transit pass programs for project residents and employees in perpetuity. Some, like Boulder, Colo., extend such programs to cover existing residents and employees. Municipalities should implement such programs in all station areas.

HCT around the world

In Montpelier, France, high capacity rail lines are built directly through major town centers, including the main public square, and directly adjacent to key destinations like the convention center and the iconic Comédie Opera House. Lines run on surface streets in between sidewalk cafes and through the public market, as a blended part of the streetscape. The transit system is a part of all residents' daily experience whether or not they are passengers, because everyone walks around trains and across lines throughout the city. These European street trams created placemaking value similar to Portland's Streetcar, but operate more reliably and efficiently due to dedicated lane operations.

Montpelier, France

SYSTEM DESIGN AND USABILITY

Integrating transit into our communities and daily lives

When designing new service, transit planners generally focus on passenger markets, route alignments and operational criteria. These are essential considerations when siting new HCT routes; however, how transit is built into

neighborhoods and the everyday lives of residents also plays a critical role in attracting passengers and can establish transit as a valued, integral part of the community. Stations, vehicles and HCT rights of way are important elements of urban form that all community members experience at some level, and they should be designed as welcoming public spaces.

Above all, riders and neighbors must feel that the system is safe, comfortable, easy to use and compatible with their neighborhoods and their daily activities. TriMet's station design guidelines encompass many system design best practices, including civic architecture that incorporates neighborhood characteristics, clear building layouts and signage systems that naturally direct smooth passenger flow, and comfortable waiting environments that offer weather protection, security and seating.

HCT rights of way as integrated streetscapes

Dedicated HCT rights of way are critical to ensure on-time reliability and desirable travel times. In addition to this functional role, HCT corridors can make transit a visible and tactile element of the built environment. When HCT vehicles are given signal priority and dedicated lanes, they do not have to compete with or get stuck in general traffic and are clearly identified as a fundamental part of the transportation network. Instead of widening streets to accommodate transit, European cities regularly take over existing general traffic lanes and convert them to dedicated lanes for streetcars, buses and bicycles, or to accommodate wider sidewalks and greenspace amenities for the community at large. At the same time, these streets and the HCT corridors should be designed to integrate into and accentuate the existing neighborhood fabric, especially when built at grade instead of underground and out of sight. Highly prominent transit lines that deliver people directly to centers of activity help animate the streetscape by attracting pedestrians.

Stations as placemakers

Specific station area plans are necessary to guide nearby land uses and ensure that street and building designs support HCT access and use. TriMet's station design guidelines also direct walkway and bicycle amenities on the station property itself as well as call for seating, lighting and 24-hour uses that create a publicly desirable place with natural activity and surveillance. ADA-accessible entrances and ramps, platforms built to match vehicle heights for easing loading and obvious paths that avoid level changes and blind corners are all fundamental to easy station navigation for all passengers.

Beyond ensuring basic access and circulation needs, station property and buildings should also be designed as a good neighbor, reflecting

HCT around the world

Dublin created an integrated land use and transportation plan that was directed not by transportation considerations, but by a broader vision for the city. Land use policies and public private partnerships focused on the character, quality and on-the-ground implementation of higher density development. Routes were designed to provide access directly into major plazas, dining and retail spaces, and to interface easily with buses and regional rail. New station construction helped revitalize abandoned, high-crime areas outside of the city, and downtown redevelopment and intensification of businesses and residences fronting the light rail lines changed the face of Dublin.

Dublin, Ireland

community characteristics and supplying a valued public space. Building designs can incorporate materials and patterns drawn from neighborhood architecture and culture, and define public spaces both inside and outside the building. Green spaces, gathering places and public art give stations and the transit system character and humanize spaces that might otherwise remain large and impersonal. Designing new stations also presents the opportunity to create highly recognizable, valued and unique community landmarks. Grandiose, whimsical or interactive architectural elements can be incorporated into otherwise standard building designs to create a visual and cultural identity for the station and its neighborhood.

Public information: consistent, easy to find and far reaching

Since people will access HCT stations by foot, bike and car, it is critical that public information successfully direct passengers to, through, and out of stations, reorient them to the neighborhood when they exit and get them back to the station for the return trip. Public information materials must be easily and completely understandable by all transit users, especially those that are unfamiliar with the system or new to the Portland metro region. Similar to designing physical spaces for seniors and persons with disabilities, creating a system that is easily understandable to all users ensures that riding transit will be a pleasant, convenient and seamless experience for all passengers.

TriMet has developed guidelines for station and stop information that at a minimum include schedules and maps for routes serving that location. Some of the major stops in the system also include digital displays with real-time information, and Transit Tracker allows users to obtain real-time information for all stops in the system via phone or TriMet's web site. An additional navigation tool could include a map that shows the station and surrounding streets and key landmarks and destinations. Prominent signs outside of the station can also be used to direct passengers to surrounding streets. Correspondingly, wayfinding elements can be placed throughout the neighborhood to direct people to the station. Passenger experience includes every part of making a trip, not just the time spent on board.

TriMet is continually evaluating and improving their public information systems by observing passengers as they make a complete trip in order to discover where confusing or uncomfortable roadblocks occur. The goal of this effort is to identify ways of improving the passenger's experience from start to finish. This total user experience includes planning a route and deciphering timetables, boarding the vehicle and paying the fare, finding a seat and riding comfortably, and requesting stops and making transfers. As part of this experience, fare structures should be simple to understand and remember, and payment media and rates should be integrated across modes and systems. Portland uses proof of payment systems and off-vehicle fare collection on MAX, and is investigating advance payment technology such as smart cards that will make fare payment at the station effortless to passengers. Prepaid and no-contact cards would make boarding faster and reduce customer confusion about how much, when and where to pay. These passes have the capacity to serve as a monthly pass as well as for pay as you go trips or offer discounted fares tailored to individual travel needs that serve a wide variety of rider groups.

Station safety and security

Transit stations are the front door of the transit system. Station design not only establishes user value but enhances usability. Well designed, secure transit stations send a clear signal to transit passengers that they are using a first class public service. Station amenities can be enhanced or even replaced by a well integrated urban streetscape, as is often the case with streetcars and urban bus malls. Standardized station design and facilities across lines and modes are also important for user comprehension.

High capacity transit modes, which often use exclusive rights of way, must still operate in busy street environments where the alignment and stations share the right of way with pedestrians, bicycles and motor vehicles. Station design, and design of trackage between stations, must minimize conflicts with people and vehicles and emphasize safety where modes intersect. In addition, security at stations and on transit vehicles is an integral element of the customer experience and can often be enhanced by design. This section highlights some best practices for creating safe and secure transit stations.[14]

Inside the station

Create inviting, safe platforms and secure station areas. Stations that follow accessible design practices convey inviting, safe and secure station areas. This can be accomplished through design, lighting, clear zones and cleanliness. Station elements should consider:

- **Station location.** Stations in low crime areas near activity centers tend to be more safe and secure. Paid fare zones increase the sense of security. Isolated stations should be closed down during off hours; if this is not possible, maintain a security presence and bright lighting throughout the night.
- **Lighting and clear wayfinding.** Lighting throughout the station and clear wayfinding signage can make stations more inviting.
- **Station design.** Stations that have dead-ends are less inviting and can encourage criminal activity.
- **Station cleanliness.** Clean stations ensure that amenities like ticket machines, pay phones and vending machines remain in working order. Cleanliness signifies that the station is monitored and well cared for, helping to reinforce safety.
- **Accessible stations.** In accordance with the Americans with Disabilities Act

14 Guidance provided in part from light rail design practices documented for the City of Bellevue, the Columbia River Crossing plan and recommendations for the Portland-Milwaukie Light Rail Project.

CPTED in practice

Tactile strips at stations

Bicycle access

Signals for light rail

Pedestrian warning gates

Accessibility guidelines, platform edges must have a tactile warning strip. The warning strip can be enhanced with additional measures similar to the feature on the ACE light rail platforms in Las Vegas, which have a warning strip preceding the platform edge strip and a square to alert passengers, especially those with physical impairments, where train doors will open. Due to variation between vehicles in the TriMet MAX fleet, consistent door location markers are not possible.

Check station designs against crime prevention through environmental design principles. CPTED principles outline ways of using the built environment to deter criminal activity. For example, a transit station facing out onto the street, viewable by any passerby, feels much more secure than a station surrounded by a high wall and closed off from the public. Early decisions about alignment (i.e., highway rights of way versus arterial corridor) can influence the level of investment needed to design and construct secure stations. The CPTED principles include making spaces feel visible to others, delineating boundaries between public and private space, and managing access through measures like a clearly marked primary entrance. The CPTED principles also prescribe keeping all elements of the station clean and maintained, which also deters crime. If the station cannot be access-restricted, follow CPTED to clearly delineate platform areas and communicate that only paying customers are allowed in that area.

Provide station art and amenities. Successful HCT stations will become an important extension of the community and civic life when the transit line opens. Artistic touches can help humanize the station environment and foster a sense of ownership among residents and business owners, encouraging community policing of suspicious activity. Any amenities like bike parking should be clearly visible outside the station to deter theft, and enclosed if possible. Benches can be designed as single seats to prevent people from sleeping on them.

Coordinate with enforcement and response agencies. While station design has the potential to deter a good portion of criminal activity, stations also need the presence of security personnel. The transit agency can work with local law enforcement and emergency workers throughout station design to ensure the station is routinely monitored. Some strategies include:

- Work with local police to add new transit stations to their rounds. If businesses near the station already employ private security services, there may be an opportunity to partner on monitoring a station.
- The number of transit police or daily visits could be increased as ridership increases and more people are using a station.
- During station design, determine how emergency vehicles will reach stations and tracks, and train first responders and police on how to access secured station areas.

Use technology to monitor the station. Closed circuit cameras not only allow agents to monitor stations, their very presence helps deter crime by increasing the feeling of visibility to the outside. Closed circuit television cameras in and around stations, as well as in parking areas can be used to monitor activity. Call boxes at stations can also be provided so that passengers can directly contact security or emergency personnel if needed. By planning for technology early in the design process, the equipment can be better integrated with the station to be unobtrusive yet still effective.

Getting to the station

Maximize predictability and minimize confusion. Safety around the station can be enhanced by increasing the predictability for drivers, bicyclist and pedestrians. This can be achieved by limiting movement choices.

- Separate station entrances for cars and pedestrians can minimize conflicts.

- Barriers at transitway may be used so that bicyclists must dismount before crossing tracks. This improves predictability for the train operator.
- Clear signage and markings provide unambiguous direction to all users.

Create safe and direct connections for non-motorized access. Bicycling and walking to stations can be encouraged by providing clear, direct, well-lit pathways to transit. Ramps or "runnels" (rails for bicycles on stairways) can improve access to platforms and secure bike storage. Pathways that require tunnels or overpasses, or routes that pass through areas without natural surveillance, are discouraged. It is important to provide direct access from adjacent bus stations to and from the train platform.

Provide pedestrian-scaled lighting. An important distinction should be drawn between roadway lighting, which is meant to illuminate roads for drivers, and pedestrian-scaled lighting. Good lighting at the pedestrian level improves people's feeling of security. In Seattle, the Department of Neighborhoods and Seattle City Light are installing pedestrian-scaled lighting at a height of 12 to 15 feet in business districts. These lights are placed on the sidewalk rather than in the road and will improve security and business exposure.[15] The Puget Sound Regional Council recommends lighting at 10 to 12 feet and providing 0.75 to 1.5 foot candles of illumination. When possible, high pressure sodium (HPS) lighting should be avoided because of its poor color rendering. TriMet's system design guidelines specify lighting conditions for various environments throughout their system. They also specify that new lighting should use F32T8 florescent lamps whenever possible rather than T12, HPS or pulse-start metal-halide lamps due to better efficiency and color rendering.

Ensure secure parking areas. CPTED principles can be used when designing parking areas. As noted above, lighting provides a better sense of security when placed at the pedestrian scale. A small but fully occupied lot feels safer than a large, mostly vacant lot. In cases where structured parking is provided, garage attendants can circulate through the garage to provide additional security. Closed circuit cameras can also be used in parking areas.

Surrounding and between stations

Provide pedestrian and bicycle warnings. Crossing gates on sidewalks can be used where there are at-grade crossings of HCT corridors. Signs showing people which way to look when crossing transitways improve safety, especially if there are three tracks. Warning signs and lights also help alert pedestrians and bicyclists. If transit runs at grade through a pedestrian zone, tactile warning strips along the entire corridor help to alert pedestrians that the street is shared with a transit line.

Provide visibility for all users. Visibility from the standpoint of the transit operators, drivers, bicyclists, pedestrians and wheelchair users should all be considered. Operators need to have a clear view of the station, track and crossing areas. Pedestrians, drivers and bicyclists should have a clear view of the tracks, roadways and sidewalks. Visibility can be achieved by providing lighting above transitways and especially at crossings.

Ensure safe interactions between vehicles and trains. Transit and cars often share rights of way, even if only where tracks cross roadways at grade. The Transportation Research Board recommends completely separate signals for both transit and cars, with consistent application of such signals throughout the system to maximize safety. [16]

In general, exclusive transitway running in the center of the street along a median is the safest type of operation because it minimizes conflicts between turning vehicles at intersections and driveways.

