

2018 Regional Transportation Plan



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PUBLIC REVIEW DRAFT

2018 Regional Transportation Plan

Chapter 7

Measuring Outcomes

June 29, 2018

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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 introduces the chapter.

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

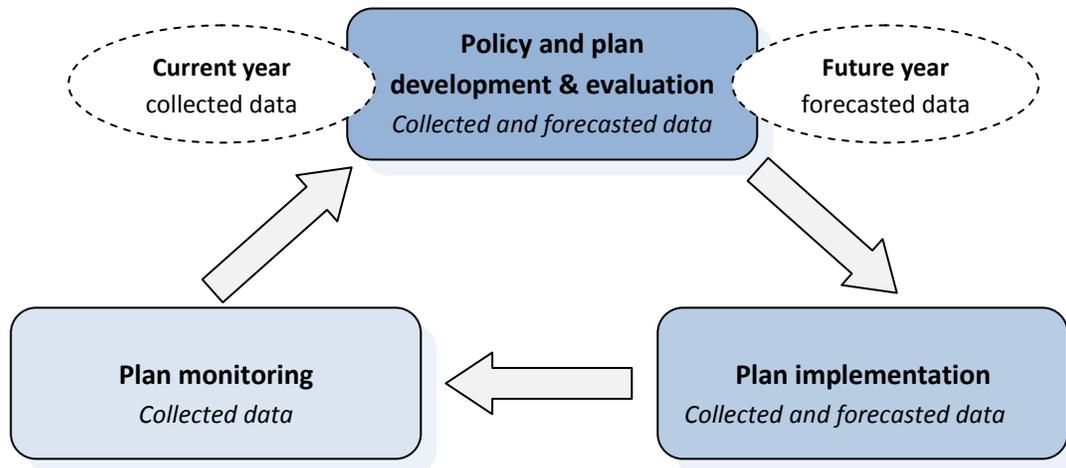
7.3 RTP System Evaluation Framework: This section describes the framework used to conduct the performance evaluation. It describes how transportation equity is measured to understand how disparities are reduced and to meet federal requirements. It describes the different geographical areas that the performance measures are reported on. It describes the investment strategies that were evaluated (the different project lists) and it provides a guide on how to read the performance measure outcomes.

7.4 How the System Performs: This section goes through each of the performance measures for which forecasted data is available and describes the outcomes of each measure.

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 monitoring as the Performance Measurement System, as shown in **Figure 7.1**.

Figure 7. 1 Regional Transportation Plan Performance Measurement System



This chapter reports 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 performance measures and benchmarks mandated by the Oregon Transportation Planning Rule (TPR), greenhouse gas emissions reduction targets and related monitoring defined in the Metropolitan Greenhouse Gas Reduction Targets Rule and federal requirements to assess potential impacts on environmental resources, historic and cultural resources and tribal lands.

Plan monitoring in support of the region’s federally-required Congestion Management Process 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.

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

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 and safety) 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 and safety in the region.

Table 7.1 How RTP System Evaluation Measures Support Meeting RTP Goals

RTP Performance Measures		RTP Goals										
		Vibrant Communities	Shared Prosperity	Transportation Choices	Reliability and Efficiency	Safety and Security	Healthy Environment	Healthy People	Climate Protection	Equitable Transportation	Fiscal Stewardship	Transparency and Accountability
Measures ● = measure highly correlated with achieving goal ◐ = measure somewhat correlated with achieving goal ○ = measure partially supports achieving goal												
How much do households spend on housing and transportation in our region? <i>(Evaluation measures under development for next RTP.)</i>												
n/a	Affordability*	●	●	◐	◐	○	○	●	○	●	There are no system evaluation measures for the Ensure Fiscal Stewardship and Deliver Accountability goals.	
How safe is travel in our region? <i>(Evaluation measures under development for next RTP.)</i>												
n/a	Safety*	●	◐	●	●	●	◐	●	◐	●		
How much do people and goods travel in our region?												
1	Multimodal Travel	●	◐	●	●	◐	●	●	●	●		
2	Active Transportation and Transit Mode Share	●	◐	●	●	◐	●	●	●	●		
How easily, comfortably and directly can we access jobs and destinations in our region?												
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	○	●	○	○	○	○	○	○	○		
How efficient is travel in our region?												
9	Multimodal Travel Times	●	●	●	●	○	○	○	○	○		
10	Congestion	◐	●	○	●	●	◐	◐	◐	○		
11	Transit Efficiency and Ridership	●	○	●	●	○	◐	○	○	○		
How will transportation impact climate change, air quality, the environment and public health?												
12	Climate Change	○	●	●	○	○	●	●	●	○		
13	Clean Air	○	●	●	○	○	●	●	◐	●		
14	Potential habitat Impact	◐	○	○	○	○	●	●	◐	●		
15	Potential historical, cultural and tribal lands impact	●	◐	○	○	○	○	◐	○	○		
16	Public health	◐	◐	○	○	○	●	●	●	○		

Performance measures with an asterix () reflects the transportation priorities identified by historically marginalized communities and serve as the basis for the federally-required Title VI Benefits and Burdens analysis.*

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**, others are not, because there is no method yet to forecast outcomes, but they are reported on here based on observed data.

As a frame of reference for the differences between 2015 and 2040, **Table 7.2 RTP System Evaluation Results Summary** provides a summary of projected changes in demographic, travel and air quality in 2040 within the Metropolitan Planning Area.

Table 7.2 RTP System Evaluation Results Summary

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.

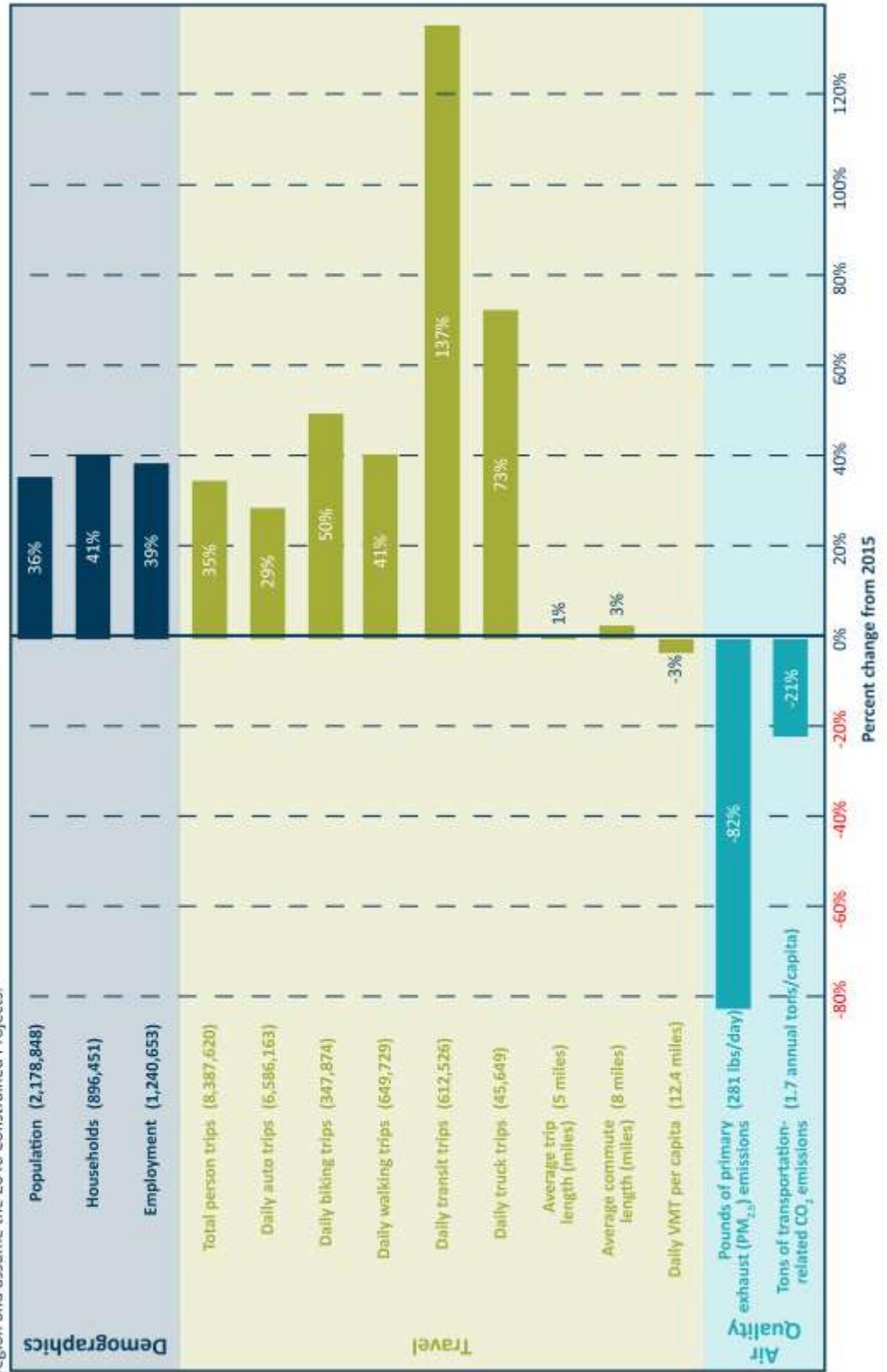


Table 7.3 provides an “at-a-glance” overview of 2018 RTP performance measures and progress made towards targets, or desired direction. Not all performance measures have a performance target. If a performance measure does not have a target, the desired direction is indicated. Performance measures for affordability and safety are included in the system evaluation because the plan does not yet have methods or tools to forecast performance for affordability or safety; therefore, observed data is cited.

Table 7.3 Results of 2018 RTP Target/Direction Assessment for the 2040 Constrained Projects



Plan meets target or desired direction



Plan does not meet target but is moving in the right direction



Plan does not meet target and is moving in the wrong direction

Measure	Target or desired direction	Performance within the metropolitan planning area	Performance in historically marginalized communities	Plan direction
How much do households spend on housing and transportation in our region?				
Affordability	By 2040, reduce the combined housing and transportation expenditure for lower-income households by 25% 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% reduction by 2025 and a 16% 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 people and goods travel in our region?				
Multimodal travel	By 2040, reduce vehicle miles traveled per person by 10% compared to 2015.	Plan reduces vehicle miles traveled per person but does not meet target. In 2040, vehicle miles traveled per person decline 5% below 2015 levels.	Not included in transportation equity analysis.	

Measure	Target or desired direction	Performance within the metropolitan planning area	Performance in historically marginalized communities	Plan direction
Active transportation and transit 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 14% to 18% of all trips, but does not meet target.	Not included in transportation equity analysis.	

How easily, comfortably and directly can we access jobs and destinations in our region?

Access to travel options – system completeness	By 2040, complete 100% of the regional network of sidewalks, bikeways, and trails.	Plan makes progress towards meeting the target, but does not reach target of completing 100% of the regional active transportation network. In 2040, 71% of sidewalks, 65% of on-street bikeways, and 47% 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% of the regional active transportation network in equity focus areas.	 Region and equity focus areas
---	--	--	--	--

Access to jobs	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. ¹	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. 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.	 Region  Equity focus areas
-----------------------	---	--	---	---

Access to community places	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. ²	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	 Region 
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¹ 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.

² This measure replaces the 2014 RTP essential destinations target. Metro will update 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 historically marginalized communities	Plan direction
			of community places reached within a short trip of driving, biking or walking compared to households in equity focus areas.	Equity focus areas
Access to bicycle and pedestrian parkways	No target for this measure. The desired direction is an increase in the number and share of households within a ¼ mile of a bicycle or pedestrian parkway.	Plan increases access to bicycle parkways to 79% of all households in 2040, and decreases access to pedestrian parkways decreases from 86% in 2015 to 85% in 2040.	Not included in transportation equity analysis.	
Access to transit	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% of households are within the desired distance to frequent all day transit; 79% of jobs are within the desired distance to frequent transit.	Plan increases access to transit in equity focus areas by 2027 and 2040.	
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. To be updated in final RTP.	Not included in transportation equity analysis.	TBD
How efficient 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 - National Highway System reliable travel	By 2040, increase the TBD% of reliable person-miles traveled on the Interstate System and on the non-Interstate National Highway System.	To be added to final RTP.	Not included in transportation equity analysis.	TBD
Congestion - Vehicle hours of delay per person	By 2040, reduce vehicle hours of delay per person by 10%.	To be added to final RTP.	Not included in transportation equity analysis.	TBD

Measure	Target or desired direction	Performance within the metropolitan planning area	Performance in historically marginalized communities	Plan direction
Congestion - Interim Regional Mobility Policy	By 2040, meet the Interim Regional Mobility Policy for level of service on locations of throughways, arterials, and regional freight network facilities. ³	Plan does not meet policy in all locations.	Not included in transportation equity analysis.	
Congestion - Freight delay	By 2040, reduce vehicle hours of delay per truck trip by 10% compared to 2015.	Plan does not meet target. Truck delay increases 358% by 2040, but this a third less delay than if the plan is not implemented.	Not included in transportation equity analysis.	
Congestion - Total cost of delay on freight network	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 strategies.	Plan decreases cost of delay 65-70% compared to not implementing the plan by 2040.	Not included in transportation equity analysis.	
Congestion - Freight reliability	By 2040, increase TBD% of Interstate System miles with reliable truck travel times.	To be added to final RTP.	Not included in transportation equity analysis.	TBD
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 doubles total boardings and increases hours of transit service 60% by 2040.	Not included in transportation equity analysis.	
How will transportation impact climate change, air quality, the environment and public health?				
Climate change	Meet or exceed Climate Smart monitoring targets to reduce greenhouse gas emissions per capita. ⁴ Reduce per capita greenhouse gas emissions from cars and small trucks by 20% by 2035 and 25% by 2040, compared to 2005 levels. ⁵	Plan meets or exceeds most monitoring targets by 2040. It makes progress towards, but 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	Not included in transportation equity analysis.	

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

⁴ Refer to Appendix J for Climate Smart Strategy monitoring targets and performance

⁵ Target was set based on GreenSTEP model. Metro uses MOVES model which does not correspond to some of the assumptions/inputs included in GreenSTEP (such as technology advances or transportation system management and operations). Therefore, performance outputs of MOVES are different and cannot be compared to GreenSTEP.

Measure	Target or desired direction	Performance within the metropolitan planning area	Performance in historically marginalized communities	Plan direction
		decrease by 21%. ⁶		
Clean air	By 2040, maintain or reduce air pollution (pounds, tons, grams) from mobile sources compared to 2015.	Plan meets target and reduces the amount of mobile source emissions of all criteria pollutants and air toxics by 2040. Certain pollutants see significant reductions.	Not included in transportation equity analysis.	
Potential habitat impact	There is no target for this measure. The desired direction is to identify projects that overlap with sensitive high value habitats and define potential mitigation strategies.	Plan includes 528 projects 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 and Tribal Lands impact	There is no target for this measure. The desired direction is to identify projects that overlap with historical and cultural resources and tribal lands, and define potential mitigation strategies for historical and cultural resources and avoid tribal lands.	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. 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 over \$31 million in annual health care costs.	Not included in transportation equity analysis.	

⁶ Output from MOVES model and cannot be accurately assessed against target set by GreenSTEP. Based on predicted outcomes of Climate Smart Strategy monitoring target, Metro predicts that per person greenhouse gas emission reduction targets for autos and small trucks will be achieved by 2040.

7.3 RTP SYSTEM EVALUATION FRAMEWORK

The evaluation element of the Regional Transportation Plan Performance Measurement System (see **Figure 7.1**) applies during periodic plan updates, which 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 local agencies, 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 7.2 2018 RTP Evaluation Framework



For the 2018 RTP update, Metro conducted two rounds of system evaluations. In the first round Metro provided system evaluation results to the public, regional policymakers and to agencies responsible for developing the project lists. Regional leaders provided policy direction based on the results of the first system evaluation results to refine the project list. Metro issued a second “call for projects” and agencies revised the original project list to better meet near-term regional priorities for safety, equity, travel options, Climate Smart Strategy implementation and congestion. The system evaluation that follows in Section 7.4 reports the results of the updated projects and programs submitted by jurisdictional partners.

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 determine whether: 1) progress is being made towards transportation priorities expressed by historically marginalized communities; 2) to 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 Right 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):⁷

- accessibility
- affordability

⁷ Due to capacity constraints and additional resource needs, the affordability system evaluation measure was deferred and recommended for development prior to the 2023 RTP.

