Metro Regional Congestion Pricing Study

Final Report

July 2021

Metro

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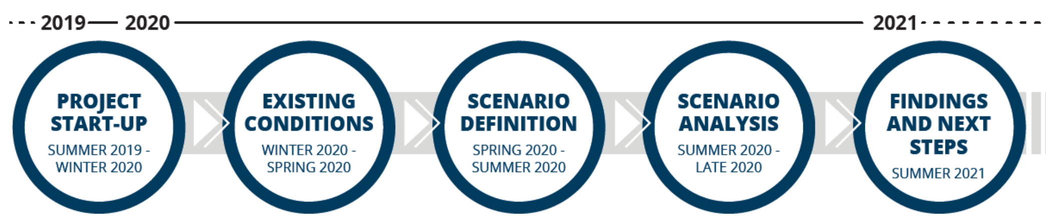
EXECUTIVE SUMMARY

What is this study?

The Metro Regional Congestion Pricing Study explored whether congestion pricing can benefit the Portland metropolitan region. Congestion pricing was identified as a high priority, high impact strategy in the 2018 Regional Transportation Plan (RTP). A range of scenarios testing different congestion pricing tools helped regional policymakers understand if pricing can help support the region's four transportation priorities set out in the RTP – climate, congestion, equity, and safety, congestion.

What was the project timeline?

This study took place over the course of approximately two years. The study included a review of existing conditions within the region, a definition of what scenarios would be considered, research of best practices and input from equity and congestion pricing experts, scenario analysis using Metro's regional travel demand model, the development of findings and the identification of next steps.



What pricing strategies did Metro explore?

Metro explored if and how four congestion pricing strategies could support the region's priorities . When implemented, each of the pricing strategies could vary by time of day, by area/facility, by types of drivers on the road and by income levels. The four congestion pricing strategies are outlined at right.

VEHICLE MILES TRAVELED FEE
Drivers pay a fee for every mile they travel

CORDON PRICING
Drivers pay to enter an area, like downtown Portland (and sometimes pay to drive within that area)

ROADWAY PRICING
Drivers pay a fee to drive on a particular road, bridge or highway

PARKING PRICING
Drivers pay to park in certain areas

Who was involved?

This study was led by Metro staff,[1] working closely with the Transportation Policy Alternatives Committee (TPAC), which was the study's technical advisory committee, the Joint Policy Advisory Committee on Transportation (JPACT), which provided policy direction, and Metro Council, which provided policy direction and overall project guidance. The City of Portland and TriMet were funding partners in the study, and project staff collaborated regularly with the City of Portland and ODOT to leverage and align parallel congestion pricing efforts.

Study methods and findings were reviewed by Metro's Committee on Racial Equity (CORE), the Oregon Department of Transportation's Equity and Mobility Advisory Committee (EMAC), the City of Portland's Pricing Options for Equitable Mobility (POEM) Task Force, and an international Expert Review Panel.[2]

How does this relate to Metro's partners' work?

Metro, ODOT, and the City of Portland are all working on projects that consider ways to price transportation to address challenges related to equity, climate change, congestion, and safety. Each agency makes decisions for different parts of our region's transportation system. Each has separate projects underway to help address issues specific to those geographies. The three agencies are coordinating their efforts to leverage each other's work, learn from one another and share findings. The findings and analysis in this report provide a foundational understanding of how congestion pricing could perform in the Portland region and also provides important best practices for designing a pricing program that apply throughout the region and state.

What are the takeaways from the Congestion Pricing Study?

Congestion pricing has the potential to help the greater Portland region meet the priorities outlined in the 2018 Regional Transportation Plan, including reducing congestion and improving mobility, reducing greenhouse gas emissions, and improving equity and safety outcomes. However, it depends how pricing is implemented in the region.

Metro used its travel demand model to conduct in-depth modeling and analysis to help regional policymakers understand the potential performance of different types of pricing tools (VMT, cordon, parking, and roadway). Each scenario was analyzed for how well it performed relative to the four regional priorities using performance metrics produced by the model.

[1] Metro hired a consultant team to support technical analysis and process for this work. The consultant team was led by Nelson\Nygaard and included Sam Schwartz Engineering, HNTB, Silicon Transportation Consultants, TransForm, Mariposa Planning Solutions and PKS International.

[2] Details on Expert Review Panel can be found here: https://www.oregonmetro.gov/sites/default/files/2021/04/07/congestion-pricing-expert-panel-flyer-20210407.pdf

RTP Goal	Performance Metric
CONGESTION & CLIMATE	Daily vehicle miles traveled
	Drive alone rate
	Daily transit trips
	Freeway vehicle hours of delay
	Arterial vehicle hours of delay
CLIMATE	Greenhouse gas and other emissions
EQUITY	Access to jobs by car
	Access to jobs by transit

Key findings from each scenario are described below.

VMT

Scenarios tested

Two scenarios were modeled with a per mileage fee, which was applied to all drivers for every mile driven on every street in the Metropolitan Planning Area. VMT B added a charge of $0.0685/mile, and VMT C added $0.132/mile.

Scenario results

VMT scenarios performed well on all metrics at a regional scale, largely because all driving trips would be charged. Total travel cost would be the highest among the pricing tools studied, but those costs would be the most widely distributed compared to other pricing options.

Equity spotlight

Some Equity Focus Areas experienced a combination of higher costs without significant improvement in jobs access. Mobility improved in much of the region and jobs access improved. There were also reductions in harmful emissions.

Future considerations

A VMT pricing program should consider whether drivers who would pay more have viable alternatives to driving, and could focus on investments (transit, pedestrian, or bicycling infrastructure) or provide discounts or caps on charges for groups that would be disproportionately impacted, either because of where they live or their ability to pay.

Cordon

Scenarios tested

A fee was applied to drivers entering into a specific area. Cordon A encompassed downtown Portland, South Waterfront, and parts of Northwest Portland. Cordon B included the entirety of Cordon A, as well as the Central Eastside Industrial District and the Lloyd District. Drivers who traveled through the cordon area, but remained on the freeways or highways, were not assessed a charge. The cordon charge was $5.63.

Scenario results

The cordons studied resulted in relatively high mode shift to transit, indicating that adding a charge for drivers in areas with good transit infrastructure could successfully shift travel modes. However, the diversion onto the nearby uncharged facilities that increased vehicle delay and decreased job access by auto would need to be explored in greater depth.

Equity spotlight

Areas inside the cordon boundary experienced lower costs and higher jobs access because of the decreasing traffic within the cordon as drivers avoided through trips and diverted to throughways and arterials adjacent to the corridor. This would be a direct benefit to communities of color and low-income households that live within the cordon boundaries (the area within the cordon is considered an Equity Focus Area). However, for those same populations outside of the cordon area, delay increased and job access for drivers decreased. Additionally, those who drove into the cordon paid higher costs, even if they would benefit from improved travel times within the cordon. Costs were low at a regional scale, but high for the individuals who entered the cordon.

Future considerations

Cordon design considerations could include expanding the cordon area to encompass more origins and destinations, pairing cordon pricing with roadway pricing on key facilities near the cordon, providing a time-of-day charge, or providing discounts or exemptions for groups that would be disproportionately impacted. Improvements to arterials near the cordon to speed transit (such as bus only lanes) could also be considered.

Parking

Scenarios tested

Increased parking charges were applied to all areas within the Metropolitan Planning Areas (MPA) boundaries that were assessed a parking charge in the 2018 RTP's 2040 Financially Constrained Scenario for both Parking A and Parking B scenarios. Parking A scenario marginally added the same parking costs; the Parking B scenario doubled the parking costs.

Scenario results

Overall, parking charging demonstrated positive results for all metrics at a regional level. The analysis shows that charging for parking could increase transit ridership – likely a direct result of charges generally being assessed in areas with good transit service and high employment. Charges were concentrated among fewer travelers compared to the VMT scenarios. While the total travel cost was low compared to other pricing scenarios, the cost to the individual drivers who parked was relatively high.

Equity spotlight

The parking scenarios showed very little change in jobs accessibility and costs throughout the region. The areas affected by parking charges have good transit service, so parking charges could be more easily avoided. Equity focus areas showed a smaller percent increase in jobs accessible by auto than non-equity focus areas.

Future considerations

The impacts to vulnerable populations should be carefully considered in a parking program, which could focus on discounts or caps on charges for key groups or revenue reinvestment to improve transit service.

Roadway

Scenarios tested

Roadway charges were applied to drivers on highways limited access highways within the MPA boundaries. Roadway A included a charge of $0.132/mile, while Roadway B included a charge of $0.264/mile.

Scenario results

The two Roadway scenarios had mixed results at a regional level, with a reduction in VMT and reduced delay on the charged roadways coupled with increased delay to nearby non-charged roadways. Burdens and benefits were not uniformly distributed and could disproportionately impact travelers that live on the outskirts of the region.

Equity spotlight

Areas further from tolled throughways tend to experience worse access to jobs by auto, which include some EFA areas. With fewer options of using the faster tolled roadways and competing with traffic on arterials that diverted from those tolled roadways, commuters here experienced somewhat slower travel by autos and transit.

Future considerations

A roadway pricing program should focus on the impacts to delay on the throughways charged as well as the impacts to nearby non-charged roadways. Impacts at a localized scale would need to be examined to understand if there were investments (such as transit, bike, or pedestrian improvements) that could improve overall performance. In addition, the travel costs should be assessed at a granular scale to understand the impact on vulnerable groups.

The analysis showed:

All four types of congestion pricing could help address congestion and climate priorities.

- All eight scenarios reduce the drive alone rate, vehicle miles traveled, and greenhouse gas emissions.
- All scenarios increase daily transit trips. (Roadway A has a minimal increase.).
- In fact, the projected improvements were comparable to modeled scenarios with much higher investment in new transportation projects.

Geographic distribution of benefits, impacts, and costs varied by scenario.

- Traffic diversion, travel time savings, and costs to travelers varied by location and by congestion pricing tool.
- Without changes, some scenarios would have disproportionate impacts on equity communities and key geographies.
- Geographic distributions of benefits and costs can inform where to focus investments and affordability strategies.
- In-depth analysis will be necessary to understand benefits (who and where) and costs (who and where) of any future projects.

There are tradeoffs for implementing pricing scenarios.

- Our current transportation funding system will not achieve Metro's climate and equity goals. The tax structure is regressive and focuses on auto infrastructure that reinforces inequity and results in high emissions.
- Overall regional transportation costs and individual traveler costs vary by scenario
- All eight scenarios increase the overall cost for travel for the region, but some scenarios spread the costs widely while others concentrate them on fewer travelers. Those that spread the costs also have the highest overall cost for travel in the region and the highest revenue potential
- Higher overall transportation costs equal higher revenue which can allow investment in improvements to address safety and equity concerns.

A summary of findings is described on the next page.