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15 Create a thriving business district, Office of Economic Development, City of Seattle, www.cityofseattle.net, accessed June 30, 2009.

16 Integration of light rail transit into city streets, TCRP report 17, Transit Research Board, 2000.

Center running transit also provides transit operators with more time to see pedestrians stepping into transit right of way and reduces exposure at the curb. For this reason, much of the MAX system constructed on arterial streets is center running (e.g., North Interstate Avenue, East Burnside Street). The new Portland Transit Mall employs a unique mix, with curb-loading stations and center-running transit between stations. If enough right of way is available, provide protected left and right turn lanes to the roadway to safely channel cars in traffic around light rail trains, reducing conflicts.

MULTIMODAL CORRIDORS

The Oregon Department of Transportation requires that any proposed HCT corridor affecting a state highway comply with a variety of ODOT regulations and standards, whether the alignment is within, adjacent to or parallel to existing right of way. This section identifies federal and state policies that would currently apply when an HCT corridor within a state highway right of way is selected for further evaluation.

General transportation and land use planning requirements

Oregon's Transportation Planning Rule[17] is a Land Conservation and Development Commission administrative rule that imposes several general requirements relevant to HCT corridors, including those affecting state facilities.

- Metro and TriMet would need to coordinate with state agencies, owners of transportation facilities and providers of transportation services (including railroads and the ODOT Rail division for rail right of way).
- The Transportation Planning Rule establishes a hierarchy of transportation plans, requiring that the RTP be consistent with state plans and local transportation safety plans be consistent with the RTP.
- The Transportation Planning Rule (Section 660-012-0060) requires that a local government take measures to mitigate significant effects of land use plan amendments on a transportation facility.

Process for further corridor evaluation: refinement plans and project development

The Transportation Planning Rule defines a refinement plan as an amendment to a transportation system plan, such as the Regional Transportation Plan, that "resolves, at a systems level, determinations on function, mode or general location which were deferred during transportation system planning." Corridor refinements are necessary where a transportation need exists, but mode, function and general location of a transportation improvement are not determined.

A refinement plan is the approach ODOT recommends for conducting further analysis of potential corridors identified in the HCT planning process and adopted in the RTP. Regardless of the type of right of way required, this process would facilitate resolution of concerns over the effect of HCT corridors on vehicular mobility and freight on state highways.

During the development of projects in an adopted transportation system plan, the projects are not "subject to further justification with regard to their need, mode, function, or general location," provided that the plan makes decisions about those project characteristics as could be done in a refinement plan. Project development would implement HCT corridors adopted in the RTP by

17 Transportation Planning Rule, OAR 660, State of Oregon.

"determining the precise location, alignment, and preliminary design (of those corridors) based on site-specific engineering and environmental studies."[18]

Mobility

The regional transportation system balances the function of providing mobility, or movement, for people, goods and services with providing the ability for people to access local destinations. The RTP defines an integrated concept of multimodal regional mobility corridors, including both limited access throughways and high capacity transit that facilitate travel through and across the region. These throughways are subject to level of service mobility standards based on the vehicle to capacity ratio defined in the Oregon Highway Plan. Action 1F.3 of the Oregon Highway Plan permits jurisdictions to adopt alternate capacity standards with approval of the Oregon Transportation Commission; Metro adopted such standards in the 2035 Regional Transportation Plan.

ODOT has articulated several options that apply where future detailed analysis of HCT corridors indicates that current or forecasted V/C ratios on an affected state highway do not meet OHP standards.[19]

Option 1: Select a HCT corridor where the state highway meets mobility standards for the region.

Option 2: Mitigate for the negative impact using design or operational strategies and request ODOT approval pursuant to Action 1F.5 of the Oregon Highway Plan. The Oregon Highway Plan lists a number of possible design or management actions that might improve performance under Actions 1F.3 and 1F.5. This approach is applicable to corridor refinement plans as well as an RTP update.

Option 3: Another approach applies to minor RTP amendments subject to Section 660.012.060 of the Transportation Planning Rule,[20] as opposed to major updates or corridor refinement plans. If developing an HCT corridor is found to have a significant effect on a transportation facility (e.g., a degradation in the facility's performance) a request could be made for ODOT approval pursuant to Action 1F.6 of the Oregon Highway Plan, where the performance standard is to avoid further degradation of the facility.

Option 4: Request Oregon Transportation Commission approval of an alternate mobility standard for the particular highway, pursuant to Action 1F.3 of the OHP. This approach is applicable to RTP updates and possibly to corridor refinement plans, if the area "is of a size necessary to support compact development, reduce the use of automobiles and increase the use of other modes of transportation, promote efficient use of transportation infrastructure, and improve air quality."

Reducing vehicle carrying capacity on freight routes

On freight routes designated in the Oregon Highway Plan, through-highway mobility is given greater importance than accessibility. In the Portland metro region, these routes include all or portions of interstate highways 5, 84, 205 and 405, state routes 8 (TV Highway), 99W, 99E, 224, Powell Boulevard and U.S. Route 26, and U.S. Route 30.

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18 Section 660-012-0010 and 660-012-0050 of the Transportation Planning Rule, OAR 660, State of Oregon.

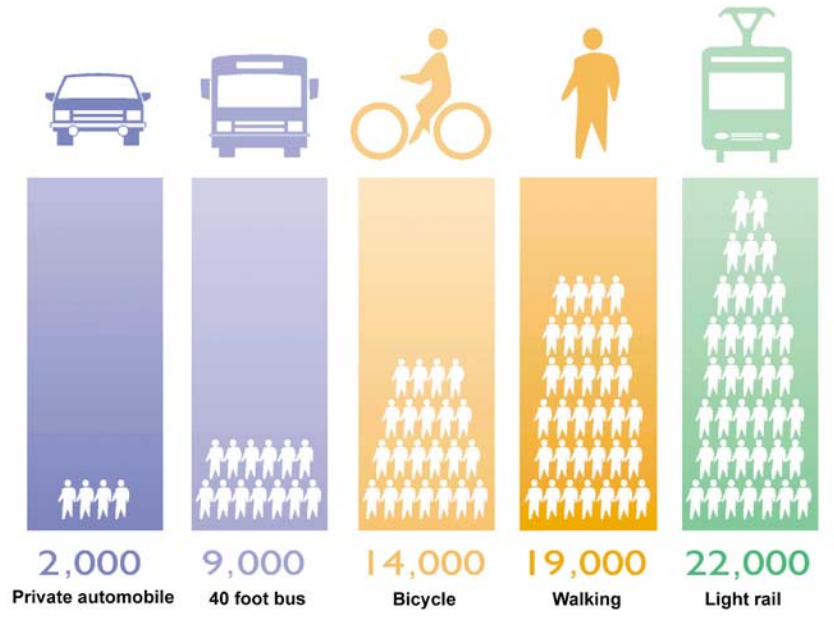
19 Oregon Highway Plan, Actions 1F.3, 1F.5, and 1F.6, p. 80-82, and Policy Element, Tables 6 & 7, State of Oregon, 1999 (amendments through July 2006).

20 "Where an amendment to a functional plan, an acknowledged comprehensive plan, or a land use regulation would significantly affect an existing or planned transportation facility, the local government shall put in place measures… to assure that allowed land uses are consistent with the identified function, capacity, and performance standards… of the facility."

Alternate mobility measures

The region is developing alternative means of measuring mobility, emphasizing person-carrying capacity rather than vehicle capacity. These alternate measures better account for the use of alternate transportation modes and a wider range of transportation options available in existing or planned mixed-use areas.

Figure 4.8: Person capacity per lane eqiuvalent[1]



Number of people crossing a 3.5-meter wide space in an urban environment during a one-hour period.

1 *Ticket to the future: 3 stops to sustainable mobility, UITP, International Association of Public Transport, Brussels, 2003.*

Oregon law precludes the Oregon Transportation Commission from permanently reducing "the vehicle-carrying capacity of an identified freight route when altering, relocating, changing or realigning a state highway unless safety or access considerations require the reduction," unless a local government, including districts such as Metro and TriMet, requests an exemption. According to the law, the commission "shall grant the exemption if it finds that the exemption is in the best interest of the state and that freight movement is not unreasonably impeded by the exemption."[21]

Acquisition of highway right of way land by public agencies

In 1991, the Intermodal Surface Transportation Efficiency Act (federal transportation authorization legislation) directed state departments of transportation to make surplus right of way constructed with at least partial federal funding available for transit projects, if doing so would not adversely impact automotive safety.[22]

An ODOT policy (formalized in 2008) stipulates that there is a reversionary clause for any right of way purchased for a highway project and transferred to a local jurisdiction. The right of way reverts

21 Creation of state highways; reduction in vehicle-carrying capacity, ORS 366.215, State of Oregon.

22 "Where sufficient land or air space exists within the publicly acquired rights of way of any highway, constructed in whole or in part with Federal-aid highway funds, to accommodate needed … public mass transit facilities, the Secretary shall authorize a State to make such … rights of way available with or without charge to a publicly or privately owned authority or company… if such accommodation will not adversely affect automotive safety."

back to ODOT if the land is not used for public road purposes "to protect the constitutionally dedicated Highway Fund contribution to the original purpose of the property."[23]

Policy considerations

Metro has already adopted mobility standards in the 2035 RTP that allow higher vehicle to capacity ratios but is also working to develop alternate measures of mobility. State regulations attempt to address the concern that increased intensity of land use around HCT stations will generate increased trips on state highway facilities and require mitigation measures to maintain highway performance standards. While these regulations are understandable, they can also act as an obstacle to furthering walkable transit-oriented communities needed to reduce regional vehicle miles traveled over the long term. Alternative mobility measures could provide a more comprehensive assessment of these impacts.

Right of way options for developing high capacity transit

Any new HCT line is faced with unique geographic, political and land use challenges and opportunities. Since many of the best opportunities for easily threading HCT lines through the metropolitan area have already been capitalized, future corridors are likely to face even greater challenges. In any one corridor, it is likely that multiple strategies for integrating HCT will be needed. This section outlines key strategies and tradeoffs.

Existing right of way (undeveloped). In urban areas, right of way is often available only along existing transportation corridors, including the roadway medians, highway shoulders and railroad alignments. For example, TriMet's practice is to use public and available railroad rights of way where possible, obtaining easements or purchasing land outright. A downside of existing, undeveloped right of way along transportation corridors is that it may be more challenging to create a high quality pedestrian environment or foster mixed-use, transit-oriented development.

- **Westside Express Service:** WES commuter rail provides an alternate route between Beaverton and Wilsonville during peak hours using 14.7 miles of freight railroad tracks shared with Portland & Western Railroad. The right of way was previously utilized for passenger service by the Oregon Electric Railway and Red Electric line.

Existing right of way

Northeast Holladay Street, before light rail

Northeast Holladay Street, after light rail

MUNI 3rd Street Light Rail, Sunnyside Station

23 Relinquishment of project right of way to local public age
Transportation, State of Oregon, May 15, 2008.

- **Westside light rail (MAX Blue Line):** In order to support concentrated development and land use patterns, the Portland region chose a railroad alignment adjacent to greenfields rather than build the light rail along already developed Highway 26 or Tualatin-Valley Highway.

Existing right of way (reallocate lane usage). Altering the use of lanes to provide exclusive transit right of way can improve travel time and reliability but may require eliminating local access or parking, particularly in mixed-use areas, which can raise community opposition.

- **Banfield light rail corridor:** Prior to MAX Blue Line construction, Northeast Holladay Street was a major westbound arterial carrying high volumes of traffic into downtown Portland. When MAX was constructed the street was converted to a double-track exclusive transitway and two westbound traffic lanes. When the auto lanes reopened after construction, they were

Right of way scenarios

Railroad right of way: Westside Express Service (WES) commuter rail is an example of an active rail corridor that was modified to carry commuter rail (light rail is also possible). There may also be unutilized space in the right of way to construct additional tracks.

Grade separated: MAX trains run on exclusive right of way in the street median, then enter grade-separated right-of-way leading to the bridge..

Side running: Blue and Red Line MAX trains run in exclusive right of way on two sets of tracks on one side of the street, adjacent to a traffic lane and on-street parking. Unutilized right of way may be available or existing traffic lanes could be converted to transit use.

Median: The photo above shows median running light rail in Barcelona, Spain. In Portland, the MAX Yellow Line runs in the median of North Interstate Avenue, which was reconfigured to accommodate the MAX. In other cases, there is unused right of way in street or freeway medians.

so underutilized that the direction was shifted to a safer, eastbound movement and a lane was converted to parking.