- safety
- environmental health

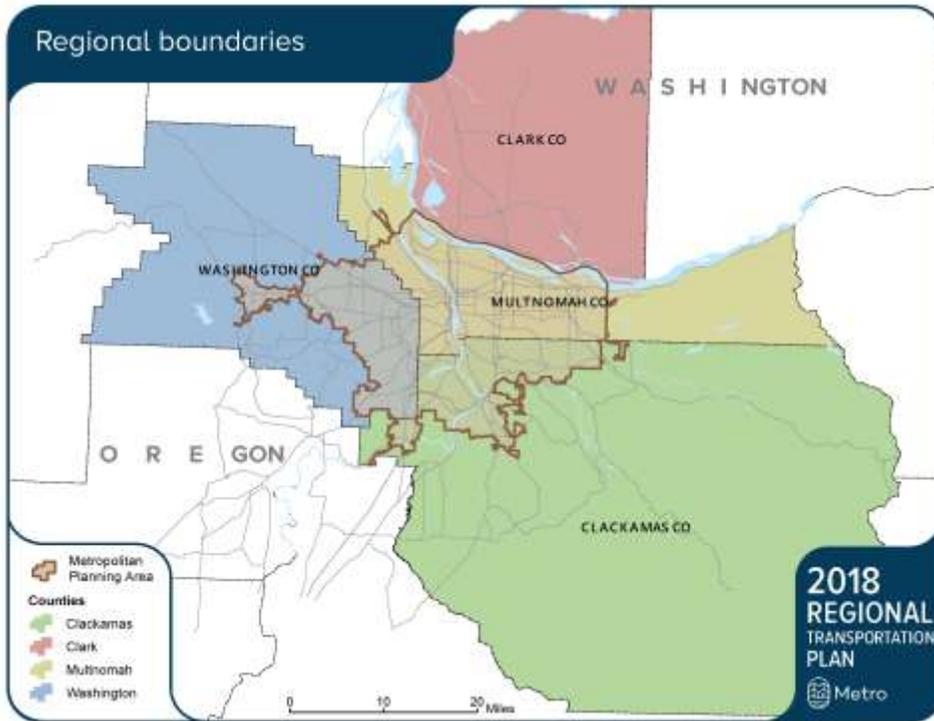
These topic areas were translated into system performance measures, which were guided by the input of a technical work group, comprised of community-based organizations, social justice advocates, public health agencies, and jurisdictional partners. A foundational element of the transportation equity evaluation of the 2018 RTP investment strategy was based on defining equity focus areas, which served as the main geography of comparisons 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-incomes, 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 serves as part of demonstrating the planning of federal investments into 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.

7.3.2 Evaluating system performance for different geographical areas

Metro evaluated the performance of the transportation system for the following geographical areas: 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.

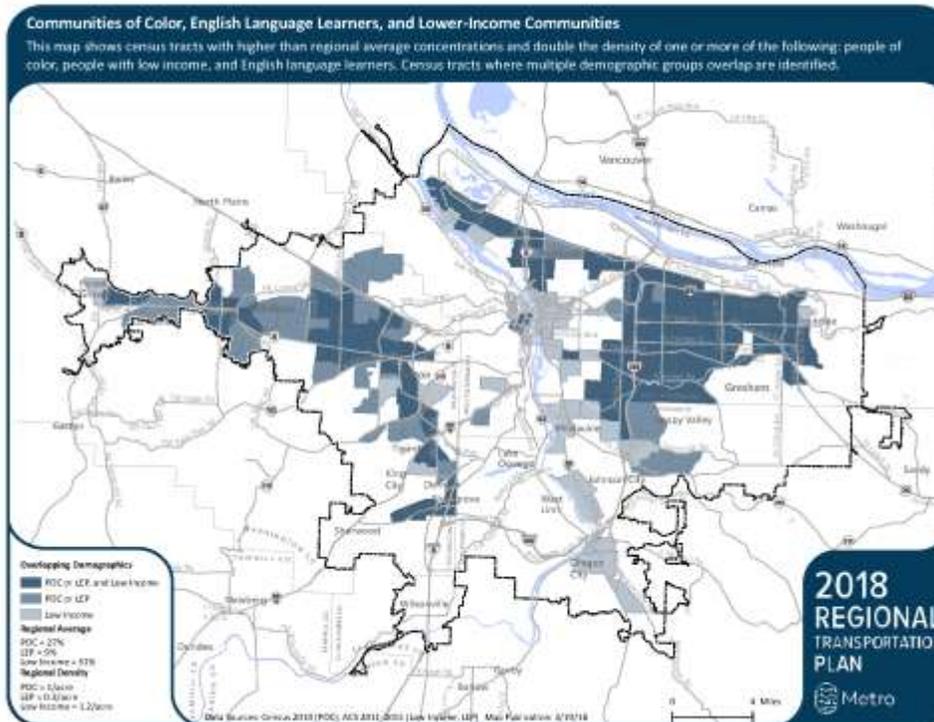


4-County Region

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

Metropolitan Planning Area Boundary (MPA)

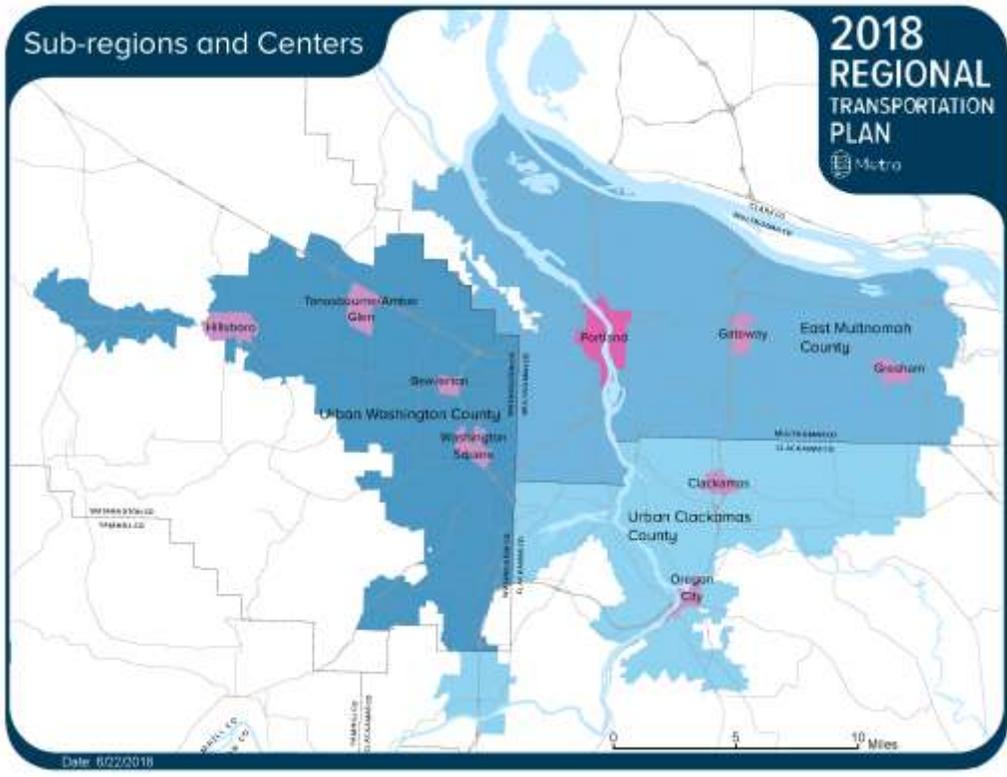
The primary geographic area for the evaluation. Refer to Chapter 1 for a map and definition of the MPA boundary, often referred to as “the greater Portland region.”



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

Equity Focus Areas

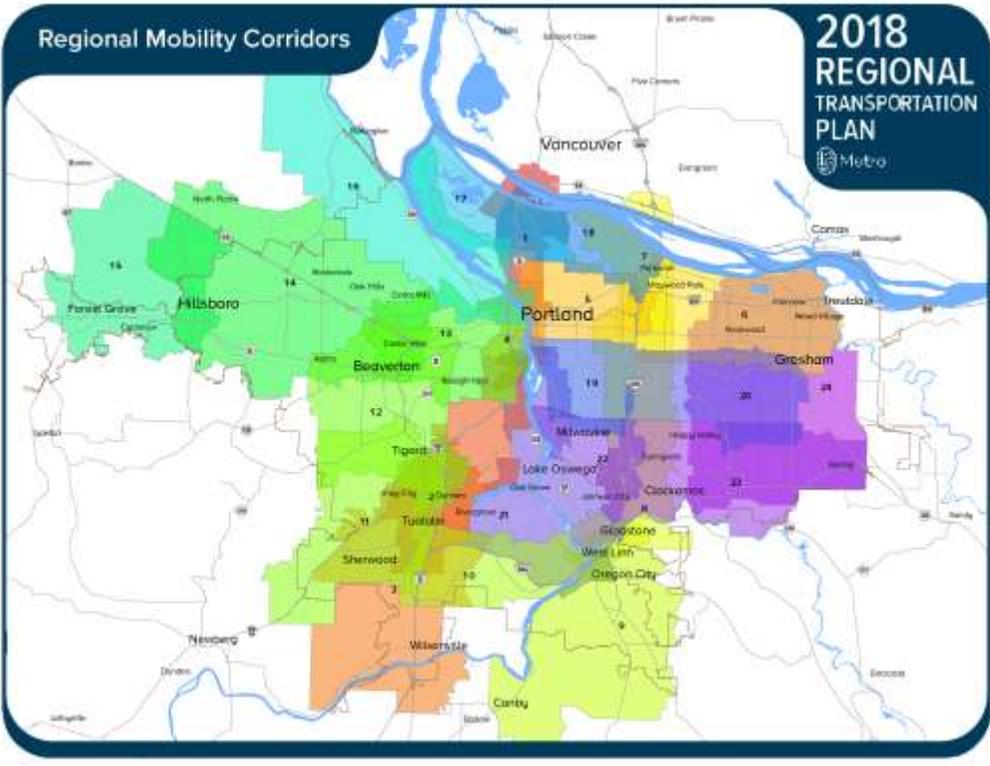
For evaluation measures that included an equity impact analysis the evaluation compares non-equity populations to equity populations. Refer to the Equity Focus Areas maps in Chapter 4.



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

Sub-Regions and Centers

Some evaluation measures include findings for three sub-regions: Portland, Urban Clackamas County, East Multnomah County and Urban Washington County, and for the 2040 Centers.



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

Mobility Corridors

Some evaluation measures include findings by Mobility Corridor.

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 is 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.
- **2035 Climate Smart Strategy** – For purposes of comparison the Climate Smart Strategy is included when data is available. This strategies reflects 2014 RTP constrained projects and programs plus additional transit service and system and demand management investments. This strategy uses projected 2035 population and employment numbers assumed in the 2014 Regional Transportation Plan.

7.3.4 How to read the system evaluation measures

Each system evaluation measure provides the same set of information. **Table 7.X** provides a quick guide on the type of information that is provided for each evolution measure.

Title of Evaluation Measure

Data source: This identifies where the data comes from. 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.

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

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

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 following system evaluation measures.

System Evaluation Measures

Affordability –The RTP does not currently have forecast affordability. Evaluation measure(s) and tools will be developed and tested in the next update of the RTP if available.

Safety - The RTP does not currently have forecast crashes. Evaluation measure(s) and tools will be developed and tested in the next update of the RTP if available.

1. **Multimodal travel**
2. **Active transportation and transit 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. **Climate change**
13. **Clean air**
14. **Potential habitat impact**
15. **Potential historic and cultural resources and tribal lands impact**

7.4.1 Multimodal travel

Data source: Metro travel forecast model

Description: System-wide # of miles traveled (total and share of overall travel) within the Metropolitan Planning Area Boundary (MPA)

- 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% 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 over 5 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 travel 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 7.3 Vehicle miles traveled per person each day

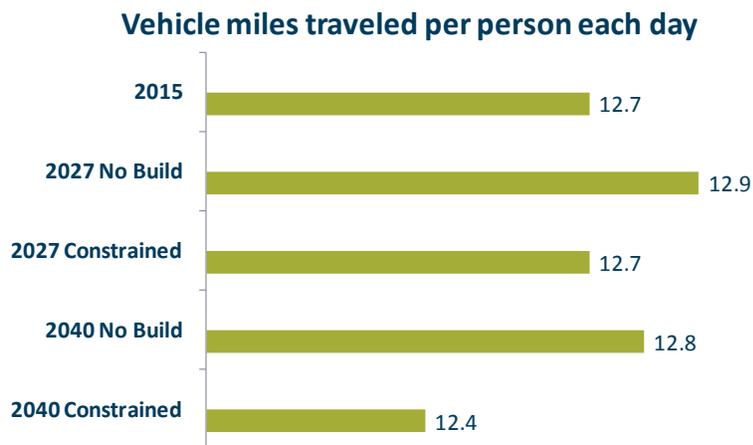


Table 7.4 Daily person miles traveled per person

Person Miles Traveled	2015 Base Year	2027 No Build	2027 Constrained	2040 No Build	2040 Constrained	Climate Smart Strategy
Total	30,403,023	36,272,364	36,639,935	41,359,645	30,403,023	N/A
Per Person	18.9	19.0	19.2	19.0	19.3	

Table 7.5 Daily vehicle miles traveled per person

Vehicle Miles Traveled	2015 Base Year	2027 No Build	2027 Constrained	2040 No Build	2040 Constrained	Climate Smart Strategy
Total VMT	20,798,618	24,534,300	24,128,244	27,879,927	27,080,813	N/A
Per person	12.7	12.9	12.7	12.8	12.4	
Per employee	23	23	23	23	22	

Table 7.6 Daily transit miles traveled per person

Transit Miles Traveled	2015 Base Year	2027 No Build	2027 Constrained	2040 No Build	2040 Constrained	Climate Smart Strategy
Total	1,814,208	2,537,005	3,212,334	3,033,836	4,449,821	N/A
Per person	1.1	1.3	1.7	1.4	2.0	
Per employee	2.0	2.4	3.0	2.4	3.6	

Table 7.7 Daily bicycle miles traveled per person

Bicycle Miles Traveled	2015 Base Year	2027 No Build	2027 Constrained	2040 No Build	2040 Constrained	Climate Smart Strategy
Total	750,707	970,434	997,531	1,198,724	1,231,182	N/A
Per person	0.5	0.5	0.5	0.6	0.6	
Per employee	0.8	0.9	0.9	1.0	1.0	

Table 7.8 Daily pedestrian miles traveled per person

Pedestrian Miles Traveled	2015 Base Year	2027 No Build	2027 Constrained	2040 No Build	2040 Constrained	Climate Smart Strategy
Total	262,288	311,833	317,059	362,741	371,304	N/A
Per person	0.2	0.2	0.2	0.2	0.2	
Per employee	0.3	0.3	0.3	0.3	0.3	

Table 7.9 Daily freight truck miles traveled

Freight Miles Traveled	2015 Base Year	2027 No Build	2027 Constrained	2040 No Build	2040 Constrained	Climate Smart Strategy
Total	361,770	501,027	500,799	651,897	651,127	N/A

7.4.2 Active transportation and transit mode share

Data source: Metro travel forecast model

Description: Evaluates percent of non-driving trips (daily walking, bicycling, and transit trips) at multiple levels (system wide, sub region, mobility corridor, central city and al centers). The data is categorized by 'trips within' and 'all trips'. 'Trips within' encompasses

all trips that occur within the center or subarea. ‘All trips’ encompasses trips to, from and within the center, sub region or corridor.

Target or desired direction: Increase non-driving 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 sub regions, centers, and mobility corridors.

Equity findings: Not included in transportation equity analysis

System wide (within MPA boundary)

Plan does not meet target of tripling walking, biking and transit region wide (within the MPA) between 2015 and 2040.

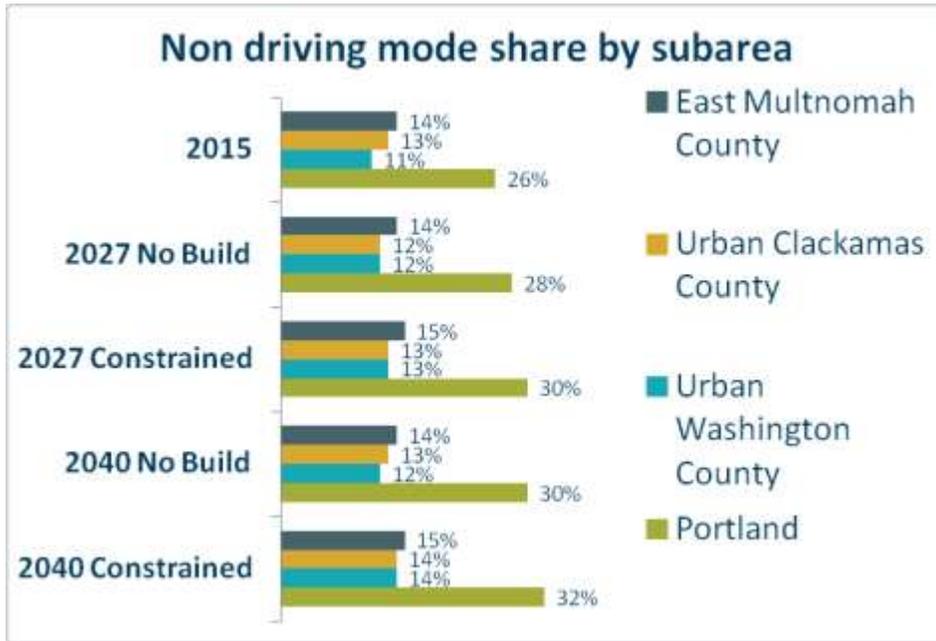
Table 7.10 Active transportation mode share within the MPA

Active transportation mode share	2015 Base Year	2027 No Build	2027 Constrained	2040 No Build	2040 Constrained	Climate Smart Strategy
Walk	7.4%	7.4%	7.6%	7.5%	7.7%	N/A
Bike	3.7%	3.9%	4.0%	4.1%	4.1%	
Transit	4.2%	4.9%	6.1%	5.2%	7.3%	

Sub-regions

As the figure below shows, there are relatively large increase from 2015 to 2040 Constrained for travel within the City of Portland (from 26 percent to 32 percent) and urban Washington County (11 percent to 14 percent), with more moderate increases within other sub regions. However, non-driving modes do not triple.

