2018 Regional Transportation Plan



2018 Regional Transportation Plan Chapter 7 Measuring Outcomes

December 6, 2018



Metro serves more than 1.5 million people in Clackamas, Multnomah and Washington counties. The agency's boundary encompasses 24 cities – from the Columbia River in the north to the bend of the Willamette River near Wilsonville, and from the foothills of the Coast Range near Forest Grove to the banks of the Sandy River at Troutdale.

Among its other responsibilities, Metro is authorized by Congress and the State of Oregon to coordinate and plan investments in the transportation system for the three-county area. Metro uses this authority to expand transportation options, make the most of existing streets and improve public transit service. As the designated metropolitan planning organization, Metro works collaboratively with cities, counties and transportation agencies to decide how to invest federal highway and public transit funds within its service area. It creates a long-range transportation plan, leads efforts to expand the public transit system and helps make strategic use of a small subset of transportation funding that Congress sends directly to metropolitan planning organizations.

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7.1 INTRODUCTION

Cities and regions around the country are facing important choices about how and where they want to grow and invest in their communities. Faced with limited funding and significant infrastructure needs, the desire for getting the most out of our transportation investments has increased. Performance-based planning has emerged over the past decade as an effective way to understand the consequences and benefits of the choices facing regions. Performance measurement is a way to build accountability and transparency into the transportation planning and decision-making process.

Why performance evaluation matters

The greater Portland region's economic prosperity and quality of life depend on a transportation system that provides every person and business with access to safe, reliable, affordable and healthy travel options.

The Regional Transportation Plan (RTP) purposefully lays out a vision and supporting goals, objectives, performance measures (and targets) and policies that guide transportation planning and decision-making in the region to achieve desired outcomes. Evaluation of the planned regional transportation system projects and programs against a set of outcomes-focused performance measures and targets provides valuable information to the public and decision-makers, including:

- Measurement of how well investment priorities submitted to the Regional Transportation Plan by local agencies, the Oregon Department of Transportation, TriMet, SMART and special districts achieve RTP goals and objectives;
- Improved communication of regional transportation needs and priorities, which is especially important given limited available funding; and
- Increased transparency and accountability throughout the analysis and decision-making process.

When used effectively, performance measures can enable more comprehensive evaluation across multiple issue areas and help communicate tradeoffs and funding decisions to stakeholders. It allows stakeholders and decision-makers to understand whether the region's investment priorities are achieving agreed upon desired outcomes. Applied effectively, performance measurement can be a powerful tool for building public confidence that the available funds are well spent.

7.1.1 Chapter organization

This chapter reports on the expected system performance of the region's investment priorities and documents whether the region achieves regional performance targets in 2040.

7.1. Introduction: This section provides an overview of the chapter.

7.2 Performance-Based Planning and the RTP: This section describes the performance-based planning framework and provides a snapshot of performance outcomes from the evaluation of the RTP projects described in Chapter 6.

7.3 RTP System Evaluation Framework: This section describes the system evaluation measures used to evaluate performance of the Plan as a whole as well as background on the transportation equity analysis and different geographical areas on which the performance measures are reported.

7.4 How the System Performs: This section describes the expected outcomes and findings for each measure to meet state and federal requirements.

7.2 PERFORMANCE-BASED PLANNING AND THE RTP

Performance measures serve as the dynamic link between Regional Transportation Plan (RTP) goals and plan implementation. The RTP refers to the cyclical process of plan development, evaluation, plan implementation and plan monitoring as the Performance Measurement System, as shown in **Figure 7.1**.





This chapter reports on the evaluation of plan performance. Through an evaluation of performance of the transportation system the region can better understand the extent to which investments in the transportation system will achieve desired outcomes and provide the best return on public investments.

This chapter also satisfies reporting requirements for performance measures and benchmarks mandated by the Oregon Transportation Planning Rule (TPR), the Oregon Metropolitan Greenhouse Gas Reduction Targets Rule and federal requirements to assess potential impacts of RTP projects on environmental resources, historical and cultural resources and tribal lands.

Plan monitoring in support of the region's federally-required Congestion Management Process and MAP-21/FAST Act reporting between the RTP update cycles is addressed in Chapter 8 and Appendix L. Some of the plan monitoring measures overlap with the performance targets and system evaluation measures, but rely on collected (observed) data rather than forecasted data.

System evaluation

The RTP is primarily evaluated using **forecasted data** from the travel model, however outcomes for some performance measures cannot currently be forecasted (affordability, safety and reliability) and these measures are not included in the system evaluation. Metro is working with federal, state and local partners to develop tools for future RTP updates that will support evaluating how the plan impacts affordability, safety and reliability in the region.

Table 7.1 lists the RTP performance measures used for plan evaluation, linking them to the RTP goals they support.

Table 7.1 How RTP System Evaluation Measures Inform Achieving RTP Goals

					RTP	Goal	s					
RTP S <u>Legen</u> $\bullet = me$ gc $\bullet = me$ ac o = me	ystem Evaluation Measures <u>d</u> easure highly correlated with achieving easure somewhat correlated with hieving goal asure partially supports achieving goal	Vibrant Communities	Shared Prosperity	Transportation Choices	Reliability and Efficiency	Safety and Security	Healthy Environment	Healthy People	Climate Leadership	Equitable Transportation	Fiscal Stewardship	Transparency and Accountability
	How much do households spen	d on ho	ousing a	and trar	nsporta	tion in	our re	gion? ¹				
n/a	Affordability*	•	•	Đ	•	0	0	•	0	•		
	How safe is travel in our region?											
n/a	Safety*	•	e	•	•	•	÷	•	e	•		
	How much do peo	ple and	l goods	travel	in our r	egion?					pue	
1	Multimodal Travel	•	e	•	•	Ð	•	•	•	•	ip" a	÷
2	Mode Share	•	e	•	•	Ð	•	•	•	•	rdsh	
	How easily, comfortably and direct	y can w	ve acce	ss jobs	and de	stinatio	ons in o	our regi	on?		ewa	
3	Access to Travel Options – system completeness *	•	÷	•	•	•	•	•	•	•	iscal St	goals.
4	Access to Jobs*	•	•	•	0	0	0	•	e	•	e "Fi	ity"
5	Access to Community Places*	•	•	•	0	0	•	•	e	•	or th	tabil
6	Access to Bicycle and Pedestrian Parkways	•	•	•	ο	•	•	•	•	•	ures fc	ccount
7	Access to Transit*	•	•	•	e	0	•	e	•	•	leas	A br
8	Access to Industry and Freight Intermodal Facilities	0	•	ο	ο	0	0	0	0	ο	ation m	ency ar
	How effic	ient is t	ravel in	n our re	gion?		T	T	T		alua	pare
9	Multimodal Travel Times	•	•	•	•	0	0	0	0	0	n ev	rans
10	Congestion	e	•	0	•	•	÷	÷	⊖	0	/ster	Ļ,
11	Transit Efficiency and Ridership	•	0	•	•	0	•	0	0	0	lo s	
	How will transportation impac historic and cu	t clima ltural p	te char laces a	nge, air Ind pub	quality lic heal	, the ei th?	nvironr	nent,			are r	
12	Carbon Emissions	0	•	•	0	0	•	•	•	0	lere	
13	Clean Air	0	•	•	0	0	•	•	e	•	Ę	
14	Potential Habitat Impact	•	0	ο	0	ο	•	•	•	•		
15	Potential Historical, Cultural and Tribal Lands Impact	•	•	ο	ο	ο	0	•	0	ο		
16	Public Health	•	•	0	0	0	•	•	•	0		
* Perfo	ormance measures with an asterix (*) r unities and serve as the basis for the fe	eflects derally	the trai -requir	nsporta ed Title	tion pri VI Ben	orities efits an	identifi d Burd	ed by h ens ana	nistorica alysis.	ally mar	ginalize	ed

 $^{^{\}scriptscriptstyle 1}$ Evaluation measures and methods to be developed for next RTP.

7.2.4 Performance measure outcomes at-a-glance

This section provides a snapshot of the various performance measures used to assess the performance of the RTP. Some of the measures are included in the system evaluation in **Section 7.4** and others are not because Metro does not yet have methods or tools to forecast some desired performance outcomes. Observed data is cited when forecast data is not available.

As a frame of reference, **Table 7.2** shows the 2015 estimates and 2040 future year projections of household, population and employment used in the system analysis for the metropolitan planning area boundary. This information was developed for use in the Regional Travel Demand Model as part of preparing a regionally-coordinated distribution of the forecasted growth for the region for local and regional planning activities. The forecasted growth distribution was adoped by the Metro Council in October 2016.²

Table 7.2 Base year (2015) and future year (2040) regional household, population andemployment

	Households	Population	Employment
2015	636,467	1,605,672	895,094
2040	896,451	2,178,848	1,240,653
Growth	+259,984	+573,176	+345,560
Percentage growth	41%	36%	39%

Source: Metro Research Center



Figure 7.2 summarizes projected changes in demographics, travel and related emissions between 2015 and 2040 within the metropolitan planning area boundary assuming the 2040 Constrained projects.

² Metro Ordinace No. 16-1371 (For the Purpose of Adopting the Distribution of the Population and Employment Growth to Year 2040 to Local Governments in the Region Consistent with the Forecast Adopted by Ordinance No. 15-1361 in Fulfillment of Metro's Population Coordination Responsibility under ORS 195.036), adopted by the Metro Council on October 13, 2016.

Figure 7.2 **2018 RTP System Evaluation Results Summary**

Totals are for travel within the metropolitan planning area for the greater Portland region and assume the 2040 Constrained projects.

hics	Population (2,178,848)	I I	l l	I.		36%		I.		1	1
rapl	Households (896 451)	I I		I		41%		I		I	I
nog	110030110103 (830,431)	I I				41/0		1	1	1	1
Der	Employment (1,240,653)	I I		I		39%		- I	1	1	I
	Total person trips (8 387 620)			I		35%				1	
	lotal person trips (0,007,020)	1 1						I.	1	I	I
	Daily auto trips (6,586,163)	1 1		l.		29%		I	1	I	I
		1 1				F 00/		I		I	I
	Daily biking trips (347,874)	1 1				50%		1	1	I	I
Daily walking trips (649,729)	1 1		l.		41%		I	1	I	I	
le l	<u>e</u>	1 1									
Irav	Daily transit trips (612,526)							137%			
	Daily truck trips (45,649)	1 1				739	и К		1	I	I
						1	1	1	1	I	1
	Average trip length (miles) (5 miles)	I I		l l	1%			1	1	I	1
	Average commute (8 miles)	I I			20/			1	1	1	1
	length (miles) (8 miles)	I I		l I	3%			1	1	1	1
	Daily VMT per capita (12.4 miles)	I I		I _	4%			- E	1	1	1
	Pounds of narticulate							1	1	1	1
ir lity	matter (PM _{2.5}) emissions (281 lbs/day)		-82%					1	1	1	1
A Qua	Metric tons of passenger (1.4 annual to	hs/capita)	-	46%				I.			I.
	venicie CO ₂ e emissions										
	-8	0% -60	-40%	-20%	0%	20% 4	0%	50% 8	30% 1	.00%	120%
		ange from 2	015				12/6/18				

Table 7.3 provides a legend for performance outcomes summarized in Table 7.4.





Table 7.4 provides an "at-a-glance" overview of performance measures used in the RTP system evaluation and progress made towards targets or desired direction by 2040 if the 2040 Constrained projects are fully implemented. Not all performance measures have a performance target. If a performance measure does not have a target, the desired direction is indicated. Performance measures for affordability and safety are included in the system evaluation. Because Metro does not yet have methods or tools to forecast performance for affordability or safety; observed data is cited.

See Section 7.4 for detailed results and findings for each measure.

Measure	Target or desired direction	Performance within the metropolitan planning area	Performance in equity focus areas	Plan direction
	How much do households spend	on housing and transportation in ou	r region?	
Affordability	By 2040, reduce the combined housing and transportation expenditure for lower-income households by 25 percent, compared to 2015 combined housing and transportation expenditure levels.	Plan does not forecast affordability or provide system evaluation results. Observed data shows that the region needs to make big strides to reduce disparities in affordability.	Observed data shows that the region needs to make big strides to reduce disparities in affordability for people of color.	Not applicable.
	How safe	is travel in our region?		
Safety	By 2035 eliminate transportation related fatalities and serious injuries for all users of the region's transportation system, with a 50 percent reduction by 2025 and a 16 percent reduction by 2020 (as compared to the 2015 five year rolling average).	Plan does not forecast safety performance and does not provide system evaluation results. Observed data from the last five years indicates that the region is not moving in the right direction to achieve target.	Annual average fatal and severe injury crashes for all modes increased or remained flat since the 2014 RTP, and are higher for people of color and people with low incomes.	Not applicable.
	How much do peopl	e and goods travel in our region?		
Mode share	By 2040, triple walking, biking and transit mode shares, compared to 2015 modeled mode shares.	Plan increases walking, biking and transit mode share from 16 percent to 20 percent of all trips, but does not meet target.	Not included in transportation equity analysis.	

Table 7.4 Expected Outcomes of the 2040 Constrained Projects – At-A-Glance

Measure	e Target or desired direction Performance within the Performance in metropolitan planning area equity focus areas		Performance in equity focus areas	Plan direction
	How easily, comfortably and directly	can we access jobs and destinations	in our region?	
System completeness (access to travel options)	By 2040, complete 100 percent of the regional network of sidewalks, bikeways and trails.	 Plan makes progress towards meeting the target, but does not reach target of completing 100 percent of the regional active transportation network. In 2040, 71 percent of sidewalks, 65 percent of on-street bikeways, and 47 percent of regional trails are complete on the regional active transportation network. 	Plan makes greater progress towards meeting the target in equity focus areas compared to non-equity focus areas, but does not reach target of completing 100 percent of the regional active transportation network in equity focus areas.	Region and equity focus areas
Access to jobs	There is no target for this measure. The desired direction is to increase the number of low and middle-wage jobs accessible to the average household in equity focus areas compared to the average household in non-equity focus areas. ³	Measure is for historically marginalized communities in equity focus areas, see next column.	The average household in an equity focus area sees an increase in the number of jobs, including low and middle wage jobs that can be reached by transit compared to the rest of the region and non-equity focus areas.	Region
			For other forms of travel (driving, biking, and walking) the increase in the number of jobs the average household in equity focus area can reach is less than what the average household in the region and in non-equity focus areas can reach in a reasonable commute time.	Equity focus areas

³ Metro will update performance measure with a target and develop evaluation methods to measure the disparities gap in access to low and middle-wage jobs for households in equity focus areas in the next RTP update.

Measure	Target or desired direction	Performance within the metropolitan planning area	Performance in equity focus areas	Plan direction
Access to community places	There is no target for this measure. The desired direction is to increase to the number of community places accessible to the average household in equity focus areas compared to the average household in non-equity areas. ⁴	Measure is for historically marginalized communities in equity focus areas, see next column.	The average household in equity focus areas sees a greater increase in the number of community places reached in a short transit trip compared to the average household in the region and non-equity focus areas. The region and non-equity focus areas see a greater increase in the number of community places reached within a short trip of driving, biking or walking compared to households in equity focus areas.	Region Region Equity focus areas
Access to bicycle and pedestrian parkways	There is no target for this measure. The desired direction is an increase in the number and share of households within a 1/4- mile of a bicycle or pedestrian parkway.	Plan increases access to bicycle parkways to 79 percent of all households in 2040, and results in a decrease in access to pedestrian parkways, decreasing from 86 percent in 2015 to 85 percent in 2040.	Not included in transportation equity analysis.	
Access to transit	There is no target for this measure. The desired direction is an increase in the number and share of households, low-income households and employment near high capacity or frequent transit service by 2040.	Plan achieves desired direction. By 2040, 66 percent of households are within the desired distance to frequent all day transit; 79 percent of jobs are within the desired distance to frequent transit.	Plan increases access to transit in equity focus areas by 2027 and 2040.	

⁴ This measure replaces the 2014 RTP essential destinations target. Metro will update the performance measure with a new target and develop evaluation methods to measure the disparities gap in access to community places for households in equity focus areas in the next RTP update.