- **Interstate MAX:** The Interstate Avenue MAX Yellow Line was constructed at grade within the existing street right of way. It replaced a five-lane arterial with a fully separated double-track median and one traffic lane in each direction with turn lanes. As a result of transferring public right of way to HCT from roadway, the project avoided any home or business displacements. North of the Kenton Street station, it was more cost-effective to build the Expo Center section of the line grade separated but within the right of way, instead of replacing or widening the existing Denver Viaduct and the Columbia Slough Bridge.[24]
- **Third Street light rail, San Francisco:** The Third Street MUNI Metro line, completed in 2006 between the Bayview District and the downtown Caltrain station, operates in a semi-exclusive right of way. Third Street is one of the city's longest north-south routes and runs along its eastern waterfront. Three traffic lanes in each direction were reduced to two lanes, which some residents perceived as a benefit because of the traffic calming impact. The line runs in a median transitway with the exception of a nine-block section in the Bayview commercial core, where it operates in one of the two traffic lanes, with parking preserved. The remaining right of way was used to expand sidewalk width.[25]

Preserved right of way. Preserving right of way for transit use is a cost-effective means of providing right of way for future transit service in developing and undeveloped areas and is identified in the RTP as an investment need and as a fiscal stewardship goal. It is also a desirable approach where HCT service along a corridor is expected to be feasible in the future. In these cases, local land use plans should provide for transit right of way.

I-205/Portland Mall Light Rail Project: The I-205 MAX line largely follows an existing transitway created when I-205 was originally constructed. This right of way allowed for faster construction, fewer traffic disruptions and few community impacts.[26]

Purchase right of way (land in other use or undeveloped). Purchasing new or additional right of way is a complementary strategy to the other right of way options. In some cases, a small strip of additional land may be needed to create sufficient width in a right of way; in other cases, whole new tracts of land in developed or undeveloped areas may be needed.

Costs

There are trade-offs between construction in a street or freeway median and adjacent to the roadway. In the median, the right of way is publicly owned, but there are potentially greater construction costs due to access issues, grade conflicts with other transportation system users and station siting issues. Construction adjacent to a roadway has potential for more displacement of residences or businesses and the need to acquire additional property outside of the public right of way. There is no one answer to whether one approach is more cost-effective the other.

24 Debate of at-grade versus grade separation construction: Interstate MAX Project, Portland, OregonTransportation Research Circular E-C058: 9th National Light Rail Transit Conference, 2003.

25 Community and systems planning for Muni's Third Street Light Rail Project, Transportation Research Circular E-C058: 9th National Light Rail Transit Conference, 2003.

26 About the I-205 Project, TriMet, trimet.org, accessed June 30, 2009.

Figure 4.9: Rough order of magnitude cost estimates for right-of-way configuration

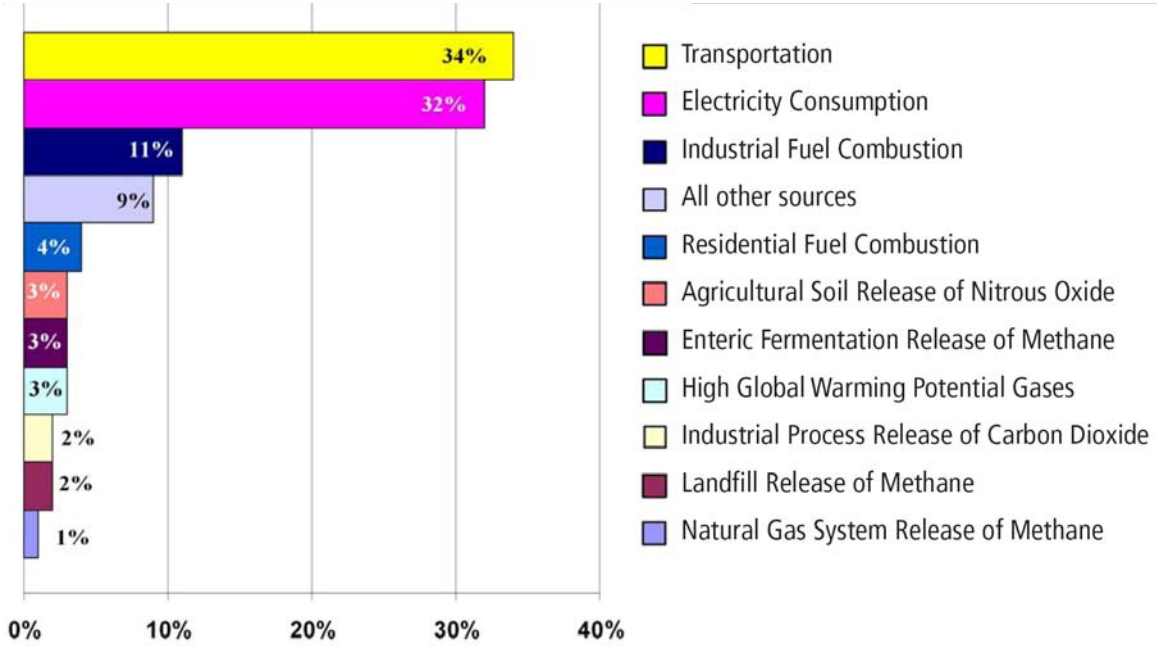
Right of way type	Right of way configuration	Estimated cost per mile (2009 dollars)	Percent difference from existing in-street median (low/high)
Existing	In-street median	$118 - $123M	–
Existing	In freeway	$130M	10%/6%
New	Adjacent to roadway	$113 - $146M	-4% / 19%
New	Adjacent to roadway, with retained fill	$120 - $153M	2%/24%

Figure 4.9 lists low and high estimates of average costs per mile for different HCT right of way configurations. These estimates were developed to evaluate potential HCT corridors and were primarily based upon actual construction costs for MAX Green Line and estimated costs for the South Corridor (Portland-Milwaukie) light rail project. The cost estimates assume light rail and are intended to provide a relative cost comparison. The right-most column shows the percentage difference between each right of way configuration and use of existing right of way in the street median. Use of the freeway median is generally 6 to 10 percent more expensive than a street median. Construction in new right of way adjacent to the existing roadway ranges from 4 percent less expensive to 19 percent more expensive. If adjacent right of way requires fill and a retaining wall, this increase is as as little as 2 percent and as much as 24 percent.

HIGH CAPACITY TRANSIT'S ROLE IN REDUCING CARBON EMISSIONS

Cities and regions across the United States have come to accept that greenhouse gas emissions are a chief cause of global warming. Oregon, a state known for environmental activism, has adopted goals of halting and cutting emissions levels across sectors. Reducing greenhouse gas emissions is especially important for the transportation field, which represents the largest source of emissions in the state (see Figure 4.10).

Figure 4.10: Major sources of Oregon greenhouse gas emissions (2004)[27]



Metro has a key role to play in reducing the region's greenhouse gas emissions because of responsibilities, regional perspective and a commitment to partnerships and collaborative solutions. This includes efforts by the Regional Transporation Plan. Metro is committed to identifying how the region can meet Oregon's greenhouse gas reduction goals, which call for arresting the growth of greenhouse gas emissions by 2010, reducing emissions to at least 10 percent below 1990 levels by 2020, and reducing emissions to at least 75 percent below 1990 levels by 2050.

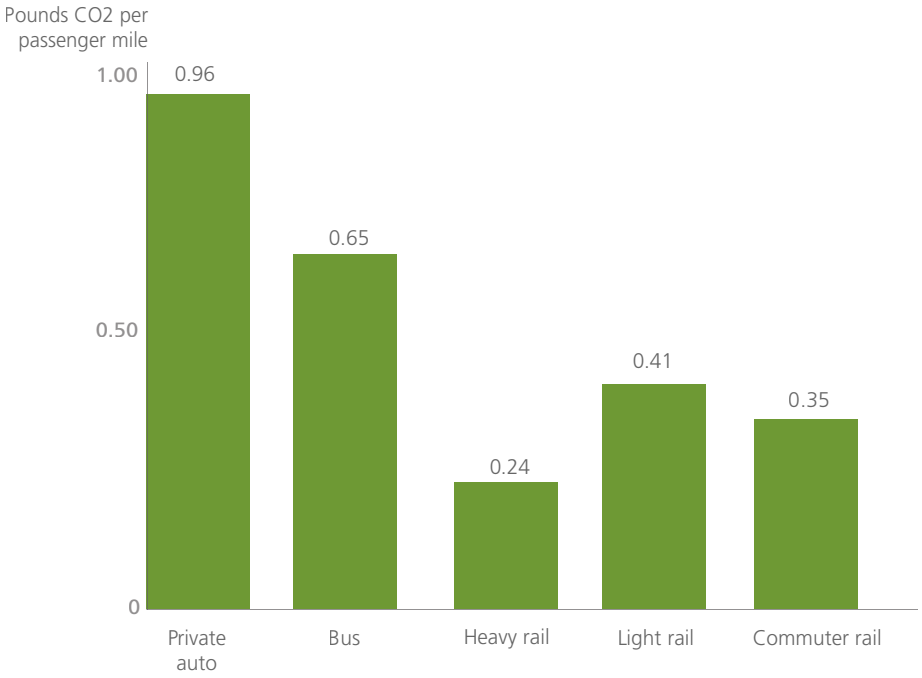
Metro is focusing on:

- developing regional greenhouse gas emissions tools to help Metro and the region assess and prioritize program options;
- coordinating with partners to create a regional climate prosperity strategy premised on the belief that successful reduction of greenhouse gas emissions and protection of the environment translates into competitive advantage and can serve as the foundation for economic growth and wealth creation in a transformed global economy.

Transportation emissions are primarily produced by personal motor vehicles. According to the Environmental Protection Agency, in 2008 passenger cars and light duty vehicles (which include vans and SUVs) accounted for 64 percent of all transportation emissions. Thus, increasing mass transit use and reducing vehicle miles traveled is a key element of a larger regional strategy for reducing the emissions produced by the transportation sector. Public transit emits far fewer emissions than auto travel, as shown in Figure 4.11.

27 A framework for addressing rapid climate change, final report to the governor, The Governor's Climate Change Integration Group, State of Oregon, January 2008.

Figure 4.11: National average greenhouse by gas emissions (2004)



The Federal Transit Administration's statistics are based on average vehicle occupancy of 1.14 for average single-occupancy vehicle work trips and 9.2 passengers per bus. Thus an increase in transit ridership affects emissions reduced: a full bus carrying 40 passengers emits 83 percent fewer greenhouse gas emissions on a per passenger basis than one carrying the average bus load. Most rail systems are powered entirely by electricity, therefore agencies purchasing electricity through clean sources – hydroelectric, wind, nuclear, solar – have a smaller carbon footprint than those using fossil fuel-produced electricity.[28] The Portland region does utilize a higher percentage of hydroelectric and wind powered sources for electricity generation than other regions in the country.

This section highlights how high capacity transit plays a key role in reducing regional greenhouse gas emissions; a particular focus is given to evaluation done locally and in other regions to quantify the most effective means for reducing greenhouse gas emissions. Findings from the review suggest the region should:

- focus on strategies that make more productive use of existing facilities and resources
- tie any transit expansions to land use changes; together they can have a large impact on CO_2
- consider cost effectiveness; some of the most popular means to reduce CO_2 emissions are the least cost-effective, but some of the most effective measures actually earn money for the economy and the implementer.

28 Calculated using carbon dioxide emissions per megawatt hour for the power supplied to the electrical grid in the particular subregion in which the transit agency operates. The data is from the U.S. Environmental Protection Agency's Emissions & Generation Resource Integrated Database (eGRID) 2006 v2.1. Subregion emission factors are used rather than state level emission factors, as regional power grids do not correspond with state lines. In addition, using the eGRID subregion data rather than the state level data is recommended by the California Climate Action Registry's general reporting protocol, chapter 14.