Figure 7.4 Non driving mode share by sub-region



Centers

Centers across the region display relatively large increases in non-driving mode share (transit, biking and walking) between 2015 and 2040. Note - “All trips” includes all travel to, from, or within the center. This measure addresses the Transportation Planning Rule’s requirement to lower drive alone mode share within centers.

Table 7.11 Non driving mode share within regional 2040 centers

Centers Non Driving mode share	2015 Base Year		2027 No Build		2027 Constrained		2040 No Build		2040 Constrained	
	Trips Within	All Trips	Trips Within	All Trips	Trips Within	All Trips	Trips Within	All Trips	Trips Within	All Trips
Portland central city	65%	38%	71%	44%	73%	48%	74%	47%	78%	54%
Amberglen regional center	40%	12%	41%	13%	44%	15%	41%	14%	48%	19%
Beaverton regional center	40%	12%	41%	13%	44%	16%	42%	13%	46%	18%
Clackamas regional center	33%	11%	34%	12%	39%	15%	35%	13%	43%	17%
Gateway regional center	37%	13%	38%	15%	41%	17%	39%	16%	43%	20%

Centers Non Driving mode share	2015 Base Year		2027 No Build		2027 Constrained		2040 No Build		2040 Constrained	
	Trips Within	All Trips	Trips Within	All Trips	Trips Within	All Trips	Trips Within	All Trips	Trips Within	All Trips
Gresham regional center	31%	13%	32%	13%	35%	16%	33%	13%	38%	17%
Hillsboro regional center	47%	18%	49%	19%	52%	22%	49%	19%	55%	24%
Oregon City regional center	25%	7%	26%	7%	28%	8%	28%	7%	30%	10%
Vancouver, WA central business district	43%	15%	48%	18%	50%	18%	50%	19%	53%	22%
Washington Square regional center	29%	9%	31%	10%	35%	12%	32%	10%	39%	14%

Mobility Corridors

Non-driving increases in most mobility corridors across the region. A corridor that shows an especially large increase is Corridor 2 - Portland to Tigard/Tualatin which increases from 15 percent to 21 percent (for trips within corridor) between the 2040 No Build and 2040 Constrained. This is likely due to the major investment in the SW Corridor High-Capacity Transit and associated projects. See Appendix I – Performance Evaluation Summary Tables for results for all mobility corridors.

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. Regional Land Inventory System (RLIS) GIS data of existing (constructed) sidewalks, bikeways, trails, and streets. Regional Transportation Plan GIS data of the planned pedestrian, bicycle, transit and roadway networks.

Description: Evaluates completeness of sidewalks, bikeways, regional trails and roadways.

- Access to transit – Sidewalks, bikeways, regional trails and new streets completed within ½ mile from light rail stops, 1/3 mile from street car stops, and ¼ mile from bus stops; existing and planned stops.

- Sidewalks - miles completed and percent complete on 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 and percent complete on 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 and percent complete on the Regional Bicycle and Pedestrian Networks (refer to maps in Chapter 3), and in equity focus areas.
- New Streets - miles completed and percent complete on the Regional Motor Vehicle Network (refer to map in Chapter 3); within 2040 centers, and in equity focus areas.

Target or desired direction:

- Hundred percent completion of the regional pedestrian and bicycle networks by 2040.
- Completion of new street projects in the 2018 Regional Transportation Plan project list.
- Increase completion of sidewalks, bikeways and trails near transit to increase access.

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

Access to transit

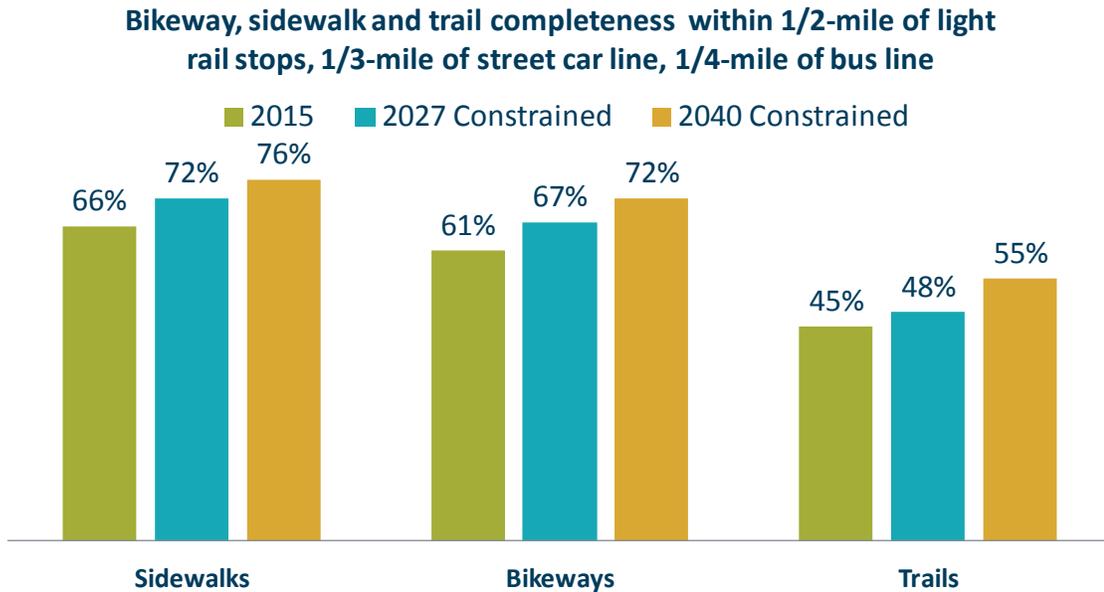
While progress is made in filling gaps in sidewalks, bikeways and trails to access transit, not all gaps are filled. By 2040, 76 percent of sidewalks are completed, 72 percent of all bikeways are completed and 55 percent of regional trails are completed within ½-mile from light rail stops, 1/3-mile from street car stops, and ¼-mile from bus stops.

Greater progress is made in increasing access to transit compared to region-wide. For example, while 76 percent of sidewalks are completed near transit, only 62 percent of sidewalks on arterial roadways are completed. This indicates that policies prioritizing access to transit are working.

Table 7.12 Access to travel options – access to transit

Access to transit	2015 Base Year	2027 No Build	2027 Constrained	2040 No Build	2040 Constrained	Climate Smart Strategy
Percent sidewalks completed within ½ mile from light rail stops, 1/3 mile from street car stops, and ¼ mile from bus stops	66%	66%	72%	66%	76%	Not evaluated
Within equity focus areas	74%	74%	81%	74%	85%	Not evaluated
Percent bikeways completed within ½ mile from light rail stops, 1/3 mile from street car stops, and ¼ mile from bus stops	61%	61%	67%	61%	72%	Not evaluated
Within equity focus areas	64%	64%	71%	64%	76%	Not evaluated
Percent trails completed within ½ mile from light rail stops, 1/3 mile from street car stops, and ¼ mile from bus stops	45%	45%	48%	45%	55%	Not evaluated
Within equity focus areas	44%	44%	49%	44%	55%	Not evaluated

Figure 7. 5 Access to transit



Sidewalk completeness

While progress is made, the target of completing 100 percent of the regional pedestrian sidewalk network is not met. Seventy-one percent of sidewalks on the regional pedestrian network are completed in 2040 in the plan.

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

By 2040, the plan completes 51 percent sidewalks within 2040 centers.

By 2040, the plan completes 62 percent of sidewalks on arterial roadways in the region (481 miles out of 773 miles).

Table 7.13 Access to travel options – sidewalk completeness

Sidewalk completeness	2015 Base Year	2027 No Build	2027 Constrained	2040 No Build	2040 Constrained	Climate Smart Strategy
Miles complete:	477	477	529	477	565	Not evaluated
Percent complete:	60%	60%	66%	66%	71%	
Planned network						
Miles complete:	300	300	330	300	350	Not evaluated
Percent complete:	71%	71%	78%	71%	82%	
Planned network within equity focus areas						
Miles complete:	772	772	797	772	822	Not evaluated
Percent complete:	48%	48%	49%	48%	51%	
Centers						
Miles complete:	578	578	596	578	614	Not evaluated
Percent complete:	55%	55%	56%	55%	58%	
Centers within equity focus areas						
Miles complete:	394	394	445	394	481	Not evaluated
Percent complete:	51%	51%	58%	51%	62%	
Arterial roadways						
Miles complete:	250	250	280	250	296	Not evaluated
Percent complete:	67%	67%	75%	67%	79%	
Arterials within equity focus areas						

Figure 7.6 Percent of sidewalks completed on the planned regional pedestrian network

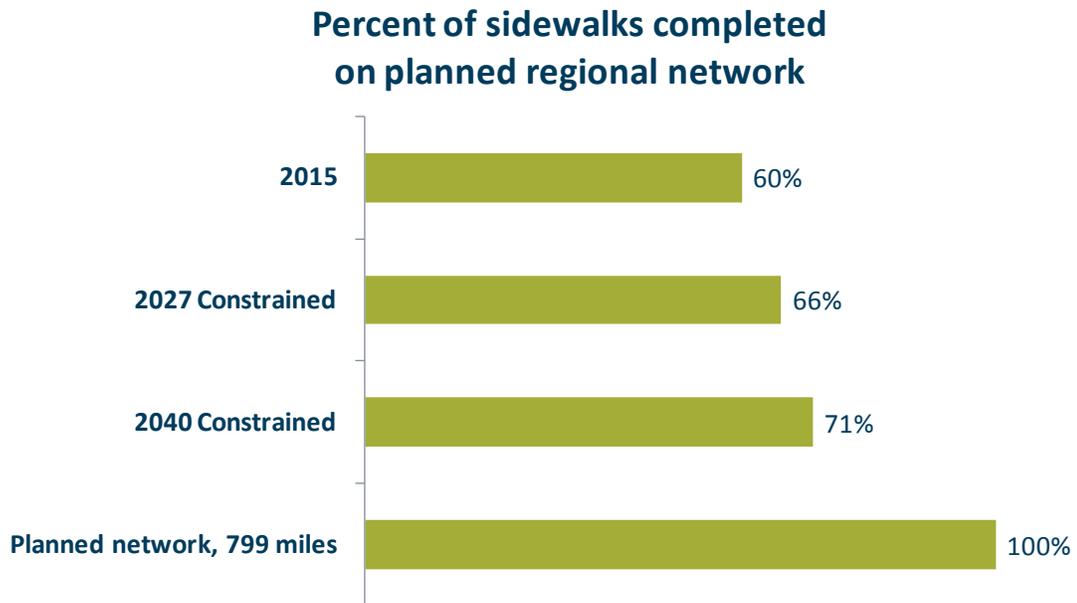
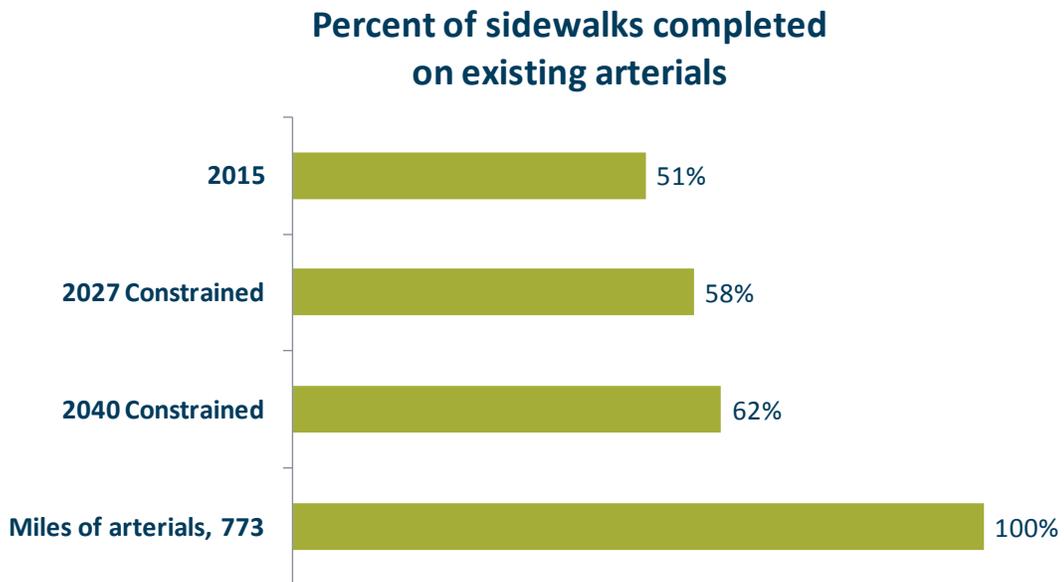


Figure 7.7 Percent of sidewalks completed on existing arterial roadways



Bikeway (on-street) completeness

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 65 percent of the planned regional bikeway network (644 out of 997 miles).

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 completes 30 percent of bikeways within 2040 centers.

By 2040, the plan completes 48 percent of bikeways on arterial roadways in the region.

Table 7.14 Access to travel options – bikeway completeness

Bikeway (on-street) completeness	2015 Base Year	2027 No Build	2027 Constrained	2040 No Build	2040 Constrained	Climate Smart Strategy
Miles complete:	538	538	598	538	644	421
Percent complete:	54%	54%	60%	54%	65%	93%
Planned network						
Miles complete:	295	295	332	295	355	Not evaluated
Percent complete:	60%	60%	68%	60%	78%	evaluated
Planned network within equity focus areas						
Miles complete:	433	433	462	433	487	Not evaluated
Percent complete:	27%	27%	28%	27%	30%	evaluated
Centers						
Miles complete:	320	320	345	320	361	Not evaluated
Percent complete:	30%	30%	33%	30%	34%	evaluated
Centers within equity focus areas						
Miles complete:	280	280	331	280	372	Not evaluated
Percent complete:	36%	36%	43%	36%	48%	evaluated
Arterial roadways						
Miles complete:	164	164	196	164	213	Not evaluated
Percent complete:	44%	44%	52%	44%	57%	evaluated
Arterials within equity focus areas						

Figure 7.8 Percent of bikeways completed on the planned regional bike network

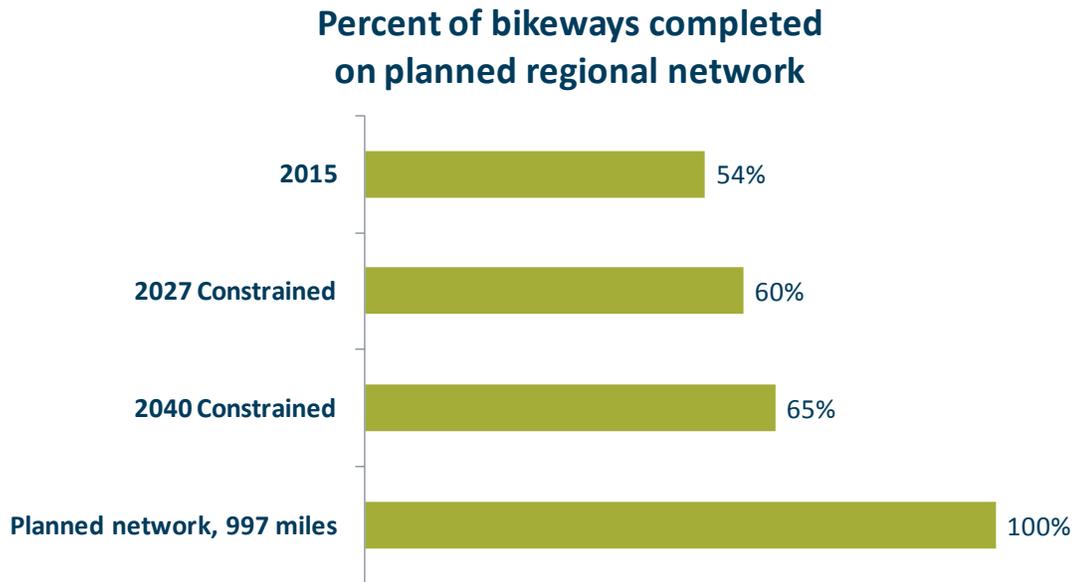
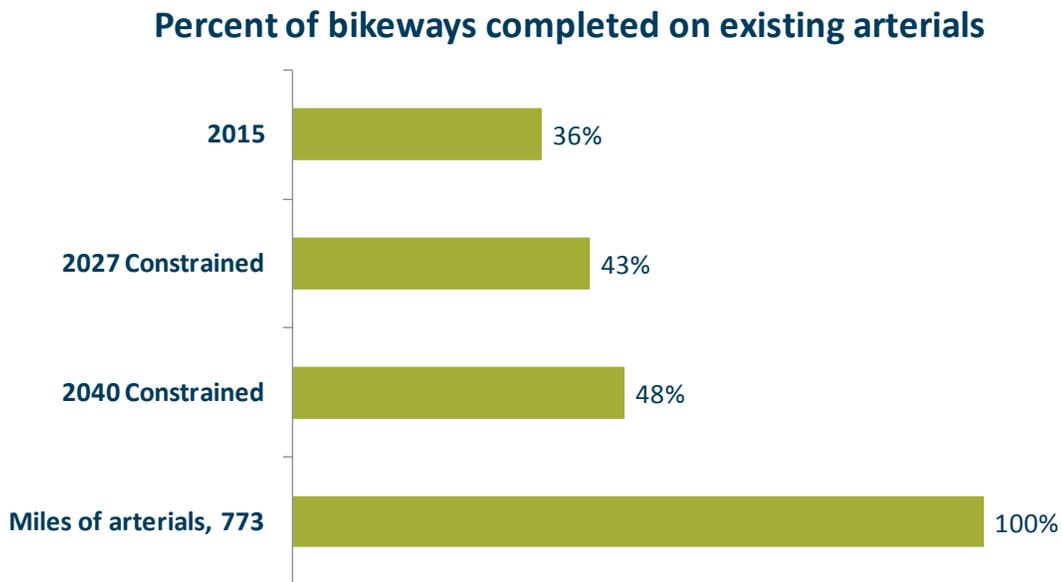


Figure 7.9 Percent of bikeways completed on existing arterial roadways



Trails (regional) completeness

While some progress is made, the target of completing 100 percent of the trail network is not met. By 2040, the plan completes 47 percent of the planned regional trail network that is identified on the regional pedestrian and bicycle networks (241 out of 525 miles).