Table ES-1 Regional Congestion Pricing Study High-Level Findings

RTP Goal	Metrics	VMT B	VMT C	COR A	COR B	PARK A	PARK B	RD A	RD B
Congestion & Climate	Daily VMT								
	Drive Alone Rate								
	Daily Transit Trips								
	2HR Freeway VHD								
	2HR Arterial VHD								
Climate	Emissions								
Equity	Job Access (Auto)								
	Job Access (Transit)								
Total Regional Travel Cost		**Med-High**	**High**	**Med-Low**	**Med-Low**	**Low**	**Low**	**Med**	**Med**

Note: Dark blue indicates better alignment with regional goals when compared to the Base scenario

Legend		Daily VMT	Drive Alone Rate	Job Access (Auto)	Job Access (Transit	Daily Transit Trips	2HR Freeway VHD	2HR Arterial VHD	Emissions
	Large Positive Change	-5% or more	-5% or more	10% or more	5% or more	10% or more	-10% or more	-10% or more	-5% or more
	Moderate Positive Change	-2% to -5%	-2% to -5%	5% to 10%	2% to 5%	5% to 10%	-5% to -10%	-5% to -10%	-2% to -5%
	Small Positive Change	-0.5% to -2%	-0.5% to -2%	1% to 5%	0.5% to 2%	1% to 5%	-1% to -5%	-1% to -5%	-0.5% to -2%
	Minimal Change	0.5% to -0.5%	0.5% to -0.5%	1% to -1%	0.5% to -0.5%	1% to -1%	1% to -1%	1% to -1%	0.5% to -0.5%
	Small Negative Change	0.5% to 2%	0.5% to 2%	-1% to -5%	-0.5% to -2%	-1% to -5%	1% to 5%	1% to 5%	0.5% to 2%
	Moderate Negative Change	2% to 5%	2% to 5%	-5% to -10%	-2% to -5%	-5% to -10%	5% to 10%	5% to 10%	2% to 5%
	Large Negative Change	5% or more	5% or more	-10% or more	-5% or more	-10% or more	10% or more	10% or more	5% or more

Note: "Positive" and "Negative" refer to progress toward regional goals, and not to numerical values (i.e., a reduction in VMT is "positive")

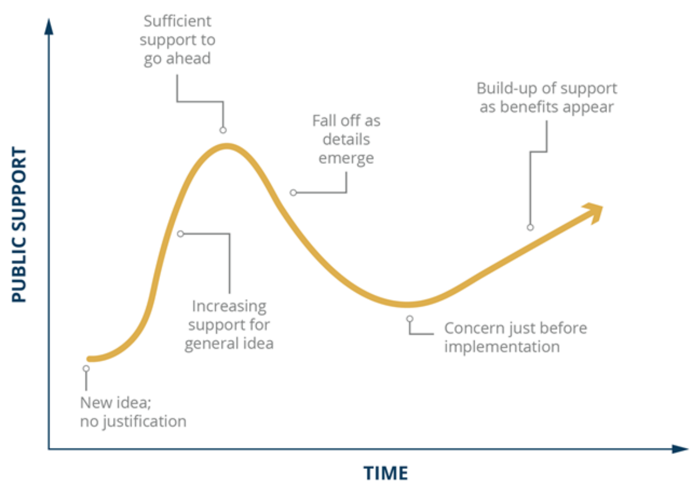
The results provided here ONLY show the effects of charging drivers under different scenarios; implementation of mitigations, discounts, or other changes to policies could result in changes to the performance of a scenario.

What are the implementation considerations?

There are many factors for the Portland metro region and its partners to consider as the region continues to explore the feasibility of implementing congestion pricing:

- Public acceptance: all pricing programs are likely to struggle with public acceptance. There is a common perception that pricing is likely to hurt transportation disadvantaged populations and that people will pay more for something without seeing a benefit. Case studies have shown acceptance grows after a pricing program is implemented, as shown in the figure below. A concerted public engagement and marketing effort would likely be needed to garner acceptance of a congestion pricing project or program.

Figure ES-1 Public Acceptance of Congestion Pricing Changes Over Time

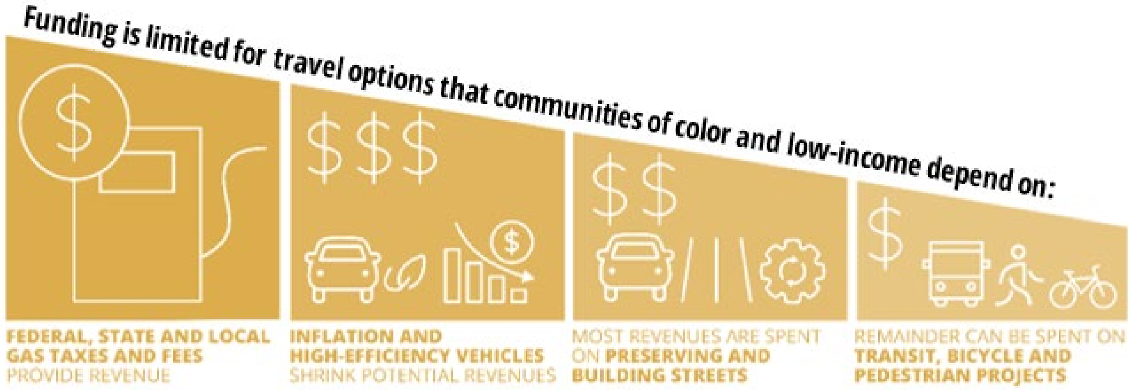


- Parking pricing is the easiest of the tools to implement since it leverages existing infrastructure and processes to introduce congestion pricing.
- Cordon pricing can leverage state of the art tolling and enforcement technologies, making implementation moderately difficult to implement.
- Although roadway pricing can leverage many tolling methods, enforcement can be difficult. Also, tolling roadways that are not limited access could be cost prohibitive, reflecting why arterial tolling is not typically priced considered.
- A VMT program could build off of the OReGO pilot but a major implementation barrier is enforcement and mandating vehicles to participate.
- A pilot phase might make sense for the Portland region to trial one or more technologies before scaling up to a region-wide system.

How can Congestion Pricing address Equity?

Many people worry that congestion pricing will hurt those least able to pay. However, our current system is inequitable. Not only are transportation funding sources regressive, but spending is also focused on automobile infrastructure over other transportation modes, as shown in Figure ES-2 below. Gas tax rates are a fixed amount per gallon regardless of a driver's ability to pay, and motor vehicle fees in Oregon are not correlated to a motorist's income nor the value of the vehicle.

Figure ES-2 Inequities within Today's System

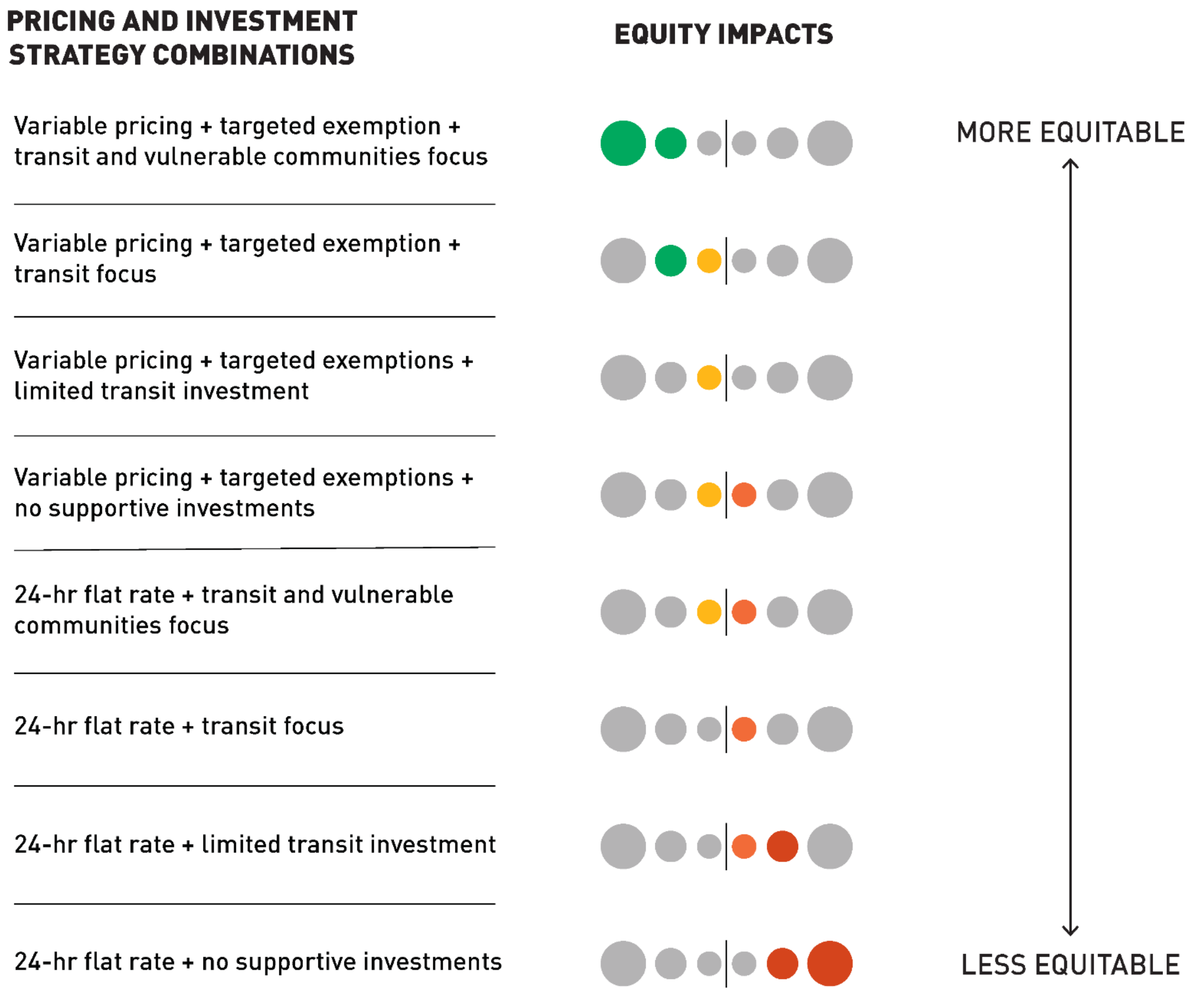


This focus favors those with more means and encourages driving. It reinforces inequity with spending focused on auto infrastructure. In addition, health impacts from high automobile reliance disproportionately harm Black, Indigenous, and People of Color (BIPOC) and low-income communities. Low-income people spend a much higher percentage of their income on transportation than high income earners. As it functions today, the current funding and spending structure will not help the region meet its urgent equity and climate goals.

Congestion pricing strategies have the potential to improve racial equity and benefit marginalized communities as well as all residents of the region. Congestion pricing tools have the potential to be more flexible than current funding in how funds are collected and what funds are spent on.

The biggest determinant of whether a congestion pricing program improves equity is how the program is designed-- how people are charged and how revenue from congestion pricing strategies is spent. A pricing program with the same charge can *improve* or *harm* equity depending on how it deals with affordability, the places it improves, and the type and locations of investments. An example of how this can be is shown as Figure ES-3 below.

Figure ES-3 Program Design Impact on Equity Outcomes



Building an Equitable Pricing Program

If carefully structured, congestion pricing can create a more fair and just transportation system, not just compared to the predominant revenue raising strategies used to pay for transportation today, but more directly to improve affordability, access, safety, and health of historically and currently excluded, impacted, and underserved communities. Congestion pricing programs and projects can improve equity outcomes by:

- Reducing harm and increasing benefits if agencies are willing to focus engagement on historically impacted residents and other stakeholders traditionally at a disadvantage and ensure they have a role in decision making at every step in the process.
- Revenue can be focused on equity outcomes. Revenues from congestion pricing can be invested in key neighborhoods or roadways, focused on transit, sidewalks, and bike lanes, or invested in senior and disabled services. Pricing benefits can be targeted to key locations where mobility improvements or air quality can be meaningfully improved.
- Affordability can be built into a program. Congestion pricing is more flexible than current funding sources. Exploring who pays and to what degree, and considering a

suite of affordability programs such as rebates or exemptions for low-income drivers, a "transportation wallet", or other investments that address affordability.