Make better use of what we have

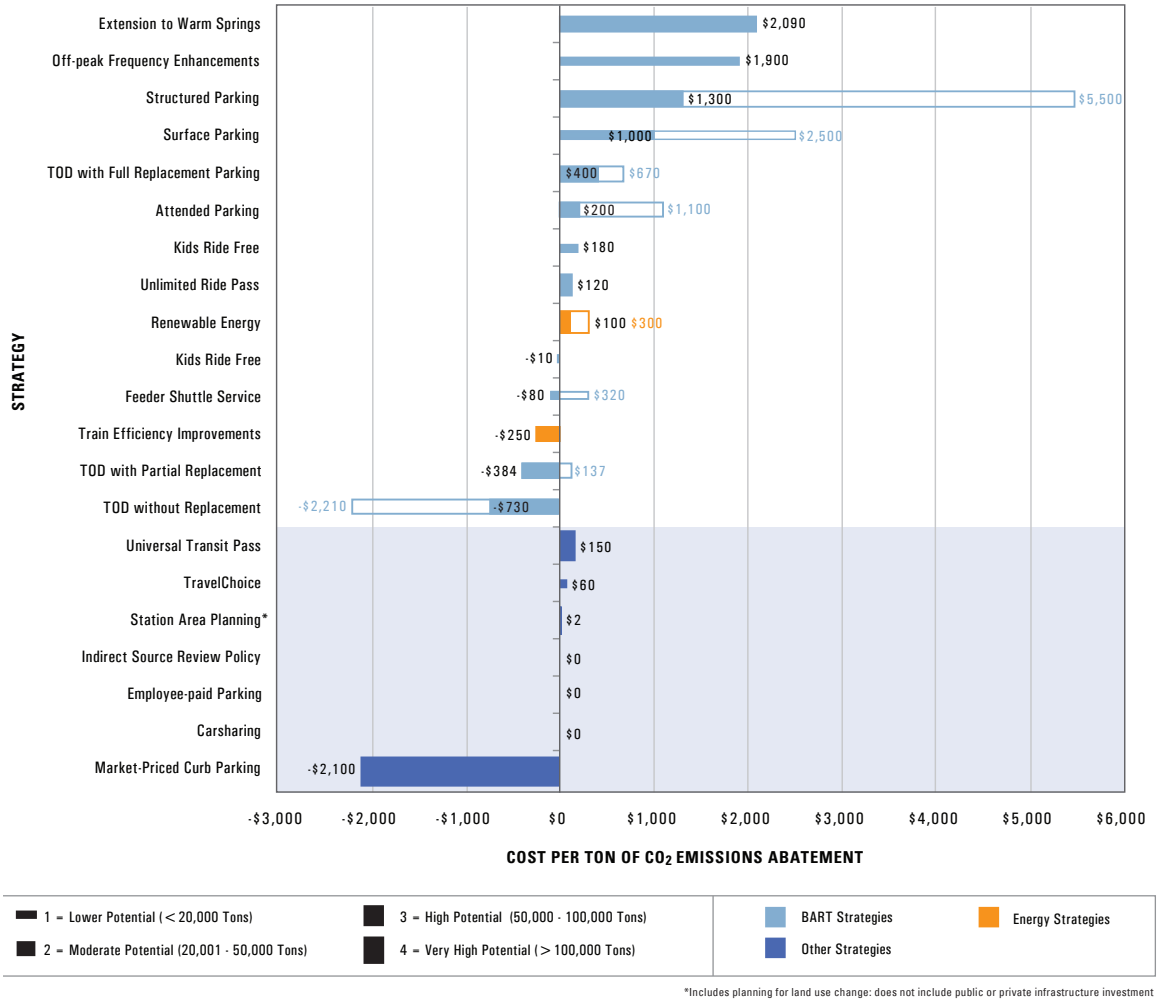
Multimodal intersection: Exclusive bus lane and bike connector crossing MAX tracks at Northeast Wheeler and Holladay streets.

The metropolitan planning organization for the San Francisco Bay Area, the Metropolitan Transportation Commission, has been heavily involved in reducing greenhouse gas emissions by promoting transit-oriented development. In 2005, MTC adopted an incentive program to encourage housing construction along the region's major new transit corridors as a way of fostering growth while minimizing energy consumption. To be awarded a station area planning grant, a municipality must accept corridor level thresholds for minimum levels of development around transit stations, develop a local station area plan to address future land use changes and incorporation of transit-oriented development elements, and create and maintain a corridor working group made of local and county planning staff, transit agencies and other stakeholders. Two cities have been awarded station area planning grants with an average of 2,595 housing units created in each. When taking into consideration the amount of vehicle miles traveled reduced by building transit accessible housing, the program reduces greenhouse gas emissions by 5,300 tons per city. At the same time, the program costs little; the credits produced in emissions reductions over the life cycle of the housing created bring the cost of the project to $2 per ton.[29]

BART recently commissioned a thorough analysis of several programs and their total cost and tons of greenhouse gas emissions reduced. Figure 4.12 illustrates the cost per ton of CO_2 reduced through various transit, land use and parking management programs. Some programs, particularly those that involve charging for parking, make money while reducing emissions; others show a high cost per ton of carbon dioxide reduced. Many of the strategies benefit not just the transit agency and the environment, but cause positive externalities in other areas of public life. For example, building transit-oriented development can improve public health by providing interesting and safe places to walk and bike.

29 BART actions to reduce greenhouse gas emissions: a cost-effectiveness analysis, Nelson\Nygaard Consulting Associates, Bay Area Rapid Transit, 2008.

Figure 4.12: Cost per metric ton of CO_2 emissions by abatement strategy



*Includes planning for land use change: does not include public or private infrastructure investment

Simple strategies such as fare incentive that fill seats at off peak times, station area planning and station access improvements can reduce greenhouse gas emissions at relatively low costs (compared with programs in other sectors) and help meet other regional land use and transportation goals.

Strategies to reduce CO_2 emissions

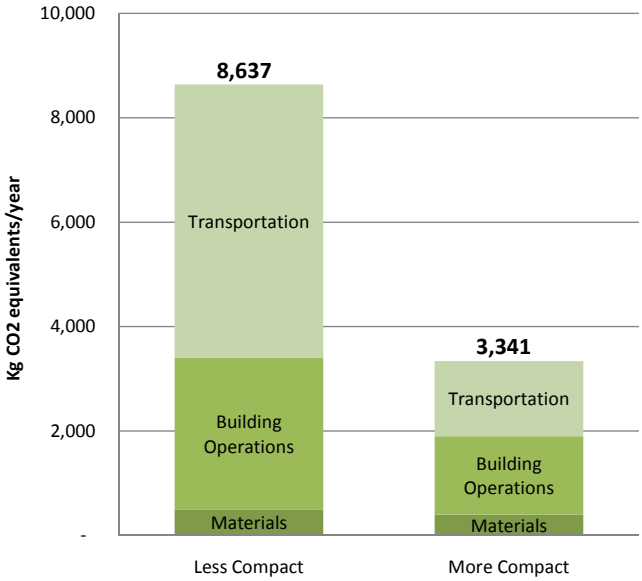
Fares. One main factor that people consider when making transportation decisions is cost. During times when the system has excess capacity, such as on weekends or off-peak hours, fare incentives can effectively shift drivers to transit, since roadways are less congested. Fare programs must be given careful thought, though, as they may result in reduced revenue for the agency. For example, when New York City Transit introduced unlimited ride weekly and monthly passes, ridership increased but revenue fell nearly 4 percent because the average fare per trip went down. New York Cit Transit did not cut service or raise fares during the 2009 recession and this change made the financial picture worse.

Better access to transit/walkable communities. The most effective way to decrease vehicle miles traveled is building communities that are more transit-oriented. As shown in Figure 4.13, people living in compact developments emit far fewer kilograms of CO_2.

BART's analysis concluded that transit-oriented development has the most potential to produce revenue and reduce emissions. When taking a typical BART station and implementing transit-oriented development in place of parking lots, BART could reduce emissions by 650 to 2,300 tons per project and achieve revenue gains of $600 to $1,400 per ton.[30]

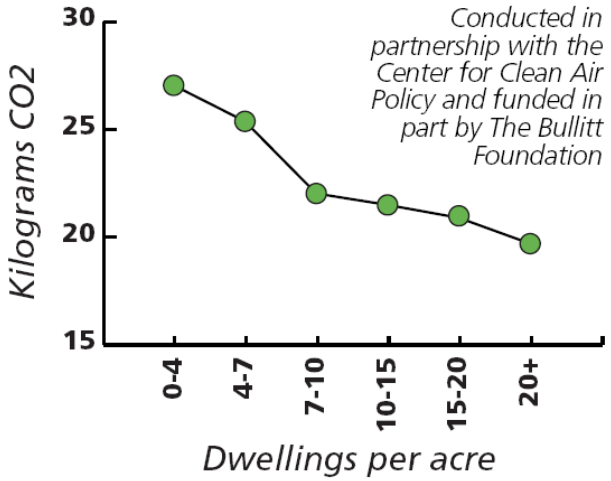
Increasing incentives for developers to build in existing MAX station areas or on frequent bus lines and developing regional and local land use policies that promote transit-oriented development will be the most cost-effective means to reduce regional greenhouse gases.

Figure 4.13: Greenhouse gas emissions and compact development



Journal of Urban Planning and Development, March 2006

Figure 4.14: Greenhouse gas emissions and dwellings per acre



Achieving sustainability through healthy community design, King County, 2005

Enhancements to existing service. Transit service strategies that shift travelers from auto travel to transit are the primary focus of efforts to reduce greenhouse gas emissions. Adding service to existing high demand, high ridership lines is an effective strategy. Speeding up existing service is often a more cost-effective strategy, since it allows transit operators to get more service for the same amount of operating cost and increases transit's competitiveness with driving. There is also an important role for local agencies that operate the streets and signal systems, since they can provide priority needed for transit to bypass traffic and speed operations using traffic signal priority, which holds a green signal to allow a train or bus to pass. TriMet is doing its part by focusing on creating a total transit system to attract every choice rider possible. To do this, the agency is focusing on service reliability, adequate capacity and complete information for customers. Measures like real-time arrival information and cell phone service updates improve customer service and play a role in attracting and retaining passengers.

30 BART actions to reduce greenhouse gas emissions: a cost-effectiveness analysis, Nelson\Nygaard Consulting Associates, Bay Area Rapid Transit, 2008.

Marketing. This is a measure that costs little in relation to many other strategies but can reap large rewards in increased ridership and ultimately greenhouse gas reduction. Measuring the effects of marketing campaigns can be difficult, but in general making sure the populace is aware and knowledgeable about available transit service is a critical step in attracting riders. Marketing has the biggest effect in instances where transit is most competitive with driving in terms of price, convenience and travel time. The BART study concluded that targeted marketing of existing transit services might be one of the most cost-effective means for reducing transportation related greenhouse gas emissions.

Transit expansion must be tied to land use changes. Most detailed analyses conducted to identify cost-effective strategies to reduce transportation related greenhouse gas emissions point to the need to increase our efforts to build dense, walkable, transportation-efficient communities and neighborhoods and to transfer the real cost of parking construction and operations to users.

Developing new HCT lines or extending existing lines is a capital intensive endeavor, but one that can drastically reduce greenhouse gas emissions if carefully executed to serve or leverage transit supportive development. A study completed for the American Public Transit Association suggests that transit service has a primary benefit from the act of substituting a mile of travel by car to a mile of travel on transit. It also offers a secondary benefit: Since transit fosters more compact and walkable communities, even those living near transit who don't use it will still reduce vehicle miles traveled as a result of being able to accomplish errands through shorter walking and cycling trips. This secondary benefit may be as much as 1.9 times as large as transit's direct impact.[31]

Strategies to reduce emissions at the agency level

Transit providers can change internal practices to further reduce greenhouse gas emissions, such as by making green practices part of procurement, fostering an environmental workplace, constructing green buildings and facilities and implementing new technologies that can reduce emissions and energy consumption.

TriMet is currently conducting a detailed assessment of its carbon footprint according to American Public Transportation Association's recommended practice for quantifying greenhouse gas emissions. The analysis is not complete yet, but data in the 2007 National Transit Database shows that TriMet's total operational footprint was 76,000 metric tons of CO_2.[32] The more detailed APTA footprint analysis will tell TriMet its debits – the amount of greenhouse gases emitted by source – as well as its credits, or how much greenhouse gases are not emitted because of TriMet's ability to shift mode choice and foster compact development. The footprint analysis will allow TriMet to identify its biggest sources of emissions and create targets for reductions.

One main source of greenhouse gas emissions for transit agencies comes from traction power. TriMet trains currently have wayside regenerative braking capability, which allows power released from braking to be briefly stored in the overhead wire and used by another train. This measure has reduced traction power needs by 20 percent; however, only 50 to 75 percent of potential power released from braking is being retained. TriMet is researching on-board regenerative braking, which allows the braking train to store the energy. This technology has the potential to capture 75 to 100 percent of the energy released from braking.[33] Other initiatives TriMet has undertaken include: using biodiesel blends containing vegetable oil and fats, installing railroad ties made of recycled plastic taken from car gas tanks and developing the South Mall light rail terminus alternative energy

31 The broader connection between public transportation, energy conservation and greenhouse gas reduction, ICF International, American Public Transit Association, February 2008.

32 Eric Hesse, TriMet Strategic Planning Analyst, e-mail message May 15, 2009.

33 Eric Hesse. TriMet Strategic Planning Analyst, phone interview. May 15, 2009.

project. This pilot project, which recently received funding from the federal stimulus package, is also planned to include solar and wind power generators at the South Mall light rail terminus.

The Metropolitan Transportation Association, the state authority running transit systems in New York City, has identified several innovative measures to cut greenhouse gas emissions, including:

- building administrative and maintenance facilities to LEED standards or higher
- using aluminum, which has a lower resistance than steel, for the third rail, resulting in less energy use from braking
- for new track construction, creating humped tracks at platforms so trains can take advantage of gravity and use less power for braking and accelerating
- retrofitting train cars with aluminum where possible to lower the train weight and thus reduce energy needs.[34]

Metro will need to work with its local, regional and national partners to ensure that critical climate change goals are met. While renewable energy sources, cleaner fuels and green technology will help to reduce greenhouse gas emissions, significant changes are needed in how communities are designed and constructed to meet reduction goals. The region's 2040 Growth Concept vision should continue to serve as a blueprint for more detailed strategies; research shows that dense, mixed-use communities that allow people to travel by foot, bike and transit are critical to climate protection.

Achieving emissions reductions requires involvement and leadership at the national, state and regional level. Many greenhouse gas emissions reduction strategies can all be undertaken by transit providers; however, some of the most important policies for reducing greenhouse gas emissions require wider, more systemic change than a transit agency can achieve on its own.