Table 7.15 Access to travel options – regional trail completeness

Regional trail completeness	2015 Base Year	2027 No Build	2027 Constrained	2040 No Build	2040 Constrained	Climate Smart Strategy
Miles complete	185	185	202	185	241	369
Percent complete:	36%	36%	40%	36%	47%	70%
Planned network						
Within equity focus areas	68 39%	68 39%	77 44%	68 39%	85 49%	Not evaluated

Percent of regional trails completed on planned regional network



New streets completeness

Note: This section and table to be completed in the final RTP once the Motor Vehicle planned system map has been updated.

Table 7.16 Access to travel options – new street completeness

New streets completeness	2015 Base Year	2027 No Build	2027 Constrained	2040 No Build	2040 Constrained	Climate Smart Strategy
Miles complete:						
Percent complete:						
Planned network						
Miles complete:						
Percent complete:						

Centers

Within equity focus areas

Equity findings: Equity focus areas see a higher rate of active transportation (i.e. sidewalk, on-street bikeway, off-street bikeway, and trail completion) compared to the overall completion rate for the region and in non-equity focus areas. In general, completion rates for planned miles of sidewalks, bicycle paths, and trails exceed region and non-equity areas 1 percent - 3 percent. When looking more closely at specific facilities, such as arterials, a slightly greater rate active transportation system completion in equity focus areas is planned compared to the overall regional active transportation network. Arterials see between 12 percent-14 percent increase in miles of sidewalk and on street bicycle completion, which is slightly greater than the region overall at 12 percent-13 percent as well as near transit and in 2040 centers. 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 in 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. In general, 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). Then when looking at completion rate of the on-street bicycle network in equity focus areas by 2040, the increase is 12 percent, and the first 8 percent of that growth in miles of completed on-street bicycle network is slated between 2018-2027. The remaining 4 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. Jurisdictional partners responded to leadership 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 a steady rate (6 percent) of completion is observed in the first 10-years and the out part (2028-2040) of the plan.

Nonetheless, the active transportation network does not see 100 percent completion in any category. Sidewalk completion, with the highest rate of completion, tops out at 83 percent in communities of color and communities with limited English proficiency region wide. When looking further, sidewalk completion in proximity to transit stops (e.g. bus, streetcar, or light rail) see 86 percent (with the 2040 financially constrained investment strategy) through 87 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 – 12.4 percent of the overall 2018 RTP investment strategy. While falling short of the region’s target to complete the active transportation network, 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 7.10 Percent sidewalks completed on planned network in equity focus areas

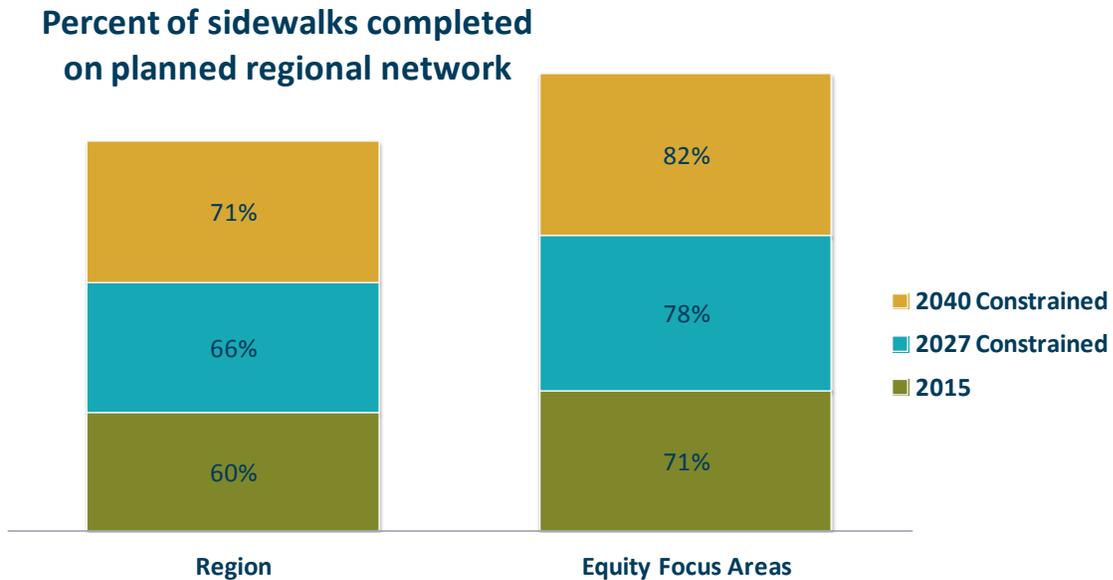
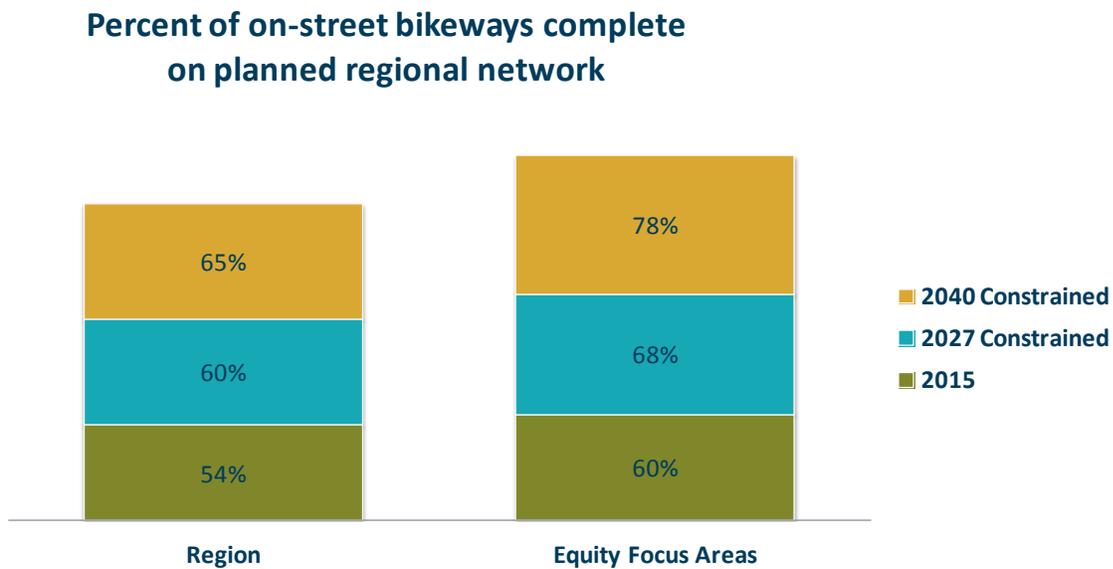


Figure 7.11 Percent bikeways completed on planned network in equity focus areas



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 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.

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 and the region by 2040.

Per recommendation by the transportation equity work group, 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 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 49percent 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 10percent of the region's 1 million projected jobs by either transit, during the 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 .8percent (biking) to 1.6percent (driving) increased job access in the typical 30 minute commute time. This illustrates 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 see increases in the number of jobs accessible, the additional investment slated for 2028 through 2040 in the full 2040 Constrained investment strategy only 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 or 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 and as a result creating further out of direction travel or longer than 30 minute bicycle commute trips. In general the average household will see a range 70 more jobs by walking to over 40,000 more jobs by transit, accessible due to the long-range investment strategy. Similar to the first 10 years, transit will see the greatest increase in the number of jobs accessible within a 45 minute transit commute at upwards of 42 percent more jobs.

Table 7.17 Change in the Number of Jobs Accessible Within a Typical Commute Time (adjusted by form of travel) in the 2027 Constrained Investment Strategy

Change in Total Number of Jobs Accessible in 2027 Constrained compared to 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 Number of Jobs Accessible in 2040 Constrained compared to 2040 No Build						
	Auto Rush Hour	Auto Non Rush Hour	Transit Rush Hour	Transit Non Rush Hour	Bike	Walk
All Jobs	36,268	37,062	40,694	40,185	-509	70
Low Wage Jobs	17,118	17,512	18,671	18,452	-255	32
Middle Wage Jobs	10,017	10,223	10,929	10,829	-131	20
High Wage Jobs	9,165	9,362	10,065	9,960	-122	18

Table 7.18 Change in the Number of Jobs Accessible, by Wage Profile, Within a Typical Commute Time for Different Communities (adjusted by form of travel)

Change in Total Number of Jobs Accessible in 2027 Constrained compared to 2027						
No Build						
All Jobs						
	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
Non-Equity Focus Areas	7,906	4,343	8,138	7,486	667	13
Middle Wage Jobs						
	Auto Rush Hour	Auto Non Rush Hour	Transit Rush Hour	Transit Non Rush Hour	Bike	Walk
Region	4,168	2,318	5,883	5,322	258	5
Equity Focus Areas	3,621	2,067	6,622	5,919	103	3
Non-Equity Focus Areas	4,596	2,488	4,711	4,341	417	6

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 in a 45 minute transit trip due to the investment strategy with 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 see the number of

middle and low wage jobs accessible in a 45-minute transit commute increase 42 percent by 2040.

The positive take away from the 2018 RTP investment strategy is there is an increase in the number of jobs accessible to the average household in the equity focus areas within a typical 45-minute transit commute trip. This patterns hold true regardless of the time of day (e.g. rush hour travel, where typically more transit service is out on the streets, or non-rush hour travel which is any other time of day). Additionally, what is also seen is with the 2018 RTP investment through 2027, an increase of 21,000 more jobs are accessible in a 45-minute transit commute for the average household in an equity focus area. But by 2040, the additional 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 transit commute 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. The result shows the region is focusing transit investments in equity focus areas to support the travel needs of historically marginalized communities.

Nonetheless, in some cases, the average household in the region and the average household in non-equity focus areas see 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 2018 RTP 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 due to the first ten years of investment. 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 with investment through 2027 and with the investments through 2040 identified in the 2018 RTP.

There are some potential different reasons for why the average household in the region and in non-equity focus areas see a greater increase in the number of jobs accessible within a typical driving, biking, or walking commute, regardless of wage profile of job type. For driving, the issue of traffic congestion may be impacting why equity focus areas may see a lesser increase in the number of jobs accessible within a 30-minute driving commute. Another factor may also be the changing land use mix of the region where the typical commute distance to work is getting longer and therefore resulting in longer travel time. For walking and bicycling, it is possible as more transportation investments build out the active transportation network, specifically in equity focus areas, more active transportation route options become available which are more attractive for riding. From the results of Access to Travel Options performance measure, 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. The result is more time spent in active travel, which 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 it is disappointing to see equity focus areas seeing lesser increases of number of jobs accessible by driving, bicycling, and walking compared to the region overall and non-equity focus areas, one consideration to take into account is that 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, which is 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 and the average household in the region can reach a little over 86,000 jobs by transit in the same 45-minute window. This means the region has already been focusing on placing transportation investments in equity focus areas and only trying to further gain more efficiency.

The mixed results demonstrate that more investigation is necessary to understand how to improve and increase the number of jobs accessible in a reasonable commute for the average household in equity focus areas across all forms of travel. While the 2018 RTP investment strategy has determined the successful approach for transit and placing transit service, it is necessary to dig in and understand how to increase the number of jobs accessible by bicycling and walking in particular. This is because 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. But more analysis is necessary to understand the results further and determine the appropriate set of strategies to make improvements. Additionally, the mixed results indicate further investigation is necessary to determine 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.

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 slated for after 2028, 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 Attachment of 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 7.19 Change in the Number of Community Places Accessible Within a Typical Commute Time for Different Communities (commute time adjusted by form of travel)

Change in Total Number of Community Places Accessible in 2027 Constrained Compared to 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 Total Number of Community Places Accessible in 2040 Constrained Compared to 2040 No Build						
All Community 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

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 further increases to 165 more reached with the 2018 RTP investments slated for the 2040 Constrained investment strategy. Whereas, 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 an 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 to open as a result of population and employment growth creating new demand for places like 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 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 and 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 ¼-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 4 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 ¼ 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.

Table 7.20 Number of households with access to regional bicycle parkways

Regional bicycle parkways	2015 Base Year	2027 No Build	2027 Constrained	2040 No Build	2040 Constrained	Climate Smart Strategy
# of HH	477,937	573,569	602,046	655,960	706,232	712,351
% of HH	75%	74%	78%	73%	79%	79%

In the 2015 base year 86 percent of households in the planning area are within ¼-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 that the percent decreases in the future is that the RTP project list does not include many projects to complete pedestrian parkways in some of the newer growth areas on the edges of the region. As many of the pedestrian parkways are frequent-service transit routes, this reflects the difficulty of providing access to high-quality transit in these areas.

Table 7.21 Number of households with access to regional pedestrian parkways

Regional pedestrian parkways	2015 Base Year	2027 No Build	2027 Constrained	2040 No Build	2040 Constrained	Climate Smart Strategy
# of HH	543,926	648,066	653,831	738,896	762,485	765,136
% of HH	86%	83%	84%	82%	85%	85%

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 ½-mile 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 ½ mile 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:

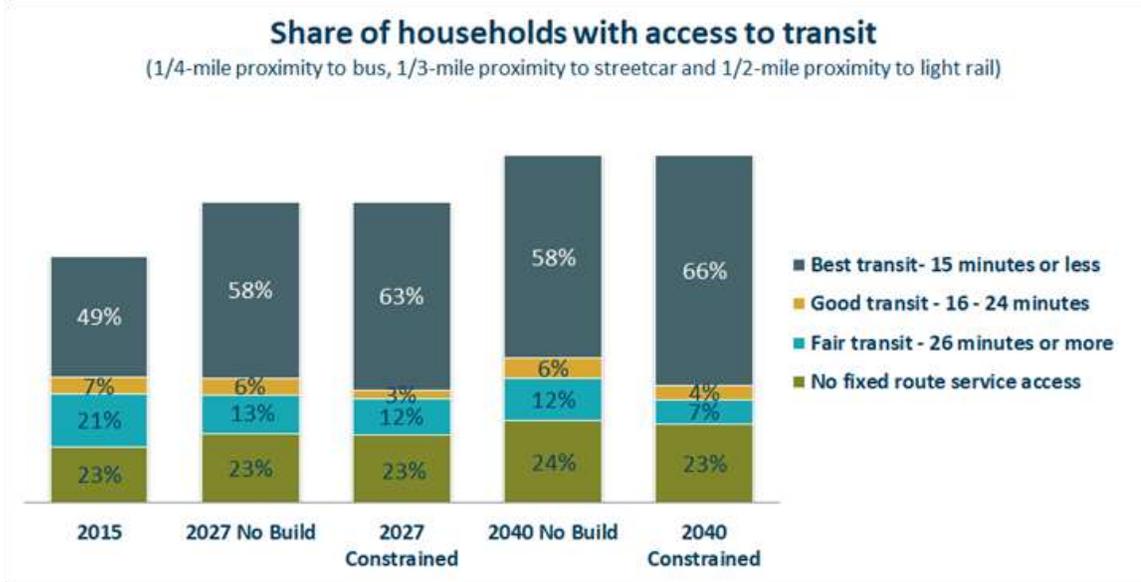
- 37 percent of households are within ¼-mile of all day frequent service
- 49 percent of low-income households are within ¼-mile of all day frequent service
- 52 percent of employment is within ¼-mile of all day frequent service:

Findings: Determining the ease, comfortableness, 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 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 access for historically marginalized communities and communities of color are expected to outperform the region as a whole, something that puts the region one step closer to establishing a more equitable transit system.