Measure	Target or desired direction	Performance within the metropolitan planning area	Performance in equity focus areas	Plan direction
Access to industry and freight intermodal facilities	There is no target for this measure. The desired direction is to reduce truck hours of delay on the freight network that provide access to intermodal facilities and industrial lands in 2040.	Plan performance is inconclusive due to limited analysis area in initial performance evaluation. More work is needed to develop this measure for use in the next RTP update.	Not included in transportation equity analysis.	Not applicable.
	How efficie	nt is travel in our region?		
Multimodal travel times	There is no target for this measure. The desired direction is to maintain or reduce travel times for transit, freight, bicycle, and motor vehicle trips.	Plan generally improves or maintains transit, truck and bicycle travel times. Auto travel times increase in most corridors.	Not included in transportation equity analysis.	
Congestion	By 2040, meet the Interim Regional Mobility Policy for throughways and arterials. ⁵	Plan does not meet policy in all locations.	Not included in transportation equity analysis.	

⁵ Refer to Chapter 3 of the 2018 RTP for Interim Regional Mobility Policy Target thresholds.

Freight delay	By 2040, reduce vehicle hours of delay per truck trip by 10 percent, compared to the 2040 No Build.	Plan does not meet target. Truck delay during the 1-3 PM time period increases 382 percent in 2040 Constrained, and increases 166 percent during the 4-6 PM peak period.	Not included in transportation equity analysis.	
Cost of freight delay	There is no target for this measure. The desired direction is to reduce growth in cost of delay (in constant dollars) on the regional freight network compared to the 2040 No Build.	Plan decreases cost of delay by 67 percent during the 1-3PM time period and by 29 percent during the 4-6PM peak period, compared to not implementing the plan by 2040.	Not included in transportation equity analysis.	\checkmark
Transit efficiency and ridership	There is no target for this measure. The desired direction is an increase in hours of transit service and ridership.	Plan more than doubles total boardings and increases hours of transit service by 60 percent by 2040.	Not included in transportation equity analysis.	

Measure	Target or desired direction	Performance within the metropolitan planning area	Performance in equity focus areas	Plan direction						
How will transportation impact climate change, air quality, the environment,										
Carbon emissions	Meet or exceed Climate Smart monitoring targets to reduce per capita greenhouse gas emissions from passenger vehicles. ⁶ Reduce per capita greenhouse gas emissions from cars and small trucks by 20 percent by 2025 and	Plan meets or exceeds most monitoring targets by 2040, making satisfactory progress implementing the Climate Smart Strategy. It makes progress towards, but	Not included in transportation equity analysis.	~						
CLIMATE SMART STRATEGY	2005 levels. ⁷	does not meet, targets to complete the active transportation network. Plan includes 9,513 transit service revenue hours, which exceeds the Climate Smart Strategy level of 9,400 hours. By 2040 annual per capita emissions from passenger vehicles decrease by 46 percent compared to 2015 levels. ⁸								
Vehicle miles traveled	By 2040, reduce vehicle miles traveled per person by 10 percent, compared to 2015.	Plan reduces vehicle miles traveled per person but does not meet target. In 2040, vehicle miles traveled per person decline 4 percent below 2015 levels.	Not included in transportation equity analysis.							

⁶ Refer to Appendix J for detailed information about the Climate Smart Strategy monitoring targets, analysis assumptions and expected performance.

⁷ The target was set by LCDC based on analysis conducted using ODOT's GreenSTEP tool. Metro uses the EPA-approved MOVES model to conduct RTP regional emissions analyses. Significant methodological differences in how GreenSTEP and MOVES estimate on-road vehicle emissions do not allow direct comparison of forecasted on-road vehicle emissions results. See Appendix J for more information.

⁸ Based on the analysis, Metro finds the region is making satisfactory progress implementing the Climate Smart Strategy and can reasonably be expected to meet the state-madated targets for reducing per capita greenhouse gas emissions from cars and small trucks by 2040. See Section 7.4.12 and Appendix J for more information.

Measure	Target or desired direction	Performance within the	Performance in	Plan direction
		metropolitan planning area	equity focus areas	
Potential habitat impact	There is no target for this measure. The purpose of this measure is to identify projects that overlap with sensitive high value habitats so that as projects move toward implementation, appropriate avoid, minimize, or mitigation strategies can be applied.	Plan identifies at least 544 projects that overlap or cross regionally identified high value habitats. Mitigation strategies are addressed specifically during the project development phase as part of the environmental and land use review, consultation and permitting processes all construction projects must undergo.	Not included in transportation equity analysis.	
Potential historical and cultural resources impact	There is no target for this measure. The desired direction is to identify projects that overlap with historical and cultural resources, and define potential mitigation strategies for historical and cultural resources.	Plan includes 62 projects located within 100 feet of historic properties listed in the National Register. Mitigation strategies are addressed specifically during the project development phase as part of the environmental and land use review, consultation and permitting processes all construction projects must undergo.	Not included in transportation equity analysis.	~
Potential tribal lands impact	There is no target for this measure. The desired direction is to identify projects that overlap with tribal lands, and define potential mitigation strategies to avoid tribal lands.	No tribal lands were identified within or adjacent to the metropolitan planning area.	Not included in transportation equity analysis.	
Public health	There is no target for this measure. The desired direction is to increase lives saved, years lived and avoid health care costs.	Plan decreases premature death and disease and avoids more thanr \$31 million in annual health care costs due to increased physical activity and reduced emissions.	Not included in transportation equity analysis.	

7.3 RTP SYSTEM EVALUATION FRAMEWORK

The system evaluation framework of the Regional Transportation Plan Performance Measurement System, shown in **Figure 7.3**, is used during periodic plan updates. Under federal law, updates occur at least every five years. During plan updates, the region reviews its goals and objectives for the transportation system and develops and refines an investment strategy comprised of infrastructure projects and programs submitted by cities, counties, the Oregon Department of Transportation, TriMet, SMART and special districts.

The Regional Transportation Plan (RTP) development and evaluation has two levels: performance targets and system performance evaluation. As previously described in Chapter 2, RTP performance targets are the highest order evaluation measures in the outcomes-based policy framework. The performance targets set quantifiable goals for the achieving the region's desired policy outcomes (though not all goals have targets). In comparison, system evaluation measures evaluate changes between current conditions (in 2015) and the set of transportation investments the region has chosen to pursue (the funding investment strategies described below). There is some overlap between the targets and the measures but they serve different functions. The performance targets are listed in Chapter 2.



Figure 7.3 2018 RTP Evaluation Framework

For the 2018 RTP update, Metro conducted three rounds of system evaluations. Following the first round of analysis, Metro engaged the public, regional policymakers and agencies responsible for developing the project lists in review and discussion of the Round 1 system evaluation findings. Based on the findings and subsequent public and stakeholder input, regional policymakers then recommended that the Metro Council direct agencies to refine the draft list of projects to better meet near-term regional priorities for improving safety, advancing equity, implementing the Climate Smart Strategy and managing congestion. In Spring 2018, Metro issued a second "call for projects" and requested agencies to revise the draft project list to better achieve the near-term regional priorities. Performance of the revised projects and programs was subsequently evaluated and reported for public review and feedback. Additional project list refinements were recommended, and subsequently adopted, following the final public comment period in summer 2018. Metro evaluated performance of the final adopted projects and programs in a third system evaluation.

The system evaluation that follows in Section 7.4 reports the performance of the adopted projects and programs. The projects and programs are described in **Appendices A, B and C**.

7.3.1 Measuring transportation equity

As part of the 2018 RTP, Metro conducted a transportation equity evaluation of the financially constrained 2018 RTP investment strategy. The equity evaluation satisfies federal requirements for Environmental Justice Impact Analysis.

The purpose of the transportation equity evaluation was to look at how well the region's planned long-range transportation investments performed relative to transportation priorities identified by historically marginalized communities. These identified transportation priorities subsequently shaped transportation-related equity goals, objectives, and performance measures in the Plan.

The transportation equity evaluation takes a system-wide look at the region's long-term investment strategy to:

- 1) determine whether progress is being made towards transportation priorities expressed by historically marginalized communities;
- 2) determine whether the financially constrained long-range transportation investment strategy, in totality, is disproportionately impacting historically marginalized communities and if mitigation measures are necessary; and
- 3) continue to learn from the assessment to propose technical refinements for future transportation equity evaluations.

The 2018 RTP transportation equity evaluation worked to incorporate and reflect previous recommendations from the 2014 Civil Rights Assessment, other agency strategic direction, federal corrective actions, as well as the latest research and best practices – drawing from national experts, think tanks, engagement, and academic partnerships. These different sources shaped and informed further how to measure equity within the context of the transportation system.

Through engagement with historically marginalized communities, the outcomes historically marginalized communities identified as priorities for the transportation system include (not in order): ⁹

- accessibility
- affordability
- safety
- environmental health

These topic areas were translated into system performance measures, which were guided by the input of a technical work group comprised of community-based organizations, social justice advocates, public health agencies and jurisdictional partners. A foundational element of the transportation equity evaluation of the 2018 RTP investment strategy was based on defining equity focus areas, which served as the main geography of comparison of performance relative to the region and the non-equity focus areas. The equity focus areas identify census tracts where there is a significant residential presence of three historically marginalized demographic groups: people of color, people in poverty/with lower income and English language learners.

Lastly, as recipient of federal transportation funds, Metro is responsible for successful integration of environmental justice (EJ) and civil rights (Title VI) standards into its transportation program and planning activities. Any program or activity receiving federal financial assistance cannot discriminate against people based on race, color, national origin, age, sex, disability, religion or income status nor prohibit a person from participating in regional activities. The programmatic evaluation of the 2018 RTP investments is used to demonstrate the planning of investments in the regional transportation system complies with federal non-discriminatory and disproportionate impact regulations.

Further detail about the 2018 RTP transportation equity system evaluation can be found in **Appendix E:** 2018 RTP Transportation Equity Evaluation.

⁹ Due to capacity constraints and additional resource needs, the affordability system evaluation measure was deferred and recommended for development prior to the 2023 RTP.

7.3.2 Evaluating system performance for different geographical areas

Metro evaluated the performance of the transportation system for the: 4-county region and metropolitan planning area. Within the metropolitan planning area (MPA), some measures were also evaluated in equity focus areas, sub-regions, regional centers and mobility corridors.





4-County Region

This area includes all of Clackamas, Multnomah, Washington and Clark Counties.

Metropolitan Planning Area (MPA) Boundary The primary geographic area for the RTP system evaluation, this is the geographic area determined by agreement between the Metropolitan Planning Organization (MPO) – Metro – and the Governor, in which the metropolitan transportation planning process is carried out by the MPO. Refer to Chapter 1 for more information about the MPA boundary and MPO responsibilities.

Figure 7.5 RTP Equity Focus Areas



Within the MPA some measures were analyzed for sub-geographies:

Equity Focus Areas Some evaluation measures include findings for equity focus areas. These areas are census tracts with higher than regional average concentrations and double the density of one or more of the following populations: people of color, English language learners, and/or people with lower income. Most of these areas also include higher than regional average concentrations of other historically marginalized communities, including young people, older adults and people living with disabilities.





Within the MPA some measures were analyzed for sub-geographies:

Sub-Regions and Centers Some evaluation measures include findings for these sub-regions: Portland, Urban Clackamas County, East Multhomah County and Urban Washington County, and for the 2040 Regional Centers and Portland Central City.





Within the MPA some measures were analyzed for sub-geographies:

Mobility Corridors Some evaluation measures include findings by Mobility Corridor. Mobility corridors represent subareas of the region and include all regional transportation facilities within the subarea as well as the land uses served by the regional transportation system. This includes freeways and highways and parallel networks of arterial streets, regional bicycle parkways, high capacity transit, and frequent bus routes. The function of this network of integrated transportation corridors is metropolitan mobility – moving people and goods between different parts of the region and, in some corridors, connecting the region with the rest of the state and beyond.

7.3.3 Evaluating system performance for different investment strategies

Metro evaluated the performance of the transportation system for six different investment strategies. Refer to **Chapters 5 and 6** for additional information on the investment strategies and the project lists. Refer to **Appendix M** for detailed information on the regional travel forecast modeling assumptions for each of the strategies.

- **2015 Base Year** This includes the "existing conditions" strategies against which the other funding assumptions are compared, and uses 2015 population and employment numbers. All transportation projects completed by 2015 are included in the Base Year.
- **2027 No Build** This strategy assumes only projects with committed funding are built by 2027 and uses 2027 projected population and employment numbers.
- **2027 Constrained** This strategy assumes that all projects and programs identified in the first ten years of the Regional Transportation Plan are completed by 2027 and uses 2027 projected population and employment numbers.
- **2040 No Build** This strategy assumes only projects with committed funding are built by 2040 and uses 2040 projected population and employment numbers.
- **2040 Constrained** This strategy assumes that all projects and programs on the full Constrained list are completed by the year 2040 and uses projected 2040 population and employment numbers.
- **2040 Strategic** This strategy assumes that all projects on the full Constrained list and all of the projects on the full Strategic list are completed by 2040 and uses projected 2040 population and employment numbers. Funding has not been identified for projects on the Strategic list, and therefore evaluation results are not shown for the Strategic investment strategies in this Chapter. Refer to Appendix I: Performance Evaluation Summary Tables for an overview of system evaluation measure outcomes for the Strategic investment strategies.

7.3.4 How to read the system evaluation measures

Each system evaluation measure provides the same set of information. The graphic below provides an overview of the type of information that is provided for each evaluation measure.

Title of Evaluation Measure

Data source: This identifies the source of the data reported. The performance measures rely on data generated by the regional travel demand forecast mode (Metro travel forecast model), MetroScope, the regional land use model and GIS analysis (Metro RLIS) to generate current and future year findings. Emissions data is generated using the MOVES model in accordance with all pertinent EPA guidance for preparing emissions estimates for air quality conformity purposes.

Description: This provides a brief description of what the system evaluation measure is and how the data was analyzed. Refer to Appendix I for a complete description of the methodologies.

Target or desired direction: Not every measure has a target. If a measure has a target, direction towards achieving the target is described. If the measure does not have a target, then the desired direction or outcome of the measure (such as increase or decrease) is described.

Findings: This provides a description of what the data evaluation is telling us.

Equity findings: If the evaluation measure evaluated the equity impact those findings are provided here.

7.4 HOW THE SYSTEM PERFORMS

This section describes the findings for each of the RTP system evaluation measures.

System Evaluation Measures

Affordability – Metro does not currently have the ability to forecast affordability. Evaluation measure(s) and tools will be developed and tested in the next update of the RTP if available. This measure will be monitored using observed data.

Safety – Metro does not currently have the ability to forecast crashes. Evaluation measure(s) and tools will be developed and tested in the next update of the RTP if available. This measure will be monitored using observed data.

Reliability – Metro does not currently have the ability to forecast system and freight reliability. Evaluation measure(s) and tools will be developed and tested in the next update of the RTP if available. This measure will be monitored using observed data.

- 1. Multimodal travel
- 2. Mode share
- 3. Access to travel options system completeness
- 4. Access to jobs
- 5. Access to community places
- 6. Access to bicycle and pedestrian parkways
- 7. Access to transit
- 8. Access to industry and freight intermodal facilities
- 9. Multimodal travel times
- 10. Congestion
- 11. Transit efficiency and ridership
- 12. Carbon emissions
- 13. Clean air
- 14. Potential habitat impact
- 15. Potential historical and cultural resources impact
- 16. Potential tribal lands impact
- 17. Public health

7.4.1 Multimodal travel

Data source: Metro travel forecast model.

Description: System-wide number of miles traveled (total and share of overall travel) within the Metropolitan Planning Area Boundary (MPA) by different modes of travel.

- Person miles traveled (total and per capita)
- Vehicle miles traveled (VMT) (total, per capita, per employee)
- Transit miles traveled (total, per capita, per employee)
- Bicycle miles traveled (*total, per capita, per employee*)
- Pedestrian miles traveled (total, per capita, per employee)
- Freight miles traveled (total)

Target or desired direction: By 2040, reduce vehicle miles traveled per person by 10 percent compared to 2015.