34 Energy/carbon, Metropolitan Transportation Authority, State of New York, www.lirr.org, accessed June 30, 2009.

5. CONCLUSION

> Planning is bringing the future into the present so that you can do something about it now.
> *—Alan Lakein, author*

As the first decade of the 21st century concludes, the world is struggling to confront the reality of global climate change, to realign the global economy toward a more sustainable future and to create energy systems that rely less on fossil fuels to run our grids and transportation systems. In this context, the Portland metro region is committed to being a great place to live and do business. To do so, it must address these issues while continuing to provide equitable and affordable housing, great parks and public spaces, and quality jobs for its residents. The region is challenged to leverage limited financial capacity to create a greater wealth of human, environmental and economic resources. This challenge is reflected in the six fundamentals adopted by Metro as part of the 2040 Growth Concept:

- healthy economy
- vibrant communities
- environment health
- transportation choices
- equity
- fiscal stewardship

The region has performed well so far. This region has on of the highest proportions of green buildings in the country, extensive renewable energy production and development, and is a national leader in growth management and natural resource protection. The Portland metro region has also established itself as a leader in sustainable transportation. Not only does it lead the nation in development of cycling infrastructure, but its public transit system is renowned for quality and innovation. In order to continue to thrive in the face of new challenges, the region must continue its proactive and innovative focus. A review of state of the industry practices summarized in this report points to a few guiding principles to accomplish regional goals:

- The best strategies make use of what we already have (infill transit-oriented development, transit efficiency improvements, etc).
- Transit expansions must be tied to land use; together they are among the most powerful tools we have to meet economic and environmental goals.
- The region's 2040 Growth Concept vision is as relevant today as when it was conceived, but we need to do more, moving quickly to manage the growth of our population while improving the health of environment.

The Regional High Capacity Transit System Plan is intended to set a framework for the continued development of a world class high capacity transit system in the Portland metro region. More importantly, it establishes a clear and measurable relationship between our investments in high capacity transit and the efficient land use patterns, sustainable development practices and placemaking principles to which we aspire.

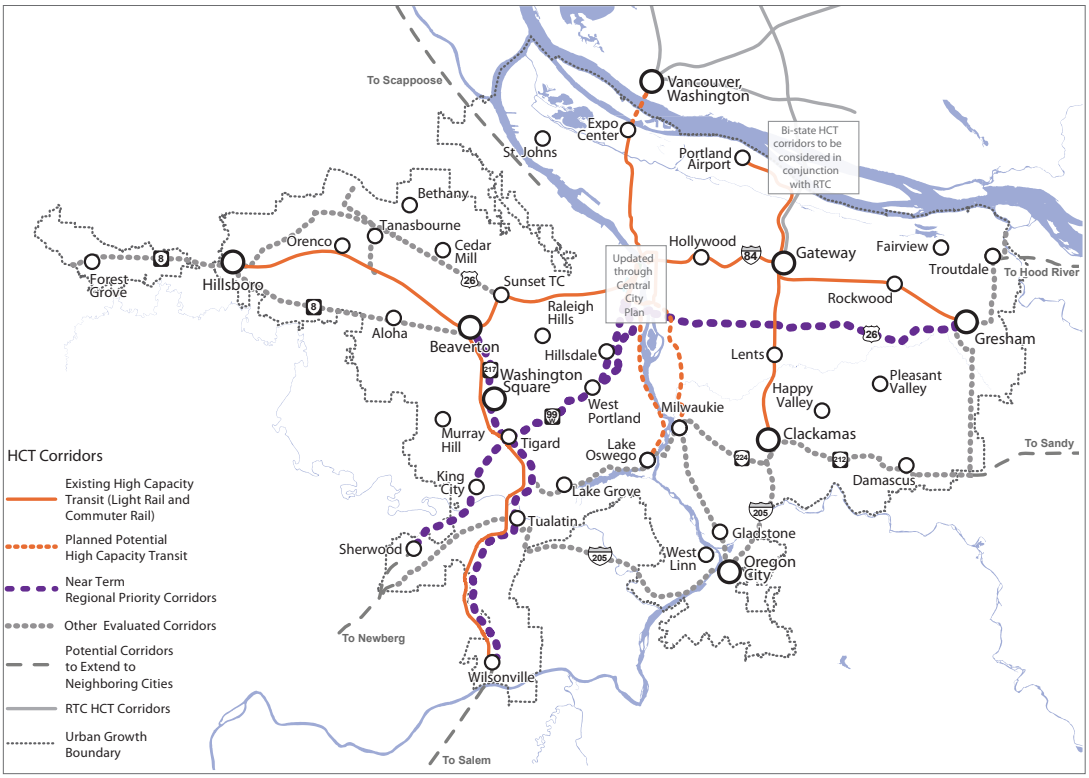
The Regional HCT System Plan makes several important contributions to the Regional Transportation Plan and the region's collaborative long range planning efforts.

Recommends top regional priorities for near-term investments in high capacity transit. Through an extensive screening and evaluation process, the plan uses a bottom line (economy, environment, community and deliverability) evaluation approach to identify the three top priorities for regional investment in high capacity transit (not necessarily listed in order of priority):

- a new HCT corridor in the vicinity of Powell Boulevard from the Portland central city to Gresham,
- a new HCT corridor running in the vicinity of Barbur Boulevard between the Portland central city, Tigard and Sherwood (with possible branch to Washington Square) and
- additional capital improvements to the WES commuter rail line that would will allow for 15-minute peak headways and the addition of midday service.

Figure 5.1 shows these near-term priority corridors alongside the region's existing and planned corridors.

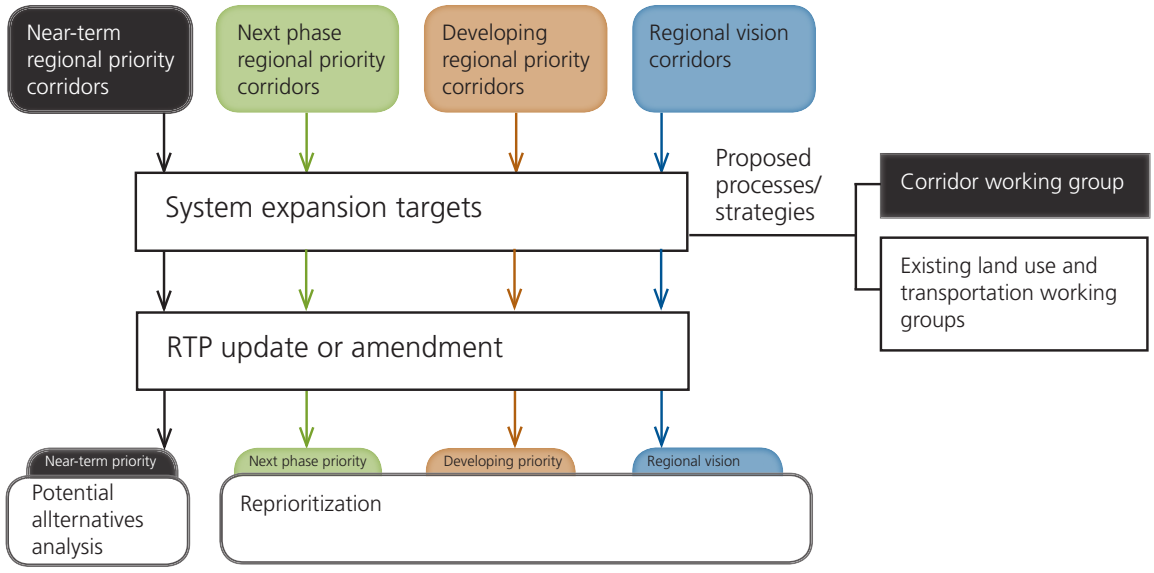
Figure 5.1: Near-term regional priority corridors



Creation of a clear and measurable framework for future system expansion prioritization. The system expansion policy provides a transparent process by which jurisdictions in regional priority corridors can work locally to advance their projects' regional priority status. When adopted as part of the 2010 Regional Transportation Plan update, the policy will set quantitative and qualitative targets that corridor communities, or working groups consisting of multiple jurisdictions, can work toward to advance a specific HCT project. Subsequent RTP updates, scheduled every four years, will serve as an opportunity to reprioritize regional funding for HCT based on interim actions taken by local jurisdictions. The system expansion plan emphasizes fiscal responsibility by ensuring that limited resources for new high capacity transit lines are spent where local jurisdictions have committed to supportive land uses, high quality access systems and management of parking resources, and proven there is broad based political support for the investment.

Figure 5.2 provides a conceptual illustration of how projects would advance between tiers and into the federal funding process.

Figure 5.2: System expansion policy process



Proposal of a new definition of high capacity transit for the Regional Transportation Plan. The plan calls for a functional definition of high capacity transit that is not mode specific, but rather addresses the critical operating and design features that attract a broad range of riders and leverage quality development and placemaking. Specifically, the regional high capacity transit system is designed to carry high volumes of passengers quickly and efficiently between regional centers. Other defining characteristics of HCT service include the ability to bypass traffic and avoid delay by operating in exclusive or semi-exclusive rights of way, faster overall travel speeds due to wide station spacing, frequent service, transit priority street and signal treatments, and premium station and passenger amenities.

This functional definition ties to system expansion policy targets, which ensures that investment outcomes are optimized, and is in line with the RTP performance based approach to prioritizing and measuring transportation investments.

Identification of best practices for high capacity transit system development and operations as well as supportive access, land use and parking strategies. This report describes the mutually supportive relationship between land use, transit service quality, transit accessibility and integration of the complete multimodal transportation system. These features largely define the level of community benefit from high capacity transit investments and require simultaneous attention in investment to optimize the achievement of regional goals.

The relationship between the factors can be described as follows:

> As density increases, more potential riders are given access to transit, if transit is available. Assuming streets and stops are designed to invite passengers, increased density will drive ridership higher. As the level of transit patronage increases in a corridor, transit providers will look to offer more frequent service and to improve the speed and reliability of service for passengers. High quality, permanent high capacity transit service makes an area attractive to

more residents, signaling to developers that the market is good for more dense housing and amenities. This relationship builds over time as long as transit is able to respond to growing demand.

The Portland metro region uses a collaborative regional approach to planning and economic development. Most importantly, the approach recognizes the tight interrelation of land use, economic development and transportation decisions in creating great communities and building a region ready to address the challenges of the 21st century. High capacity transit is an important tool to this end. The Regional HCT System Plan provides a framework by which HCT investments support urban growth, housing, regional affordability, environmental protection and livability goals. Like any element of community development, the plan is not static. Rather, it sets a dynamic course where wholistic system development is a priority, and future investments are measured against targets that advance a broad set of regional goals. As our predecessors have proven, we can accomplish what is beyond common expectation and that which is greater than the goals of any one organization.

> If you have accomplished all that you have planned for yourself, you have not planned enough. *—Edward Everett Hale, author*

RESOLUTION NO. 09-4052

BEFORE THE METRO COUNCIL

FOR THE PURPOSE OF ACCEPTING THE REGIONAL HIGH CAPACITY TRANSIT SYSTEM TIERS AND CORRIDORS, SYSTEM EXPANSION POLICY FRAMEWORK AND POLICY AMENDMENTS FOR ADDITION TO THE 2035 REGIONAL TRANSPORTATION PLAN, STATE COMPONENT	)))))))	RESOLUTION NO. 09-4052 Introduced by Councilor Carlotta Collette

WHEREAS, in 1975, elected leaders set the stage for the Metro Area's balanced transportation system by rejecting the so-called Mt. Hood Freeway project between the Marquam Bridge and Lents neighborhood after public outcry over its expected cost and the destruction of developed neighborhoods that would be harmed by its construction; and

WHEREAS, the Metro Area chose a different development option and adopted the 1975 Interim Transportation Plan, setting aside plans for large new highway projects in favor of a multitude of street and roadway projects and a network of transitways along major travel corridors to meet future travel demand; and

WHEREAS, a systemwide network examination of regional high capacity transit corridors was completed in 1982 and adopted by Metro that resulted in nearly 90 miles of light rail transit, commuter rail and streetcar being built and/or planned for construction by 2016; and

WHEREAS, the Metro Area's 2040 Growth Concept and 2035 Regional Transportation Plan seek to prepare for the expected increase in growth in the Metro Area by providing multiple transportation options, including having pedestrian, bike and transit play a large role in facilitating growth within the Metro Area's current capacity; and

WHEREAS, expansion of the high capacity transit system will continue to reduce vehicle miles traveled, greenhouse gas emissions and the Metro Area's transportation carbon footprint; and

WHEREAS, high capacity transit is one of many important elements the Metro Area can use to build great communities; and

WHEREAS, a broad list of 55 potential high capacity transit corridors developed with the community and local jurisdictions was screened to the 18 most promising corridors based on criteria including ridership, cost, environmental constraints, social equity, transit connectivity, traffic congestion and region 2040 Growth Concept land uses; and

WHEREAS, the resulting 18 potential high capacity transit corridors were further analyzed based on a set of evaluation criteria that was approved by the Joint Policy Advisory Committee on Transportation (JPACT), Metro Policy Advisory Committee (MPAC) and the Metro Council; and

WHEREAS, the evaluation criteria were derived from the six outcomes of the Metro Council for a successful region, and are based on the three Regional Transportation Plan (RTP) categories of community, environment and economy, and also include a high capacity transit-specific category of deliverability; and

WHEREAS, the resulting 18 potential high capacity transit system corridors are prioritized and placed into the tiers of near term regional priority corridors, next phase regional priority corridors, developing regional priority corridors and regional vision corridors; and

WHEREAS, the regional high capacity transit system plan corridors which have been placed into tiers will be incorporated into the RTP and long-range land use and transportation planning efforts; and the 18 high capacity transit corridors will be regularly reviewed through the RTP; and

WHEREAS, the system expansion policy provides a framework for advancement of regional high capacity transit corridors, and identifies a distinct set of planning and policy actions and targets that will support successful high capacity transit implementation, including proposed amendments to the RTP; and,

WHEREAS, at its meeting on June 12, 2009, the Joint Policy Advisory Committee on Transportation recommended approval of the following; now therefore

BE IT RESOLVED THAT:

1. The Metro Council accepts the regional high capacity transit system plan tiers and corridors (Exhibit A), system expansion policy framework (Exhibit B), and recommended policy amendments (Exhibit C) for addition to the 2035 Regional Transportation Plan, State Component.