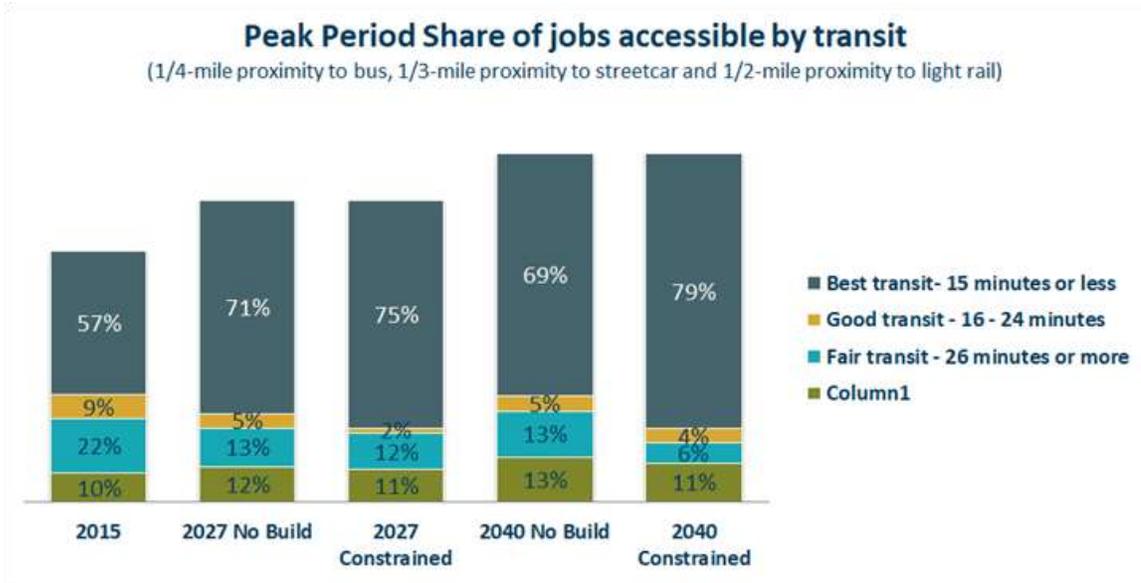
Proximity to stations: There is no motivation to use transit if it's geographically inaccessible, and even if it's geographically accessible there's no point in using it if it doesn't take you where you want to go. Good transit planning considers these concepts of access concurrently. The good news is that the future looks bright for both qualifiers of access. As the graph below highlights we can expect more than 3/4th 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. Figure 12 and 13 shows the percentages of households and jobs with access and frequencies to transit. Figures 14 through 17 present the access and frequencies for jobs, households, low-income households and low-income households in communities of color for various timeframes analyzed.

Figure 7.12 Share of households with access to transit



More than three-quarters of the households in the region are expected to be near higher frequency transit. The number of households with 15-minute 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 7.13 Share of jobs with access to transit

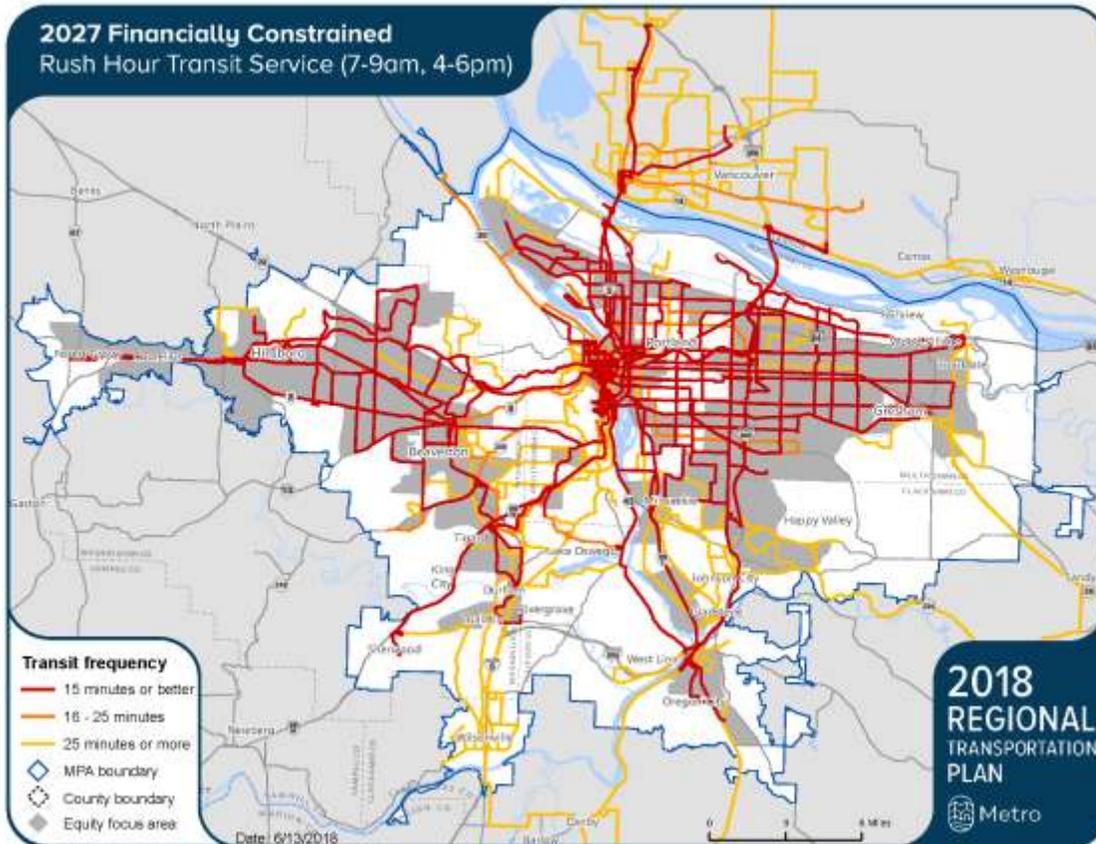


Approximately 90 percent of the jobs in the region are located near transit. As shown in the figure above, the number of jobs accessible by 15-minute or better transit service increases significantly between today and the 2040 financially constrained investment

strategies. The increase in transit service and frequencies means that more people are able to access job opportunities.

The following figures show transit service by Investment Strategy.

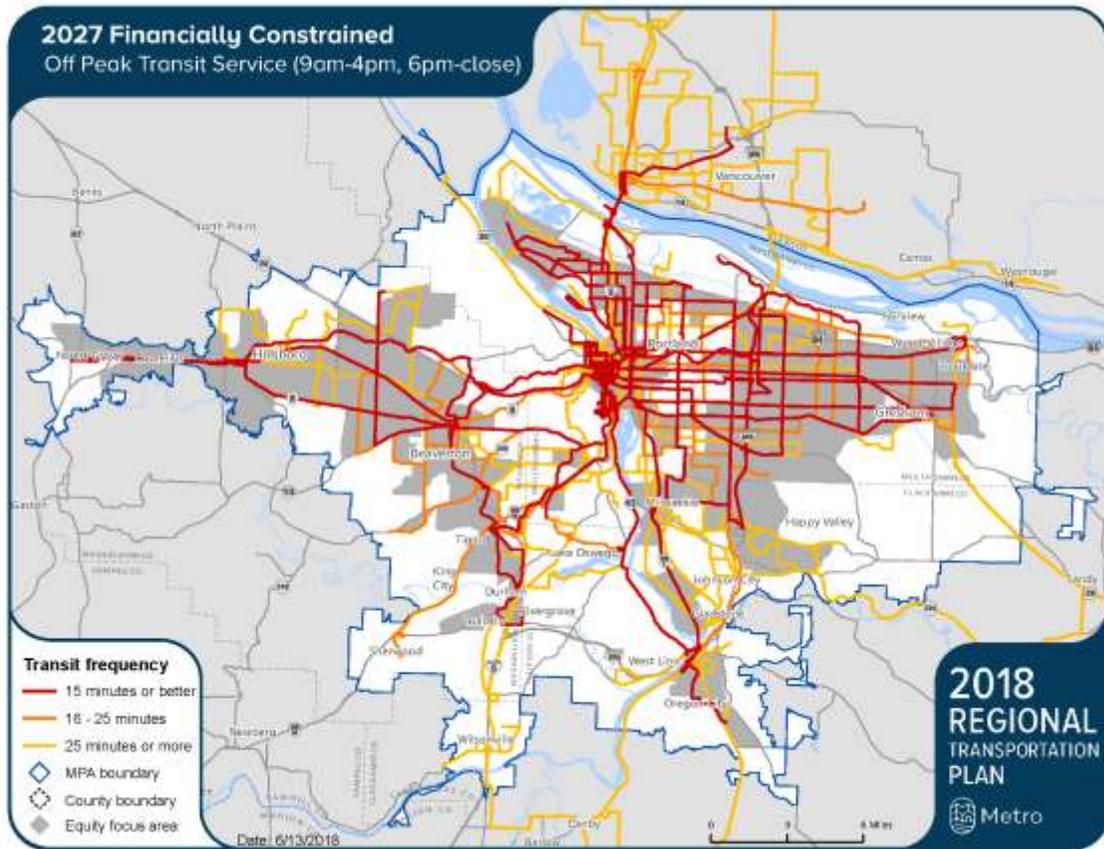
Figure 7.14 2027 Constrained Rush Hour Transit Service



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

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

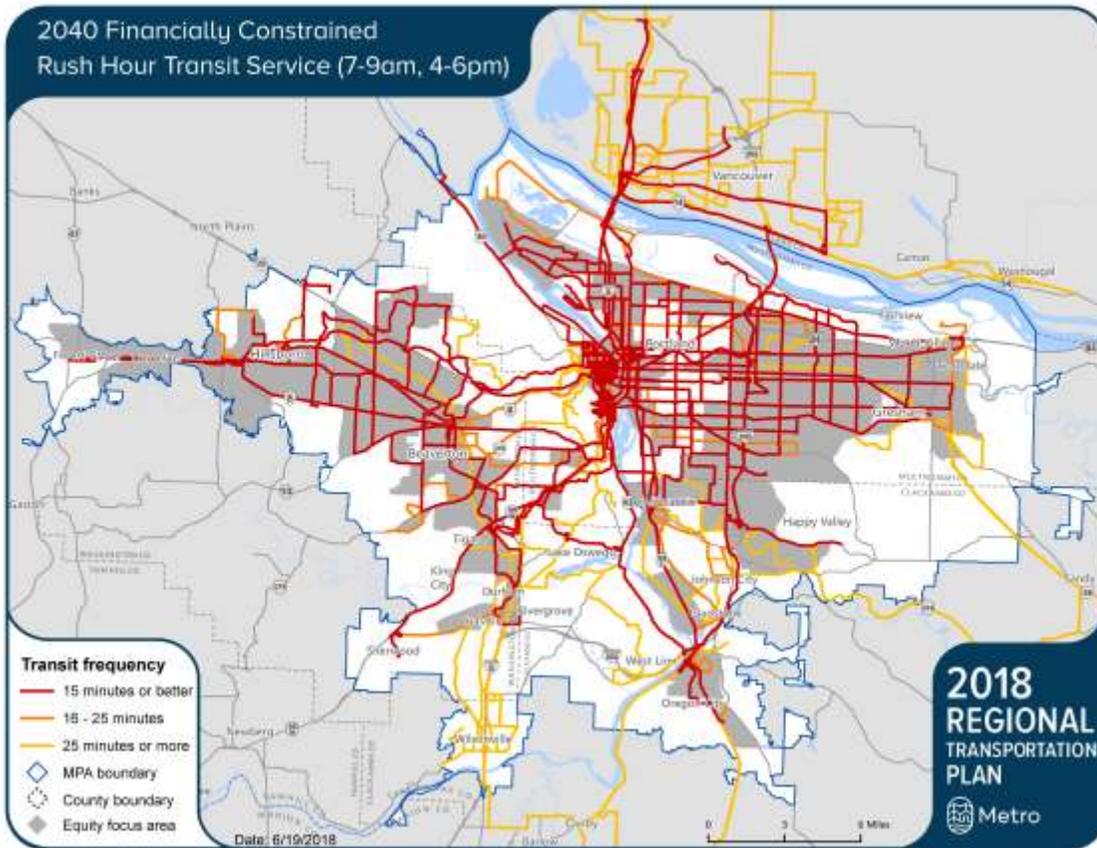
Figure 7.15 2027 Constrained Off-peak Transit Service



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

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

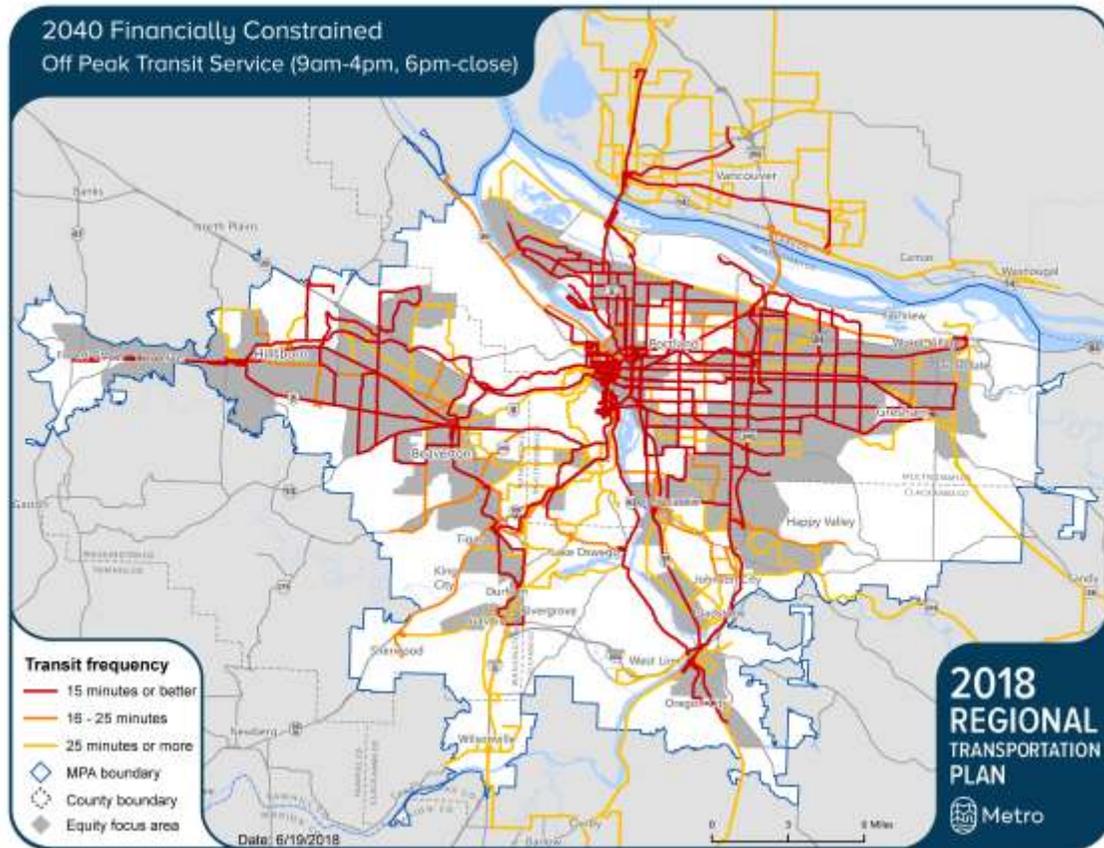
Figure 7.16 2040 Constrained Rush Hour Transit Service



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

- 79% of jobs
- 66% of households
- 75% of low-income households
- 85% of low-income households in the equity focus areas

Figure 7.17 2040 Constrained Off-Peak Transit Service Access



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

- 72% of jobs
- 58% of households
- 69% of low-income households
- 79% 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. 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.

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 maintaining of travel times in from 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 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 an 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 an 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 an 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 an 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 an 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 reduction in truck travel time for the 2040 Financially Constrained (FC) and 2040 Strategic (S) compared to the 2040 No Build:

- CEID to Vancouver CBD: 12-1 PM = 20-21% less; 2-3 PM = 18-19% less
- CEID to Vancouver CBD: 5-6 PM = 23-24% less
- I-5 @Morrison Bridge to Tualatin Industrial: 12-1 PM = 7% less; 2-3 PM = 2-3% less
- I-5 @Morrison Bridge to Tualatin Industrial: 5-6 PM = 2% less
- I-84/I-205 to Fed Ex Troutdale: 12-1 PM & 2-3PM = stay the same
- I-84/I-205 to Fed Ex Troutdale: 5-6 PM = stay the same
- I-5 @Morrison Br. to Hillsboro Industrial: 12-1 PM = 3% less; 2-3 PM = stay the same
- I-5 @Morrison Br. to Hillsboro Industrial: 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 18 – 24 percent over the 2040 No Build strategies. However, for the other 3 major freeway corridors in the region (I-5 south, I-84 east of I-205 and US 26 west of Hillsboro) the truck travel times stay virtually the same or have only a slight reduction (3-7 percent) during off-peak travel times.