Findings: Overall travel (person miles traveled – all modes) per capita is increasing in future strategies while vehicle miles traveled per capita decreases 4 percent between 2015 and the 2040 Constrained strategies – making progress towards the target, but not reaching it. That means that other modes such as transit and bicycling are increasing. In the 2040 Constrained strategies transit miles traveled per person increases by 82 percent from 1.1 to 2.0, and bicycle miles traveled per person increases by 20 percent, from 0.50 to 0.60 between 2015 and 2040. Miles traveled by any mode are higher per employee than per capita.

Equity findings: Not included in transportation equity analysis.



Figure 7.8 Vehicle miles traveled per person each day (within the MPA)

Table 7.5 Daily person miles traveled per person

Person Miles Traveled	2015 Base Year	2027 No Build	2027 Constrained	2040 No Build	2040 Constrained	2040 Strategic
Total	30,403,023	36,272,364	36,639,935	41,359,645	42,069,444	42,236,504
Per Person	18.9	19.0	19.2	19.0	19.3	19.4

Table 7.6 Daily vehicle miles traveled per person

Vehicle Miles Traveled	2015 Base Year	2027 No Build	2027 Constrained	2040 No Build	2040 Constrained	2040 Strategic
Total	20,798,618	24,534,300	24,128,244	27,879,927	27,098,119	26,883,845
Per person	13.0	12.9	12.7	12.8	12.4	12.3
Per employee	23.2	22.9	22.5	22.5	21.8	21.7

Table 7.7 Daily transit miles traveled per person

Transit Miles Traveled	2015 Base Year	2027 No Build	2027 Constrained	2040 No Build	2040 Constrained	2040 Strategic
Total	1,814,208	2,537,005	3,212,334	3,033,836	4,421,606	4,860,131
Per person	1.1	1.3	1.7	1.4	2.0	2.2
Per employee	2.0	2.4	3.0	2.4	3.6	3.9

Table 7.8 Daily bicycle miles traveled per person

Bicycle Miles Traveled	2015 Base Year	2027 No Build	2027 Constrained	2040 No Build	2040 Constrained	2040 Strategic
Total	750,707	970,434	997,531	1,198,724	1,231,769	1,204,307
Per person	0.5	0.5	0.5	0.6	0.6	0.6
Per employee	0.8	0.9	0.9	1.0	1.0	1.0

Table 7.9 Daily pedestrian miles traveled per person

Pedestrian Miles Traveled	2015 Base Year	2027 No Build	2027 Constrained	2040 No Build	2040 Constrained	2040 Strategic
Total	262,288	311,833	317,059	362,741	371,315	368,959
Per person	0.2	0.2	0.2	0.2	0.2	0.2
Per employee	0.3	0.3	0.3	0.3	0.3	0.3

Table 7.10 Daily freight truck miles traveled

Freight	2015	2027	2027	2040	2040	2040
Miles Traveled	Base Year	No Build	Constrained	No Build	Constrained	Strategic
Total	361,770	501,027	500,799	651,897	651,127	650,913

7.4.2 Mode share

Data source: Metro travel forecast model

Description: Evaluates percent of non-drive alone trips (daily walking, bicycling, transit and shared ride trips) at multiple geographies (region-wide, sub region, mobility corridor, and 2040 design type). The data is categorized by 'trips to, from within.'

Target or desired direction: Increase non-drive alone mode share at all geographic levels. Triple walking, biking and transit region wide by 2040 compared to 2015 levels.

Findings: Findings for mode share are provided below for region-wide, sub-regions, centers and other 2040 design types and mobility corridors.

Equity findings: Not included in transportation equity analysis

Region-wide (within MPA boundary)

Plan does not meet target of tripling walking, biking, shared ride and transit within the MPA between 2015 and 2040.

Travel Mode	2015 Base Year	2027 No Build	2027 Constrained	2040 No Build	2040 Constrained	2040 Strategic
Walk	7	7	8	8	8	8
Bike	4	4	4	4	4	4
Transit	4	5	6	5	7	8
Shared ride	37	37	37	36	36	36
Drive alone	45	45	43	45	43	43

Table 7.11 Regional mode share (within the MPA)

Note: For all trips to, from and within the metropolitan planning area boundary, except school bus trips. Values have been rounded.



Figure 7.9 Non driving mode share within the MPA

Sub-region non-drive alone mode share

As the figure below shows, there are relatively large increases in walking, bike, shared ride and transit from 2015 to 2040 Constrained for travel within the City of Portland (from 26 percent to 32 percent) and urban Washington County (from 11 percent to 14 percent), with more moderate increases within other sub-regions. However, non-drive alone mode share does not triple for any sub-region.



Figure 7.10 Non-drive alone mode share by sub-region

Table 7.12 Non-drive alone mode share by sub-region

Sub-region	2015 Base Year	2027 No Build	2027 Constrained	2040 No Build	2040 Constrained	2040 Strategic
City of Portland	61	62	63	63	65	65
East Multnomah County	57	56	57	56	57	57
Urban Clackmas County	54	54	55	53	55	55
Urban Washington County	52	52	53	52	54	54

Note: For all walking, biking, transit and shared ride trips to, from and within each sub-region. Does not include school bus trips. Values are rounded.

Centers and other 2040 land use design types

Shown in **Table 7.13**, centers across the region display relatively large increases in non-SOV mode share (transit, biking, walking and shared ride) between 2015 and 2040 demonstrating the RTP continues to comply with Section 0035(5) of the Oregon Transportation Planning Rule.

First adopted in the 2000 RTP and approved by the Land Conservation and Development Commission in 2001, the RTP targets shown in Tables 7.13 and 7.14 reflect the non-SOV mode share needed to comply with Section 0035(5). Section 0035(5) allows the RTP to include an "alternative standard" to measure progress in reducing reliance on the automobile in place of the requirement to achieve a specific reduction in per capita vehicle miles traveled. Cities and counties are responsible for identifying actions that will result in progress towards achieving these targets as they develop local transportation system plans, as required in Section 3.08.230 of the Regional Transportation Functional Plan. Progress toward achieving the targets is monitored through scheduled updates to the RTP.

2040 Center	2015 Base Year	2027 No Build	2027 Constrained	2040 No Build	2040 Constrained	2040 Strategic	RTP Target
Portland central city – downtown	74	77	77	80	83	84	
Portland central city – Lloyd district	60	69	69	71	71	77	
Portland central city – Central eastside	54	65	65	67	73	73	60-70%
Portland central city – River district	72	75	75	76	80	80	
Portland central city – South Waterfront	57	62	62	65	72	73	
Amberglen regional center	51	52	54	52	56	56	
Beaverton regional center	52	52	56	52	57	57	
Clackamas regional center	51	52	55	52	56	57	
Gateway regional center	53	53	56	53	57	58	45-55%
Gresham regional center	54	54	57	54	58	58	
Hillsboro regional center	54	54	56	53	57	57	
Oregon City regional center	52	50	52	50	52	53	

Table 7.13 Non-drive alone mode share for 2040 centers
2040 Center	2015 Base Year	2027 No Build	2027 Constrained	2040 No Build	2040 Constrained	2040 Strategic	RTP Target
Washington Square regional center	47	48	51	48	52	52	
Vancouver, WA – downtown	51	52	52	52	55	55	
Town centers Tier 1	53	54	54	54	57	58	55%
Town centers Tier 2	50	50	50	50	53	53	50%
Town centers Tier 3	49	49	49	49	51	51	45%
Town centers Tier 4	52	51	51	50	51	52	45%

Note: For all walking, biking, transit and shared ride trips to, from and within each designated 2040 area. Does not include school bus trips.

Table 7.14 Non-drive alone mode share for other 2040 Growth Concept Design T	ypes
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Other Design Types	2015 Base Year	2027 No Build	2027 Constrained	2040 No Build	2040 Constrained	2040 Strategic	RTP Target
Station communities Tier 1	54	55	55	55	59	60	55%
Station communities Tier 2	42	44	44	45	49	50	45%
Station communities Tier 3	51	51	51	50	53	53	45%
Mainstreets and corridors	52	52	52	52	54	55	40-55%
Industrial areas	42	42	42	42	43	44	40%
Employment areas	45	46	46	46	47	48	45%
Neighborhoods	51	50	50	50	52	52	45%

Note: For all walking, biking, transit and shared ride trips to, from and within each designated 2040 area. Does not include school bus trips.

Mobility Corridors

Walking, biking and transit mode share increases in all mobility corridors across the region as shown in **Table 7.15**.

Mobility Corridor	2015 Base Year	2027 No Build	2027 <u>Const</u> rained	2040 <u>No B</u> uild	2040 Constrained	2040 <u>Strat</u> egic
Corridor 1						
Portland	20	20	20	20	22	22
Central City	26	29	30	30	32	32
to Vancouver						
Corridor 2						
Portland to		10	10		24	~1
Tigard/	15	16	18	1/	21	21
Tualatin						
Corridor 3						
Tualatin to	14	14	15	14	16	16
Wilsonville			-		-	-
Corridor 4						
Portland						
Central City	53	58	60	60	64	64
Loon						
Corridor 5						
Portland						
Central City	29	32	33	33	35	36
to Gateway						
Corridor 6						
Gateway to						
	14	15	16	15	17	17
	14	15	10	15	17	17
Fairview						
Corridor 7						
Gateway to						
Clark	17	18	19	18	20	20
County						
County						
Corridor 8	47	40	20	10	24	22
Gateway to	17	18	20	19	21	22
Oregon City						
Corridor 9						
Oregon City	17	17	17	17	18	18
to Willamete	_,		_,	_,		10
Valley						
Corridor 10						
Oregon City	20	20	21	19	21	21
to Tualatin						
Corridor 11						
Tigard and						
Tualatin to	14	14	15	14	17	17
Sherwood /						
Newberg						
Corridor 12						
Beaverton to	13	14	15	14	16	17
Tigard						

Table 7.15 Walking, Biking and Transit Mode Share Within Regional Mobility Corridors

Mobility Corridor	2015 Base Year	2027 No Build	2027	2040 No Build	2040 Constrained	2040 Strategic
		No Bullu	Constrained	NO Bullu	Constraineu	Strategic
Corridor 13 Portland Central City	46	48	50	49	52	52
to Beaverton						
Corridor 14						
Beaverton to	13	13	14	13	15	16
Consider 15						
Corridor 15	20	21	22	22	n n	25
HIIISDOFO to	20	21	22	22	23	25
Forest Grove						
Corridor 16						
Portland						
Central City	41	44	45	45	47	47
to Columbia						
County						
Corridor 17						
Rivergate to	23	24	24	24	25	26
I-5						
Corridor 18						
Columbia	17	18	19	19	20	20
Corridor						
Corridor 19						
Portland City	24	20	20	20	20	20
Center to	24	20	20	20	20	20
Lents						
Corridor 20						
Lents to	16	16	17	16	17	18
Gresham						
Corridor 21						
Portland						
Central City						
to Oregon	18	19	20	20	22	22
City/West						
Linn						
Corridor 22						
Milwaukie to	18	19	21	20	23	23
Clackamas	10	15	~	20	25	25
Corridor 22						
Claskamas to	12	14	15	11	16	16
Clackamas to	15	14	15	14	10	10
Damascus						
Corridor 24						
Fairview /						
Wood Village	4.0	10		10		
/ Troutdale /	13	13	14	12	14	14
Нарру						
Valley/						
Damascus						

Note: For all walking, biking and transit trips within each regional mobility corridor. Values have been rounded.

7.4.3 Access to travel options – system completeness

Data source: State and local agency Geographic Information System (GIS) data for sidewalk, bikeway, regional trail and street projects included in the RTP project database. Regional Land Inventory System (RLIS) GIS data of existing (constructed) sidewalks (as of 2012), bikeways (as of 2016) and trails (as of 2017). Regional Transportation Plan GIS data of the planned pedestrian, bicycle and transit networks (regional pedestrian and bicycle networks include regional trails). Data for arterial roadways was compiled from State of Oregon (Nov 2016), Metro Travel Model skims (2015), and RLIS (May 2017).

Description: Evaluates completeness of sidewalks, bikeways and regional trails for each of the RTP investment scenarios for the following:

- Access to transit Miles of sidewalks, bikeways and regional trails completed within 1/2mile from existing and planned light rail stops, 1/3-mile from streetcar stops, and 1/4mile from bus stops; region wide and in equity focus areas.
- **Sidewalks** Miles completed of the Regional Pedestrian Network (refer to map in Chapter 3); within 2040 centers, on existing arterial roadways and in equity focus areas.
- **Bikeways (on-street)** Miles completed of the Regional Bicycle Network (refer to map in Chapter 3); within 2040 centers, on existing arterial roadways and in equity focus areas.
- **Trails (regional)** Miles completed on the Regional Bicycle and Pedestrian Networks (refer to maps in Chapter 3) and in equity focus areas.

Target or desired direction: Hundred percent completion of the Regional Pedestrian and Bicycle Networks by 2040.

Findings: See below. Findings for equity focus areas are provided at the end.

Access to transit

All findings described are for the 2040 Constrained investment strategy in the RTP. While progress is made in filling gaps in sidewalks, bikeways and trails near transit, not all gaps are filled. By 2040, 74 percent of all sidewalks, 69 percent of all bikeways and 57 percent of regional trails are completed within 1/2-mile from light rail stops, 1/3-mile from street car stops, and 1/4-mile from bus stops, as shown in **Table 7.16 and Figure 7.11**.

However, greater progress is made completing sidewalk, bikway and trail gaps near transit compared to region-wide completion. For example, while 74 percent of all sidewalks near transit are completed by 2040, 70 percent of sidewalks on arterial roadways are completed and only 69 percent of sidewalks are completed on the planned Regional Pedestrian Network. This indicates that policies and investments prioritizing access to transit are working.

 Table 7.16 Percent of all sidewalks, bikeways and trails completed near transit and near transit within equity focus areas

	2015 Base Year	2027 No Build	2027 Constrained	2040 No Build	2040 Constrained	2040 Strategic
Percent of sidewalks completed near transit	63%	63%	70%	63%	74%	76%
Percent of bikeways completed near transit	57%	57%	65%	57%	69%	71%
Percent trails completed near transit	45%	45%	48%	45%	57%	65%
Percent of sidewalks completed near transit within equity focus areas	73%	73%	80%	73%	83%	84%
Percent of bikeways completed near transit within equity focus areas	59%	59%	69%	59%	72%	74%
Percent of trails completed near transit within equity focus areas	44%	44%	49%	44%	56%	66%

Note: Near transit means within 1/2-mile from light rail stops, 1/3-mile from streetcar stops and 1/4-mile from bus stops. Source: 2018 RTP Project Database and Regional Land Information System



Figure 7.11 Percent of all sidewalks, bikeways and trails completed near transit

Note: Near transit means within 1/2-mile from light rail stops, 1/3-mile from streetcar stops and 1/4-mile from bus stops.

Source: 2018 RTP Project Database and Regional Land Information System

Sidewalk completeness

All findings described are for the 2040 Constrained investment strategy in the RTP. While progress is made, the target of completing 100 percent of the regional pedestrian sidewalk network is not met. Sixty-nine percent of sidewalks on the planned regional pedestrian network were completed in 2040, as shown in **Table 7.17 and Figure 7.12**.

Additionally, the Plan makes progress towards completing sidewalks in 2040 centers and on arterial roadways, but not all gaps are filled.

By 2040, the plan will complete 51 percent sidewalks within 2040 centers.

By 2040, the plan will complete 63 percent of sidewalks on the 773 miles of arterial roadways in the region.