2. Acceptance of the regional high capacity transit system tiers and corridors, system expansion policy framework and policy amendments is not a final land use decision. The Metro Council will make a final land use decision on these matters when it adopts the 2035 Regional Transportation Plan, State Component, by ordinance.

ADOPTED by the Metro Council this 9TH day of JULY 2009.

David Bragdon, Council President

Approved as to Form:

Daniel B. Cooper, Metro Attorney

Officially Approved
Approvato Ufficialmente
Consiglio Metropolitano
METRO COUNCIL
Metro Council

Resolution No. 09-4052 Page 2 of 2

Regional High Capacity Transit System Plan Tiers and Corridors

Corridors are not ranked within the tiers. Corridors are shown in numeric order by the corridor identification number. Also refer to the attached map.

Tier	Corridor Description (Mode As Evaluated) [1]	HCT Corridor Number	RTP Mobility Corridor Reference	Actions		
				Actions for Next 4-Years		
Near Term Regional Priority	Portland to Gresham in the vicinity of Powell Corridor (LRT)	10	5 - Central City – Gateway; 6 – Gateway to Gresham/Fairview/Wood Village/Troutdale	See the System Expansion Policy Framework's potential local actions and potential regional support, figure 2.	The location of High Capacity Transit and local land use actions and investments will influence future capacity for residential and employment in the region.	Location of High Capacity Transit may influence the location of future Urban Reserves and Urban Growth Boundary expansions.
	Portland to Sherwood in the vicinity of Barbur/Hwy 99W Corridor (LRT)	11	2 – Central City – Tigard; 4 – Portland Central City; 20 – Tigard - Sherwood			
	Beaverton to Wilsonville (LRT) in the vicinity of WES[2]	34[2]	2 – Central City – Tigard; 3 - Tualatin – Wilsonville; 19 – Beaverton – Tigard; 22 – Beaverton – North Plains			
Next Phase Regional Priority Corridors	CTC to Oregon City in the vicinity of I-205 Corridor (LRT)[3]	8[3]	8 – Clackamas – Oregon City	See the System Expansion Policy Framework's potential local actions and potential regional support, figure 2.	The location of High Capacity Transit and local land use actions and investments will influence future capacity for residential and employment in the region.	Location of High Capacity Transit may influence the location of future Urban Reserves and Urban Growth Boundary expansions.
	Park Ave to Oregon City in the vicinity of McLoughlin Corridor(LRT extension)[3]	9[3]	8 – Clackamas – Oregon City; 11 – Milwaukie to Clackamas			
	Sunset Transit Center to Hillsboro in the vicinity of Hwy 26 Corridor/ Evergreen (LRT)	17[4]	22 – Beaverton – North Plains; 24 – Beaverton to Forest Grove			
	Tanasborne (LRT extension)[4]	17D[4]	22 – Beaverton – North Plains			
	Clackamas Town Center to Washington Square in the vicinity of I-205/217 Corridors(LRT)	28	2 – Central City – Tigard; 7 – Oregon City – Tualatin; 8 – Clackamas – Oregon City			
	Clackamas Town Center to Washington Square in the vicinity of RR ROW (LRT)	29	2 – Central City – Tigard; 11 – Milwaukie to Clackamas			
	Beaverton to Hillsboro in the vicinity of TV Highway (LRT)	32	24 – Beaverton – Forest Grove			
	Gateway to Salmon Creek in the vicinity of I-205 Corridor[5]	55[5]	9 – Gateway – Clark County			
Developing Regional Priority Corridors	Hillsboro to Forest Grove (LRT extension)	12	24 – Beaverton – Forest Grove	See the System Expansion Policy Framework's potential local actions and potential regional support, figure 2.	The location of High Capacity Transit and local land use actions and investments will influence future capacity for residential and employment in the region.	Location of High Capacity Transit may influence the location of future Urban Reserves and Urban Growth Boundary expansions.
	Gresham to Troutdale Extension (LRT Extension)	13	6 – Gateway – Gresham/Fairview/Wood Village/Troutdale			
Regional Vision Corridors	Troutdale to Damascus (LRT)	13D	15 - Gresham/Fairview/Wood Village/Troutdale – Damascus	See the System Expansion Policy Framework's potential local actions and potential regional support, figure 2.	The location of High Capacity Transit and local land use actions and investments will influence future capacity for residential and employment in the region.	Location of High Capacity Transit may influence the location of future Urban Reserves and Urban Growth Boundary expansions.
	Clackamas Town Center to Damascus (LRT)	16	12 – Clackamas – Happy Valley; 13 – Happy Valley - Damascus			
	Sherwood to Tualatin (LRT)	38S	20 – Tigard – Sherwood/Newberg			

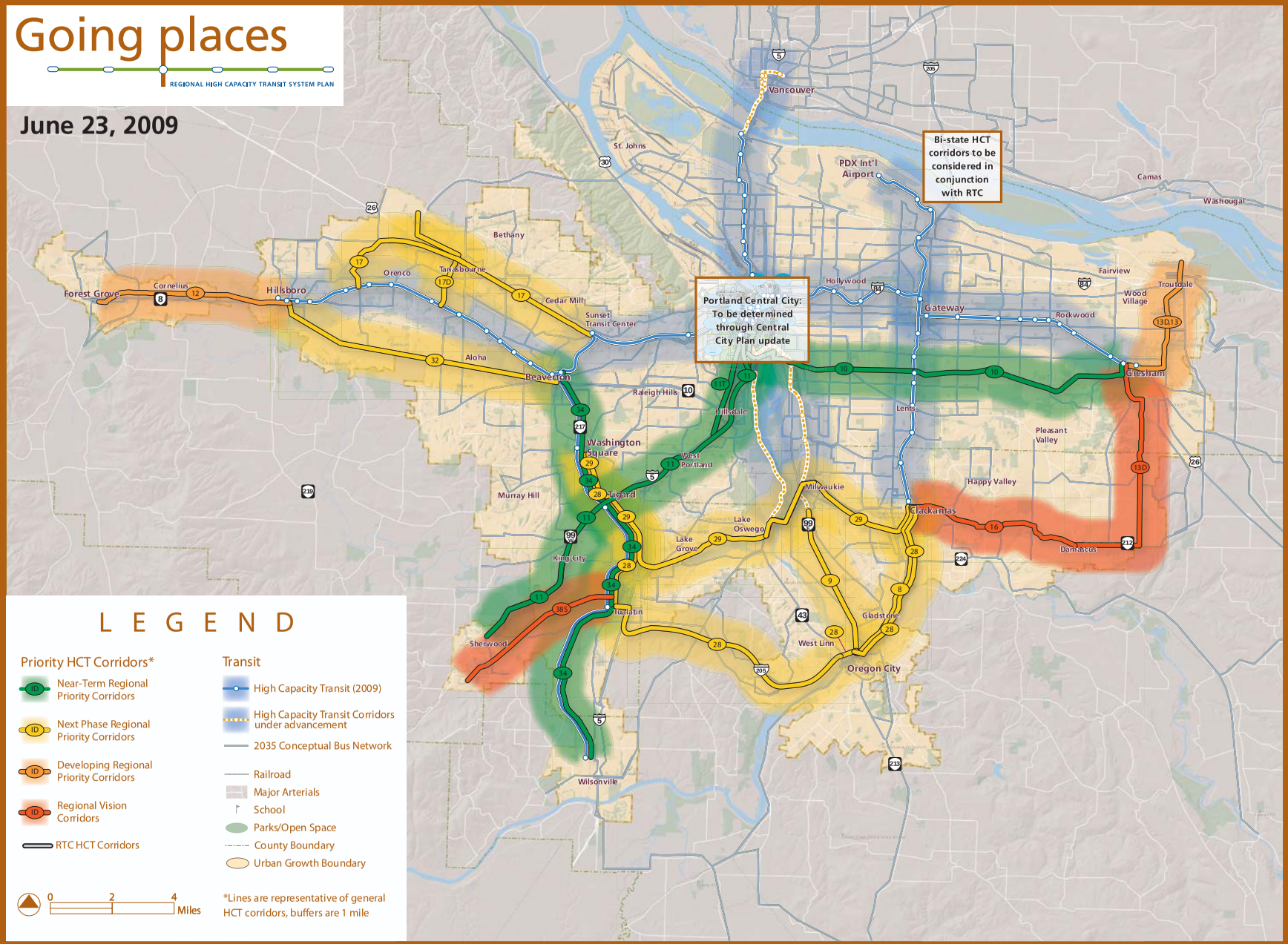
[1] The location of the alignment is to be decided through a corridor refinement plan and/or alternatives analysis.

[2] The WES Corridor (34) service upgrades are currently included in the federal RTP financially constrained list of projects to all day, 15 minute service. Service improvements that mimic light rail service will be examined in phases. Some portions of this corridor are included in corridors 28, 29 and potentially 11.

[3] Corridor 9 to be studied in conjunction with corridor 8.

[4] Corridor 17D to be studied in conjunction with corridor 17.

[5] Corridor 55 was selected as part of Southwest Washington Regional Transportation Council (RTC) HCT System Plan and was not ranked based on the evaluation criteria.


Going places
REGIONAL HIGH CAPACITY TRANSIT SYSTEM PLAN
June 23, 2009
Bi-state HCT corridors to be considered in conjunction with RTC
Portland Central City: To be determined through Central City Plan update
Vancouver
St. Johns
PDX Int'l Airport
Camas
Washougal
Bethany
Forest Grove
Cornelius
Hillsboro
Orenco
Tanasbourne
Cedar Mill
Sunset Transit Center
Aloha
Beaverton
Hollywood
Gateway
Rockwood
Fairview
Wood Village
Troutdale
Gresham
Raleigh Hills
Hillsdale
Lents
Pleasant Valley
Happy Valley
Washington Square
West Portland
Tigard
Murray Hill
Milwaukie
Clackamas
Damascus
Lake Oswego
Lake Grove
King City
Tualatin
Sherwood
West Linn
Gladstone
Oregon City
Wilsonville
LEGEND
Priority HCT Corridors*
Near-Term Regional Priority Corridors
Next Phase Regional Priority Corridors
Developing Regional Priority Corridors
Regional Vision Corridors
RTC HCT Corridors
Transit
High Capacity Transit (2009)
High Capacity Transit Corridors under advancement
2035 Conceptual Bus Network
Railroad
Major Arterials
School
Parks/Open Space
County Boundary
Urban Growth Boundary
0 2 4 Miles
*Lines are representative of general HCT corridors, buffers are 1 mile

Regional high capacity transit system expansion policy framework
6-24-09

BACKGROUND
Making the Greatest Place helps define how regional and local aspirations come together to create vibrant, healthy and sustainable communities. The challenges of climate change, rising energy costs, economic globalization, aging infrastructure and population growth require regional land use and transportation decisions to be supported by local decisions and actions. While regional land use policy has positioned the Portland metro region as a model for transit-supportive development, much of the region remains auto dependent due to the relatively low level of transit supportive land use regionwide. With limited resources, it is essential that future regional investments in high capacity transit (HCT) be used to leverage achievement of land use and economic development goals.

PROCESS FOR HIGH CAPACITY TRANSIT PROJECT ADVANCEMENT - PRIORITY TIERS AND SYSTEM EXPANSION POLICY FRAMEWORK
The regional high capacity transit system tiers and corridors identify near- and long-term regional HCT priorities. The system expansion policy component of the plan provides a framework to advance future regional HCT corridors by setting targets and defining regional and local actions that will guide the selection and advancement of those projects.

High capacity transit priority tiers
As described in Figure 1, regional HCT system corridors are grouped into one of four priority tiers, along with specific targets and various steps local jurisdictions could follow to advance a project to a higher tier. The four tiers relate to an HCT corridor's readiness and regional capacity to study and implement HCT projects. Corridors within each tier would be updated with each RTP or by RTP amendment. The four tiers are:

- **Near-term regional priority corridors**: Corridors most viable for implementation in next four years.
- **Next phase regional priority corridors**: Corridors where future HCT investment may be viable if recommended planning and policy actions are implemented.
- **Developing regional priority corridors**: Corridors where projected 2035 land use and commensurate ridership potential are not supportive of HCT implementation, but which have long-term potential based on political aspirations to create HCT supportive land uses.
- **Regional vision corridors**: Corridors where projected 2035 land use and commensurate ridership potential are not supportive of HCT implementation.