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 Oswego 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

National Highway System Travel Reliability

Data source: TBD

Description: Measures the change in reliable person-miles traveled on the Interstate System and on the non-Interstate National Highway System

Target or desired direction: By 2040, increase the TBD% of reliable person-miles traveled on the Interstate System and on the non-Interstate National Highway System.

Findings: This measure is under development and will be reported as the RTP is finalized.

Vehicle Hours of Delay Per Person

Data source: Metro travel forecast model

Description: Measures the change in vehicle hours of delay (VHD) per person within congested throughway corridors in the region compared to the 2040 No Build.

Target or desired direction: By 2040, reduce vehicle hours of delay per person by 10%, within the metropolitan planning area (MPA).

Findings: This measure is under development and will be reported as the RTP is finalized.

Interim Regional Mobility Policy

Locations of throughways, arterials, and regional freight network facilities 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 and two hour pm peak. 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 occurs as a result of the congested link. Refer to Chapter 3 for interim regional mobility policy thresholds for congestion.

Target or desired direction: No Target. Desired direction is to reduce total miles of throughways and arterials that exceed 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 are congested, compared to the 2015 Base year.

Total congested miles ($v/c = 0.9$ to <1.0) in the 2040 No Build strategies are 50 miles greater during the mid day one hour and 71 miles greater during the two hour peak than they are in the 2015 Base. Total severely congested miles ($v/c \geq 1.0$) in the 2040 No Build strategies are 14 miles greater during the mid-day one hour and 76 miles greater during the two hour peak than they are in the 2015 Base. In 2040, total congested miles in the region are reduced by 41 percent in the mid day one hour in the 2040 Constrained compared to the 2040 No Build. Total severely congested miles in the region are reduced by 26 percent in the mid day one hour in the 2040 Constrained compared to the 2040 No Build.

The following tables show the number of miles of throughways and arterials that are congested or severely based on the volume/capacity ratio. Though congested, many of these miles meet the interim regional mobility policy. For example, in the 2040 Constrained investment strategy there are 53 throughway miles that are congested in the 4-6 PM time period, but only 33.7 of those miles do not meet the interim regional mobility policy at some point during the 4-6 PM commute time period. For all three 2040 investment strategies (2027 Constrained and 2040 Constrained and 2040 Strategic) there is an increase in the number of throughway and arterial network miles that do not meet the mobility policy, compared to the 2015 Base year.

Table 7.22 Congested Throughway Network Miles

	2015 Base Year		2027 No Build		2027 Constrained		2040 No Build		2040 Constrained	
	Mid Day (12-1)	PM Peak (4-6)								
Total Congested Throughway Miles ($v/c =$ 0.9 to <1.0)	8	30	12	44	12	41	34	50	17	53
Total Severely Congested Throughway Miles ($v/c \geq$ 1.0)	2	15	5	25	5	19	9	31	6	23

Table 7.23 Congested Arterial Network Miles

	2015		2027		2027		2040		2040	
	Base Year		No Build		Constrained		No Build		Constrained	
	Mid Day (12-1)	PM Peak (4-6)								
Total Congested Arterial Miles (.v/c= 0.9 to <1.0)	4	30	10	56	10	47	27	82	18	74
Total Severely Congested Arterial Miles (v/c >= 1.0)	3	16	5	38	5	34	10	60	8	50

The following tables identify number 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. In the tables below “Both hours 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 or 5-6 PM hours are not included in the miles of segments in the “Both hours 4-6 PM hours.”

Table 7.24 Throughway Network Miles Not Meeting Regional Mobility Policy

Travel period	2015	2027	2027	2040	2040
	Base Year	No Build	Constrained	No Build	Constrained
12 -1 PM	2.2	10.1	8.2	30.7	15.4
Both Hours 4-6 PM	4.7	21.0	12.9	27.6	17.7
One hour 4-5 PM*	9.7	13.0	13.6	14.1	13.0
One Hour 5-6 PM*	5.1	3.5	1.1	1.7	3.0
Total miles 4-6 PM	19.6	37.4	27.6	43.5	33.7

**Not included in “Both Hours 4-6 PM” network miles*

Table 7.25 Arterial Network Miles Not Meeting Regional Mobility Policy

Travel period	2015 Base Year	2027 No Build	2027 Constrained	2040 No Build	2040 Constrained
12 -1 PM	5.8	11.2	12.1	28.9	19.1
Both Hours 4-6 PM	14.4	34.0	29.1	58.9	46.0
One hour 4-5 PM*	2.4	4.0	4.0	4.1	5.1
One Hour 5-6 PM*	2.8	7.3	5.9	6.6	7.1
Total miles 4-6 PM	19.6	45.3	39.0	69.6	58.1

**Not included in "Both Hours 4-6 PM" network miles*

Table 7.26 Percent Throughway Network Miles Not Meeting Regional Mobility Policy

Travel period	2015 Base Year	2027 No Build	2027 Constrained	2040 No Build	2040 Constrained
12 -1 PM	1.46%	2.82%	3.04%	7.25%	4.73%
Both Hours 4-6 PM	3.61%	8.53%	7.32%	14.76%	11.36%
One hour 4-5 PM*	0.61%	1.00%	1.00%	1.04%	1.26%
One Hour 5-6 PM*	0.71%	1.83%	1.48%	1.64%	1.74%
Total miles 4-6 PM	4.93%	11.36%	9.80%	17.44%	14.36%

**Not included in "Both Hours 4-6 PM" network miles*

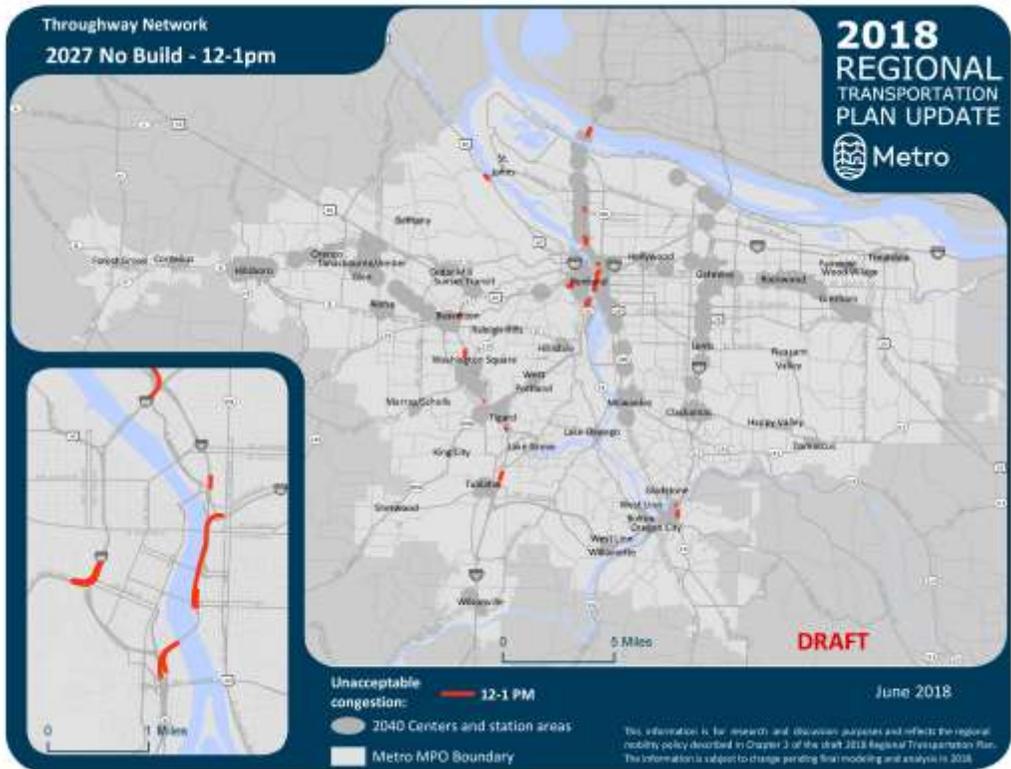
Table 7.27 Percent Arterial Network Miles Not Meeting Regional Mobility Policy

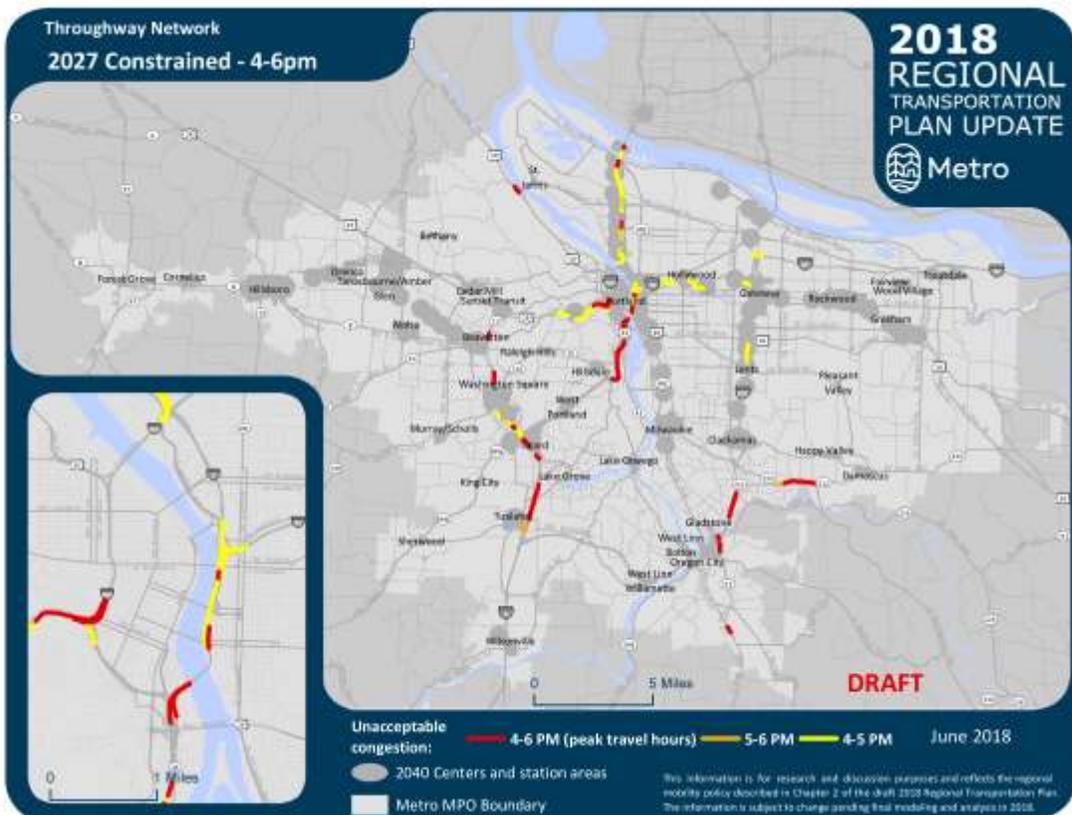
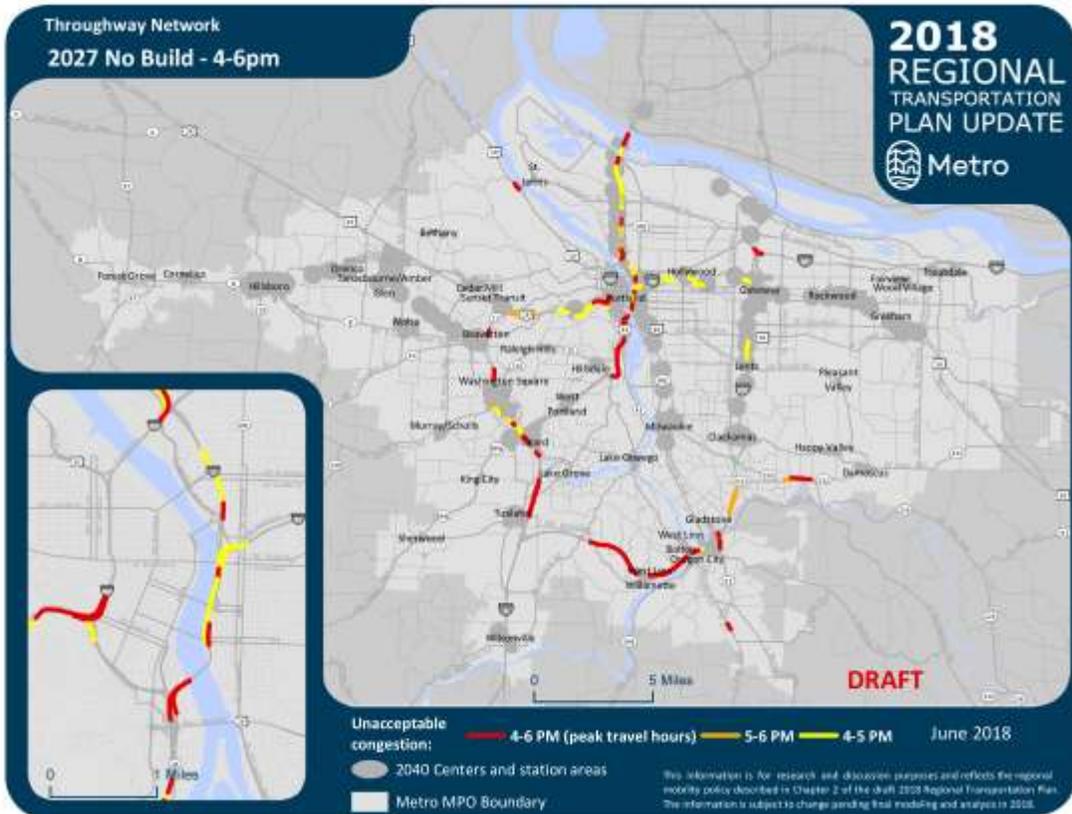
Travel period	2015 Base Year	2027 No Build	2027 Constrained	2040 No Build	2040 Constrained
12 -1 PM	0.06%	0.26%	0.21%	0.80%	0.39%
Both Hours 4-6 PM	0.12%	0.54%	0.33%	0.71%	0.45%
One hour 4-5 PM*	0.25%	0.34%	0.35%	0.37%	0.33%
One Hour 5-6 PM*	0.13%	0.09%	0.03%	0.05%	0.08%
Total miles 4-6 PM	0.51%	0.97%	0.71%	1.13%	0.86%

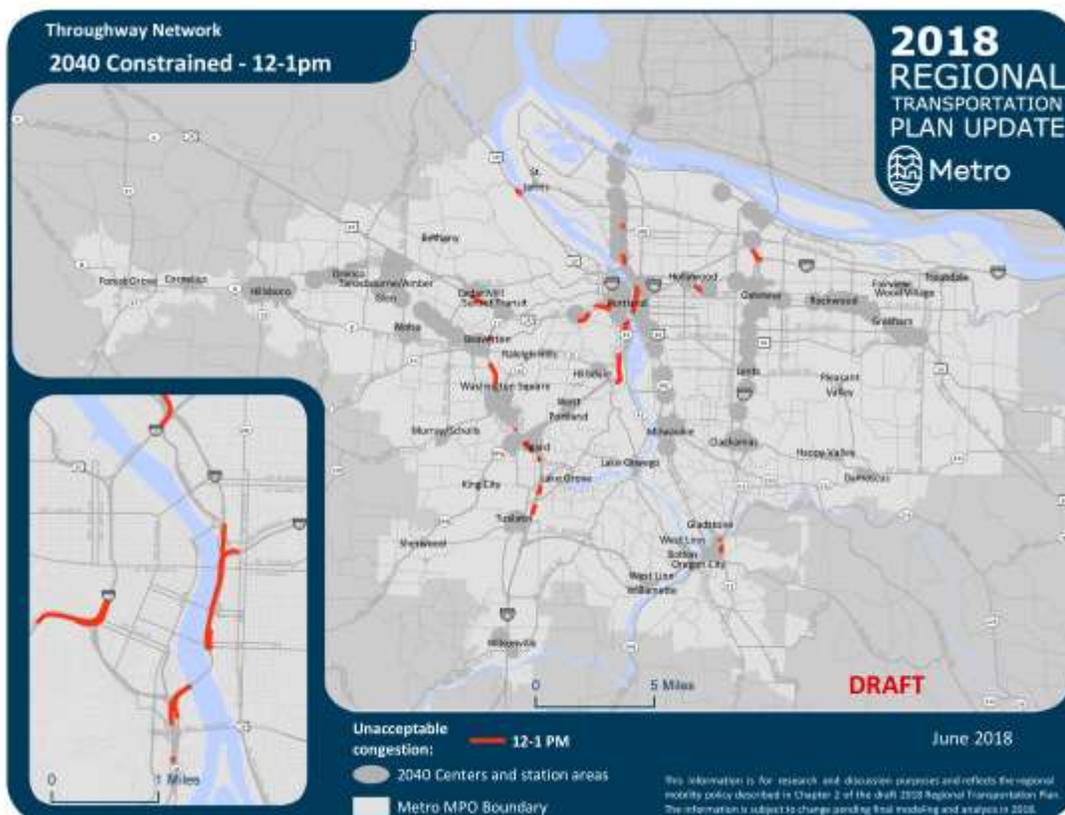
**Not included in "Both Hours 4-6 PM" network miles*