Figure ES-4 An Equity Framework for Road Pricing

INCREASED ACCESS TO OPPORTUNITY

- Does it overcome barriers (financial, cultural, technological, geographic) to accessing new mobility, so vulnerable populations actually benefit?
- Does it improve, not impede, the movement of public transit?
- Does it increase access to jobs, education, health care, and other destinations?
- Does it reduce travel times for low-income households?
- Does it prioritize the needs and trip patterns of vulnerable populations?

AFFORDABLE OPTIONS

- Is the price low enough for low-income individuals to regularly use the service?
- In instances where existing services such as bus lines are being cut, are there mechanisms to ensure that transportation costs don't increase for low-income households?
- Is it likely to reduce transportation costs in the long run (e.g. by reducing the need for vehicle ownership or for parking in new developments)?

MORE HEALTHY & SAFE COMMUNITIES

- Does it reduce air pollution and greenhouse gas emissions, both of which disproportionately burden low-income communities and people of color?
- Does it serve people with disabilities, or people who walk or bike?
- Are there policies in place to prevent discrimination or racially-biased policing?
- Is it likely to improve health and reduce health disparities for vulnerable populations (e.g. by reducing crashes and fatalities or focusing vehicle electrification in impacted communities)?

REDUCED INCOME INEQUALITY & UNDEREMPLOYMENT

- Does it increase employment with stable, well-paying jobs?
- Does it create pathways for low-income individuals to enter the new mobility work force?
- Are there policies in place to ensure fair treatment of the labor force (e.g. providing a living wage, ability to unionize, benefits, etc.)?[9]
- Are we creating programs to train workers and replace jobs that will be lost with vehicle automation?

Source: TransForm 2017

As part of the Congestion Pricing Study, Metro reached out to three groups with expertise in equity: Metro's CORE, the City of Portland's POEM Task Force, and ODOT's EMAC to discuss and receive feedback on the RCPS methods for assessing equity benefits and impacts.

These groups confirmed that there are concerns around congestion pricing disproportionately impacting those least able to pay. They agreed that any pricing program must have meaningful engagement with community and equity groups early. Combining their feedback with equity experts in the field helped clarify the importance of engagement and the importance of a project conducting in depth technical analysis (including mapping) to help determine who benefits and who is impacted by a program.

Key findings from an equity perspective

While the Equity Focus Areas see an increase in percent change of jobs accessible by auto in six of the eight scenarios, they benefit less than non-equity focus areas across the board. Related to access to community places, each pricing scenario results in increased access for equity focus areas and non-equity focus areas. Equity focus areas benefit more than non-equity focus areas for accessibility by auto for the cordon scenarios and the roadway scenarios. When it comes to change in access to community places by transit, the benefit to non-equity focus areas exceeds the benefit to equity focus areas for all scenarios.

Key findings from an equity perspective:

- Go beyond a toolkit
- Connect analysis to further study
- Design scenarios to address barriers
- Inform expenditure framework
- Develop supportive programs
- Establish pre- and post-deployment monitoring

What are the recommendations?

Below are general recommended considerations for both policymakers and future project owners and operators, as well as specific recommendations that would apply to each group.

- Congestion pricing can be used to improve mobility and reduce emissions. This study demonstrated how these tools could work with the region's land use and transportation system.
- Define clear goals and outcomes from the beginning of a pricing program. The program priorities such as mobility, revenues, or equity should inform the program design and implementation strategies. Optimizing for one priority over another can lead to different outcomes.
- Recognize that benefits and impacts of pricing programs will vary across geographies. These variations should inform decisions about where a program should target investments and affordability strategies and in depth outreach.
- Carefully consider how the benefits and costs of congestion pricing impact different geographic and demographic groups. In particular, projects and programs need to conduct detailed analysis to show how to:
    - maximize benefits (mobility, shift to transit, less emissions, better access to jobs and community places, affordability, and safety) and

    - address negative impacts (diversion and related congestion on nearby routes, slowing of buses, potential safety issues, costs to low-income travelers, and equity issues).

- Congestion pricing can benefit communities that have been harmed in the past, providing meaningful equity benefits to the region. However, if not done thoughtfully, congestion pricing could harm BIPOC and low-income communities, compounding past injustices.
- Conversations around congestion pricing costs, revenues, and reinvestment decisions should happen at the local, regional, and when appropriate the state scale, depending on the distribution of benefits and impacts for the specific policy, project, or program being implemented.

Specifically For Policy Makers

- Congestion pricing has a strong potential to help the greater Portland region meet the priorities outlined in its 2018 Regional Transportation Plan, specifically addressing congestion and mobility; climate; equity; and safety.
    - Technical analysis showed that all four types of pricing analyzed improved performance in these categories;
    - Best practices research and input from experts showed there are tools for maximizing performance and addressing unintended consequences.
- Given the importance of pricing as a tool for the region's transportation system, policy makers should include pricing policy development and refinement as part of the next update of the Regional Transportation Plan in 2023, including consideration of other pricing programs being studied or implemented in the region.

Specifically For Future Project Owners/Operators

- The success of a specific project or program is largely based on **how** it is developed and implemented requiring detailed analysis, outreach, monitoring, and incorporation of best practices.
- Coordinate with other pricing programs, including analysis of cumulative impacts and consideration of shared payment technologies, to reduce user confusion and ensure success of a program.
- Conduct meaningful engagement and an extensive outreach campaign, including with those who would be most impacted by congestion pricing, to develop a project that works and will gain public and political acceptance.
- Build equity, safety, and affordability into the project definition so a holistic project that meets the need of the community is developed rather than adding "mitigations" later.
- Establish a process for ongoing monitoring of performance, in order to adjust and optimize a program once implemented.

What are the next steps?

Since its identification as a high priority, high impact strategy in the 2018 RTP, Metro staff and leaders endeavor to better understand how our region could use congestion pricing to manage traffic demand to meet climate goals without adversely impacting safety or equity. This study delineates the impacts pricing could have in helping the region:

- Reduce traffic congestion;
- Improve equity by reducing disparity;
- Enhance safety by getting to Vision Zero; and
- Support the climate by reducing greenhouse gas emissions.

The study's Expert Review Panel demonstrated that congestion pricing is effective in encouraging drivers to change their behavior (using more sustainable travel modes like transit, walking, or biking; driving less; and driving at different times) and reducing congestion and greenhouse gas emissions.

Leaders around the region and state should use the findings from this study to inform policies, including the development of the 2023 RTP and other transportation projects that may include congestion pricing in the future. We expect this study will inform the work of implementing agencies as they propose new congestion pricing projects at the local level.

PROJECT TERMS AND DEFINITIONS

Terms and Definitions

- **Base Scenario:** Modeling scenario that provides the basis of comparison for how different congestion pricing modeled scenarios perform. The 2027 Financially-Constrained Model Scenario from the 2018 Regional Transportation Plan was the Base Scenario for this analysis. (See Appendix C.)

- **Congestion Pricing:** Motorists pay directly for driving on a particular roadway or for driving or parking in a particular area*. Congestion Pricing* includes using variable road or parking tolls (higher prices under congested conditions and lower prices at less congested times and conditions).

- **Congestion Pricing Tools or Families:** Types of congestion pricing that can be used to toll `motorists to affect their behavior. In this study, Metro analyzed four different pricing tools: roadway pricing (motorists are charged tolls to drive on particular roadways); parking pricing (drivers pay to park in certain areas); cordon pricing (motorists are charged to enter a congested area); vehicle miles traveled (VMT) pricing (a.k.a. road user charge) (motorists are charged for each mile driven).

- **Community places:** The Access to Community Places performance measure is calculated by using existing data from the U.S. Bureau of Labor Statistics to identify the existing **community places** that provide key services and/or daily needs (defined in assumptions) for people in the region. Community places, for purposes of this analysis, included hospitals and other medical services, civic places such as post offices, churches, social services, libraries, schools, and colleges, financial institutions such as banks and credit unions, grocery stores, and essential retail services such as hardware stores, pharmacies, and laundry services.

- **Metro:** Metro is the federally-mandated metropolitan planning organization (MPO) designated by the governor of Oregon to develop an overall transportation plan and to program federal funds. Metro serves more than 1.5 million people in Clackamas, Multnomah and Washington counties. The agency's boundary encompasses Portland, Oregon and 23 other cities – from the Columbia River in the north to the bend of the Willamette River near Wilsonville, and from the foothills of the Coast Range near Forest Grove to the banks of the Sandy River at Troutdale. Unusual for an MPO, Metro has a regionally-elected council which consists of a president, elected regionwide, and six councilors who are elected by district every four years in nonpartisan races. Metro Council is advised by the Joint Policy Advisory Committee representing the region on transportation issues. Metro is also the agency responsible for the regional growth plan, land use vision, and urban growth boundary among other duties.

- **Regional Transportation Plan 2018 (RTP)**: As the metropolitan planning organization for the Portland metropolitan area, Metro is authorized by Congress and the State of Oregon to coordinate and plan investments in the transportation system for Clackamas, Multnomah, and Washington counties. This is done through periodic updates to the Regional Transportation Plan. The Regional Transportation Plan is a blueprint to guide investments for all forms of travel – motor vehicle, transit, bicycle, and walking – and the movement of goods and freight throughout the Portland metropolitan region. The plan identifies current and future transportation needs, investments needed to meet those needs and what funds the region expects to have available to over the next 25 years to make those investments a reality.

- **Equity Focus Areas:** Locations identified as part of the 2018 RTP Equity analysis that include census tracts with high concentrations of people of color, people in poverty and people with limited English proficiency.

Table 1 Equity Focus Areas

Community	Geography Threshold
People of Color	The census tracts which are above the regional rate for people of color (28.6%) AND the census tract has twice (2x) the population density of the regional average (regional average is 1.1 person per acre).
People in Poverty	The census tracts which are above the regional rate for low-income households (28.5%) AND the census tract has twice (2x) the population density of the regional average (regional average is 1.1 person per acre).
People with Limited English Proficiency	The census tracts which are above the regional rate for limited English proficiency speakers (7.9%) AND the census tract has twice (2x) the population density of the regional average (regional average is .3 person per acre)

Source: Metro, 2018 RTP transportation equity work group

- **Joint Policy Advisory Committee on Transportation (JPACT):** JPACT is a body comprised of 17 members that serve as elected officials or representatives of transportation agencies across Portland metropolitan region. JPACT develops plans and makes recommendations on priorities to the Metro Council on transportation needs in the Portland Metropolitan region. The Metro Council must adopt the recommendations before they become transportation policies.