Table 7.17 Number and percent of sidewalk miles completed on the planned pedestrian network, in centers and on arterials

Sidewalk	2015 Base Vear	2027 No Build	2027 Constrained	2040 No Build	2040 Constrained	2040 Strategic
completeness			CAE		702	
Planned network	500	500	645	500	/03	/3/
	55%	55%	63%	55%	69%	72%
Planned network within equity focus areas	355 69%	355 69%	397 77%	355 69%	418 81%	422 82%
	773	773	806	773	830	840
Centers	47%	47%	49%	47%	51%	52%
Centers within	577	577	599	577	616	622
equity focus areas	55%	55%	57%	55%	58%	59%
Artorials	393	393	449	393	489	505
Arteriais	51%	51%	58%	51%	63%	65%
Arterials within	249	249	282	249	299	301
equity focus areas	66%	66%	75%	66%	80%	80%

Source: 2018 RTP Project Database and Regional Land Information System



Figure 7.12 Percent of sidewalks completed on the planned regional pedestrian network

Source: 2018 RTP Project Database and Regional Land Information System





Source: 2018 RTP Project Database and Regional Land Information System

Bikeway (on-street) completeness

All findings described are for the 2040 Constrained investment strategy in the RTP. While some progress is made, the target of completing 100 percent of the regional pedestrian sidewalk network is not met. By 2040, the plan completes 63 percent of the planned regional bikeway network (731 out of 1,158 miles), as shown in **Table 7.18 and Figure 7.14**.

Additionally, the plan makes progress towards completing bikeways in 2040 centers and on arterial roadways, but not all gaps are filled.

By 2040, the plan will complete 31 percent of bikeways within 2040 centers.

By 2040, the plan will complete 66 percent of bikeways on arterial roadways in the region.

On-street bikeway	2015	2027	2027	2040	2040	2040
completeness	Base Year	No Build	Constrained	No Build	Constrained	Strategic
Planned network	596	596	679	596	731	771
Flaimed network	51%	51%	59%	51%	63%	67%
Planned network within equity focus	324	324	374	324	400	411
areas	56%	56%	65%	56%	70%	/1%
Contors	439	439	476	439	498	509
Centers	27%	27%	29%	27%	31%	31%
Centers within	321	321	352	321	364	370
equity focus areas	30%	30%	33%	30%	34%	35%
Artorials	435	435	478	435	507	529
Arteriais	56%	56%	62%	56%	66%	69%
Arterials within	238	238	265	238	277	281
equity focus areas	63%	63%	71%	63%	74%	75%

 Table 7.18 Number of miles and percent of on-street bikeways completed

Source: 2018 RTP Project Database and Regional Land Information System





Source: 2018 RTP Project Database and Regional Land Information System



Figure 7.15 Percent of bikeways completed on existing arterial roadways

Source: 2018 RTP Project Database and Regional Land Information System

Regional Trails completeness

All findings described are for the 2040 Constrained investment strategy in the RTP. While some progress is made, the target of completing 100 percent of regional trails on the pedestrian and bicycle networks is not met. By 2040, the Plan will complete 51 percent of the planned regional trail network that is identified on the regional pedestrian and bicycle networks, 262 out of 509 miles. Note: The total number of miles of regional trails on the pedestrian and bicycle networks does not include all regional trails, nor does it include some off-street bikeways.

Regional trail completeness	2015	2027	2027	2040	2040	2040
	Base Year	No Build	Constrained	No Build	Constrained	Strategic
Planned network	185	185	204	185	262	296
	36%	36%	40%	36%	51%	58%
Planned network within equity focus areas	68 39%	68 39%	75 43%	68 <i>39%</i>	90 51%	109 62%

Source: 2018 RTP Project Database and Regional Land Information System

Equity findings: All findings described are for the 2040 Constrained investment strategy in the RTP. Equity focus areas see a higher level of active transportation (i.e. sidewalk, on-street bikeway, and trail) completion compared to the overall completion rate for the region and in non-equity focus areas. In general, level of completion for planned miles of sidewalks, on-street bikeways and trails exceed region and non-equity areas of one to three percent. When looking at

the rate of completion on arterials, a slightly lower rate of active transportation system completion in equity focus areas is planned compared to the overall regional active transportation network. In 2040, arterials see between 20 to 16 percent increase in miles of sidewalk and onstreet bikeway completion, which is lower than the region overall at 24 to17 percent increase. Overall, however, the results illustrate that in the refinement phase, partners placed further focus to complete the active transportation network in equity focus areas while also balancing considerations like urban arterial facility and proximity to a transit stop.

Furthermore, what is also observed is that greater rates of completion are in equity focus areas within the first 10 years (2018-2027) of the 2018 RTP investment strategy. Also, a greater proportion of the active transportation investment relative to other types of transportation investment is in the first 10 years of the plan (28.8 percent of 2018-2027 investment; 14.9 percent of 2028-2040 financially constrained). When looking at completion rate of the on-street bicycle network in equity focus areas by 2040, the increase is 14 percent, and the first 9 percent of that growth in miles of completed on-street bicycle network is planned between 2018-2027. The remaining 5 percent growth in miles of on-street bicycle network is set for the outer years of the investment strategy. This is a change from what was observed in the first round of performance evaluation of the 2018 RTP where more active transportation investments were planned for the outer years of the Plan period. Jurisdictional partners responded to Metro Council direction to advance and further complete the active transportation network in the first 10 years of the 2018 RTP. The one area where this statistic diverges slightly is with regional trails, where 4 percent of completion is observed in the first 10 years and 8 percent in the outer part (2028-2040) of the Plan.

Nonetheless, the active transportation network does not see 100 percent completion in any category by 2040. Sidewalk completion on the planned network tops out region-wide at 83 percent in equity focus areas, 58 percent in 2040 centers and 80 percent on arterials. When looking further, sidewalk completion in proximity to transit stops (e.g. bus, streetcar, or light rail) sees 83 percent (with the 2040 financially constrained investment strategy) through 84 percent (with the 2040 strategic investment strategy) completion. The overall 2018 RTP investment level in active transportation ranges between \$1.84 billion (in the 2040 financially constrained) to \$2.98 billion (in the 2040 strategic). This range makes up between 10.7 percent to 12.4 percent of the overall 2018 RTP investment strategy.

While falling short of the region's target to complete the active transportation network by 2040, the focus on advancing active transportation projects in the first ten years of the Plan and placing active transportation investments in equity focus areas at a greater levels than the non-equity focus areas indicate there is not an disproportionate or disparate impact.



Figure 7.16 Percent sidewalks completed on planned network in equity focus areas

Source: 2018 RTP Project Database and Regional Land Information System



Figure 7.17 Percent bikeways completed on planned network in equity focus areas

Source: 2018 RTP Project Database and Regional Land Information System

7.4.4 Access to jobs

Data source: Geospatial project information for proposed transportation projects provided by project sponsors and forecasted employment/jobs from MetroScope. Projections of jobs and geographic distribution of employment is based on underlying U.S. Bureau of Labor Statistics data (Quarterly Census of Employment and Wages) and assumptions regarding growth for the employment industries in MetroScope, and the Metro travel forecast model.

Description: Number and percent change of jobs (classified by wage groups – low, middle, and high) accessible by driving, transit, bicycling, and walking region-wide, in equity focus areas (people of color, English language learners and lower income) and in non-equity focus areas within the following commute times:

- 30 minutes by auto*
- 45 minutes by transit*
- 30 minutes by bike
- 20 minutes by walking

*Includes access and egress times.

Low-wage jobs were defined as jobs that pay an annual salary between \$0 - \$39,999. Middle-wage jobs were defined as jobs that pay an annual salary between \$40,000 - \$65,000. High-wage jobs were defined as jobs that pay an annual salary greater than \$65,000. See Appendix I for more information on how the travel time and annual salary assumptions were developed.

Target or desired direction: No target. Desired direction is to increase the number of jobs accessible to the average household within a reasonable commute, with a focus on increasing middle and low-wage job access for the average household in equity focus areas compared to non-equity focus areas in the region by 2040.

Per recommendation by the transportation equity work group, Metro will update the performance measure with a target and develop evaluation methods to measure the disparities gap in access to low and middle-wage jobs for households in equity focus areas for the next update of the RTP.

Findings: In general, the 2018 RTP investment strategy increases the number of jobs the average household can reach within a commute time adjusted by travel mode. With the first ten years of investment outlined in the 2027 Constrained investment strategy, the average household will see a range of 18 more jobs by walking to 21,000 more jobs by transit accessible due to the investment strategy (See Table 7.17). The additional number of jobs accessible means the average household in the region is able to reach upwards of 49 percent of all the jobs in the region within a typical commute time, depending on the form of travel. Interesting to note is that the average household is able to reach approximately 10 percent of the region's 1 million projected jobs by either transit, during rush hour, or by bicycle within their respective commuting times (45 minutes for transit, 30 minutes for bicycling). By far, the investment in transit in the 2040 Constrained investment strategy show larger gains in the number of jobs accessible, where nearly

25 percent more jobs become accessible to the average household within a 45 minute transit trip. Comparatively, driving and biking saw closer to .8 percent (biking) to 1.6 percent (driving) increased job access in the typical 30-minute commute time. This illustrates that the multimodal investments in the 2027 Constrained investment strategy is making a positive impact in increasing the number of jobs accessible across different forms of travel, giving households more options for commuting to work.

While the 2027 Constrained investment strategy sees increases in the number of jobs accessible, the additional investment planned for 2028 through 2040 in the full 2040 Constrained investment strategy further increases the number of jobs the average household can reach within a typical commute time. For driving, transit and walking, the increase in the number of jobs at a minimum doubles with some cases the increase being 3 to 4 times greater than the gains seen within the first ten years. The one exception is bicycling, where a decrease in the number of jobs accessible within a 30 minute bicycle ride is projected. The decrease may be due to the greater number of route and facilities options available for bicycle commutes, creating further out of direction travel or longer than 30 minute bicycle commute trips. In general, the average household will see a range of 70 more jobs by walking to over 40,000 more jobs by transit as a result of the long-range investment strategy. Similar to the first 10 years, transit will see the greatest increase in the number of jobs, upwards of 42 percent, accessible within a 45-minute transit commute.

Change in Total Number of Jobs Accessible in 2027 (reflects difference between 2027 Constrained and 2027 No Build)						
	Auto Rush Hour	Auto Non Rush Hour	Transit Rush Hour	Transit Non Rush Hour	Bike	Walk
All Jobs	15,169	8,460	21,448	19,371	907	18
Low Wage Jobs	7,194	4,040	10,197	9,192	411	9
Middle Wage Jobs	4,168	2,318	5,883	5,322	258	5
High Wage Jobs	3,807	2,102	5,368	4,857	239	4
	Change	in Total Numb	er of Jobs Acce	ssible in 2040		
	(reflects differe	ence between 2	2040 Constraine	ed and 2040 No I	Build)	
	Auto	Auto Non Rush	Transit	I ransit	Piko	M (-11-
	Rush Hour	Hour	Rush Hour	Hour	DIKE	waik
All Jobs	Rush Hour 36,268	Hour 37,062	Rush Hour 40,694	40,185	-509	70
All Jobs Low Wage Jobs	Rush Hour 36,268 17,118	Hour 37,062 17,512	Rush Hour 40,694 18,671	Hour 40,185 18,452	-509 -255	70 32
All Jobs Low Wage Jobs Middle Wage Jobs	Rush Hour 36,268 17,118 10,017	Hour 37,062 17,512 10,223	Rush Hour 40,694 18,671 10,929	Hour 40,185 18,452 10,829	-509 -255 -131	70 32 20

Table 7.20 Change i	in the Number of Jobs	Accessible Within a	Typical Commute Time
0			/ 1

	(*	Chang offects differen	e in Number of J	obs Accessible in	2027	d)				
	(1)	enects unteren			1 2027 NO BUII	u)				
	Auto Rush Hour	Auto Non Rush Hour	Transit Rush Hour	Transit Non Rush Hour	Bike	Walk				
Region	15,169	8,460	21,448	19,371	907	18				
Equity Focus Areas	13,210	7,534	24,155	21,549	365	11				
Non-Equity Focus Areas	16,694	9,087	17,157	15,797	1,467	25				
	Low Wage Jobs									
	Auto Rush Hour	Auto Non Rush Hour	Transit Rush Hour	Transit Non Rush Hour	Bike	Walk				
Region	7,194	4,040	10,197	9,192	411	9				
		,	,			-				
Equity Focus Areas	6,277	3,595	11,502	10,235	162	5				
Equity Focus Areas Non-Equity Focus Areas	6,277 7,906	3,595 4,343	11,502 8,138	10,235 7,486	162 667	5				
Equity Focus Areas Non-Equity Focus Areas	6,277 7,906	3,595 4,343	11,502 8,138 Middle W	10,235 7,486 /age Jobs	162 667	5				
Equity Focus Areas Non-Equity Focus Areas	6,277 7,906 Auto Rush Hour	3,595 4,343 Auto Non Rush Hour	11,502 8,138 Middle W Transit Rush Hour	10,235 7,486 /age Jobs Transit Non Rush Hour	162 667 Bike	5 13 Walk				

Table 7.21 Change in the Number of Jobs Accessible, by Wage Profile, Within a TypicalCommute Time for Different Communities

Equity findings: For the average household within an equity focus area, the number of jobs accessible within a typical commute time by different forms of travel is expected to increase. The average household in an equity focus area will see upwards of 11 more jobs within a 20-minute walk to over 24,000 more jobs within a 45-minute transit trip due to the 2018 RTP investment strategy through 2027. With the addition of the 2018 RTP investment strategy beyond 2027 to 2040, the increase in the number of jobs accessible for the average household in equity focus areas goes up to 65 more jobs within a 20-minute walk to over 44,000 more jobs in a 45-minute transit trip. When looking more specifically at low-wage and middle-wage jobs, as a result of the 2018 RTP investment strategy, the average household in equity focus areas sees the number of middle and low wage jobs accessible in a 45-minute transit commute increase 42 percent by 2040.

6,622

4,711

5,919

4,341

103

417

3

6

2,067

2,488

3,621

4,596

The positive take away from the 2018 RTP investment strategy is that there is an increase in the number of jobs accessible to the average household in the equity focus areas within a typical 45-

Equity Focus

Non-Equity Focus

Areas

Areas

minute transit commute trip. This pattern holds true regardless of the time of day (e.g. rush hour travel, when typically there is more transit service available, or non-rush hour travel, any other time of day). Additionally, with the 2018 RTP investment through 2027, there is an increase of 21,000 more jobs accessible in a 45-minute transit commute for the average household in an equity focus area. By 2040, the additional planned investment increases the number of jobs accessible within a 45-minute transit commute to over 44,000 for the average household in the equity focus areas. A similar pattern is observed when looking at both low and middle wage jobs. The number of low and middle wage jobs accessible within a 45-minute for the average household in equity focus areas increases by a little over 10,000 (low wage) and a little under 6,000 (middle wage) in 2027 to just over 21,000 (low wage) and over 12,300 (middle wage) jobs. This result shows the region is focusing transit investments in equity focus areas to support the travel needs of historically marginalized communities.

In some cases, the average household in the region and the average household in non-equity focus areas sees a greater increase in the number of jobs within a typical driving, bicycling or walking commute compared to the equity focus areas. For example, with the planned investments through 2027, the non-equity focus areas see an increase of 1,467 more jobs accessible by bicycle in a 30-minute commute, whereas equity focus areas see an increase of 365 more jobs in a 30-minute commute. This same pattern of non-equity areas seeing an increase in the number of jobs accessible is observed when looking at jobs by their wage profile (low, medium, high), primarily in driving, bicycling, and walking modes with investment through 2027 and with the investments through 2040 as identified in the 2018 RTP.

There are some potential reasons for why the average household in the region and in non-equity focus areas sees a greater increase in the number of jobs accessible within a typical driving, biking, or walking commute, regardless of wage profile. For driving, traffic congestion may impact why equity focus areas may see a lesser increase in the number of jobs accessible within a 30-minute driving commute. Another factor may be the changing land use mix in the region where the typical commute distance is getting longer, resulting in longer travel times.

For walking and bicycling, it is possible that as more transportation investments build out the active transportation network, specifically in equity focus areas, that more route options become available that are more attractive for riding and walking. The results of the Access to Travel Options performance measure indicate that the region did focus active transportation investments in equity focus areas. The increased number of available route options may encourage people commuting to work to bike a little bit further or slightly out of direction to access a better bicycling or walking facility. More time spent in active travel may be an indirect benefit. Whereas in the non-equity focus area, especially in the less developed areas of the region, a new bicycle facility which may have not existed and without other route options would vastly open up access for commuting. The results may illustrate the swings or a decrease in the number of jobs accessible within a 20-minute walk commute or 30-minute bicycle commute is not a detrimental result because it is impacting travel behavior and choice. More analysis would be needed to fully understand these results.