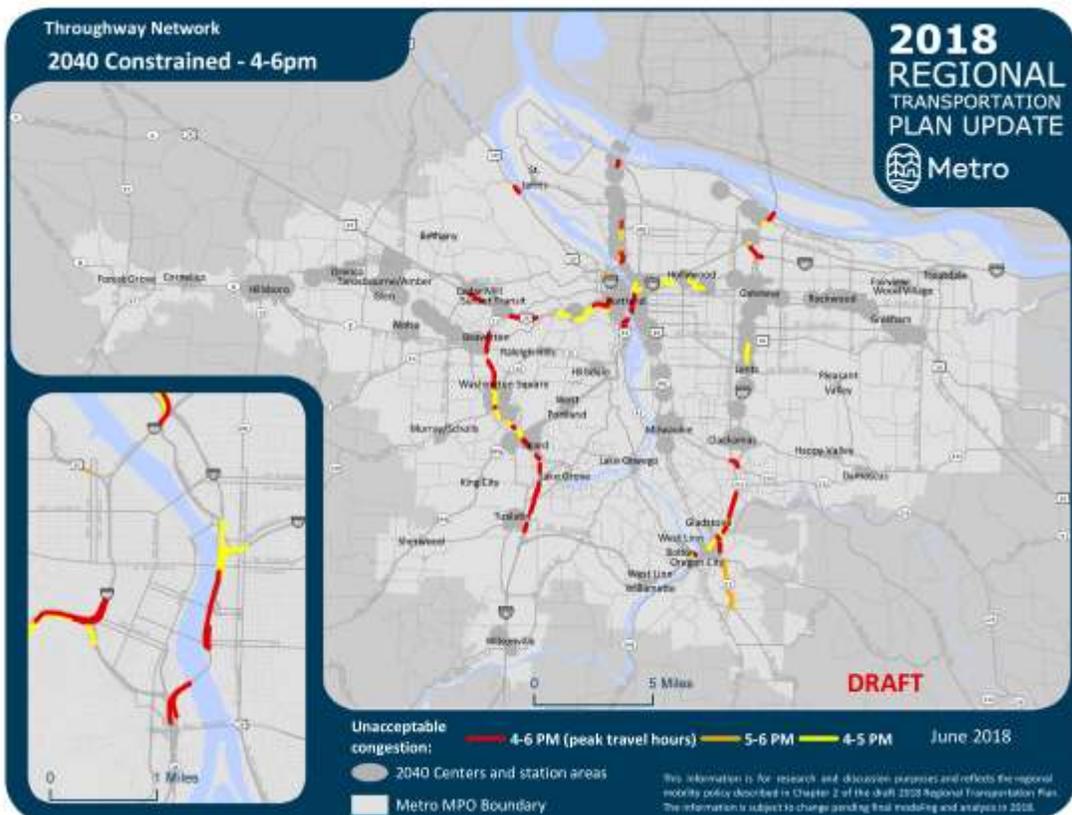
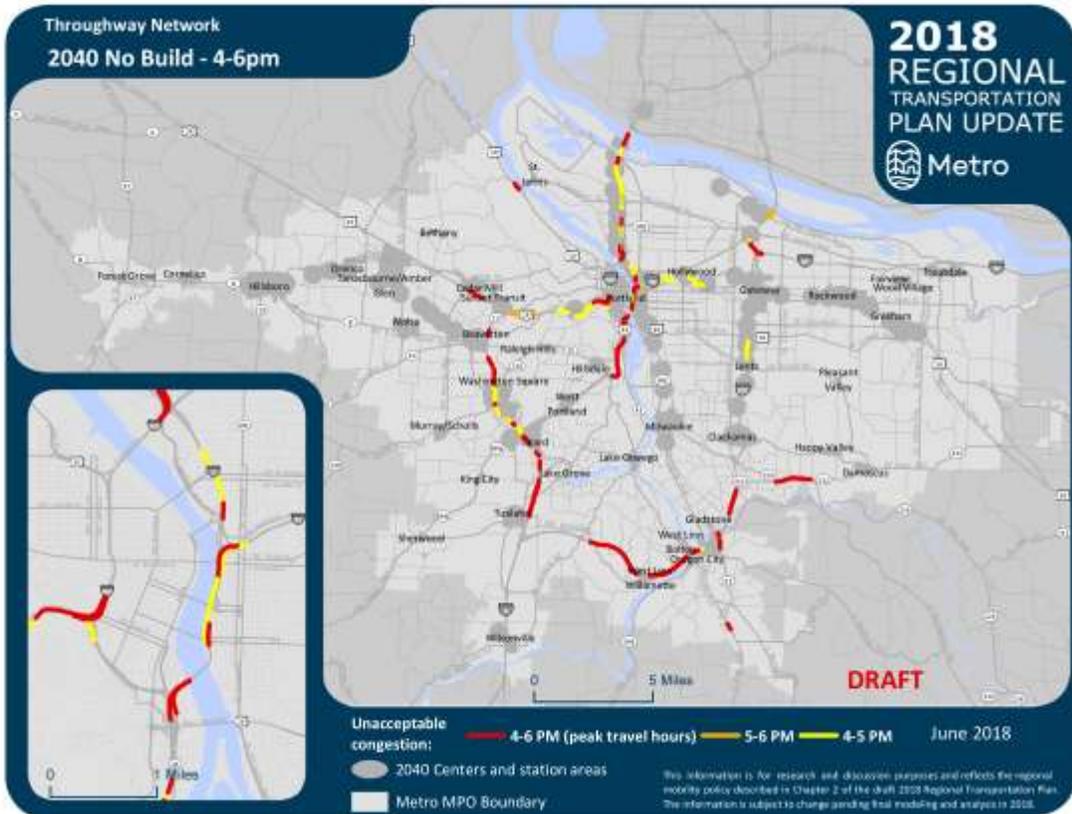
Findings: The percent of throughway network miles not meeting the regional mobility policy, for total miles during 4-6 PM, climbs from 4.93% in the 2015 Base to 11.36% in 2027 and 17.44% in 2040 with the No Build strategies. However, the 2027 Constrained and 2040 Constrained improves those numbers to 9.5% and 14.36% respectively. Overall, the percent of throughway network miles not meeting the regional mobility policy keeps going up over time due to the large increases in regional population, and constrained investment strategies help reduce those increases, but are still greater than 2015.

The following maps highlight locations exceeding the mobility policy in either direction (identified as "unacceptable congestion"), showing the most congested segments in red.









Findings: On the throughway network during the PM peak, the 2027 Constrained on I-205 from Stafford Road to Highway 99E meets the regional mobility policy, where the 2027 No Build failed to meet the mobility policy in that segment of I-205 during both hours from 4-6 PM. The segment of I-5 between I-84 and the Fremont Bridge has more segments that meet the regional mobility policy in the 2027 Constrained than in the 2027 No Build. In the 2027 No Build the length of I-5 that does not meet the mobility policy during the 4-5 PM hour is much longer than in the 2027 Constrained, and a short segment fails to meet the policy during both hours from 4-6 PM.

On the throughway network during the PM peak, the 2040 Constrained on Highway 224 from 122nd to Rock Creek Junction (224/212 split) meets the regional mobility policy, where the 2040 No Build failed to meet the mobility policy in that segment of Highway 224 during both hours from 4-6 PM.

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% compared to 2015.

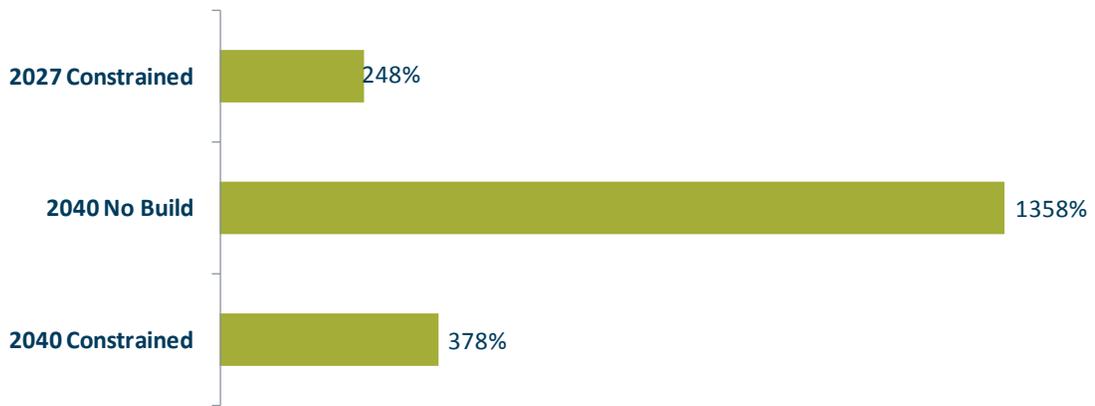
Findings: Between 2015 and 2040, truck delay on the regional freight network increases significantly for all investment strategies during all three time periods. However, when compared with the 2040 No Build both 2040 RTP investment systems show a slower pace of growth in delay in each travel period (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 65 percent less than the 2040 No Build and the 2040 Strategic truck delay is 69 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 27 percent and 29 percent, respectively.

Table 7.28 Truck Vehicle Hours of Delay (VHD) on the Regional Freight Network

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

Figure 7.18 Percent change in truck hours of delay on the regional freight network, 1-3 pm

Truck hours of delay from 1-3pm on regional freight network
(percent change from 2015)



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 (7-9am), the two-hour mid-day travel period (1-3pm) and in the two-hour pm peak period (4-6pm). Values of time are taken from ODOT report The Value of Travel-Time: Estimates of Hourly Value of Time for Vehicles in Oregon in 2016. 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. All values are held constant for both 2015 and 2040.

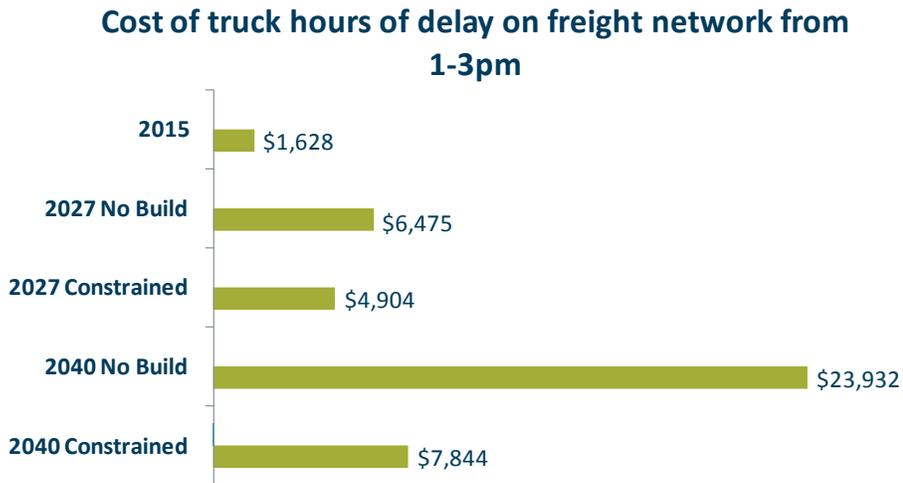
Target or desired direction: No target. Desired direction is to reduce growth in cost of delay (in constant dollars) on the regional freight network in the two-hour mid-day and two-hour pm peak as compared to the 2040 No Build strategies.

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 RTP Federal Priorities or the 2040 Investment Strategy results in a 65 percent - 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 RTP Federal Priorities or 2040 Investment Packages reduce cost of delay by 27 percent -29 percent compared to the 2040 No Build.

Table 7.29 Cost of Truck Vehicle Hours of Delay (VHD) on the Regional Freight Network within the MPA (delay accrued where v/c exceeds 0.9)

Travel period	2015 Base Year	2027 No Build	2027 Constrained	2040 No Build	2040 Constrained
7-9 AM peak hours Cost of delay	\$6,534	\$13,604	\$11,715	\$21,598	\$4,921
1-3 PM Mid-day Cost of delay	\$1,628	\$6,475	\$4,904	\$23,932	\$7,844
4-6 PM peak hours Cost of delay	\$4,594	10,852	\$8,646	\$17,185	\$12,203

Figure 7.19 Cost of truck hours of delay on the freight network, 1-3 pm



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.

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 an 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.

Table 7.30 Transit productivity

Transit productivity	2015 Base Year	2027 No Build	2027 Constrained	2040 No Build	2040 Constrained	Climate Smart Strategy
Total Boardings	428,740	615,330	769,150	740,000	1,084,520	Not evaluated
Daily Revenue Hours	6,430	7,390	8,880	7,560	10,290	9,400
AWD transit boardings/revenue hour*	65	80	85	100	105	Not evaluated

*For the entire region including transit agencies serving Clark, Clackamas, Multnomah and Washington counties