System expansion policy framework
The system expansion policy framework is designed to provide a transparent process agreed to by Metro and local jurisdictions to advance high capacity transit projects through the tiers. The framework is based on a set of targets designed to measure corridor readiness to support a high capacity transit project.

The system expansion policy framework:

1. Identifies which near-term regional priority corridor(s) should move into the federal project development process toward implementation; and
2. Delineates a process by which potential HCT corridors can move closer to implementation, advancing from one tier to the next through a set of coordinated Metro and local jurisdiction actions.

Based on the tiered category, regional actions would be aligned with work in each corridor while local actions would focus on meeting HCT system expansion targets. In near-term corridors, formal **corridor working groups** would be established. Other corridors would coordinate work through existing processes.

Figure 1: System expansion policy framework

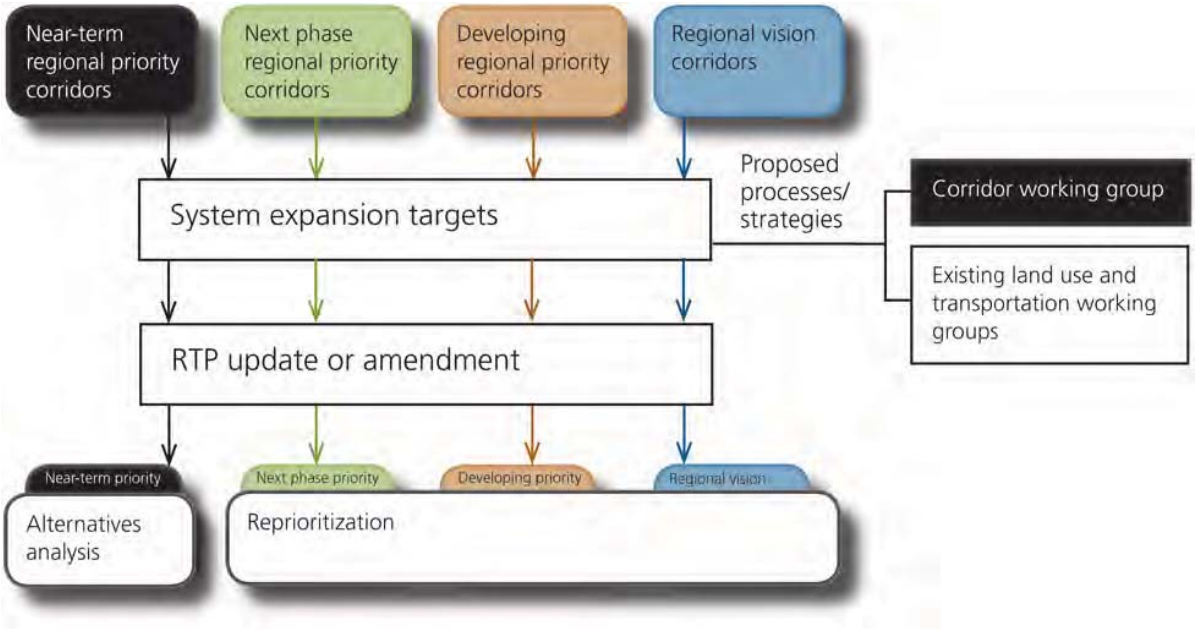


Figure 2: HCT system expansion policy framework concept

Tiers	Summary	Potential methods to reach targets		Potential system expansion targets	Potential strategies
		Potential local actions (applied to each corridor)	Potential regional support (assistance with corridor assessment against system expansion targets)		
Near-term regional priority corridors[1]	Corridors most viable for implementation in next four years.	• Develop corridor problem statement • Define corridor extent • Assess corridor against system expansion targets • Create ridership development plan/ land use/TOD plans for centers and stations • Assess mode and function of HCT • Create multimodal station access and parking plans • Assess financial feasibility	• Create land use/TOD plans for centers and stations • Analyze station siting alternatives • Coordinate with MTIP priorities • Perform multi-modal transportation analysis • Create multimodal station access and parking plans • Start potential Alternatives Analysis	• Transit supportive land use/station context • Community support • Partnership/political leadership • Regional transit network connectivity • Housing needs supportiveness • Financial capacity – capital and operating finance plans • Integrated transportation system development	• Corridor working group • Existing land use and transportation working groups
Next phase regional priority corridors[1]	Corridors where future HCT investment may be viable if recommended planning and policy actions are implemented.	• Develop corridor problem statement • Define corridor extent • Assess corridor against system expansion targets • Create ridership development plan/ land use/TOD plans for centers and stations • Assess mode and function of HCT	• Create land use/TOD plans for centers and stations • Analyze station siting alternatives • Coordinate with MTIP priorities	• Transit supportive land use/station context • Community support • Partnership/political leadership • Regional transit network connectivity • Housing needs supportiveness • Financial capacity – capital and operating finance plans	• Existing land use and transportation working groups

[1] The location of the alignment is to be decided through a corridor refinement plan and/or alternatives analysis.

Tiers	Summary	Potential methods to reach targets		Potential system expansion targets	Potential strategies
		Potential local actions (applied to each corridor)	Potential regional support (assistance with corridor assessment against system expansion targets)		
Developing regional priority corridors[1]	Corridors where projected 2035 land use and commensurate ridership potential are not supportive of HCT implementation, but which have long-term potential based on political aspirations to create HCT supportive land uses.	• Develop corridor problem statement • Define corridor extent • Assess corridor against expansion targets • Create ridership development plan/ land use/TOD plans for centers and stations	• Create land use/TOD plans for centers and stations • Analyze station siting alternatives	• Transit supportive land use/station context • Community support • Partnership/political leadership • Regional transit network connectivity	• Existing land use and transportation working groups
Regional vision corridors[1]	Corridors where projected 2035 land use and commensurate ridership potential are not supportive of HCT implementation.	• Develop corridor problem statement • Define corridor extent • Assess corridor against system expansion targets • Create ridership development plan/ land use/TOD plans for centers and stations	• Create land use/TOD plans for centers and stations	• Transit supportive land use/station context • Community support	• Existing land use and transportation working groups

[1] The location of the alignment is to be decided through a corridor refinement plan and/or alternatives analysis.

Attachment 1 - System expansion policy terms and definitions

This section provides a description of terms and definitions used in this document to describe the proposed process for HCT project advancement.

Local action descriptions

Local actions would be structured to reach tiered targets. Some or all of the following actions could be taken to advance a project, depending on the tier placement.

Develop corridor problem statement: The corridor problem statement defines the purpose of and establishes goals for the proposed HCT investment (i.e., congestion mitigation, economic development, etc.). It assesses the role of the project in addressing other regional transportation priorities and identifies opportunities for integration with other transportation system improvements in the corridor.

Define corridor extent: As in an FTA Alternatives Analysis, the definition of corridor extent could include a project extent that encompasses multiple alignment corridors or options.

Assess corridor against system expansion targets: The identification of progress toward all system expansion targets for the current priority tier.

Create ridership development plan/land use/TOD plans for centers and stations: Assessment of potential future ridership based on current land use projections, identified station areas and local zoning. This might involve demand modeling, but could effectively use Transit Orientation Index (TOI) scores within ½ mile of identified station areas. A ridership development plan could include assessment of: TOI score, residential density, employment density, potential cost effectiveness and transit supportive land uses (zoning and station typology aspirations).

Assess mode and function of HCT: Definition of the HCT modes that are most relevant for meeting the primary function of a corridor's problem statement. Selection of a lower cost mode could improve the corridor's ability to meet targets.

Create multimodal station access and parking plan: The station access plan would ensure that station designs optimize opportunities for intermodal connections and TOD by planning for an urban block pattern. The parking management plan would help local jurisdictions develop transit supportive parking policies that include development of potential parking districts. It could also establish maximum parking requirements, pay-for-parking, park-and-ride development and management plans, and other parking code changes such as unbundling parking for new development.

Assess financial feasibility: Assessment of the financial feasibility of the region to advance an HCT project. The analysis would consider and propose incentives to finance existing and future infrastructure improvements, using tools such as system development charge credits, tax abatement, improvement districts and tax increment financing (TIF).

Regional support descriptions

Regional support will be necessary to advance any corridor. Regional actions may already be in place, such as work coordinated through the transportation system plans; however, specific regional actions to support HCT project advancement would vary based on the tier.

Create land use and transit-oriented development plans for station areas: Land use and TOD plans for corridors would be reviewed for local areas to ensure that station areas within a defined corridor extent can meet defined targets for ridership and transit supportive land use.

Analyze station siting alternatives: Locations of stations is critical to the success of the HCT system. Metro has advanced tools to work in tandem with locals to assess the trade-offs between potential station areas.

Coordinate with MTIP priorities: HCT investments should align with regional priorities for transportation and land use investments. MTIP prioritization would support development or preparation of a corridor as an HCT project.

Perform multi-modal transportation analysis: Metro will assist with the preparation and production of transportation modeling for near-term regional priority corridors. Metro will assist corridors in other tiers as well; however, methods will vary.

Create station access and parking plans: Parking availability is one of the strongest determinants of transit ridership and has the potential to add significant value to leverage regional HCT investment. Metro has tools for the region to review parking plans for all land use types.

Start potential alternatives analysis: The region can begin the process to help projects advance into federal alternatives analysis process.

Proposed system expansion target descriptions

A small set of system expansion targets will be identified to measure project readiness and contribution to regional goals. These targets will provide clear direction to local jurisdictions that desire to advance projects. System expansion targets would vary based on the tier.

Transit supportive land use/station context: Under this target, each station along a proposed alignment should be evaluated for ridership potential based on the jurisdictions' demonstrated willingness to promote transit supportive development. Specific targets could be set for residential, commercial and employment density in station areas. Additionally each station should undergo an evaluation to determine: (1) the capacity for station area development, (2) ability to create good station access for all modes and (3) any issues with station capacity or functionality.

Community support: This measure would be qualitative, based on expressed support for HCT service in the corridor.

Partnership/political leadership: This measure would be qualitative based on demonstrated political leadership, development of strategic partnerships and demonstrated advancement of local aspirations.

Regional transit network connectivity: This measure would assess the role the project plays in filling key regional transit system gaps, connectivity with the existing and planned systems and ability for existing system facilities to support the investment. It would also measure a project's impact on the regional HCT system's ability to increase system capacity to deal with malfunction, incident or construction/maintenance, and the ability for existing station and track infrastructure to support the investment.

Housing needs supportiveness: This measure would assess the contribution of the project to improve overall housing and transportation affordability for populations of concern.

Financial capacity – capital and operating finance plans: This measure would assess the capacity to fund capital and operations with no significant negative consequences on existing infrastructure or transit system operations. This evaluation could include:

- **Capital finance plan**: A qualitative rating based on whether a project is partially or fully funded, the availability of local capital funds and competition for funding that is needed for core system capacity enhancements or maintenance.

- **Operating finance plan**: A preliminary analysis of the financial capacity to operate using measures such as estimated farebox recovery, cost effectiveness (total annualized operating and capital cost per passenger), and the stability, reliability and availability of proposed operating subsidy.

Integrated transportation system development: This measure would quantitatively assess the role each project would play in addressing a broad range of regional transportation priorities, particularly those priorities for the Mobility Corridor in which the corridor is located.

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This document describes elements of the federal 2008 Regional Transportation Plan recommended for update based on the work concluded through the High Capacity Transit System Plan.

1. <u>Define the function of high capacity transit within an integrated transportation system</u>

Current Regional Transportation Plan policy: As defined in the Regional Transportation Plan, page G-7, "High capacity transit is characterized by carrying a larger volume of passengers using larger vehicles and/or more frequent service than a standard fixed route bus system. It operates on a fixed guideway or within an exclusive right-of-way, to the extent possible. Service frequencies vary by type of service. Passenger infrastructure is provided at transit stations and station communities, including real-time schedule information, ticket machines, special lighting, benches, shelters, bicycle parking, and commercial services. Using transit signal priority at at-grade crossings and/or intersections preserves speed and schedule reliability. Park and-ride lots provide important and necessary access to the high capacity transit network."

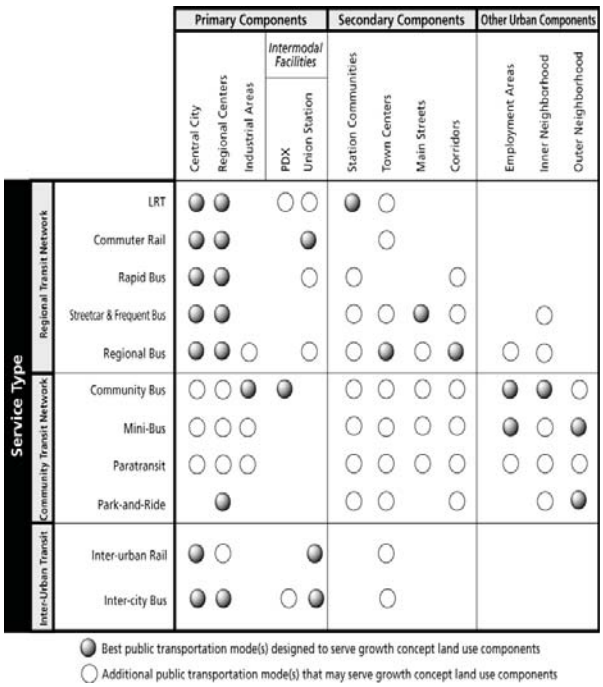
What we've heard: In public involvement efforts and committees, staff has heard conflicting understanding and opinions about the purpose and function of high capacity transit. High capacity transit could serve corridors with access and many stops or it could serve centers with speed and few stops. Some participants wanted more suburban-to-suburban service and faster service through downtown Portland.