- **Transportation Policy Alternatives Committee (TPAC):** TPAC provides technical input to the JPACT on transportation planning and funding priorities for the Portland metropolitan region. TPAC reviews regional plans and federally-funded transportation projects, and advises area leaders on transportation investment priorities and policies related to transportation. TPAC's 21 members consist of technical staff from the same governments and agencies as JPACT, plus a representative from the Southwest Washington Regional Transportation Council, and nine community members appointed by the Metro Council. In addition, the Federal Highway Administration, Federal Transit Administration, City of Vancouver, Clark County, Washington Department of Ecology and C-TRAN System have each appointed an associate non-voting member to the committee. *TPAC acted as the technical advisory committee for this study.*

Definitions of Performance Metrics

- **Daily VMT:** Vehicle miles traveled (daily).
- **Drive Alone Rate:** Percentage of total daily trips undertaken by drivers without passengers.
- **Daily Transit Trips:** Number of total transit trips (daily).
- **2HR Freeway VHD:** Freeway vehicle hours of delay. The total time accrued by all vehicles traveling on model freeway links with volume-to-capacity ratio of over 0.9 during the PM peak.
- **2HR Arterial VHD:** Arterial vehicle hours of delay. The total time accrued by all vehicles traveling on model arterial links with volume-to-capacity ratio of over 0.9 during the PM peak.
- **Emissions:** Percent change in greenhouse gas and other emissions including: CO2e, PM2.5, PM10, NOx, and VOC, calculated using Metro's Multi-Criteria Evaluation (MCE) tool, which estimates quantitative social return on investment of scenarios and applies emission rates derived from Metro's application of EPA's MOVES model to VMT of each scenario.
- **Job Access (Auto):** Number of jobs within 30 minutes by auto, averaged by Transportation Analysis Zone (TAZ) and weighted by number of households.
- **Job Access (Transit):** Number of jobs within 45 minutes by transit, averaged by TAZ and weighted by number of households
- **Total Regional Travel Cost:** Average weekday (2027) sum of all users' cost to travel, including auto operating cost, tolls, parking charges, and transit fares, expressed in thousands of 2010$.

1 INTRODUCTION

Metro is the Metropolitan Planning Organization (MPO) authorized by Congress and the State of Oregon to coordinate and plan investments in the transportation system for the three-counties – Clackamas, Multnomah, and Washington – and the 24 cities that comprise the Portland Metropolitan Planning Area. Metro uses this authority to expand transportation options, make the most of existing streets, and improve public transit service.

As an MPO, Metro works collaboratively with cities, counties, and transportation agencies to decide how to invest federal highway and public transit funds within its service area. It creates a long-range Regional Transportation Plan (RTP), leads efforts to expand the public transit system, and helps make strategic use of a small subset of transportation funding that Congress sends directly to MPOs.

Typically, Metro committees are made up of elected officials, technical staff from the three counties and dozens of cities inside Metro's boundaries, and subject matter experts. Two of these groups – the Joint Policy Advisory Committee on Transportation (JPACT) and the Transportation Policy Alternatives Committee (TPAC) were directly involved in the creation and development of this study.

- ***JPACT –*** Comprised of transportation representatives from across the region, JPACT recommends priorities and develops plans for the region. The Metro Council must adopt the recommendations before they become transportation policies. JPACT comprises 17 members who serve as elected officials or representatives of transportation agencies in the region.
- ***TPAC –*** the TPAC provides technical input to JPACT on transportation planning and funding priorities for the region. TPAC reviews regional plans and federally funded transportation projects and advises area leaders on transportation investment priorities and policies related to transportation. TPAC's 19 members consist of technical staff from the same governments and agencies as JPACT plus a representative from the Southwest Washington Regional Transportation Council and six community members appointed by the Metro Council. In addition, the Federal Highway Administration, Federal Transit Administration, City of Vancouver, Clark County, Washington Department of Ecology, and C-TRAN System have each appointed an associate non-voting member to the committee.

1.1 Study Purpose

Leaders in the Metro region have long recognized the importance of pairing investments in transportation capacity building with travel demand management tools. The 2018 RTP identified congestion pricing as a high priority, high impact strategy. The RTP directed Metro staff to conduct an analysis to understand the ability for different congestion pricing tools to help the region meet its priorities. Metro staff evaluated a range of scenarios testing four different congestion pricing tools (described in Figure 1) to understand if pricing could help meet the region’s four transportation priorities set out in the RTP:

- **Congestion** – by improving mobility
- **Climate** – by reducing greenhouse gas emissions
- **Equity** – by reducing disparity
- **Safety** – by getting to Vision Zero

The goal of this study is:

"To understand how our region could use congestion pricing to manage traffic demand to meet climate goals without adversely impacting safety or equity."

Figure 1 Congestion Pricing Strategies

Congestion Pricing Strategies

Congestion pricing could include a range of tools, including:

VEHICLE MILES TRAVELED FEE
Drivers pay a fee for every mile they travel

CORDON PRICING
Drivers pay to enter an area, like downtown Portland (and sometimes pay to drive within that area)

ROADWAY PRICING
Drivers pay a fee to drive on a particular road, bridge or highway

PARKING PRICING
Drivers pay to park in certain areas

Each of these pricing strategies could vary by time of day, by area, by types of drivers on the road, and by income levels.

Congestion pricing for the purpose of this study is the application of a price mechanism (such as roadway tolls, parking costs, variable tolls, or a charge per mile driven) to alert drivers to the external cost of their trip. It has been demonstrated to be effective at getting drivers to change their behavior (using more sustainable travel modes like transit, walking or biking, driving less, and driving at different times) and reduce congestion and greenhouse gas emissions where it has been implemented.

Leaders around the region may use the findings from this study to inform policies, including the development of the 2023 RTP, and other transportation projects that may include tolling in the future. The findings may also provide information for policymakers who want to propose new congestion pricing projects at the local level.

1.2 Study Timeline

This study took place over the course of approximately two years, as shown in Figure 2, Project Timeline. The study included a review of existing conditions within the region, a definition of what scenarios would be considered, the analysis of these scenarios using Metro's regional travel demand model, the development of findings from this analysis, and identifying next steps.

Figure 2 Project Timeline

1.3 Who was Involved?

This study was led by Metro staff, working closely with TPAC, JPACT, and Metro Council throughout the process. The City of Portland and TriMet were funding partners in the study, and project staff collaborated regularly with the City of Portland and ODOT to leverage and align parallel congestion pricing efforts. The team reviewed project equity analysis methods with Metro's Committee on Racial Equity (CORE), the Oregon Department of Transportation's Equity and Mobility Advisory Committee (EMAC), and the City of Portland's POEM Task Force for feedback.

Metro hired a consultant team to support technical analysis and process for this work. The consultant team was led by Nelson\Nygaard and included Sam Schwartz Engineering, HNTB, Silicon Transportation Consultants, TransForm, Mariposa Planning Solutions and PKS International.

Once at the findings stage, Metro convened an Expert Review Panel to review the data, methods, and findings of this study. The Expert Review Panel provided feedback on Metro's work along with their own experiences with congestion pricing, in a webinar with JPACT and the Metro Council. This webinar was open to the public. The panel consisted of five experts listed below:

- **Clarrissa Cabansagan**, Director of Programs at Transform; National leader in transportation policy and mobility justice.
- **Daniel Firth**, Transport and Urban Planning Director at C40; Congestion pricing leader in London, Stockholm, and Vancouver.
- **Rachel Hiatt**, Assistant Deputy Director for Planning at San Francisco County Transportation Authority; Project manager of the Downtown Congestion Pricing Study.
- **Sam Schwartz**, Founder and CEO at Sam Schwartz Transportation Consultants; Father of NYC congestion pricing.
- **Christopher Tomlinson**, Executive Director at State Road and Tollway Authority, Georgia Regional Transportation Authority, Atlanta-region Transit Link Authority; Expert in political, policy, and legal aspects of tolling.

The Expert Review Panel was moderated by Jennifer Wieland, Managing Director at Nelson\Nygaard. The recording of the panel is available on the project webpage at www.oregonmetro.gov/regional-congestion-pricing-study. Approximately 120 people attended the webinar.

There were several highlights from the Panel's independent review of Metro's work, and from the webinar discussion:

- The Panel found the methods used in this study to be sound, logical, and consistent with other places that have implemented congestion pricing.
- The panel found the findings from the study to also be consistent with their experiences with congestion pricing projects' performance elsewhere.
- The group advised project implementers to take the time up front to confirm the project purpose, and then focus on fulfilling that purpose, with an understanding that the design of a

congestion pricing program could look different, depending on the purpose it is being designed for.

- The Panel discussed the critical importance of centering equity, and the very real albeit unintended consequences that can arise from not doing so.
- The group recommended reaching out broadly, to all stakeholders – and recognizing the diversity of different stakeholder groups – recognizing that not all groups will be supportive, and that public acceptance of the effort will change over time.
- The Panel discussed the differences between congestion pricing and transit-oriented development between urban, suburban, and rural contexts. Every place is unique, and it is critically important to customize the pricing program to meet a region's unique needs. That said, pricing has been shown to be successful in all types of settings at improving mobility and addressing other priorities.

These tenets supported Metro's technical findings and informed the Agency's recommendations as described in Chapter 8.

1.4 **How to use this Report**

There are eight chapters in this report:

- *Chapter 1: Introduction* – describes the purpose and timeline of the project and who was involved.
- *Chapter 2*: *Metro's Commitment to Equity* – describes best practices for implementing congestion pricing programs equitably, including the steps to create an equitable process. It also provides an overview of the key metrics used to evaluate potential congestion pricing strategies in the Portland Metro Region as well as the engagement process.
- *Chapter 3: A Quick Look at the System Today* – provides information about current conditions and discusses the importance of thoughtful analysis of the benefits and impacts of congestion pricing to transportation disadvantaged communities.
- *Chapter 4: Methodology* – provides detail on the data and methods used to conduct the study's analysis, including the performance measures used in the analysis.
- *Chapter 5: Scenario Modeling Overview & Findings* – details key findings from the travel demand modeling analysis by scenario and by performance measure.
- *Chapter 6: Feasibility and Implementation Considerations* – summarizes key considerations for implementation of congestion pricing.
- *Chapter 7: Complexity of Revenue* – provides several considerations about collecting and using revenues generated from congestion pricing.
- *Chapter 8: Conclusions & Recommendations* – summarizes key recommendations from this study for policy makers and project champions.

2 METRO'S COMMITMENT TO EQUITY

Metro as an agency has a commitment to advancing equity within the region. Metro's *Strategic Plan to Advance Racial Equity, Diversity, and Inclusion* is a guiding document for the agency. Metro recognizes that there are severe disparities in the Portland region that have been created and reinforced by systemic racism. Metro is leading with race in its efforts to improve equity.

By beginning to address the barriers experienced by people of color in the Portland metropolitan area, Metro also effectively identifies solutions and removes barriers for other groups, like women, low-income residents, people with disabilities, LGBTQ community, older adults, and young people. The result will be that all people in the Portland area will experience better outcomes.

This chapter begins by providing an overview of best practices in implementing an equitable congestion pricing program followed by a description of how Metro threaded equity throughout the Regional Congestion Pricing Study process.

2.1 Best Practices for Implementing Congestion Pricing Programs in an Equitable Manner

Congestion pricing strategies can be used to increase accessibility and sustainability, and to mitigate traffic congestion in the Portland region. As the region continues planning for roadway pricing, Metro and implementing agencies must analyze the various impacts that congestion pricing will have on vulnerable communities.