While equity focus areas experience less increase in the of number of jobs accessible by driving, bicycling, and walking compared to the region overall and non-equity focus areas, equity focus areas have a greater number of jobs accessible within a typical commute across all forms of travel. For example, in 2027 without the 2018 RTP investment strategy, the average household in equity focus area can reach a little over 107,000 jobs, about 10 percent of all the region's jobs by transit, in a 45-minute commute. For the non-equity focus areas, the average household can reach a little over 57,000 jobs while the average household in the region can reach a little over 86,000 jobs by transit in the same 45-minute window. This indicates the region has been focusing on placing transportation investments in equity focus areas and not only trying to gain efficiency.

The mixed results demonstrate that more investigation is necessary to understand how to improve and increase the number of jobs accessible by a reasonable commute for the average household in equity focus areas across all forms of travel. While the 2018 RTP investment strategy has determined a successful approach for transit including locating transit service, it is necessary to understand how to increase the number of jobs accessible by bicycling and walking in particular. Historically marginalized communities tend to use transit, bicycling, and walking for more of their travel trips. In addition to further investment, other strategies may be necessary, such as land use strategies, travel options education and demand management. More analysis is necessary to determine an appropriate set of strategies to make improvements and whether there is a potential disproportionate or disparate impact.

7.4.5 Access to community places

Data source: Geospatial project information for proposed transportation projects from project sponsors; U.S. Bureau of Labor Statistics – Quarterly Census of Employment and Wages (2013) and select North American Industry Classification System (NAICS) codes, and Metro travel forecast model.

Description: Measure access by bicycling, walking, transit, and driving region-wide, in equity focus areas (people of color, English language learners and lower income), and in non-equity focus areas within the following travel times:

- Automobile 20 minutes*
- Transit 30 minutes*
- Bicycle 20 minutes
- Walk 20 minutes

*Includes access and egress times.

Analysis is based on the locations of existing community places and does not factor in possible additional community places as a result of population and employment growth. MetroScope spatially distributes non-residential land uses and employment at a coarse granularity; finer detail on the locations of community places is necessary to predict future community places growth. As a result, the increase in the number of community places which can be reached within a short driving, transit, walking, or bicycling trip may be greater than discussed in the findings. Community places, for purposes of this analysis, included hospitals and other medical services, civic places, such as post offices, churches, social services, libraries, schools and colleges, financial institutions, such as banks and credit unions, grocery stores, and essential retail services, such as hardware stores, pharmacies and laundry services. See Appendix I for more information on the NAICS codes and list of community places included this analysis.

Target or desired direction: No target. Desired direction is that by 2040, increase the number of community places accessible for the average household in equity focus areas compared to the average household in non-equity focus areas.

Per recommendation by the transportation equity work group, Metro will update performance measure and develop evaluation methods to measure the disparities gap in access to community places for households in equity focus areas for the next update of the RTP.

Findings: Region wide, the 2040 Constrained investment strategy increases the number of community places accessible within a short driving and transit trip. With the 2018 RTP investments through 2027, the average household in the region can get to 33 to 57 more community places in a short driving trip, or 78 to 100 more community places in a short transit trip depending on the time of day. With further investment planned for after 2027, the 2018 RTP investment strategy further increases the number of community places reached in a short driving or transit trip to upwards of 76 to 143 more community places accessible to the average household.

While the 2040 Constrained investment strategy is showing positive progress in the greater number of places accessible, little or no change in the number of community places accessible in a short walking or bicycling trip is observed as a result of the investment strategy. In general, the average household in the region can reach 66 community places in a short walk and 360 community places in a short bicycle ride. See **Appendix E** for full accessibility tables. Nonetheless, individual investments in active transportation may have a more significant impact in increasing the number of community places reached for an individual community than what the system-wide evaluation is showing.

Table 7.22 Change in the Number of Community Places Accessible Within a Typica
Commute Time for Different Communities

Change in Number of Community Places Accessible in 2027 (reflects difference between 2027 Constrained and 2027 No Build)										
	All Community Places									
	Auto Rush Hour	Auto Non Rush Hour	Transit Rush Hour	Transit Non Rush Hour	Bike	Walk				
Region	57	33	100	78	1	0				
Equity Focus Areas	52	31	120	90	1	0				
Non-Equity Focus Areas	59	35	72	60	1	1				
	Change in N (reflects differe	umber of Com nce between 2	munity Places A 040 Constrained	ccessible in 20 4 and 2040 No E	l o Juild)					
			All Commu	nity Places						
	Auto Rush Hour	Auto Non Rush Hour	Transit Rush Hour	Transit Non Rush Hour	Bike	Walk				
Region	114	76	143	139	0	1				
Equity Focus Areas	101	69	165	161	0	0				
Non-Equity Focus Areas	123	79	109	105	1	1				

Note: Typical commute time varies by form of travel.

Equity findings: When looking more closely at the analysis in the equity focus areas, the 2018 RTP 2027 Constrained and 2040 Constrained investment strategies result in more community places which can be reached in a short transit trip compared to the region and non-equity focus areas. This means the average household in the equity focus areas see a greater increase in the number of community places reached in a short transit trip compared to the average household in the region or in non-equity focus areas as a result of the investment strategy. The equity focus areas see an increase of 90 to 120 more community places reached in a 30-minute transit trip depending on the time of day in the 2027 Constrained investment strategy. The number of community places reached further increases to 165 with the 2018 RTP investments planned for the 2040 Constrained investment strategy. The region and non-equity areas see an increase range from 60 to 109 (non-equity focus areas) and 78 to 143 (region) with the 2018 RTP investment strategy.

While the significant increases in the number of community places reached in a short transit trip for the average household in a equity focus area is a positive sign, when it comes to other forms of travel (i.e. driving, walking, and bicycling), the region and non-equity focus areas see a greater increase in the number of community places reached within a short trip. For example, in a 20 minute drive, depending on the time of day, the average household in the region can reach 114 more community places in 2040 as a result of the 2018 RTP investments. This is 13 more community places than the average household in an equity focus area. This means the average household in the region and in a non-equity focus area is seeing greater benefit in reaching community places in a short trip as a result of the 2018 RTP investment strategy compared to the average household in an equity focus area.

As described earlier in this section, minimal change was observed in the number of community places reached in a short bicycle or walking trip in the region. The same result is seen in non-equity focus areas and in equity focus areas. While the change is a difference of one more community place reached within a short bicycle or walking trip, the increase was generally observed more consistently in non-equity focus areas than equity focus areas. As described earlier in this section, the results may not fully show the increased numbers of community places reached as a result of the investment strategy since the analysis did not account for future community places opening as a result of population and employment growth creating new demand for grocery stores, doctors/dental offices, and other retail or services.

Additionally, as described more fully in the Access to Jobs analysis, the results for the number of community places reached within a short trip (15 minutes for bicycling, 20 minutes for walking) may not fully capture the benefits being gained by implementing the active transportation investments in the 2018 RTP. As new sidewalks and bikeways get built, new route options become available which may attract more out of direction travel in order to have a more pleasant walking or bicycling experience. This may result in trips taking longer than 15 or 20 minutes to get to different destinations, but more time spent in active travel with the associated health benefits.

The mixed results from the access to community places evaluation measure for the equity focus areas indicate further investigation is necessary to determine whether there is a potential disproportionate or disparate impact.

7.4.6 Access to bicycle and pedestrian parkways

Data source: Metro Regional Land Inventory System, Geographic Information Systems.

Description: Evaluates number and percent of households within 1/4-mile of a bicycle or pedestrian parkway (the highest level regional bicycle and pedestrian facilities – typically built as regional multi-use trails or along arterials). See Chapter 3 for more detail on these routes.

Target or desired direction: No target for this measure. The desired direction is an increase in the number and share of households within a 1/4-mile of a bicycle or pedestrian parkway.

Findings: In the 2015 base year, over 75 percent of households in the planning area are within ¼-mile of a regional bicycle parkway. This increases to over 77 percent in the 2027 Constrained system and slightly more in the 2040 Constrained and 2040 Strategic investment strategy.

Access to regional bicycle parkways	2015 Base Year	2027 No Build	2027 Constrained	2040 No Build	2040 Constrained	2040 Strategic	
Number of households	477,937	573,569	602,046	655,960	706,232	712,351	
Percent of households	75%	74%	78%	73%	79%	79%	

Table 7.23 Number of households with access to regional bicycle parkways

In the 2015 base year, 86 percent of households in the planning area are within 1/4-mile of a regional pedestrian parkway. This percent decreases slightly to 84 percent in the 2027 Constrained investment strategy, rising slightly to 85 percent in the 2040 Constrained and the 2040 Strategic investment strategy. One reason for the future decrease is that the RTP project list does not include many projects to complete pedestrian parkways in some of the newer growth areas on the edge of the region. As many of the pedestrian parkways are on frequent-service transit routes, this reflects the difficulty of providing access to high-quality transit in these areas.

Access to regional pedestrian parkways	2015 Base Year	2027 No Build	2027 Constrained	2040 No Build	2040 Constrained	2040 Strategic
Number of households	543,926	648,066	653,831	738,896	762,485	765,136
Percent of households	86%	83%	84%	82%	85%	85%

Table 7.24 Number of households with access to regional pedestrian parkways

7.4.7 Access to transit

Data source: Metro travel forecast model.

Description: Number and share of households within 1/4-mile of bus, 1/3-mile from streetcar and 1/2-mile of high capacity transit or frequent service transit, region-wide, and in equity focus areas households (POC and LEP) and (POC, LEP and LI).

Number and share of jobs within 1/4-mile of bus, 1/3-mile from streetcar and 1/2-mile of high capacity transit or frequent service transit, region-wide and by subareas.

Target or desired direction: Per the Climate Smart Strategy, the 2035 monitoring targets for access to transit are:

- 37 percent of households are within 1/4-mile of all day frequent service
- 49 percent of low-income households are within 1/4-mile of all day frequent service
- 52 percent of employment is within 1/4-mile of all day frequent service:

Findings: Determining the ease, comfort and directness of our transit system is no easy task, but the analysis shows that at the very least we are headed in the right direction. Under each of the investment strategies, the majority of the households and jobs in the region have access to 15-minute or better transit service. Between 70-85 percent of the jobs in the region would be accessible by frequent service transit in 2040. The majority of the households, 60 -70 percent, in the region would also have access to frequent service transit. There would be a higher percentage of jobs and households with access to frequent service transit during the peak rush hours and off-peak hours.

Equity findings: Low-income households region wide and in the equity focus areas would have greater percentage of households with access to frequent service compared to the region as a whole. Across the 2027 Constrained, 2040 Constrained and 2040 Strategic investment strategies, transit access is expected to increase for historically marginalized communities and communities of color and is expected to outperform the region as a whole, putting the region one step closer to establishing a more equitable transit system.

Proximity to stations: There is no motivation to use transit if it's geographically inaccessible, and even if it's geographically accessible there's no point in using it if it doesn't take you where you want to go. RTP transit planning considers these concepts of access concurrently. The good news is that the future looks bright for both qualifiers of access. As the graph below highlights, we can expect more than three-quarters of the region's households to have access (proximity) to transit by 2040, the majority being classified as "best transit" operating at 15-minute or better intervals. Additionally, 90 percent of the jobs in the region are accessible by transit. **Figures 7.18 and 7.19** shows the percentages of households and jobs with access to transit by frequency of planned transit service. **Figures 7.20 through 7.23** present the access and frequencies for jobs, households, low-income households and low-income households in communities of color for various time frames analyzed.



Figure 7.18 Share of households with access to transit during rush hour

More than three-quarters of the households in the region are expected to be near higher frequency transit. The number of households with 15-minutes or better transit service increases significantly between today and the future 2040 financially constrained investment strategies. The jobs in our region see even higher rates of transit access.



Figure 7.19 Share of jobs with access to transit during rush hour

Approximately 90 percent of the jobs in the region are located near transit. As shown in the figure above, the number of jobs accessible by 15-minute or better transit service increases significantly between today and the 2040 financially constrained investment strategies. The increase in transit service and frequencies means that more people are able to access job opportunities.

The figures that follow show transit service by RTP Investment Strategy.



Figure 7.20 2027 Constrained rush hour transit service

Estimated share jobs and households near 15-minute or better rush hour service by 2027:

- 75 percent of jobs
- 63 percent of households
- 72 percent of low-income households
- 82 percent of low-income households in the equity focus areas



Figure 7.21 2027 Constrained off-peak transit service

Estimated share of jobs and households near 15-minute or better daytime and evening service by 2027:

- 67 percent of jobs
- 53 percent of households
- 63 percent of low-income households
- 72 percent of low-income households in the equity focus areas



Figure 7.22 2040 Constrained rush hour transit service

Estimated of jobs and households near 15-minute or better rush hour service by 2040:

- 77 percent of jobs
- 65 percent of households
- 74 percent of low-income households
- 84 percent of low-income households in the equity focus areas



Figure 7.23 2040 Constrained off-peak transit service

Estimated share of jobs and households near 15-minute or better daytime and evening service by 2040:

- 69 percent of jobs
- 57 percent of households
- 68 percent of low-income households
- 78 percent of low-income households in the equity focus areas

7.4.8 Access to industry and freight intermodal facilities

Data source: Metro travel forecast model.

Description: Extent that industrial land and freight intermodal facilities are transportation constrained. This measure was developed and tested, but not fully implemented or evaluated as part of the 2018 RTP update. The intent is to measure the number of trucks that are coming from or going to freight intermodal facilities or industrial land within each of the Regional Mobility Corridors, and determine the hours of truck delay they are experiencing on the regional freight network. The times of day that were measured include the AM peak (7-9 AM), the mid-day for trucks (1-3 PM) and the PM peak (4-6 PM). The two areas chosen to test were the Tualatin and Sherwood Industrial Area off Tualatin-Sherwood Road (in mobility corridor 11); and the Marine Terminals 5 and 6 and the rail yards off Marine Drive (in mobility corridor 17).

Target or desired direction: There is no target for this measure. The desired direction is to reduce truck hours of delay on the freight network that provide access to intermodal facilities and industrial lands in 2040.

Findings: Incomplete and inconclusive due to testing being limited to two areas with freight intermodal facilities/rail yards or industrial land. Intermodal facilities and rail yards are not the only places that attract large numbers of freight trucks. According to the truck model, in 2015 the Tualatin and Sherwood Industrial Area generates 30 percent more truck trips (regardless of time period) than does the North Portland industrial area that includes Marine Terminals 5 and 6 and two rail yards. By 2040, that difference increases to about 33 percent more truck trips regardless of time period.

See Chapter 10 of the Regional Freight Strategy for more information on the methodology used to test this measure. This measure will be more fully developed as part of the next RTP update (due in 2023).

Equity findings: Not included in transportation equity analysis.

7.4.9 Multimodal travel times

Motor Vehicle Travel Times

Data source: Metro travel forecast model.

Description: Evaluates mid-day and PM peak travel time between 20 regional origin-destination pairs.

Target or desired direction: No target. Maintain motor vehicle travel times between key origin-destinations.

Findings: With the exception of the Central City to Vancouver corridor, motor vehicle travel time increases, generally by a few minutes, for all three 2040 investment strategies compared to the 2015 Base Year, for both travel periods and all origin-destinations. Evening peak travel times grow at a faster pace the mid-day travel times.

Overall, the 2040 Constrained and the 2040 Strategic investment strategies decrease motor vehicle travel time when compared to the 2040 No Build. Central City to Vancouver shows a 4-6 minute improvement in travel time in the 2040 Constrained.

Refer to Appendix I for tables showing travel times for each of the mobility corridors.

Equity findings: Not included in transportation equity analysis.

Transit Travel Times

Data source: Metro travel forecast model.

Description: Evaluates mid-day and PM peak transit travel times between 18 origins and destinations across the region.

Target or desired direction: No target. Reduce transit travel times between key origin-destinations.