Recommendation: Update the RTP to define the function of high capacity transit as carrying a larger volume of passengers using larger vehicles and/or more frequent service than a standard fixed route bus, with a majority of an HCT line separated from traffic. The update should include language to reflect that the level of investment in High Capacity Transit should be warranted based on performance targets. HCT targets would be based on the ability of a capital investment to move people more efficiently than can be achieved by a fixed-route bus in traffic.

RTP update method: Regional High Capacity Transit System Plan system expansion policy targets would set clear guidelines about what HCT investment is fiscally appropriate based on projected demand. This would help guide the level of investment necessary for individual corridors.

2. <u>Define the role of HCT in providing service to town centers and employment areas</u>

RTP Figure 3.14



Current Regional Transportation Plan policy: Under the current Regional Transportation Plan, Figure 3.14, high capacity transit (LRT, commuter rail, and rapid bus) is designed to provide core transit service to primary components, which include the central city, regional centers, and Union Station, and to the secondary component, station communities. High capacity transit (LRT, commuter rail, and rapid bus) is designed to provide additional public transportation modes that may serve growth concept land use components include the Portland Airport (PDX) and town centers.

What we've heard: In public involvement efforts and committees, staff has heard a desire for town centers, employment areas and major activity centers (e.g., the Oregon Zoo) to be served by high capacity transit.

Recommendation: Update the RTP with defined targets for mode-neutral transit service frequencies to serve each of the 2040 Growth Concept land uses. Performance targets would guide the mode type and clarify what major investment is appropriate. Activity centers are not clarified in the 2040 Growth Concept, and no specific service targets are recommended.

RTP update method: Regional High Capacity Transit System Plan system expansion policy targets would set clear guidelines about what HCT investment is fiscally appropriate based on projected demand. This would help guide the level of investment necessary for individual corridors.

3. <u>Define HCT modes and resolve if rapid streetcar should be added as potential high capacity transit mode and clarify the role of commuter rail</u>

Current Regional Transportation Plan policy: Under the current Regional Transportation Plan, page 3-38, high capacity transit facilities and services include light rail transit, commuter rail, bus rapid transit, intermodal passenger facilities and park-and-ride lots.

The Regional Transportation Plan, page G-15, defines streetcar as: "Fixed-route transit service mixed in traffic for locally oriented trips within or between higher density mixed-use centers. Streetcar services provide local circulator service and may also serve as a potent incentive for denser development in centers. Service runs typically every 15 minutes and streetcar routes may include transit preferential treatments, such as transit signal priority systems, and enhanced passenger infrastructure, such as covered bus shelters, curb extensions and special lighting."

The Regional Transportation Plan, page G-3, defines commuter rail as: "Short-haul rail passenger service operated within and between metropolitan areas and neighboring communities. This transit service

operates in a separate right-or-way on standard railroad tracks, usually shared with freight use. The service is typically focused on peak commute periods but can be offered other times of the day and on weekends when demands exists and where capacity is available. The stations are typically located one or more miles apart, depending on the overall route length. Stations offer infrastructure for passengers, bus and LRT transfer opportunities and parking as supported by adjacent land uses. See also Inter-city rail."

The Regional Transportation Plan, page G-8, defines inter-rail as "Inter-city passenger rail that is part of the state transportation system and extends from the Willamette Valley north to British Columbia. Amtrak already provides service south to California, east to the rest of the continental United States and north to Canada. These systems should be integrated with other transit services within the metropolitan region with connections at passenger intermodal facilities."

What we've heard: In public involvement efforts and committees, staff has heard that there are discrepancies existing in the current RTP. Rapid streetcar is being proposed in the Portland to Lake Oswego corridor, but rapid streetcar is not defined in the RTP. The High Capacity Transit System Plan has identified potential commuter rail lines to neighboring communities, but these lines would fall in between the RTP definitions of commuter rail definition and inter-city rail.

Recommendation: Update the RTP to replace the mode description type with mode function and performance targets. Targets for all modes performing as high capacity transit will be added, including the modes of commuter rail and rapid streetcar.

RTP update method: Regional High Capacity Transit System Plan system expansion policy targets would set clear guidelines about what HCT investment is fiscally appropriate based on projected demand. This would help guide the level of investment necessary for individual corridors.

4. <u>Define the coordination of land use, station area and transportation investments with HCT investments</u>

Current Regional Transportation Plan policy: There is currently no Regional Transportation Plan policy directing concurrent land use, transportation and transit planning in high capacity transit corridors.

What we've heard: In public involvement efforts and committees, staff has heard an emphasis on the importance of combining placemaking efforts and land use planning with future high capacity transit investments. Public participants were interested in creating links between stations and neighborhoods by integrating stations into surrounding communities, considering pedestrian and bike facilities around stations, and providing good local transit service to get people to HCT stations.

Recommendation: Update the RTP to incorporate the system expansion policy for advancement of high capacity transit corridors to include land use coordination and action by local communities to advance HCT projects.

RTP update method: Regional High Capacity Transit System Plan system expansion policy targets will include land use targets in association with measuring the value of potential future HCT investments.

STAFF REPORT

IN CONSIDERATION OF RESOLUTION NO. 09-4052 FOR THE PURPOSE OF ACCEPTING THE REGIONAL HIGH CAPACITY TRANSIT SYSTEM TIERS AND CORRIDORS, SYSTEM EXPANSION POLICY FRAMEWORK AND POLICY AMENDMENTS FOR ADDITION TO THE 2035 REGIONAL TRANSPORTATION PLAN STATE COMPONENT

Date: June 25, 2009 Prepared by: Tony Mendoza 503-797-1726

BACKGROUND

The Regional High Capacity Transit (HCT) System Plan identifies corridors where new HCT could be developed over the next 30 years and prioritizes corridors based on evaluation criteria adopted by the region, and sets a framework to advance projects in the future. This staff report summarizes the study process, provides key results and describes proposed policy changes.

Role of high capacity transit

Metro's *Making the Greatest Place* process will position the region as a national leader in addressing the 21st century challenges of energy independence, carbon neutrality, population growth, sustainable economic development and human health. Continued development of a world class, HCT system is part of an integrated strategy to accommodate the region's rapidly increasing population, while reducing the negative impacts of growth on land, air and water quality and the ability to get around. Regional land use policy has positioned the Portland metro area to effectively employ transit supportive development policy and implementation. It is essential that HCT future investments leverage achievement of land use and economic development goals.

Regional HCT System Plan outcomes

The Regional HCT System Plan is not intended as a review of the regional transit structure or its management, or as a complete service analysis of the existing HCT system. Rather, the plan applies technical evaluation of possible investments to set near- and long-term priorities and aligns HCT project advancement in a way that supports and enhances the goals of the Regional Transportation Plan (RTP) and the region's 2040 Growth Concept. HCT system capital investments must be implemented as part of a broad corridor strategy that includes supportive land use and transit-oriented development (TOD), comprehensive parking programs, access systems for pedestrians and cyclists, park and rides and feeder bus networks. The Regional HCT System Plan creates a new policy framework where these elements lead or parallel investment in HCT.

Regional HCT System Plan process

Significant work has been done by Metro's technical team as well as the HCT MTAC/TPAC Subcommittee and other Metro policy committees. Steps completed in the process to date include:

- early plan public outreach and stakeholder interviews to identify major issues and objectives, and to develop an initial universe of corridors to be evaluated

- formation of and meetings with a "Think Tank" group, a group of regional leaders in a number of related fields formed to provide high-level concept development to guide the Regional HCT System Plan
- development of a long list of 55 potential regional high capacity transit corridors
- development and application of a set of eight screening criteria to narrow the 55 corridors to 18 promising corridors.
- development and adoption of 25 detailed evaluation criteria used to prioritize the 18 corridors
- stakeholder and public review of evaluation criteria
- evaluation and prioritization of the 18 adopted regional HCT system corridors
- development of a system expansion policy which sets a framework to advance HCT corridors into development.

RESOLUTION MATERIALS

Exhibit A delineates HCT system plan tiers and corridors. These tiers and corridors are the result of months of technical work and iterations of review by the MTAC/TPAC HCT Subcommittee, TPAC, MTAC, MPAC, and JPACT.

Exhibit B explains the system expansion policy framework, as described in more detail below.

Exhibit C illustrates recommended policy amendments for addition to the 2035 RTP, State Component based on lessons learned through the HCT planning process.

EXHIBIT A: Regional high capacity transit system plan tiers and corridors

An intense evaluation process revealed that ridership, though not weighted, is an important indicator of how a corridor scores since many of the evaluation criteria relate to ridership. In short, the more use a corridor has, the more benefits the corridor will produce. In addition to the technical analysis, public outreach efforts and a survey of Metro's standing committees revealed that ridership (or ridership potential) was seen as the most important single factor in determining where new HCT investments should be made.

HCT modes

To ensure that all corridors were evaluated evenly, all HCT corridors were examined as light rail. This was also done to limit the potential for subjective judgments about appropriate modes for a corridor, which could favor one corridor over another.

Mode selection will be a critical component of the system expansion policy for future selection of priority corridors, and targets will be set to help guide what the appropriate investment should be for each corridor.

EXHIBIT B: Regional high capacity transit system expansion policy

System expansion policy framework

The system expansion policy framework is designed to provide a transparent process to advance high capacity transit projects through the tiers. The framework is based on a set of targets designed to measure corridor readiness to support a high capacity transit project, as described in *Exhibit B.*

System expansion targets

The targets or thresholds set through the system expansion policy will provide clarity for actions local jurisdictions can take to move a corridor to a higher tier or prepare a corridor for advancement. Regional actions will also be required to ensure projects move forward in partnership. Targets will be based on measurable factors that support ridership such as household and employment densities and sidewalk connectivity. Additionally, targets will be set for community support and political leadership. These targets will be finalized in conjunction with the completion of the 2035 RTP, State Component.

EXHIBIT C: Recommendations for regional transportation plan updates

Over the course of the HCT System Plan process, several policy questions arose. These policy questions are addressed in *Exhibit C.* This document seeks to address policy questions of the function of HCT and definitions of HCT modes and to define the framework of the system expansion policy.

ANALYSIS/INFORMATION

Known opposition

Representatives from Forest Grove (including the mayor) and Cornelius have concurred with the validity of the technical analysis but are on record as opposing the tiered ranking of Corridor 12 (Hillsboro to Forest Grove) in the developing regional priority category.

Legal antecedents

Resolution No. 09-4025 *For the Purpose of Adopting the Regional High Capacity Transit System Plan Screened Corridors and Evaluation Criteria.*

Ordinance No. 82-135 *For the Purpose of Adopting the Regional Transportation Plan*

Resolution No. 83-383 *For the Purpose of Endorsing the Regional Light Rail Transit (LRT) System Plan Scope of Work and Authorizing Funds for Related Engineering Services*

Resolution 07-383 1B *For the Purpose Of Approving the Federal Component of the 2035 Regional Transportation Plan (RTP) Update, Pending Air Quality Conformity Analysis*

Anticipated effects

Adoption of this resolution would enable the prioritized HCT corridors to be included in the RTP, State Component, set a policy framework for the advancement of high capacity transit projects through the system expansion policy, and set a policy framework for HCT within the RTP, State Component.

Budget impacts

There would be no direct impact on the Metro budget as a result of taking action on this resolution.

RECOMMENDED ACTION

Approve Resolution No. 09-4052 For the Purpose of Accepting the Regional High Capacity Transit System Tiers and Corridors, System Expansion Policy Framework and Policy Amendments for Addition to the 2035 Regional Transportation Plan State Component

Resolution exhibits

Exhibit A: High capacity transit system plan tiers and corridors
Exhibit B: System expansion policy framework
Exhibit C: Recommended policy amendments for addition to the 2035 Regional Transportation Plan, State Component

Staff report attachments

Council has previously received the following document in the draft form:

- High Capacity Transit System detailed evaluation report on May 12, 2009

Council will receive the following documents when they have been finalized after council's final adoption of Resolution:

- High Capacity Transit System detailed evaluation report
- Regional High Capacity Transit System Plan summary report
- Public outreach summary report

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A regional approach simply makes sense when it comes to protecting open space, caring for parks, planning for the best use of land, managing garbage disposal and increasing recycling. Metro oversees world-class facilities such as the Oregon Zoo, which contributes to conservation and education, and the Oregon Convention Center, which benefits the region's economy.

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