Throughout the 20th Century (and indeed, before then as well), transportation and infrastructure planning has disproportionately burdened and harmed communities of color through negligent and intentionally racist planning practices. Because of this, many communities with lower income and minority households today, in the 21st Century have limited access to jobs and basic services like grocery stores even today and have on-going health concerns due to roadways being built through their communities. If Metro and implementing agencies do not prioritize equity during the congestion pricing planning process, the pricing of different roadways or geographic areas may disproportionately impact lower income groups, people with disabilities, and minority populations.

By beginning to address the barriers experienced by people of color in the Portland metropolitan area, Metro and its regional partners can also effectively identify solutions and remove barriers for other transportation disadvantaged populations, like women, low-income residents, people with disabilities, the LGBTQ community, older adults, and young people. This can result in better quality of life and health outcomes for all people in the Portland area.

How can pricing advance racial and social justice?

Agencies across the US and at all levels of government have planned and invested in transportation plans and projects in ways that have led to inequitable outcomes. People of color, immigrants, people experiencing lower incomes, people with disabilities, and other marginalized groups have historically been excluded from transportation decision-making and borne the brunt of the negative impacts of transportation projects. The unequal legacy of transportation planning includes well documented cases of highway construction projects targeting low income and BIPOC communities, investments that have disproportionately benefited white and higher income suburban car commuters over transit users in urban centers, and regressive forms of taxation to pay for it all.

Today, the legacy of inequitable transportation and land use planning has contributed to differences in outcomes along race, class, and ability in every region of the US. Race, income, and other demographic markers influence access to quality jobs, life expectancy, and other indicators of health and well-being.

To begin to repair the harms of the past, Metro and its partners must move past the legal minimum "harm reduction" approach in transportation planning to an approach that focuses the benefits of policies and investments on historically impacted communities and those with the greatest access barriers. By focusing on the communities and populations with the greatest needs, investments (and outcomes) will be more equitable, and Metro and its partner agencies will be able to create the greatest benefits for the region.

Interest in congestion pricing programs and projects has emerged in recent years as a way for cities, regions, and states to raise revenues in conditions where gas taxes and other revenue sources are declining, and as a strategy for meaningful climate action and traffic reduction. But discussions of pricing programs and projects have immediately faced scrutiny, skepticism, and concerns for their perceived impacts on low income, BIPOC, and other historically and currently excluded, impacted, and underserved populations. These concerns are legitimate. Pricing programs can negatively impact people already at a disadvantage. For example, pricing can increase costs for low-income drivers, create barriers to access jobs and other opportunities for certain populations, and cause traffic safety impacts along corridors already experiencing acute collisions due to spillover/cut through traffic[3].

If carefully structured, congestion pricing can create a more fair and just transportation system, not just compared to the predominant revenue raising strategies used to pay for transportation today, but more directly to improve affordability, access, safety, and health of historically and currently excluded, impacted, and underserved communities. Congestion pricing programs and projects can improve equity outcomes by:

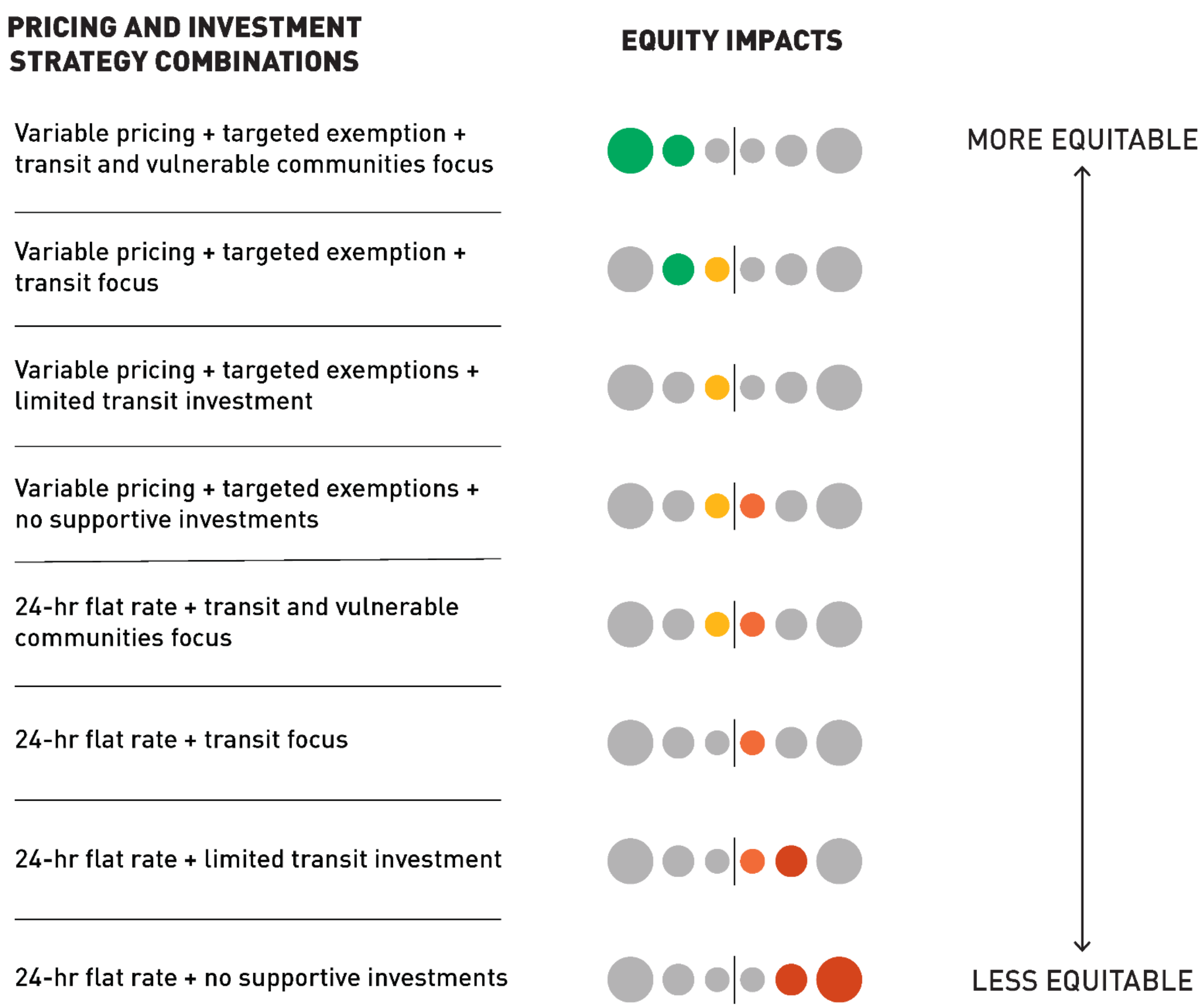
- Reducing harm and increasing benefits if agencies are willing to focus engagement on historically impacted residents and other stakeholders traditionally at a disadvantage and ensure they have a role in decision making at every step in the process.
- Committing to targeted investments of net toll revenues for locally supported improvements such as improved transit infrastructure and services and traffic safety improvements.
- Exploring who pays and to what degree, and considering a suite of affordability programs such as rebates or exemptions for low-income drivers, a "transportation wallet", or other investments that address affordability.

[3] The City of Portland has identified a high crash network of streets and intersections, and has prioritized funding that will improve safety on these streets, with an objective of eliminating traffic deaths and serious injuries. See https://www.portland.gov/transportation/vision-zero/high-crash-network for more information.

> **Transportation Wallet for Residents of Affordable Housing**
>
> Portland Bureau of Transportation (PBOT) in late 2018, started developing and implementing a pilot project that creates an incentive package for people living in existing affordable housing sites to access free transportation options, which includes transit passes, microtransit, and rideshare credits. This package is called Transportation Wallet and is being administered by PBOT in partnership with seven community organizations to up to 500 residents in selected housing developments.

The biggest determinant of whether a congestion pricing program improves equity is how the program is designed—who benefits, how people are charged, and how revenue from congestion pricing strategies is spent. A pricing program with the same charge can *improve* or *harm* equity depending on how it deals with affordability, the places it improves, and the type and locations of investments. An example of how this can be is shown as Figure 3 below.

Figure 3 Program Design Impact on Equity Outcomes



What are the steps to create an equitable pricing study?

It is critical that congestion pricing projects go above the legal minimum protections and procedures, including the National Environmental Policy Act (NEPA), and move from a harm reduction approach to an equity advancement approach. Released in 2019, TransForm's *Pricing Roads, Advancing Equity* report and toolkit is helping inform congestion pricing strategies and projects up and down the west coast, from Seattle to Los Angeles. The report and toolkit lay out a structure for agencies to consider when planning for pricing, including the five steps outlined in **Table 2**. TransForm's five steps mirror elements of other equity and tolling best practices, including the Governmental Alliance for Racial Equity's (GARE) *Racial Equity Toolkit*, the City of Portland Office of Equity and Human Rights *Racial Equity Toolkit Worksheet*, and the National Cooperative Highway Research Program's (NCHRP), *Assessing the Environmental Justice Effects of Toll Implementation or Rate Changes*. Best practices are also outlined in Figure 4.

Table 2 Steps to Consider when Planning for Pricing

TransForm's Pricing Roads, Advancing Equity Five Steps	NCHRP Tolling Assessment Steps	GARE Racial Equity Toolkit Steps & Questions	City of Portland Racial Equity Toolkit Worksheet Steps
1. Identify Who, What, and Where	1. Frame the Project 2. Identify the Applicable Requirements Governing Decisions 3. Recognize the Relevant Decision-Makers and Stakeholders	1. Proposal: What is the policy, program, practice, or budget decision under consideration? What are the desired results and outcomes? 2. Data: What's the data? What do the data tell us? 3. Community engagement: How have communities been engaged? Are there opportunities to expand engagement?	1. Set Equitable Outcomes 2. Collect and Analyze Data 3. Understand the Historical Context 4. Engage those most Impacted
2. Define Equity Outcome and Performance Indicators	4. Scope Approach to Measure and Address Impacts	*See #1 "Proposal" above*	*See # 1 "Set Equitable Outcomes" above*
3. Determining Benefits and Burdens	5. Conduct Impact Analysis and Measurement	4. Analysis and strategies: Who will benefit from or be burdened by your proposal? What are your strategies for advancing racial equity or mitigating unintended consequences?	*See #2 "Collect and Analyze Data" above*
4. Choose Programs that Advance Transportation Equity	6. Identify and Assess Mitigation Strategies	*See #4 "Analysis and Strategies" above*	5. Develop Racially Equitable Strategies and Refine Outcomes 6. Implement Changes

Table 2 Steps to Consider when Planning for Pricing

TransForm's Pricing Roads, Advancing Equity Five Steps	NCHRP Tolling Assessment Steps	GARE Racial Equity Toolkit Steps & Questions	City of Portland Racial Equity Toolkit Worksheet Steps
5. Provide Accountable Feedback and Evaluation	7. Document Results for Decision Makers and the Public 8. Conduct Post-Implementation Monitoring	5. Accountability and communication: How will you ensure accountability, affordability, communicate, and evaluate results? 6. Implementation: What is your plan for implementation?	7. Evaluate/ Accountability/ Report Back

The following steps should be considered when designing an equitable pricing assessment, study, plan, or project.