Figure 7.20 Boardings per revenue hour

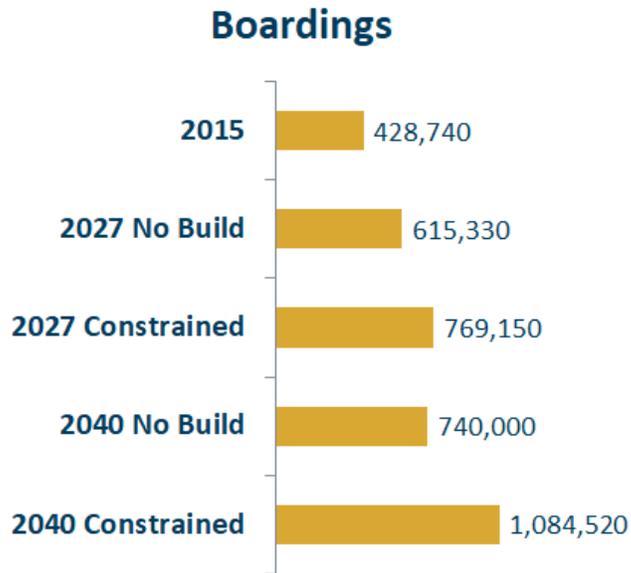


Figure 7.21 Revenue hours of service

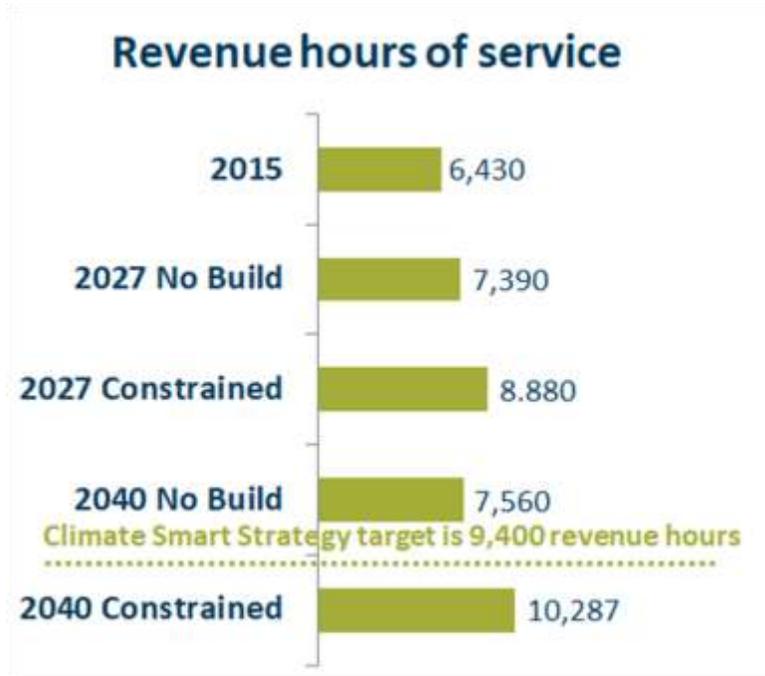


Figure 7.22 Average Weekday (AWD) Transit Boardings per Revenue Hour

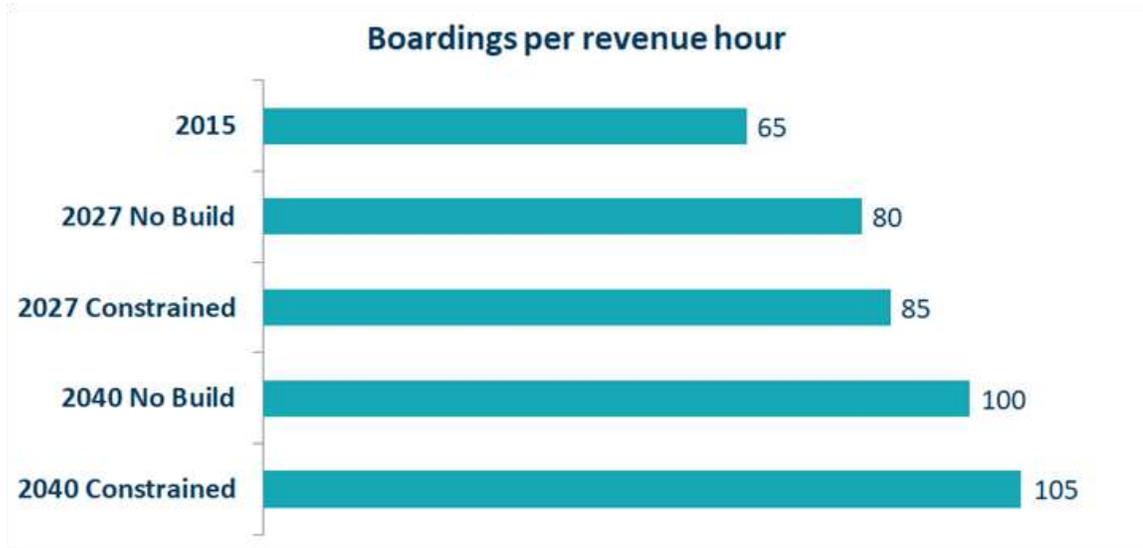
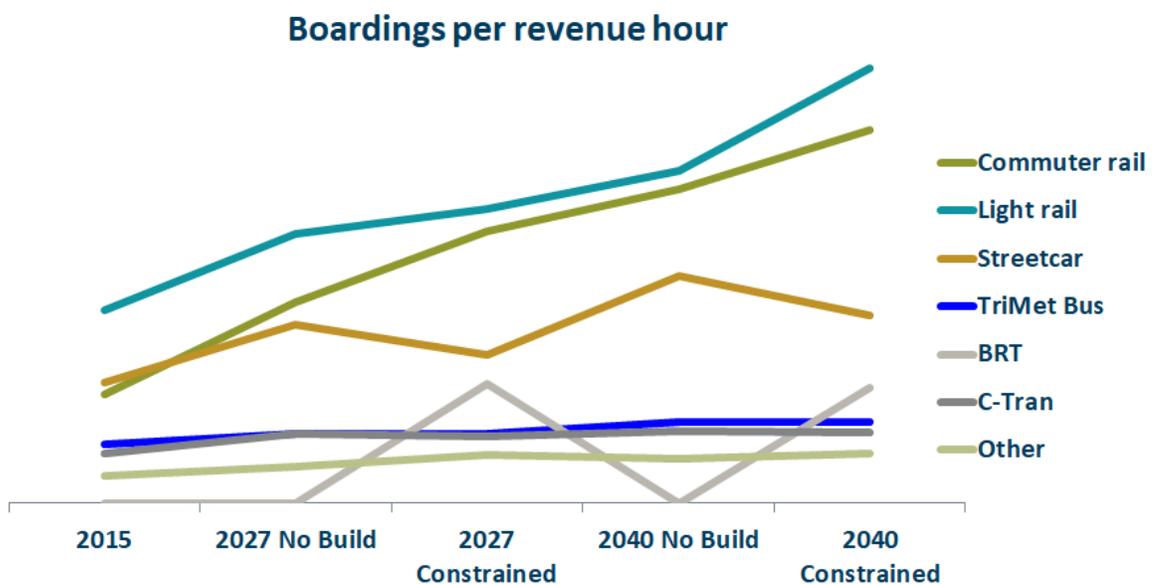


Figure 7.23 Average Weekday (AWD) Transit Boardings per Revenue Hour by transit mode



7.4.12 Climate change

Data source: Transportation project information input into Metro’s travel demand model for outputs to be included in the U.S. EPA approved MOVES2014a emission model.

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

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. 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 a post-processing emissions model (known as MOVES2014a) which includes information about vehicle fleet mix, fuel composition, and emissions rates to determine what the projected emissions of greenhouse gases would be with and without the proposed transportation investments for the Portland airshed in 2027 and 2040. Then the emissions are divided by projected population estimates to understand emissions per capita and ultimately the reduction level.

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 20 percent by 2035 and 25 percent by 2040, compared to 2005 levels.

To assess progress towards the target, the region's Climate Smart Strategy calls for the implementation of nine key land use and transportation policies to reduce greenhouse gas emissions and meet a regionally set target of 29 percent below 2005 emissions levels. 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 to meeting the region's greenhouse gas reduction target. Refer to Appendix J for details on the monitoring targets and performance outcomes.

Findings: The 2018 RTP investment strategy reduces daily tons of greenhouse gas emissions from 2015 by 12 percent in 2027 and 19 percent by 2040. Annual per capita tons of greenhouse gas emissions go down in the 2027 and 2040 Constrained investment strategies. The 2040 Constrained investment strategies does not quite reach the Climate Smart Strategy of a 25 percent reduction by 2035, but the 2040 Strategic strategies does, with a 27 percent reduction of annual greenhouse gas emissions per person. This indicates that additional funding and prioritization of Climate Smart Strategy policies may be needed to achieve greenhouse gas emission targets by 2035.

The reduction in greenhouse gas emissions is a positive sign recognizing the region is expected to grow by over 500,000 people and 300,000 more jobs by 2040. In general the mix of multimodal transportation projects combined with fleet turnover, technology, and fuel economy assumptions is making progress in addressing climate change and helping to achieve the region's Climate Smart Strategy.

By 2040 it is expected that the region's transit system will be delivering 9,513 transit service revenue hours, exceeding the Climate Smart Strategy monitoring target of 9,400 transit service hours.

Equity findings: Not included in transportation equity analysis.

Table 7.31 Projected Mobile Source Greenhouse Gas Emissions by Investment Strategy

	2015 Base Year	2027 No Build	2027 Constrained	2040 No Build	2040 Constrained	Climate Smart Strategy
Average daily transportation-source GHG emissions (Carbon dioxide (in tons, measured in summer))	14,420	12,774	12,627	11,944	11,673	11,596
Percent Reduction Per/Day	N/A	11%	12%	17%	19%	20%
Annual Per Person Reduction from 2015 (Tons)	N/A	.3	.3	.4	.5	.5
Annual Per Person Reduction from 2015 (Percent)		-10%	-12%	-16%	-21%	-20% in 2035 -25% in 2040

Note: Annual per person greenhouse gas emissions in 2015 were 3.3 tons

7.4.13 Clean air

Data source: Transportation project information input into Metro’s travel demand model for outputs to be included in the U.S. EPA approved MOVES2014a emission model.

Description: Evaluates projected mobile source emissions of criteria pollutants: carbon monoxide (CO), nitrogen oxide (NO_x), volatile organic compounds (VOC), and particulate matter (PM₁₀ and PM_{2.5}) and transportation-related air toxics.⁸

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. 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 a post-processing emissions model (known as MOVES2014a) which includes information about vehicle fleet mix, fuel composition, and emissions rates to determine what the projected

⁸ 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

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

Equity findings: Not included in transportation equity analysis.

Table 7.32 Projected Mobile Source Emissions by Investment Strategy and by Air Pollutant

Average daily pollutant emissions	2015 Base Year	2027 No Build	2027 Constrained	2040 No Build	2040 Constrained	Climate Smart Strategy
Carbon monoxide (CO) (Winter)(pounds)	223,827	147,341	146,386	77,891	77,256	Not evaluated
Nitrogen oxide (NOX) (Summer) (pounds)	61,159	14,558	14,466	8,630	8,535	
Volatile organic compounds (VOC) (Summer) (pounds)	13,309	4,273	4,219	3,024	2,936	
Particulate Matter 10 exhaust (PM ₁₀) (Winter) (pounds)	1,739	566	562	319	314	
Particulate matter 2.5 exhaust (PM _{2.5}) (Winter) (pounds)	1,575	509	505	285	281	
Acrolein (Summer) (pounds)	16	5	5	3	3	
Arsenic (Summer)(grams)	68	79	79	90	88	
Benzene (Summer) (pounds)	356	83	82	46	45	

Average daily pollutant emissions	2015 Base Year	2027 No Build	2027 Constrained	2040 No Build	2040 Constrained	Climate Smart Strategy
1,3-Butadiene (Summer) (pounds)	41	5	5	2	2	
Chromium 6 (Summer)(grams)	0.4	0.4	0.4	0.5	0.4	
Diesel Particulate Matter* (Summer) (pounds)	621.7	145.0	143.8	53.1	52.4	
Formaldehyde (Summer) (pounds)	252	85	84	65	64	
Naphthalene Gas (Summer)(grams)	14,398	3,953	3,913	2,470	2,410	

Note: Results show Summer or Winter pollution

Figure 7.24 Projected Mobile Source Criteria Pollutant Emissions by Investment Strategy

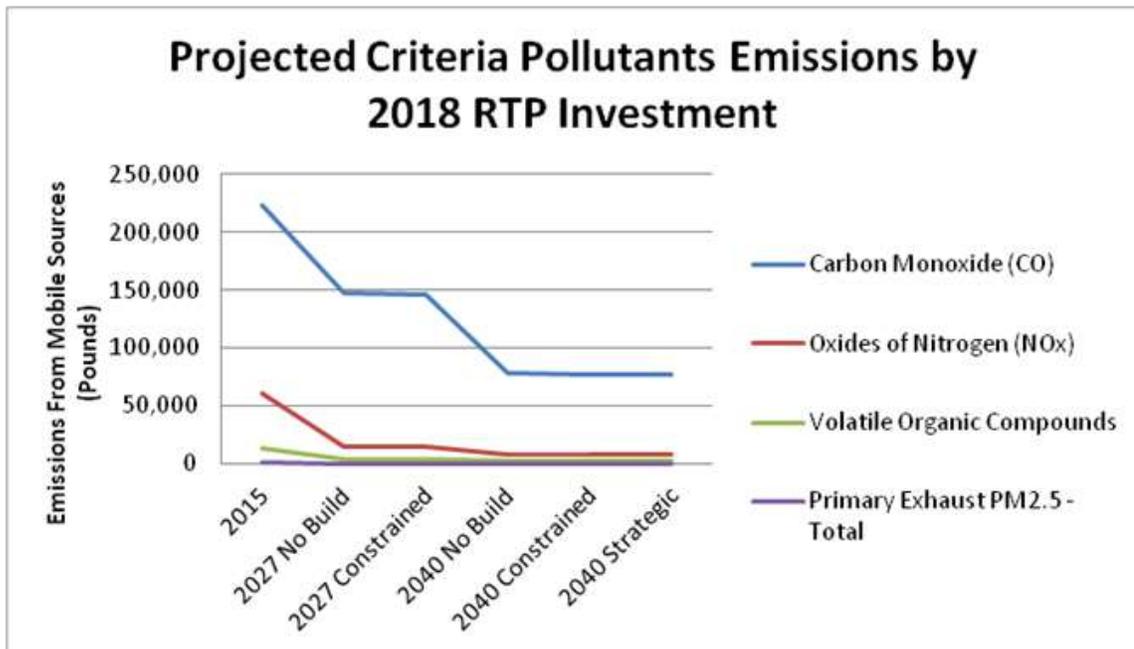
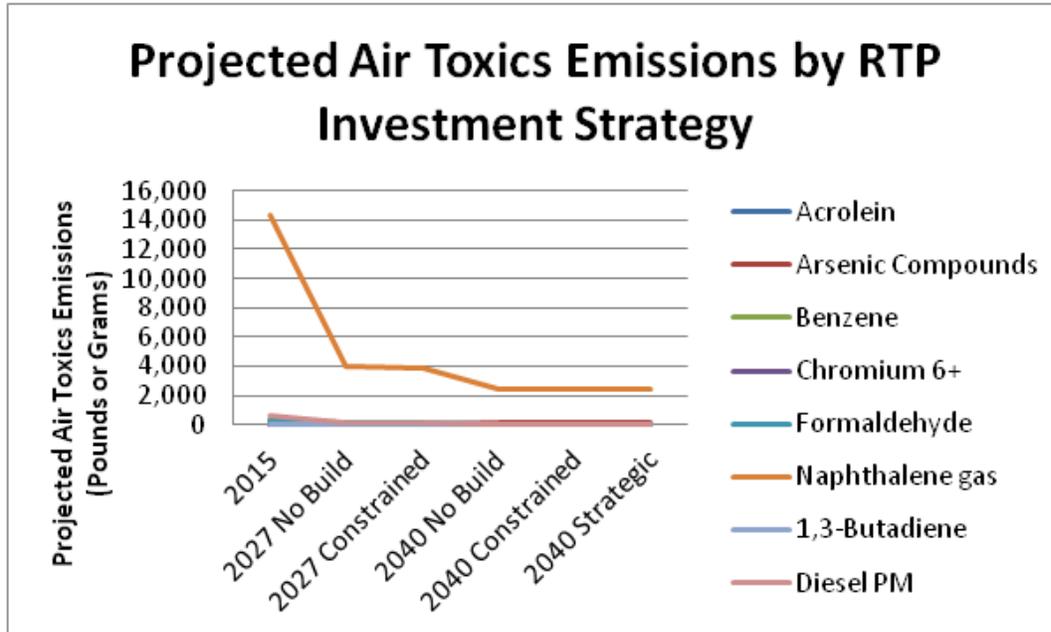


Figure 7.25 Projected Mobile Source Air Toxics Pollutant Emissions by Investment Strategy



7.4.14 Potential habitat impact

Data source: Regional Conservation Strategy data developed and maintained by the Intertwine Alliance in partnership with Metro.⁹

Description: Evaluates the potential impacts of transportation projects on identified regional and urban high value habitat areas defined in the Regional Conservation Strategy.¹⁰

This analysis used the Regional Conservation Strategy’s high value habitat as its basis. The Regional Conservation Strategy serves as a framework for efforts to conserve biodiversity within the greater Portland-Vancouver region. Data was developed from 2010 to 2013 by the Intertwine – a broad coalition of public, civic, private, and nonprofit organizations. 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.

The RTP project lists in Appendix A, B and C identify projects that intersect with high-value habitat areas. It is important to note a project’s inclusion on this list does not guarantee the project will impact a given environmental resource; rather, the agency

⁹ Information about development of the Regional Conservation Strategy and data can be found at: www.regionalconservationstrategy.org

¹⁰ A map of the regional and urban high value habitat areas can be found at: www.regionalconservationstrategy.org/document/8

responsible for the project should be aware of its potential impacts and work to mitigate any potential issues during the project development phase. Potential environmental mitigation activities are described in Chapter 3 of the Plan.

Target or desired direction: There is no target for this measure. The desired direction is to avoid sensitive habitats

Findings: Potential project impacts are shown in **Table 7.31** for each investment strategies. A total of 508 projects in the 2040 Constrained list intersect with high value habitats identified in the Regional Conservation Strategy. Overall, these projects make up nearly 60 percent 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 Chapter 3 of the Plan. 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 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.

Table 7.33 Potential Habitat Impact Analysis

	2015 Base Year	2027 No Build	2027 Constrained	2040 No Build	2040 Constrained	Climate Smart Strategy
Number of projects that intersect high value habitat areas	N/A	N/A	245	N/A	508	Not evaluated
Percent of all RTP projects that intersect high value habitat areas	N/A	N/A	35%	N/A	73%	Not evaluated

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

Table 7.34 2040 Constrained RTP Projects Potentially Impacting Environmental Resources by Project Type

Type of capital project	High value habitat areas
Roads and bridges	199
Throughways	22
Transit capital	22
Freight	13
Bike and pedestrian	225
Transportation System Management	27

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

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: None.

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. ¹¹

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.

¹¹ For more information on each site visit www.nationalregisterofhistoricplaces.com/or/state.html and click on Clackamas, Multnomah or Washington County.

Table 7.35 2040 Constrained RTP Projects Potentially Impacting Historical and Cultural Resources by Project Type

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	0
Throughways	1	0
Transit capital	17	0
Freight	1	0
Bike and pedestrian	17	0
Transportation System Management	5	0

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 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 to estimate the health effects of regional transportation investments using the Integrated Transport and Health Impacts Model (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. (Metro and the Oregon Health Authority (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% of fine particle 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% 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.

Table 7.36 Average per person weekly minutes of biking and walking

	2015 Base Year	2027 No Build	2027 Constrained	2040 No Build	2040 Constrained	Climate Smart Strategy
Average per person weekly minutes walking	31.6	33.4	36.5	34.4	39.6	Not comparable
Average per person weekly minutes of biking	16.4	17.8	18.3	19.3	19.8	Not comparable
Total average per person weekly minutes of biking and walking	48	51.2	54.8	53.7	59.4	Not comparable

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 PM2.5 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% 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 7.37 Estimated lives and years saved from increased physical activity and reduced mobile source air pollution

	2027 No Build	2027 Constrained	2040 No Build	2040 Constrained	Climate Smart Strategy
Estimated lives saved annually	15	17	19	22	Not comparable
Estimated Disability Adjusted Life Years (DALY)	209	260	272	354	Not comparable

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 7.38 Health care costs avoided (\$2017)

	2027 No Build	2027 Constrained	2040 No Build	2040 Constrained	Climate Smart Strategy
Annual health care costs saved	\$17 million	\$20 million	\$26 million	\$31 million	Not comparable

Note: Estimates rounded to the nearest million