Findings: In general, most corridors see a decrease or a maintaining of travel times from the 2015 Base Year to the 2040 Constrained; some corridors see decreases in transit time between 10 and 46 minutes. There are modest increases in transit travel times during the PM peak travel period from the 2015 Base Year to the 2040 Constrained in some corridors. For example:

- Gateway to Vancouver Mall decrease in travel time of 15.4 minutes in the 12-1 travel period and decrease of 13.2 minutes in the 4-6 PM peak.
- Gateway to Oregon City decrease in travel time of 12.4 minutes in the 12-1 travel period and decrease of 12.8 minutes in the 4-6 PM peak.
- Clackamas Town Center to Oregon City decrease in travel time of 13.4 minutes in the 12-1 travel period and decrease of 9.5 minutes in the 4-6 PM peak.
- Tualatin to Oregon City decrease in travel time of 35.3 minutes in the 12-1 travel period and decrease of 12.4 minutes in the 4-6 PM peak.
- Tigard to Sherwood decrease in travel time of 10.5 minutes in the 12-1 travel period and an increase of 6.2 minutes in the 4-6 PM peak.
- Tualatin to Sherwood decrease in travel time of 46.4 minutes in the 12-1 travel period and decrease of 26.9 minutes in the 4-6 PM peak.

Refer to **Appendix I** for tables showing travel times for each of the mobility corridors.

Equity findings: Not included in transportation equity analysis.

Freight Travel Times

Data source: Metro Travel Forecast Model.

Description: Evaluates the one hour mid-day (12-1 PM), mid-day for trucks (2-3 PM) and PM peak (5-6 PM) truck travel times for 24 routes (one for each mobility corridor) that use the regional freight network, and start and/or end at a major industrial site (rail yard, intermodal facility, major industrial site, etc.).

Target or desired direction: No target. Maintain or decrease truck travel times for routes on the regional freight network within mobility corridors.

Findings: The following modeled results for major freeways are for the percent change in truck travel time for the 2040 Financially Constrained (FC) compared to the 2040 No Build (percents have been rounded):

- Central Eastside Industrial District in Portland to downtown Vancouver: 12-1 PM = 21 percent less; 2-3 PM = 18 percent less
- Central Eastside Industrial District in Portland to downtown Vancouver: 5-6 PM = 24 percent less
- I-5 @Morrison Bridge to Tualatin Industrial Area: 12-1 PM = 7 percent less; 2-3 PM = 2 percent less
- I-5 @Morrison Bridge to Tualatin Industrial Area: 5-6 PM = 2 percent less
- I-5 @Morrison Bridge to I-84/I-205: 12-1 PM = 1 percent less; 2-3 PM = 2 percent more
- I-5 @Morrison Bridge to I-84/I-205: 5-6 PM = 2 percent less
- I-84/I-205 to Fed Ex Troutdale: 12-1 PM and 2-3PM = stay the same
- I-84/I-205 to Fed Ex Troutdale: 5-6 PM = stay the same
- I-5 @Morrison Bridge to Hillsboro Industrial Area: 12-1 PM = 3 percent less; 2-3 PM = 2 percent more
- I-5 @Morrison Bridge to Hillsboro Industrial Area: 5-6 PM = stay the same

Due to the Columbia River Crossing/I-5 capacity project and the I-5 Rose Quarter project, truck travel times between the Central Industrial Eastside District (CEID) and downtown Vancouver, Washington improve by about 18 to 23 percent over the 2040 No Build. Due to smaller-scale throughway investments on I-5 south of downtown Portland, truck travel times between the Morrison Bridge and the Tualatin Industrial Area improve slightly during the PM peak period (1.5 percent less) and improve by 2.1 to 6.6 percent during the off peak periods. However, for I-84 east of I-5 and US 26 west of Hillsboro, the truck travel times during the peak period are about the same (.4 to 2.2 percent less) and have only small variations during off-peak travel times (3 percent less to about 2 percent more).

The following modeled results are for the Sunrise Corridor area between I-205 and US 26 in Boring, and show the percent reduction in truck travel time for the 2040 Financially Constrained (FC) compared to the 2040 No Build:

- Clackamas Industrial Area to Highway 212 at US 26: 12-1 PM = 10 percent less; 2-3 PM = 12 percent less
- Clackamas Industrial Area to Highway 212 at US 26: 5-6 PM = 15 percent less
- Due to completion of the Sunrise Highway project between 122nd and 172nd truck travel times between the Clackamas Industrial Area and US 26 in Boring improve by about 10 to 15 percent (depending on the time period) over the 2040 No Build.
- Capacity improvements on Highway 217 occur within the 2040 Strategic scenario and provide faster travel times on Highway 217 from US 26 to I-5. Compared to the 2040 No Build the truck travel times on Highway 217 southbound between US 26 and I-5 are about 13 percent faster in the PM peak period and about 10 to 11 percent faster during the off peak periods with the 2040 Strategic.

Refer to Appendix I for tables showing travel times for each of the mobility corridors.

Equity findings: Not included in transportation equity analysis.

Bicycle travel times

Data source: Metro Travel Forecast Model.

Description: Evaluate changes in bicycle travel times between key origins and destinations.

Target or desired direction: No target. Decrease or maintain bicycle travel times between key origins and destinations.

Findings: Bicycle travel times do not change significantly in most corridors – bicycle travel times remain reliable. One notable exception is that the travel time between Lake Oswego and the Park Avenue MAX Station reduces by over 68 percent (from approximately 39 minutes to 12 minutes) due to the RTP project that will construct a bicycle and pedestrian bridge over the Willamette River between Lake Owego and Oak Grove. See **Appendix I** for a table showing bicycle travel times within all origin/destination pairs.

Refer to **Appendix I** for tables showing travel times for each of the mobility corridors.

Equity findings: Not included in transportation equity analysis.

7.4.10 Congestion

Interim Regional Mobility Policy

Locations of throughways and arterials that do not meet regional mobility policy.

Data source: Metro Travel Forecast Model.

Description: Identifies number and percent of network miles and locations within the Metropolitan Planning Area (MPA) that exceed the interim regional mobility policy for congestion in the one hour mid-day (1-2 PM) and two-hour pm peak (4-6 PM) periods. Note that the mileage calculation is based on the length of the modeled network link associated with the point of congestion. It does not include the length of the queuing that may occur as a result of the congested link. Congestion is measured by using the ratio of volume to capacity. Refer to Chapter 3 for interim regional mobility policy thresholds for congestion.

Target or desired direction: Meet the interim regional mobility policy thresholds for congestion.

Findings: All three 2040 investment strategies (2027 and 2040 Constrained and 2040 Strategic) see an increase the number of network miles that do not meet the Interim Regional Mobility Policy, compared to the 2015 Base year. In particular, certain state highway segments (listed in **Appendix I**) in the system will not meet the mobility standards in Table 7 of Oregon Highway Plan (OHP) under Policy 1F.1 of the OHP by 2040, even with the investments to the system proposed in the 2018 RTP. In this situation, OHP Policy 1F.5 establishes a different performance standard for the 2018 RTP.

"For purposes of evaluating ... transportation system plans, in situations where the volume to capacity ratio for a highway segment ... is currently above the standards in Table 6 or Table 7 ... and transportation improvements are not planned within the planning horizon to bring performance to the established target, the mobility target is to avoid further degradation."

The region has many more identified needs for improvement of highway performance than there is feasible funding available to address (RTP Chapter 5). As described in Chapter 5, the RTP includes a financially feasible implementation program and feasible policies, projects and supporting strategies. As a result, the RTP improves performance as much as feasible and implements a number of projects, strategies and actions aimed at avoiding further degradation.

The Plan fails to meet the current v/c thresholds, particularly for the region's throughway system, triggering the need for a refinement plan to consider alternative approaches for measuring and addressing mobility and transportation system adequacy under the Oregon Transportation Planning Rule and Oregon Highway Plan Policy 1F. Metro and ODOT have committed to updating the interim regional mobility policy to better align with the comprehensive set of goals and desired outcomes identified in the RTP. As allowed under OHP Policy 1F.3, the refinement plan's resulting alternative highway mobility targets are expected to reflect the balance between relevant objectives related to land use, economic development, social equity, and mobility and

safety for all modes of transportation. Described in Chapter 8 (Section 8.2.3.1), an updated policy will be considered for approval by JPACT and the Metro Council as an amendment to the RTP as part of the next RTP update (due in 2023). The updated policy for state-owned facilities will be considered for approval by the OTC as an amendment to Policy 1F of the Oregon Highway Plan.

Tables 7.25 and 7.26 show the number and percent of miles of throughways and arterials that do not meet the interim regional mobility policy. Mileage is counted twice if both directions of a throughway or arterial segment do not meet the mobility policy. "4-6 PM" means the miles of throughways or arterials that do not meet the mobility policy during the full two-hour peak period. Segments that do not meet the policy in only the 4-5 PM or 5-6 PM travel periods are not included in the miles of segments in the "4-6 PM (both hours)."

Figures 7.24 through 7.29 show throughway network locations exceeding the mobility policy in either direction in red (identified as "unacceptable congestion") for the one-hour mid-day (12-1 PM) and two-hour evening peak (4-6 PM) periods for the 2015 base year, 2027 Constrained and 2040 Constrained. Refer to **Appendix I** for a list of each state-owned facility that does not meet the interim regional mobility policy for the one-hour mid-day (12-1 PM) and two-hour evening peak (4-6 PM) periods.

Travel period	2015 Base Year		2(No	2027 No Build		2027 Constrained		2040 No Build		2040 Constrained		2040 Strategic	
	Miles	%	Miles	%	Miles	%	Miles	%	Miles	%	Miles	%	
12-1 PM	4.0	2%	9.7	4%	9.6	4%	25.9	9%	16.8	6%	15.2	5%	
4-6 PM ¹	15.6	6%	38.4	14%	32.4	12%	59.6	22%	48.1	18%	44.8	16%	
4-6 PM² both hours	10.9	5%	28.7	11%	23.8	9%	50.8	19%	39.6	14%	36.3	13%	
4-5 PM one hour	2.0	<`1%	2.6	1%	2.6	1%	2.9	1%	3.5	2%	4.0	2%	
5-6 PM one hour	2.7	<`1%	7.1	2%	6.0	2%	6.0	2%	5.0	2%	4.4	2%	

Equity findings: Not included in transportation equity analysis.

Table 7.25 Throughw	av network miles	that do not meet	regional m	obility policy

Table notes:

¹ Includes all miles exceeding the Interim Regional Mobility Policy Threshold during anytime between 4-6 PM.

² Does not include miles exceeding the Interim Regional Mobility Policy Threshold for a single hour (e.g., 4-5 PM or 5-6 PM)

Percentages are rounded to the nearest percent.

Travel period	2015 Base Year		2027 No Build		2027 Constrained		2040 No Build		2040 Constrained		2040 Strategic	
	Miles	%	Miles	%	Miles	%	Miles	%	Miles	%	Miles	%
12-1 PM	5.8	<`1%	11.2	<`1%	12.1	<`1%	28.9	<`1%	19.1	<`1%	17.2	<`1%
4-6 PM ¹	19.6	<`1%	45.3	1%	39.0	1%	69.6	2%	58.1	1%	51.8	1%
4-6 PM² both hours	14.4	<`1%	34.0	<`1%	29.1	<`1%	58.9	2%	46.0	1%	41.8	1%
4-5 PM one hour	2.4	<`1%	4.0	<`1%	4.0	<`1%	4.1	<`1%	5.1	<`1%	5.1	<`1%
5-6 PM one hour	2.8	<`1%	7.3	<`1%	5.9	<`1%	6.6	<`1%	7.1	<`1%	4.9	<`1%

Table 7.26 Arterial network miles that do not meet regional mobility policy

Table notes:

¹ Includes all miles exceeding the Interim Regional Mobility Policy Threshold during anytime between 4-6 PM.

² Does not include miles exceeding the Interim Regional Mobility Policy Threshold for a single hour (e.g., 4-5 PM or 5-6 PM)

Percentages are rounded to the nearest percent.



Regional Mobility Policy Update

There has been increasing discussion of the role of motor vehicle volume-to-capacity (v/c) as a performance metric. The region and local communities across the region have adopted goals such as improving safety for all roadway users (e.g., pedestrians, bicyclists, freight and transit users) and encouraging infill development to implement the 2040 Growth Concept, which often conflict with meeting v/c thresholds.

The region has committed to updating the interim regional mobility policy to better align with the comprehensive set of goals and desired outcomes identified in the RTP. Chapter 8 (Section 8.2.3.1) describes a proposed work plan for considering measures aimed at system efficiency, including peoplemoving capacity, person throughput and system completeness. This work is anticipated to be completed prior to the next RTP update, due in 2023.












Freight Truck Delay

Data source: Metro travel forecast model.

Description: Evaluates truck delay for freight movement using the regional freight roadway network in the two-hour AM peak (7-9 AM), the two-hour mid-day travel period (1-3 PM) and in the two-hour pm rush hour (4-6 PM). Figure 2.15 provides a map of the regional freight system which includes the roadway network. The hours of delay are reported in the table below for trucks. The truck delay is only accrued when the volume of all vehicles exceeds 90 percent of the roadways capacity.

Target or desired direction: By 2040, reduce vehicle hours of delay per truck trip by 10 percent compared to 2015.

Findings: Between 2015 and 2040, truck delay on the regional freight network increases significantly for all investment strategies during all three time periods. However, when compared with the 2040 No Build both 2040 RTP investment systems show a slower pace of growth in delay in each travel period (example is 1-3 PM as shown in bar chart below). In the two-hour mid-day (1-3 PM) the 2040 Financially Constrained truck delay is 67 percent less than the 2040 No Build and the 2040 Strategic truck delay is 72 percent less than the 2040 No Build. In the two-hour pm peak (4-6 PM) the 2040 Financially Constrained and the 2040 Strategic truck delay is less than the than 2040 No Build by 29 percent and 32 percent, respectively.

	2015	2027	2027	2040	2040	2040
Travel period	Base Year	No Build	Constrained	No Build	Constrained	Strategic
7-9 AM peak hours of delay	219	456	393	724	500	481
1-3 PM Mid-day hours of delay	55	217	164	802	263	223
4-6 PM peak hours of delay	154	364	290	576	409	392

Table 7.27 Truck vehicle hours of delay (VHD) on the Regional Freight Network



Figure 7.30 Truck hours of delay on the Regional Freight Network from 1-3 PM

Total Cost of Traffic Delay on Freight Network

Data source: Metro travel forecast model.

Description: Evaluates average cost of delay for freight movement in the two hour AM peak period (7-9 AM), the two-hour mid-day travel period (1-3 PM) and in the two-hour PM peak period (4-6 PM). Values of time are taken from ODOT report The Value of Travel-Time: Estimates of Hourly Value of Time for Vehicles in Oregon in 2015. The cost of delay takes into account both auto and truck delay that occurs on the regional freight network. Auto value of time is calculated at \$23.68 per hour. The value of time for trucks include both time of the driver as well as operating expenses. The travel forecast model distinguishes medium and heavy trucks. Medium trucks are identified as two-axle, six-tire, single-unit vehicles (Class 5). The value of time for medium trucks is calculated at \$28.20 per hour. Heavy trucks are vehicles with 3 or more axle single unit or trailers (Class 6 and above). The value of time for heavy trucks is calculated at \$30.72 per hour. The travel forecast model allocates 35 percent of trucks to medium category and 65 percent to heavy category. The per hour value of time dollar amounts for trucks are the same for both 2015 and 2040.

Target or desired direction: No target. Desired direction is to reduce growth in cost of delay (in constant dollars) on the regional freight network in the two-hour mid-day and two-hour pm peak as compared to the 2040 No Build strategies.

Findings: In the 2040 No Build, the cost of delay on the regional freight network increases almost four fold during the two-hour PM peak compared to the 2015 Base Year. For the 2040 No Build, the cost of delay on the regional freight network increases almost 15 fold during the two-hour mid-day period. However, implementation of the 2040 Constrained or the 2040 Strategic results in a 65 to 70 percent decrease in the cost of delay for the mid-day peak period compared to the 2040 No Build strategy. For the two-hour PM peak travel period the 2040 Constrained or 2040

Strategic investments reduce cost of delay by 27 percent to 29 percent compared to the 2040 No Build.