Identify who, what, and where. One of the first steps in an equitable study or project is to scope out different project/program alternatives, their location, and the populations of concern that may be affected by the project or program.

1. **Who** are the populations of concern in the project/plan area - people with disabilities, immigrant populations, people of color, people experiencing low income?
2. **What** are the potential pricing programs?
3. **Where** are the pricing programs located, particularly in relation to populations of concern? **Where** do populations of concern live, work, and travel in the project/study area? **Where** are the destinations within the project area that populations of concern frequent?

Engage and partner with representatives of impacted communities each step of the way. In order to build trust and best inform project and study outcomes, it's critical to meaningfully engage and partner with representatives of historically excluded and impacted communities in the study/project/program area(s). This can take the form of the establishment of an equity stakeholder committee (including stipends to value participants' time), hiring consultants or community engagement liaisons with deep ties and trust with impacted communities in the area, establishing a participatory budgeting process for the investment of net toll revenues, and funding community based organizations in the area to directly engage their communities and serve as an additional sounding board for key questions along the arch of the planning process.

Define equity and establish equitable goals and objectives. With substantial community input and collaboration with representatives of impacted communities, agencies should gain consensus on equity definitions and to establish the equitable direction for the project, program, or study. It is important to be as explicit as possible. For example, is the goal to avoid further harm to historically impacted communities, to rectify historic injustices, or to build trust in communities that have been excluded and undervalued in past transportation decision making?

Define Equity Outcome and Performance Indicators. The next step is to identify and commit to equity indicators to assess the benefits and burdens of pricing. Measurable indicators can and should be established for both outcome equity (such as affordability, access to opportunity, community health) and process equity (community engagement) indicators.

Figure 4 An Equity Framework for Road Pricing

INCREASED ACCESS TO OPPORTUNITY

- ⇨ Does it overcome barriers (financial, cultural, technological, geographic) to accessing new mobility, so vulnerable populations actually benefit?
- ⇨ Does it improve, not impede, the movement of public transit?
- ⇨ Does it increase access to jobs, education, health care, and other destinations?
- ⇨ Does it reduce travel times for low-income households?
- ⇨ Does it prioritize the needs and trip patterns of vulnerable populations?

AFFORDABLE OPTIONS

- ⇨ Is the price low enough for low-income individuals to regularly use the service?
- ⇨ In instances where existing services such as bus lines are being cut, are there mechanisms to ensure that transportation costs don't increase for low-income households?
- ⇨ Is it likely to reduce transportation costs in the long run (e.g. by reducing the need for vehicle ownership or for parking in new developments)?

MORE HEALTHY & SAFE COMMUNITIES

- ⇨ Does it reduce air pollution and greenhouse gas emissions, both of which disproportionately burden low-income communities and people of color?
- ⇨ Does it serve people with disabilities, or people who walk or bike?
- ⇨ Are there policies in place to prevent discrimination or racially-biased policing?
- ⇨ Is it likely to improve health and reduce health disparities for vulnerable populations (e.g. by reducing crashes and fatalities or focusing vehicle electrification in impacted communities)?

REDUCED INCOME INEQUALITY & UNDEREMPLOYMENT

- ⇨ Does it increase employment with stable, well-paying jobs?
- ⇨ Does it create pathways for low-income individuals to enter the new mobility work force?
- ⇨ Are there policies in place to ensure fair treatment of the labor force (e.g. providing a living wage, ability to unionize, benefits, etc.)?[9]
- ⇨ Are we creating programs to train workers and replace jobs that will be lost with vehicle automation?

1. **Process equity:**
   - *Public participation:* As noted above, focused engagement of historically excluded and impacted communities is fundamental to reaching equitable outcomes for any project or plan. Agencies can select indicators to measure process equity - the degree to which equitable community engagement is achieved.
2. **Outcome equity:**
   - *Affordability:* Affordability naturally looms large when discussing congestion pricing. Agencies should identify indicators to assess the potential affordability implications on different

demographics and geographies, such as low-income drivers who live and/or work in areas without good transportation options, urban transit users, and businesses and delivery services.

- *Access to opportunity:* Theoretically congestion pricing should create less congestion, thereby increasing access and reliability to jobs and other needs. But this is not always the case everywhere it is applied, nor are the access benefits evenly distributed. For example, the Roadway scenarios saw diversion of trips from the highway to the local arterial network to avoid paying the toll – the greater the toll, the greater the diversion. Diversion created congestion on some routes. Agencies can choose indicators to study the employment and education access implications of populations of concern by various modes.
- *Community health:* Congestion pricing can have positive and negative impacts on communities with longstanding health disparities. Agencies can select health and safety indicators to study the implications on populations of concern - positive & negative.

Analyze benefits and burdens. Once indicators have been selected, agencies should conduct the necessary assessments to identify the extent to which the identified populations of concern are impacted by project or program alternatives. Special attention should be placed on travelers by geography, mode, and demographics of interest. As agencies plan for the assessment process, it's important to ask the following questions:

- To what extent can the required analytical/assessment processes and tools accomplish what is needed in order to identify whether or not and to what degree the project or program is advancing equity?
- What additional analytical/assessment processes and tools are needed in order to bridge any gaps?
- How many rounds of analysis/assessment are needed to provide the greatest level of clarity and assurance about the implications of various programs and strategies?

Program and strategy selection. The program and strategy selection stage may naturally be where the greatest community interest is likely to emerge over the course of the process. The assessment phase preceding the selection phase should shed light on which pricing programs are most likely to advance equity. The assessment phase should also provide some sense of the kinds of strategies that may be able to further increase benefits and reduce harm to communities and populations at a historic and current disadvantage. At this point in the process, selection of a pricing program and associated pricing strategies should take place, depending on the degree of community support. Which package of congestion pricing program(s) and revenue reinvestment strategies do impacted communities prefer?

Accountable feedback and evaluation. A project or program is not over after the ribbon cutting ceremony. Pricing programs and projects offer the opportunity to continue to make changes over time in response to changing conditions and community priorities. Agencies should continue to monitor, assess, report back, obtain input, and modify over time to achieve equitable outcomes, focusing on fostering transparency and building trust with impacted communities. If, for example, a pricing project or program is not hitting the mark on affordability indicators/metrics, this provides an opportunity for the responsible agency to revisit the program approach and revenue reinvestment strategies in consultation with impacted community residents and stakeholders.

How does revenue reinvestment help advance equity?

As opposed to other traffic reduction and transit improvement projects and programs, congestion pricing has the virtue of being able to produce surplus revenues that can be reinvested for strategic purposes, including equity goals and objectives. In combination with careful selection and geographic placement of the pricing strategy/program, pricing revenue investments on geographies or populations at a disadvantage may lead to net benefits for communities and populations at a disadvantage. The step of reinvesting revenue with an equity focus is critical. Increasing travel options, creating new connections, and prioritizing affordable modes can support equity, but strategies must be informed by community members. Pricing also offers the ability to provide exemptions, rebates, and discounts, for example to persons experiencing low income - something that taxes generally cannot do. Revenue reinvestment also provides the opportunity to democratize spending, providing input opportunities and even direct decision-making power on how to spend pricing revenues with impacted communities and stakeholders (such as through participatory budgeting).

In depth analysis with modeling and mapping can show the geographies where benefits and impacts are likely to occur with a project. This analysis can help project implementers to understand where to focus investments (and outreach) and what types of investments make sense to improve equity. For example, if a roadway toll results in drivers diverting to a nearby arterial to avoid the charge, the project could look at the type of investments that could reduce the negative impacts to that arterial.Agencies and communities will need to strike a balance between affordability programs and the kinds of strategies that can best increase access to opportunity, mode shift, improve community health/safety, or other desirable outcomes. Examples of the kind of equitable programs and strategies that could be funded by pricing revenues can be found in Figure 5.

Figure 5 Sample Strategies to Advance an Equity Agenda

Strategy	Examples
Affordability and Driver Assistance	**Driver Discounts, Caps, and Exemptions**, such as: • Free or discounted transponders • Toll discounts or credits for low-income households • Exemptions for people with disabilities • No tolls during off-peak hours
	Cash Payments for those without credit cards or bank accounts
	Transit Discounts, such as: • ORCA LIFT transit discounts • Subsidized bike and car share memberships or rides
Greater Mobility Options and Safer Active Transportation Networks	**Improved Transit Service,** including: • New routes to more destinations • Faster, more reliable service • Improved stations/stops
	Carpool and Vanpool Programs, such as: • Carpool matching services • New vanpool routes
	Pedestrian/Bike Improvements, including: • Improved pedestrian network • Improved bicycle network • Pedestrian-scale lighting
	Emerging Mobility Options, such as: • Bike share • Car share • Creative use of rideshare services to connect to transit • Shuttles • Carpool apps and programs
Programs for Seniors and People with Disabilities	**Accessible Information**, such as senior help lines and materials
	Targeted Transit/Shuttle Routes
Healthier Communities	**Encourage Clean Air Vehicles,** through strategies such as: • Credits for drivers • Purchase clean transit vehicles

Equity and Transportation Funding and Investments in the Portland Metro Region

Funding, Investments, Benefits and Burdens, and Restrictions

Transportation funding and revenue allocation reinforces inequity in Oregon today. Many people worry that congestion pricing will hurt those least able to pay. However, our current system is inequitable. Not only are transportation funding sources regressive, but spending is also focused on automobile infrastructure over other transportation modes, as shown in Figure 4 below. Gas taxes rates are a fixed amount per gallon regardless of a driver's ability to pay, and motor vehicle fees in Oregon are not correlated to a motorist's income nor the value of the vehicle.

According to ODOT, the agency will collect over $5.3 billion in total revenue during the 2017-2019 biennium: 23 percent of the funds coming from the federal government and 77 percent coming from state sources. Federal funds come from the Highway Trust Fund which attains 84 percent of its revenue from gas taxes. State funding sources include state fuels tax, taxes on heavy trucks, driver and motor vehicle fees, and bond proceeds and Certificates of Participation.

These funding sources are regressive. Gas taxes rates are a fixed amount per gallon regardless of a driver's ability to pay. In addition, motor vehicle fees in Oregon are not correlated to a motorist's income nor the value of the vehicle.

About $1 billion (19 percent) of total revenue flowing through ODOT is distributed to Oregon cities, counties, and other agencies. This leaves about $3.94 billion remaining for ODOT's 2017–2019 biennial operating budget and ending balance. Figure 6 below illustrates the disparities that exist between revenues generated in total, and those that can be spent on non-automobile related investments.

This focus favors those with more means and encourages driving. It reinforces inequity with spending focused on auto infrastructure. The current structure will not achieve the region's urgent climate and equity goals. In addition, health impacts from high automobile reliance disproportionately harm BIPOC and low-income communities. Low-income people spend a much higher percentage of their income on transportation than high income earners. As it functions today, the current funding and spending system will not help the region meet its equity and climate goals.

Figure 6 Inequities within Today's System

The Highway Division accounts for about two-thirds, or about $2 billion, of ODOT's 2017–2019 legislatively approved budget. The division spends its resources on maintaining the highway system, bridge and pavement preservation projects, adding capacity to highways, and bicycle/pedestrian projects (Source: ODOT).

Revenue Investments and Inequity

The perception that everyone benefits or benefits equally from "free" roads not being priced is a misconception. Car-focused spending of transportation dollars favors people that can afford to purchase and maintain a private car and who drive more.

Roadway-focused spending disproportionately benefit white people and those that have more means. In the Portland Metro area, people of color are more likely to rely on transit, walking, and carpooling. Nearly 20% of African American households, 14% of Latino households, and 13% of Asian households live without a car (Source: Metro 2018 RTP). In addition, racial minorities are four times more likely than whites to rely on transit for their work commute.[4] Low-income people, disabled people, and seniors are also much more likely to rely on transit.

Government provision of free roads and auto infrastructure acts like a matching grant, whereby those that can afford to own and operate a car are given the benefit. Those that cannot afford auto ownership or that are unable to drive, do not receive the same benefit.

Transportation investments that focus on transit, walking, and biking infrastructure, especially if targeted to areas with concentrations of transportation disadvantaged groups can improve equity. Figure 7 demonstrates equity impacts of different investment strategies.

Figure 7 Revenue Investment Equity Matrix

REVENUE INVESTMENT EQUITY MATRIX	
INVESTMENT STRATEGY	***EQUITY IMPACTS***
Road expansion	Does not add more affordable options.
Mix of road expansion and transit	Some drivers can shift to new, more affordable modes. Transit users also benefit.
Transit, walking, and bike infrastructure with targeted carpool, vanpool, and new mobility options where needed	Allows greater shift to more affordable and sustainable modes.
Transit, walking, and bike infrastructure with an **intensive focus on vulnerable communities**	Significant expansion of commute options and a reduction in user costs (if fares are reduced on transit and other mobility options).

Source: TransForm

Transportation Cost Burden

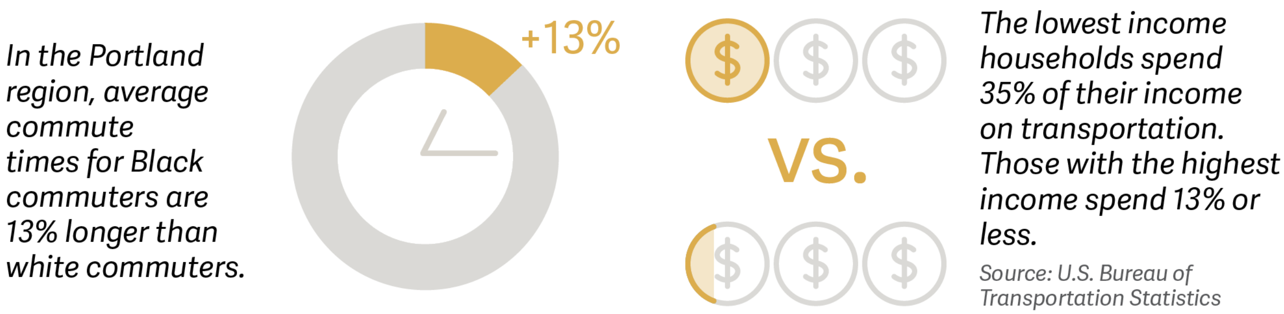
The transportation cost burden reflects the amount of household income that is spent on transportation-related expenses. Transportation-related expenses include the cost to own and operate a vehicle (including maintenance), to ride transit, and to own and maintain a bicycle. The transportation cost burden is typically around 20% of a household's income. In the Portland region, this ranges from 10% - 35% of a household's income and is directly correlated with income status. The lowest income households spend more than 1/3 of their salary on transportation, whereas those with

[4] Oregon Household Activity Survey, 2011

the highest incomes spend closer to 1/10 of their salary on transportation. This is illustrated in Figure 8 below.

There are also public health impacts correlated with race and income status. In the Portland region, the 10 lowest income and 10 highest minority neighborhoods experience more exposure to toxic air than the average neighborhood[5].

Figure 8 Inequitable Transportation Cost Burden



Potential Limitations on the Use of Revenues

The use of revenue generated from a congestion pricing program may be subject to legal limits at the state and/or federal level. In May 1980, Measure 1 passed. The specific Oregon constitutional language states **"[...] use of revenue from taxes on motor vehicle use and fuel [...] shall be used exclusively for the construction, reconstruction, improvement, repair, maintenance, operation and use of public highways, roads, streets and roadside rest areas in this state" (Article IX Section 3a).** This provision *may* place limits on spending from a congestion pricing program depending on whether the different types of congestion pricing are deemed to be a tax or a fee. Based on past practices, the limit is unlikely to apply to parking charges. However, it is unclear how the other pricing tools may be affected.

Metro also assessed which items the Highway Trust Fund dollars could be spent on. There is some uncertainty regarding restrictions that would need to be explored as program or project efforts moved forward.

How to Create Holistic Projects within this Potential Limitation

Potential spending limitations do not have to get in the way of a holistic approach to solving transportation problems when implementing congestion pricing. Based on best practices research and input from pricing experts, congestion pricing projects should incorporate an in-depth analysis of potential benefits and impacts for the project early on. Then, the congestion pricing project *itself* can be defined to include investments that address impacts and bring about improvements to safety, equity, climate, and mobility. That could include any strategy that addresses concerns that are not listed as eligible for funding based on creating a project that works for the region.

[5] 2012 Portland Air Toxics Solutions Committee Report and Recommendations, Oregon Department of Environmental Quality.

2.2 Equity in the Regional Transportation Plan

The Regional Congestion Pricing Study (RCPS) is a technical analysis that was identified in the 2018 Regional Transportation Plan (RTP) as an implementation action. Metro's leadership has long recognized the importance of pairing investments in transportation capacity building with travel demand management tools. Consequently, Chapter Eight of the RTP directed staff to conduct an analysis to understand the ability for different congestion pricing tools to help the region meet its priorities: addressing congestion/mobility, addressing climate, addressing equity, and addressing safety.

The RTP was created with over three years of extensive engagement to identify priorities and needed analysis. Therefore, the RCPS focused on the technical analysis of potential outcomes of different types of pricing as they would function in the Portland area, based on its specific land use and transportation system. Engagement was focused on getting input on the proposed methods of analysis and indicators of success – outcome equity rather than process equity. The next steps for the region, proposing projects or developing policy around the technical findings, should feature a deeper level of engagement.

The RCPS used transportation modeling to assess benefits and impacts for different types of congestion pricing; in particular, whether these tools could help the region meet its priorities. These benefits and impacts were assessed for the equity focus areas in comparison to the region to better understand potential unintended consequences resulting from congestion pricing. The details of these findings are included in Chapter 5: Scenario Modeling Overview & Findings.

2.3 Equity Measures Included in the RCPS Effort

Equity was a central tenet to the RCPS analysis. The analysis started with a review of the region's current transportation system (see Chapter 3). It is acknowledged that the transportation network is not equitable and continues to reinforce inequity through the taxing system in how revenues are collected and spent. Furthermore, the RCPS analysis explored what access looks like specifically for the equity focus areas within the Portland Metropolitan Region, and for specific transportation disadvantaged groups. There is agreement that congestion pricing is a tool that could improve equity if implemented correctly. Best practices and input from equity stakeholders/experts are important and are established in this Chapter. The Chapter also documents those equity outcomes featured in the RCPS methodology and analysis, as well as guidance from equity experts at CORE, EMAC, and the POEM Task Force consulted as part of the RCPS effort.

The equity analysis relied on research and analysis and input from experts in the field with experience addressing equity as a part of congestion pricing programs and methods for obtaining meaningful feedback from often marginalized communities. In addition, the Metro team reached out to three groups with equity expertise in the region for feedback on the methodology: Metro's CORE, the City of Portland's POEM Task Force, and ODOT's EMAC.

The Metro team explained that primary indicators of whether a program is equitable are focused on how a program is designed. The same pricing project (i.e., $3.00 toll to drive on a road) can have vastly different equity impacts depending on these considerations:

- Is affordability built into the program?
- Are there caps or discounts for key populations? Do they take into account the ability to pay or the accessibility of alternatives to driving? Who is paying and how much?
- Where are the revenues invested? (i.e., are they invested in key neighborhoods with equity issues or that are impacted negatively by the new charges?)
- Are they invested in transit, pedestrian facilities, or transit that disproportionately serve marginalized groups?
- Are they invested in senior and disabled services or targeted to other key groups?
- Who benefits?
- Is the pricing program designed to target the mobility benefits and/or air quality benefits to populations and areas that have been historically marginalized?

The analysis of different pricing scenarios was not iterative and did not dive into how the program elements around equity would be addressed within a project. Rather, the RCPS used available technical tools to understand potential benefits and areas of concern by modeling and mapping different pricing scenarios. This was done by testing different pricing strategies against baseline conditions and other potential strategies, assessing performance with the Portland region's land use and transportation system to see what the outcomes would be for the general population and key groups, and incorporating feedback from Equity Stakeholders and Experts. The technical tools used for this effort included Metro's travel demand model, Metro's Multiple Criteria Evaluation tool, GIS, and Census data.

RCPS methods to assess equity performance of different pricing scenarios included:

- Applying best practices when conducting the analysis;
- Crafting recommendations for any future projects and policies to incorporate best practices;
- Reaching out to equity groups for feedback on methods and gather feedback;
- Using Metro's regional transportation model to demonstrate how congestion pricing tools can perform in our region with our land use and our transportation system;
- Comparing different pricing scenarios' performance relative to each other and to a baseline scenario from the RTP (the 2027 Financially-Constrained Scenario);
- Analyzing model outputs that demonstrate equity – primarily improvements to access to jobs via transit and automobile; and
- Generating maps that show changes in transportation costs and mobility benefits geographically distributed through the Metropolitan Planning Area (MPA).

Metro produced several maps including:

- Changes in travel costs for residents (increased or decreased costs) relative to the base scenario for census tracts;
- Changes in access to jobs by transit from the census tracts relative to the base scenario (45-minute access);

- Changes in access to jobs via automobile for census tracts relative to the base scenario (30-minute access); and
- Overlays of the equity focus areas to demonstrate whether pricing scenarios result in impacts or benefits for key populations of concern.

The analysis also measured whether there were improvements in access to community places[6] that provide key services and/or daily needs. For this high-level review, Metro did not delve deeper into census data and mapping that could be predictive of equity impacts – such as potential impacts and benefits to households with disabilities, elderly populations, or other potential transportation considerations. An actual pricing project would be expected to perform an in-depth assessment of the benefits or impacts to these groups and determine if it was appropriate to modify the design of the project or introduce mitigations for negative impacts such as fee discounts or caps for key groups or geographies, or investments in infrastructure or services that would improve transportation benefits for negatively impacted groups.

Table 3 shows the performance measures used to assess how well different pricing tolls performed relative to the four regional priorities.

Table 3 RTP Priorities and Performance Measures

2018 RTP Priority	Outcome Being Measured	Performance Measures Proposed for RCPS (All measures except safety are outputs from Metro's Regional Transportation Model)
Equity	• Accessibility	• Access to jobs (emphasis on middle-wage) • Access to community places
Safety	• Eliminate fatal & severe injury crashes for all modes of travel	• Level of investment in improvements that address fatalities and serious injuries on high injury corridors or roadways experiencing diversion (safety countermeasures)
Climate Change	• Reduce emissions from vehicles	• Percent reduction of greenhouse gases per capita • Percent reduction of criteria pollutants and transportation air toxics • Percent reduction of vehicle miles traveled per capita • Shift in travel behavior
Traffic Congestion	• Multimodal travel times • Mode split/shift • Mode miles traveled (e.g., person miles traveled, vehicle miles traveled)	• Travel time between regional origin-destination pairs during mid-day and evening commute hour peak by mode of travel (e.g., auto, transit) • Mode split for single-occupancy vehicles • System-wide number of miles traveled (total and share of overall travel) by different modes of travel • Avg weekday transit boardings for all transit service providers (e.g., TriMet, SMART, C-TRAN and Portland Streetcar, Inc.)