Table 7.28 Cost of truck vehicle hours of delay on the Regional Freight Network within the	!
MPA	

Time period	2015 Base Year	2027 No Build	2027 Constrained	2040 No Build	2040 Constrained	2040 Strategic
7-9 AM cost of delay	\$6 <i>,</i> 534	\$13,604	\$11,715	\$21,598	\$14,921	\$14,363
1-3 PM cost of delay	\$1,628	\$6,475	\$4,904	\$23,932	\$7,844	\$6,667
4-6 PM cost of delay	\$4,594	10,852	\$8,646	\$17,185	\$12,203	\$11,689

Note: Delay is accrued where v/c exceeds 0.9.





7.4.11 Transit efficiency and ridership

Data source: Metro Travel Forecast Model and area transit agencies.

Description: Evaluates average weekday (AWD) transit boarding rides per revenue hour for high capacity transit and bus combined for all transit service providers – TriMet, SMART, C-TRAN and Portland Streetcar, Inc.

Target or desired direction: No target. Increase AWD transit boarding rides and revenue hours of service

Findings: Total boardings and revenue hours of transit service both increase dramatically between 2010 and 2040. The 2027 and 2040 Financially Constrained Investments Strategies show and increase in AWD boardings and revenue hours of service over the 2027 and 2040 No Build reflecting the addition of new high capacity transit and expanded bus service.

Transit productivity	2015 Base Year	2027 No Build	2027 Constrained	2040 No Build	2040 Constrained	2040 Strategic
Daily transit boardings	429,640	616,073	775,729	740,672	1,085,970	1,196,525
Daily revenue hours	6,577	7,607	8,868	7,780	10,263	12,462
Daily transit boardings per revenue hour	65	81	87	95	106	96

Table 7.29 Transit productivity

Note: For the entire four-county region, including transit agencies serving Clark, Clackamas, Multnomah and Washington counties.





Note: This figure includes TriMet, SMART, C-TRAN and Portland Streetcar, Inc.



Figure 7.33 Average weekday transit revenue hours of service (all providers)

Note: This figure includes TriMet, SMART, C-TRAN and Portland Streetcar, Inc.





Source: Metro Travel Demand Model



Figure 7.35 Average weekday transit boardings per revenue hour by transit mode

7.4.12 Carbon emissions

Data source: The on-road vehicle emissions estimates for the 2018 RTP were produced within a software framework that combines the regional transportation model with EPA's emissions projection MOVES model, version MOVES2014a. A newer version of MOVES (MOVES2014b) has since been released, but it should be noted that the improvements incorporated into this update pertain almost exclusively to estimates of non-road emissions and are, therefore, not relevant to this analysis.

Description: Evaluates projected mobile source emissions of carbon dioxide (CO2) a primary greenhouse gas pollutant to determine mobile source greenhouse gas emissions in the base year and for 2027 and 2040 to determine if mobile source greenhouse gas emissions are declining as a whole and on a per capita basis.

Metro's current implementation of MOVES was developed for air quality conformity purposes in accordance with all pertinent EPA guidance included in the document, "Using MOVES to Prepare Emission Inventories in State Implementation Plans and Transportation Conformity: Technical Guidance for MOVES2010, 2010a and 2010b" (April 2012).

Metro estimates future mobile source greenhouse gas emissions by using existing and proposed transportation project information and inputting the project information into the travel demand model to understand the travel behavior in the region with and without proposed investments at key times in the future (2027 and 2040). Key travel behavior outputs include trip generated, mode split (i.e. percentage of trips taken by different transportation modes), trip distances, and vehicles miles traveled. This information is then taken into the MOVES2014a emissions model to

estimate projected greenhouse gas emissions with and without the proposed transportation investments for the Portland airshed in 2027 and 2040. Then the total vehicle emissions are divided by projected population estimate to understand emissions per capita and ultimately the reduction level from the base year of 2015. Detailed information about the fleet and technology assumptions used in the 2018 RTP on-road vehicle emissions analysis and a comparative assessment of VisionEval and MOVES emissions estimation methodologies is provided in Appendix J.

Target or desired direction: The target adopted in the 2014 Climate Smart Strategy is to reduce per capita greenhouse gas emissions from cars and small trucks by 29 percent by 2035, and 25 percent by 2040, compared to 2005 levels. The Climate Smart Strategy performance measures and monitoring targets were adopted with an acknowledgement that they will be reviewed during development of the 2018 Regional Transportation Plan to address new information, such as federal transportation performance-based planning rulemaking. At the time of adoption, Metro also anticipated transitioning from using ODOT's GreenSTEP software tool (VisionEval) to the Environmental Protection Agency's MOVES model for forecasting on-road mobile source greenhouse gas emissions in the region. This transition was anticipated because Metro maintains and implements MOVES to conduct federally-required air quality and other on-road vehicle emissions analysis, and does not have the expertise nor the resources necessary to maintain and implement VisionEval on an on-going basis. Further, significant methodological differences in how VisionEval and MOVES estimate on-road vehicle emissions do not allow for direct comparison of forecasted on-road vehicle emissions results.

To assess progress towards the targets, the region's Climate Smart Strategy calls for the implementation of nine key land use and transportation policies to reduce greenhouse gas emissions. Monitoring targets are used to track progress. One of the most significant transportation strategies outlined in the Climate Smart Strategy is increasing transit service hours. The Climate Smart Strategy called for 9,400 transit service revenue hours (excluding C-TRAN) within the metropolitan planning area boundary by 2035 to meet the region's greenhouse gas reduction target. Refer to **Appendix J** for details on the monitoring targets and other performance outcomes.

Findings: The 2018 Regional Transportation makes satisfactory progress towards implementing the Climate Smart Strategy and, if fully funded and implemented, can reasonably be expected to meet the state-mandated targets for reducing per capita greenhouse gas emissions from cars and small trucks (light-duty vehicles) for 2035 and 2040.

- By 2040, the plan, together with advancements in fleet and technology, is expected to reduce total annual greenhouse gas emissions from all on-road vehicles by 19 percent (compared to 2015 levels) and annual per capita greenhouse gas emissions from all on-road vehicles by 40 percent (compared to 2015 levels).
- By 2040, the plan, together with advancements in fleet and technology, is expected to reduce total annual greenhouse gas emissions from passenger cars and passenger trucks by 27

percent (compared to 2015 levels) and reduce annual per capita greenhouse gas emissions from passenger cars and passenger trucks by 46 percent (compared to 2015 levels).

Due to differences in emissions analysis tools, the 2018 RTP greenhouse gas emissions estimates are not directly comparable to the state-mandated greenhouse gas emissions reduction targets that were set using VisionEval. However, the findings above and in Appendix J demonstrate the region is making satisfactory progress implementing the Climate Smart Strategy.

The findings also demonstrate that more investment, actions and resources will be needed to ensure the region achieves the mandated greenhouse gas emissions reductions defined in OAR 660-044-0060. In particular, additional funding and prioritization of Climate Smart Strategy investments and policies will be needed.

Equity findings: Not included in transportation equity analysis.

Table 7.30 Projected mobile source greenhouse gas emissions — all vehicles

	2015 Base Year	2027 No Build	2027 Constrained	2040 No Build	2040 Constrained	2040 Strategic
Average daily GHG emissions from all vehicles (metric tons)	14,418	12,773	12,625	11,942	11,670	11,597
Percent reduction from 2015	N/A	-11%	-12%	-17%	-19%	-20%
Percent reduction per person from 2015	N/A	-25%	-26%	-39%	-40%	-41%

Note: Results are from MOVES 2014a and reflect summer emissions within the metropolitan planning area boundary.

Table 7.31 Projected mobile source greenhouse gas emissions – passenger vehicles only

	2015 Base Year	2027 No Build	2027 Constrained	2040 No Build	2040 Constrained	2040 Strategic
Average daily GHG emissions from passenger vehicles (metric tons)	11,472	9,732	9,611	8,564	8,357	8,299
Percent reduction from 2015	N/A	-15%	-16%	-25%	27%	-28%
Percent reduction per person from 2015	N/A	-28%	-29%	-45%	-46%	-47%

Note: Results are from MOVES 2014a and reflect summer emissions within the metropolitan planning area boundary.

7.4.13 Clean air

Data source: The on-road vehicle emissions estimates for the 2018 RTP were produced within a software framework that combines the regional transportation model with EPA's emissions projection MOVES model, version MOVES2014a. A newer version of MOVES (MOVES2014b) has since been released, but it should be noted that the improvements incorporated into this update pertain almost exclusively to estimates of non-road emissions and are, therefore, not relevant to this analysis.

Description: Evaluates projected mobile source emissions of criteria pollutants: carbon monoxide (CO), nitrogen oxide (NO_X), volatile organic compounds (VOC), and particulate matter (PM_{10} and $PM_{2.5}$) and transportation-related air toxics identified with guidance from the Oregon Department of Environmental Quality.¹⁰

Metro estimates future mobile source emissions by using existing and proposed transportation project information and inputting the project information into the travel demand model to understand the travel behavior in the region with and without proposed investments at key times in the future (2027 and 2040). Key travel behavior outputs include trip generated, mode split (i.e. percentage of trips taken by different transportation modes), trip distances, and vehicles miles traveled. This information is then taken into the MOVES2014a emissions model which includes information about vehicle fleet mix, corporate average fuel economy (CAFÉ) standards, fuel composition, and emissions rates to determine what the projected emissions of individual air pollutants would be with and without the proposed transportation investments for the Portland airshed in 2027 and 2040.

Target or desired direction: Decrease the amount (e.g. grams, ounces, pounds, or tons) of mobile source air pollutants in the 2027 Constrained and 2040 Constrained compared to the 2015 Base Year.

Findings: The 2018 RTP investment strategy in 2027 and 2040 show a significant reduction of criteria pollutants emissions and transportation-related air toxics emissions from mobile source pollution compared to 2015 base year emissions. Certain pollutants including carbon monoxide, volatile organic compounds, benzene, and naphthalene gas see significant reductions in the pounds or grams of emissions reduced by 2027 and further in 2040.^{11and 12} In looking more closely, the investment strategy also provides further reductions from the no-build conditions in 2027 and 2040, meaning despite projected population growth and economic activity, the region's

¹⁰ Nitrogen oxide and volatile organic compounds are precursors to Ozone. Transportation-related air toxics are: Acrolein, Arsenic, Benzene, 1,3-Butadiene, Chromium 6, Diesel particulate matter plus diesel exhaust organic gases (Diesel PM), Formaldehyde, Naphthalene, Polycyclic organic matter

¹¹ Long-term emissions projections of carbon monoxide from mobile sources are expected to remain in decline as updated technology has reduced the amount of carbon monoxide from vehicles.

¹² Ambient levels of volatile organic compounds, a precursor pollutant to ozone pollution has been steadily rising. Therefore, while mobile source emissions of volatile organic compounds pollution is expected to decline, ozone pollution impacting public health remains a matter of concern for the region.

investment in a multimodal transportation system is making progress in reducing mobile source air pollution emissions.

			<u> </u>			
Pollutant	2015 Base Year	2027 No Build	2027 Constrained	20 <mark>40</mark> No Build	2040 Constrained	2040 Strategic
Carbon monoxide (CO) (Winter)	223,788	115,027	114,192	72,028	71,302	71,076
Nitrogen oxide (NOx) (Summer)	61,147	14,556	14,462	8,628	8,534	8,514
Volatile organic compounds (VOC) (Summer)	13,306	4,272	4,218	3,024	2,936	2,913
Particulate Matter 10 exhaust (PM ₁₀) (Winter)	1,739	566	562	319	314	313
Particulate Matter 2.5 exhaust (PM _{2.5}) (Winter)	1,575	509	505	285	281	280

Equity findings: Not included in transportation equity analysis.

	· · ·		
Table 7.32 Estimated mobile source	e emissions by a	air pollutant –	criteria pollutants

Note: Results are from MOVES 2014a and reflect pounds of summer or winter emissions within the metropolitan planning area boundary.





Pollutant	2015 Base Year	2027 No Build	2027 Constrained	2040 No Build	2040 Constrained	2040 Strategic
Diesel Particulate Matter* (pounds)	622	145	144	53	52	52
Acrolein (pounds)	16	5	5	3	3	3
Benzene (pounds)	356	83	82	46	45	45
1,3-Butadiene (pounds)	41	5	5	2	2	2
Formaldehyde (pounds)	252	85	84	65	64	63
Arsenic (grams)	68	79	79	90	88	88
Chromium 6 (grams)	0.35	0.40	0.40	0.45	0.45	0.44
Naphthalene Gas (grams)	14,394	3,952	3,912	2,470	2,409	2,397

Table 7.33 Estimated mobile source emissions by air pollutant – air toxics

Note: Results are from MOVES2014a and reflect summer emissions within the metropolitan planning area boundary.







Figure 7.38 Estimated mobile source emissions of selected air toxics

7.4.14 Potential habitat impact

Data source: Several different data were used to evaluate potential impact to habitat in the region. Refer to **Appendix F** for additional information on the data sources and methodology used for this performance measure. Data used:

- Metro Title 13 inventory. Adopted by Metro in September 2005, this inventory combines Regionally Significant Riparian & Upland Wildlife habitat, Habitats of Concern, and impact areas into one integrated layer. This regional dataset has not been updated since 2005 but is included because it is the official dataset and for comparison to the Regional Conservation Strategy and Oregon Conservation Opportunity Areas (see next two bullets).
- **Regional Conservations Strategy (RCS) high value habitat areas**. Data was developed from 2010 to 2013 by the Intertwine Alliance a broad coalition of public, civic, private, and nonprofit organizations. The data identifies the top twenty-five percent high value habitat areas within an eight-mile buffer of the urban growth boundary and the Bull Run Watershed. The analysis considered many features, including existing vegetation, wetlands, hydric soils, floodplains, habitat patch size and shape, distance from streams and wetlands, and the presence of roads. High Value areas ranked in the top quarter of all areas because of the type, location, and size of their habitat.¹³

¹³ Information about development of the Regional Conservation Strategy and data can be found at: www.regionalconservationstrategy.org

- **Oregon Department of Fish and Wildlife Conservation Opportunity Areas.** Data is was adopted in 2016 by the Oregon Department of Fish and Wildlife in the Oregon Conservation Strategy, the official State Wildlife Action Plan for Oregon. Conservation Opportunity Areas (COAs) are places where broad fish and wildlife conservation goals would best be met and are indentified through a rigorous process that combines multiple datasets.¹⁴
- **Fish bearing streams.** Oregon Fish Habitat Distribution data (2018) is from the Oregon Department of Fish and Wildlife and identifies. These data describe areas of suitable habitat believed to be used currently or historically by native or non-native fish populations. The term "currently" is defined as within the past five reproductive cycles. Historical habitat includes suitable habitat that fish no longer access and will not access in the foreseeable future without human intervention. This information is based on sampling, the best professional opinion of Oregon Dept. of Fish and Wildlife or other natural resources agency staff biologists or modeling. Due to natural variations in run size, water conditions, or other environmental factors, some habitats identified may not be used annually.¹⁵
- **Oregon Fish Passage Barriers.** Data is from the Oregon Department of Fish and Wildlife and was last updated in 2017. The data contains both passable and impassable barriers to native migratory fish. Data from multiple agencies have been compiled into this standardized dataset that is stewarded by ODFW. Separate datasets exist for current barriers and removed / replaced barriers.
- **Wetlands.** Data for the wetlands analysis is from the U.S. Fish and Wildlife National Wetlands Inventory. It is clipped to the Intertwine's Regional Conservation Strategy extent and published to RLIS in 2016; does not include local wetland inventories.
- **Floodplains and flood hazard areas.** Data is published by the Federal Emergency Management Agency (FEMA) and was published to RLIS in October 2018. The data identifies areas with a 1-percent-annual-chance flood event, the 0.2-percent-annual-chance flood event, and areas of minimal flood risk.

Description: Evaluates the potential impacts of transportation projects on identified regional and urban high value habitat areas defined in the Metro's Title 13 inventory, in the Regional Conservation Strategy, Oregon Conservation Opportunity Areas, to fish bearing streams and fish passage barriers, to wetlands, floodplains and flood hazard areas.¹⁶ This analysis used the datasets listed above and refers to the Regional Conservation Strategy as the framework for efforts to conserve biodiversity within the greater Portland-Vancouver region.

¹⁶ A map of the regional and urban high value habitat areas can be found at: www.regionalconservationstrategy.org/document/8

¹⁴ Information on the Conservation Opportunity Areas can be found at: <u>http://oregonconservationstrategy.org/conservation-opportunity-areas/</u>

¹⁵ Data and information is available through the Oregon Department of Fish and Wildlife's Nartural Resources Information Management Program <u>https://nrimp.dfw.state.or.us/nrimp/default.aspx</u>

Appendix F includes a list of the projects which intersect with the analysis areas of potential habitat impact. Projects in the RTP, represented as points and lines in the geographical information system (GIS) shapefiles, were given a 100-foot buffer and overlaid with the analysis areas listed above. Any project within the 100-foot buffer that wholly or partially intersected with one or more of the analysis areas is flagged in the project lists and included in the tables below. Projects that could not be represented as a point or a line (for example regional programsor system management projects) were not included in the analysis.

Habitat analysis areas are not exclusive. For example, regional data on wetlands is included in the Title 13 inventory, the Regional Conservation Strategy high value habitat areas, Oregon Conservation Opportunity Areas, and the wetlands inventory. Each of the analysis areas have overlapping, but unique, boundaries. Therefore, the number of projects identified in each analysis area should not be added together.

Target or desired direction: There is no target for this measure. The purpose of this measure is to identify projects that overlap with sensitive high value habitats so that as projects move toward implementation, appropriate avoid, minimize, or mitigation strategies can be applied.

Findings: The number and percent of projects that intersect with one or more analysis area is shown in **Table 7.36** for each of the investment strategies. **Appendix F** includes maps showing the location of projects in each analysis area. A total of 459 projects in the 2040 Constrained list intersect with high value habitats identified in the Regional Conservation Strategy, while 544 intersect with Title 13 inventory high value habitat areas. Overall, these projects make up nearly 59 percent and 70 percent, respectively, of the total 2018 RTP investment strategy, excluding operations and programmatic projects.

While many RTP projects overlap with identified high value habitats, it is important to note that the potential alignments for many proposed projects are conceptual until more detailed project development work is conducted. Projects that intersect high value areas should consider alignment options that avoid the resource area as well as environmental mitigation strategies during future project development as described in the design policy section Chapter 3 of the Plan and in **Appendix F**. Identifying areas of potential conflict early in the transportation planning process allows for more meaningful consideration of mitigation strategies, including project alignment, design and construction features that avoid or minimize impacts on the resource area. Many of these strategies are addressed specifically during the project development phase as part of the environmental and land use review, consultation and permitting processes all construction projects must undergo.

Resource area	2015 Base Year	2027 No Build	2027 Constrained	2040 No Build	2040 Constrained	2040 Strategic
Title 13 inventory high value habitat areas	N/A	N/A	267 67%	N/A	544 70%	726 71%
Regional Conservation Strategy (RCS) high value habitat areas	N/A	N/A	219 55%	N/A	459 59%	634 62%
Oregon Conservation Opportunity Areas (COAs)	N/A	N/A	118 30%	N/A	228 29%	301 29%
Fish bearing streams	N/A	N/A	136 34%	N/A	286 37%	395 38%
Fish passage barriers	N/A	N/A	101 25%	N/A	195 25%	269 26%
Wetlands	N/A	N/A	191 48%	N/A	394 51%	542 53%
Floodplains and flood hazard areas	N/A	N/A	178 45%	N/A	341 44%	459 45%

Table 7.34 Potential habitat impact analysis - number and percent of projects

Note: This table shows the number and percent of RTP projects that are within 100 feet of identified resource areas. Operations and programmatic projects were not included in this analysis.

Table 7.35 Number of 2040 Constrained projects potentially impacting environmental

resources, by project type

Type of capital project	Title 13 high value habitat areas	RCS high value habitat areas	Oregon COAs	Fish bearing streams	Fish passage barriers	Wetlands	Floodplain and flood hazard areas
Roads and bridges	319	269	113	167	102	244	173
Throughways	35	32	18	29	30	32	29
Transit capital	36	32	27	29	21	29	36
Freight	27	18	20	8	8	16	30
Bike and pedestrian	289	266	110	149	100	211	172
Transportation System Management	20	17	13	13	8	10	19

Note: Operations and programmatic projects without a specific geographic location were not included in this analysis. Oregon COAs are Conservation Opportunity Areas designated by the Oregon Department of Fish and Wildlife.

7.4.15 Potential impacts to historic and cultural resources and tribal lands

Data source: Tribal lands data from the Bureau of Indian Affairs and listed historic properties data from the National Register of Historic Places.

Description: Evaluates the potential impacts of proposed RTP projects on listed historic and cultural resources and tribal lands identified in the metropolitan planning area.

Target direction: There is no target for this measure. The purpose of this measure is to identify projects that overlap with historic and cultural resources or tribal lands so that as projects move toward implementation, appropriate avoid, minimize, or mitigation strategies can be applied.

Findings: Metro reviewed tribal lands data available from the Bureau of Indian Affairs to identify potential federally recognized tribal lands in the planning area. No tribal lands were identified within or adjacent to the metropolitan planning area. In addition, Metro reviewed data from the National Register of Historic Places. More than 650 historic places and structures have been listed in the National Register in the planning area. The data is available upon request from the Metro Research Center.¹⁷

Using Geographic Information System (GIS) mapping software and data from National Register of Historic Places, the analysis identified 72 projects within the planning area that are located within 100 feet of historic properties listed in the National Register, of which 62 projects are in the 2040 Constrained list.

Type of capital project	Number of projects located within 100 feet of listed historic and cultural resources	Number of projects located on tribal lands
Roads and bridges	21	
Throughways	1	
Transit capital	17	0
Freight	1	0
Bike and pedestrian	17	
Transportation system management	5	

Table 7.36 Number of 2040 Constrained RTP projects potentially impacting historical and cultural resources or tribal lands, by project type

Note: Operations and programmatic projects were not included in this analysis.

The historic and aesthetic value of the built environment is also recognized as key to the quality of life of the region's residents. Where transportation improvements are developed which may impact on such resources, appropriate mitigation and design elements should be addressed. Section 106 of the National Historic Preservation Act (NHPA) requires all federal agencies to take

¹⁷ For more information on each site visit www.nationalregisterofhistoricplaces.com/or/state.html and click on Clackamas, Multnomah or Washington County.

into account the effects of their undertakings on historic properties. All properties listed in the National Register are protected by the Oregon State Historic Preservation Office (SHPO).

Oregon Revised Statute (ORS) 358.653 requires state agencies and all "political subdivisions" of the state—including counties, cities, universities, school districts and local taxing districts—to consult with the Oregon State Historic Preservation Office to avoid inadvertent impacts to historic properties for which they are responsible. Impacts are usually the result of construction projects, but may also include the transfer of properties out of public ownership.

Potential transportation project related impacts to historic and cultural resources may include physical changes to historic transportation infrastructure, effects of road widening on historic settings or structures, effects on historic roadside elements, effects of air pollution on resources due to increased traffic, and disturbance or infringement on cultural landscapes. The nature of these impacts is highly location and project specific, and the information about historic and cultural resources is constantly evolving. It is important for each project to be evaluated in the specific context and timeframe in which it is designed with up-to-date information.

Typically, mitigation activities include the preservation and documentation of these assets, along with context-sensitive design of new or renovated infrastructure to complement existing streetscape or architectural features as closely as possible. Identifying these areas of potential conflict early in the transportation planning process allows for more meaningful consideration of mitigation strategies, including project alignment, design and construction features that avoid or minimize impacts on the historic and cultural resources in the project area. Many of these strategies are addressed specifically during the project development phase as part of the environmental and land use review, consultation and permitting processes all construction projects must undergo.

7.4.16 Public health

Data source: Integrated Transport and Health Impacts Model (ITHIM), MOVES model and regional travel model, Oregon Health Authority vital statistics.

Overall description: Metro partnered with Multnomah County Public Health and the Oregon Health Authority (OHA) to estimate the health effects of regional transportation investments using ITHIM. ITHIM uses information about travel behavior to estimate changes in chronic disease and premature deaths associated with lack of physical activity and from air pollution – two documented leading causes of death and chronic disease in the greater Portland region. *Note: Metro and the OHA used ITHIM in a series of Health Impact Assessments (HIAs) during the Climate Smart Strategy planning process that concluded in 2014.*

For the 2018 RTP, Metro, Multnomah County Public Health and the OHA used ITHIM to estimate changes in death and disease resulting from a change in travel behavior attributed to the investments proposed in the 2018 RTP. Three key pieces of information are needed to run ITHIM: average minutes of walking and cycling per person per week, and change in fine particle (PM2.5) pollution.

Metro modeled travel behavior for the Base Year and each of the investment strategies; walking and cycling minutes include trips accessing transit stops. Using the MOVES model, Metro estimated change in the mass of fine particulate matter (PM2.5) released by mobile sources for each scenario. MOVES outputs are in units of mass (e.g. grams per year), but ITHIM uses a concentration to estimate health benefits. Although there is not a standard practice for converting a mass estimate to a concentration, the analysis used a recent PM2.5 inventory provided by the Oregon Department of Environmental Quality for Multnomah County suggesting that on-road emissions account for approximately 11 percent of fine particulate pollution. Using 2015 monitor data from three air monitors in the region, an average baseline concentration was calculated. The final step was applying the percentage changes from MOVES to the portion of PM2.5 attributable to on-road sources in the region, resulting in estimates for each investment strategy. These estimates do not account for changes in particle pollution from other sources, such as residential wood combustion or industrial point sources.

2015 Base Year death and burden of disease estimates for each disease were compiled from Oregon Health Authority vital statistics. Number of deaths between 2011-2015 were downloaded from the Oregon Public Health Assessment Tool (OPHAT) and averaged for the five year period. Disability Adjusted Life Years (DALY) are calculated by summing Years of Life Lost (YLL) and Years of Living with a Disability (YLD) for each disease. DALYs are a unit of disease burden that combine years of life lost with years of living with a disability. When summed across a population, changes in DALYs can be thought of as changes in the burden of disease within that population. YLL are calculated using the World Health Organization (WHO) DALY Template from number of deaths by age group, gender and life expectancy at the time of death. YLD are imputed for the Metropolitan Planning Area from WHO Global Burden of Disease 2010 estimate for the US.

For future years, population numbers changed but the age distribution was kept the same across all investment strategies. This enables more direct comparisons with 2027 Constrained investment strategy and isolates the effect of changes in travel behavior.

As in most scenario modeling exercises, these results should be interpreted primarily as a way to compare investment strategies, as opposed to a prediction of what will likely come to pass. The results reported here are not a comprehensive estimate of health effects. ITHIM omits several diseases and causal pathways that are related to transportation, but for which no model module has been created. Among the effects not modeled are diseases and deaths associated with traffic noise, non-particle air pollution, and traffic injuries. Both noise and air pollution are associated with cardiovascular disease and diabetes (Babisch, 2014; Dzhambov, 2015). The estimate of risks from air pollution are not adjusted for noise. Although ITHIM includes a model for injuries, the input data necessary to use it was not available. This shortcoming is notable because of the high burden of death and disability from traffic crashes. Unintentional injuries were the fourth leading cause of death in the 3-county area from 2012-2016. Including traffic crashes could therefore substantially alter estimates of health impacts from the RTP. Finally, estimates are based on present disease rates, not projected rates based on estimated trends.

Overall findings: The burden of premature death and disease decreases under all investment strategies, with the 2040 Strategic slightly outperforming the 2040 Constrained in comparison to

the 2040 No-Build Scenario. The 2040 Constrained investment strategy achieves substantially greater benefits than the 2040 No Build, a 26 percent larger reduction in the burden of disease. Benefits from reduced air pollution accrue mostly in the first 10 years of the planning period, resulting in minimal additional benefits between 2027 and 2040.

The bulk of the health benefits from the proposed RTP are attributable to the reductions in air pollution. This is a departure from past studies and is a result of relatively small changes in total physical activity estimated by the travel model. Air pollution reductions are primarily driven by improvements in vehicle efficiency anticipated under current regulations, which is why health benefits are seen even in the No Build investment strategies. Health benefits from air quality could increase if vehicle emissions became further curtailed through regulation, infrastructure investment, or by faster than anticipated adoption of technologies such as electric vehicles. Similarly, health benefits could be greater if additional pollution reductions occur outside of the transportation sector – changes not modeled for this measure.

Average per person weekly minutes of biking and walking

Description: The regional travel model estimates an average # of weekday miles traveled walking and biking per person. This is converted to an average weekly minutes per person spent walking or biking.

Target or desired direction: No target for this measure. The desired directions to increase weekly minutes of biking and walking, ideally to reach the recommended 150 minutes of moderate intensity physical activity.

Findings: As shown in **Table 7.36** the 2040 Constrained investment strategy increases weekly minutes of biking and walking per person to 59.4 minutes, compared to 48 minutes in the 2015 Base Year, a 24 percent increase. Though beneficial, the increase does not meet national guidelines, as published by the US Dept of Health & Human Services (2008), which recommend at least 150 minutes per week of moderate intensity physical activity.

	2015 Base Year	2027 No Build	2027 Constrained	2040 No Build	2040 Constrained	2040 Strategic
Average weekly minutes walking per person	31.6	33.4	36.5	34.4	39.6	40.8
Average weekly minutes of biking per person	16.4	17.8	18.3	19.3	19.8	19.3
Total average weekly minutes of biking and walking per person	48	51.2	54.8	53.7	59.4	60.1

Table 7.37 Average per person weekly minutes of biking and walking

Estimated lives saved annually from increased physical activity and reduced air pollution

Description: For physical activity, ITHIM first converts time spent walking and biking into metabolic equivalent tasks (METs), a consistent unit of energy expenditure from exercise. For air pollution, the model uses average annual PM 2.5 concentrations to estimate disease related to air pollution. The outputs of ITHIM are expressed as change in deaths and change in disability adjusted life years (DALYs).

Target or desired direction: No target for this measure. The desired directions to increase the number of lives saved and increase the number of years lived.

Findings: The burden of premature death and disease decreases under all investment strategies, with the 2040 Strategic investment strategy outperforming the 2040 Constrained in comparison to the 2040 No-Build Scenario. As detailed in **Table 7.36**, the 2040 Constrained Scenario achieves substantially greater benefits than the 2040 No Build, a 26 percent larger reduction in the burden of disease. Benefits from reduced air pollution accrue mostly in the first 10 years of the planning period, resulting in minimal additional benefits between 2027 and 2040.

Table 7.38 Estimated lives and years saved from increased physical activity and reduced a	air
pollution	

	2027 No Build	2027 Constrained	2040 No Build	2040 Constrained	2040 Strategic
Estimated lives saved annually	15	17	19	22	23
Estimated Disability Adjusted Life Years (DALY)	209	260	272	354	379

Healthcare costs saved

Description: ITHIM uses a cost-of-illness approach consistent with the method used for the Climate Smart Strategy HIAs (Iroz-Elardo et al. 2014) and the US EPA (US EPA, 2007). This method uses large-scale studies of the cost of treating specific illnesses in the US and estimates the regional share of that cost. In this case, we used the CDC Chronic Disease Cost Calculator to arrive at estimates for direct (medical treatment) and indirect (absenteeism) costs of illness for the greater Portland region in 2027 and 2040. The Chronic Disease Cost Calculator does not provide estimates for specific cancers, nor for dementia. Therefore this method does not estimate avoided costs associated with dementia or cancer (lung, breast, and colon) even though it estimates the change in the burden of these diseases. This means that the total cost estimate is an underestimate. Consistent with methods from previous studies, it applies the population attributable fraction (percent change in DALYs from baseline) to arrive at an estimated change in treatment cost.

Target or desired direction: Lower healthcare costs.

Findings: Over \$30 million in health care costs are avoided in the 2040 Constrained and 2040 Strategic investment strategies.

Table 7.39 Health care costs avoided (in 2017\$)

	2027	2027	2040	2040	2040
	No Build	Constrained	No Build	Constrained	Strategic
Annual health care costs saved	\$17 million	\$20 million	\$26 million	\$31 million	\$32 million

Note: Estimates are rounded to the nearest million.

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