[6] Community places, for purposes of this analysis, included hospitals and other medical services, civic places, such as post offices, churches, social services, libraries, schools and colleges, financial institutions, such as banks and credit unions, grocery stores, and essential retail services, such as hardware stores, pharmacies and laundry services.

2.4 Targeted Engagement with Equity Stakeholders and Experts

Metro reached out to three groups with expertise in equity: Metro's CORE, the City of Portland's POEM Task Force, and ODOT's EMAC to discuss and receive feedback on the RCPS methods for assessing equity benefits and impacts.

Metro met with the entire CORE group to introduce the RCPS in September 2020, and then with a subset of the CORE to discuss methods in more depth in December 2020; with a subgroup of the POEM Task Force in December, and with the EMAC in February 2021.

Metro shared the technical nature of the study to understand the outcome equity of different types of pricing. Staff also shared that a program would need to be designed to address equity by building affordability into a pricing program (potential discounts and exemptions), focusing revenue on equity outcomes (key neighborhoods, transit/bike/pedestrian facilities, and senior and disabled services), and targeting pricing benefits to key locations (mobility benefits and air quality).

Metro reviewed the RCPS methods to assess benefits and impacts to equity by focusing access to jobs and community places and transportation costs. These benefits and impacts would be mapped and how they impacted EFAs would be compared to how they impacted the general region. In addition, the study would assess travel times, costs, mode shift, and congestion, and reductions in emissions and pollutants.

The groups discussed these items and generally agreed that the metrics and focus on the geographic distribution of benefits and costs were helpful to understand pricing tools' performance. The groups also agreed that an actual project/program would need to conduct a much more detailed analysis. Finally, they agreed that the current system is inequitable.

Key themes heard from the groups:

- Go beyond a toolkit
- Community must be engaged throughout projects;
- Design scenarios to address barriers
- Promises made for equity are not guaranteed
    - How can we ensure targeted revenue, discounts, etc. are carried out?
- Pricing should be paired with an access strategy;
- Access to jobs, education, and community services;
- Public health should be considered –*emissions helpful, but there is more;*
- Focus on the future state we want then assess where the benefits occur;
- Concern that wealthier drivers will just pay the toll and continue business as usual;
- Focus on using revenues to make alternative transportation and transit more viable for BIPOC and low-income communities (ex. "transportation wallet");
- Concern over potentially disparate impacts

- BIPOC and low-income residents, especially those who commute off-peak and to multiple jobs;
- Suburban/rural areas versus urban areas that are less car dependent;

- Issues with car culture/difficulty in using transit/privacy concerns;
- How can a pricing project increase equity rather than "do no harm"?
- How will COVID / work from home change commute patterns and needs?
- Interest in continuing the conversation.
- Establish post-deployment monitoring.

How should Metro and its partners engage equity focus areas in the process in future phases of study?

During the planning process, the agency should identify the equity focus areas (census tracts that represent communities where the rate of people of color (POC) or people with limited English proficiency (LEP) is greater than the regional average or people with low income) that exist within the Portland region. These are the communities that should be included in discussions with Metro and its partners to evaluate the impacts of congestion pricing. While doing this, the agency can engage and form partnerships with neighborhoods, community leaders, and community organizations to address any concerns such as affordability, access to opportunities, and community health.

In addition, resources should be provided to lower income communities and neighborhoods that are in the vicinity of roadways being considered in pricing scenarios. Some potential resources for these communities should include introducing programs to dedicate pricing revenues to affordability programs for low-income auto-users, public transit improvements, and bicycle and pedestrian improvements in communities faced with heavy congestion and health disparities.

Based on the best practices and analysis, the community engagement for upcoming efforts should be focused on communities of color and individuals with different languages and different levels of English proficiency that would potentially be disproportionately impacted by transportation projects which feature congestion pricing. Best practices would be to invite community members to join the planning process during the early stages of the project and work with community leaders who can be advocates for the communities that they represent. Community-based organizations can serve as an effective liaison for reaching communities of color. There are *many* diverse community and ethnic groups in the region; including the Bhutanese, Nepali, Micronesian, Chuukese, Malaysian, Singaporean, Syrian, Thai, Filipinos, Indian, indigenous, and African groups that are usually underrepresented during the community engagement process. To engage these groups further, working with ethnic media outlets may encourage more ethnic groups to be involved and to stay well-informed during the planning process. As with other best practices, ethnic media should be engaged early in the planning process.

Community organizations that should be included in future outreach:

1. Pacific-islander Asian Family Center & Immigrant and Refugee Community
2. African House
3. Slavic Center
4. Asian Health Center
5. Lutheran Church
6. Catholic Charity
7. Latino Network
8. Urban League
9. Asian Pacific American Network of Oregon
10. Neighborhood Associations
11. Japan-America Society of Oregon
12. Japanese American Citizens League
13. Japanese American Museum of Oregon (formally known as Oregon Nikkei Legacy center)
14. Chinese American Citizens Alliance-Portland Lodge
15. Chinese Consolidated Benevolent Association
16. The Filipino American Association of Portland & Vicinity

Throughout the early planning phases, Metro and its partners should solicit advice from community leaders and liaisons to craft key messages that are culturally relevant and sensitive. Some people of color have fluent English proficiency, whereas others will have limited English proficiency (LEP).

Once relationships with communities and community leaders have been established, Metro and its partners can continue to work with trusted community leaders to engage with other community members who may be less informed about the effort. Additional opportunities for community participation such as speaking and engaging at local events and gatherings and reaching out to student populations is encouraged to increase the level of participation.

Main takeaways for public outreach to communities of color are to:

- Be mindful of the public's interest
- Build long-term and meaningful relationships
- Ensure that the information being discussed is easy to understand
- Provide ample time for community members to participate

3 A QUICK LOOK AT THE SYSTEM TODAY

The current transportation system in the Metro region, in Oregon, and across the United States is not equitable and continues to reinforce inequity through the taxing system in how revenues are collected and spent. This section explores today's transportation funding sources, funding restrictions, and access to jobs for the region's equity focus areas.

3.1 Mapping Access to Opportunity via Auto and Transit

A first step in the RCPS was to analyze the current conditions of the transportation system. Several indicators, such as access to jobs by transit, equity focus areas, and low-income residents, help to document how the transportation system is currently serving people in Portland. These indicators help to frame the technical analysis results and what the influence of a congestion pricing program could be on the region in Chapter 5.

Equity Focus Areas

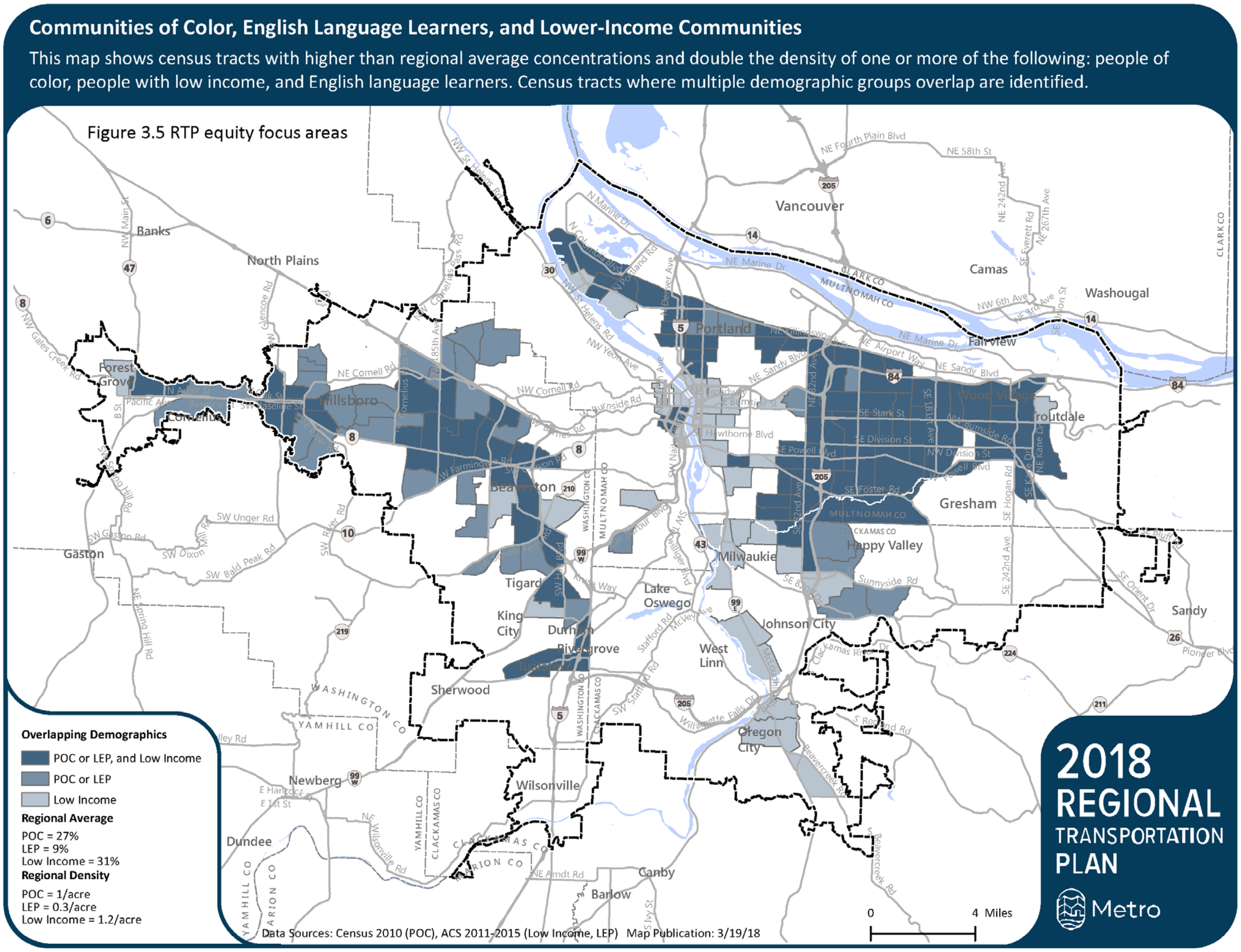
As part of the 2018 RTP equity analysis, Metro identified equity focus areas (EFAs), which are census tracts with high concentrations of people of color, people in poverty and people with limited English proficiency. **Table 4** indicates the thresholds used for identifying EFAs, while Figure 9 displays the locations of EFAs within the region. These EFAs were used to help analyze scenarios tested as part of this study. More in-depth analysis of benefits and impacts would be necessary before implementing a pricing program. Other congestion pricing studies or projects may study impacts to EFA populations, or to additional populations as appropriate.

Table 4 Equity Focus Areas

Community	Geography Threshold
People of Color	The census tracts which are above the regional rate for people of color (28.6%) AND the census tract has twice (2x) the population density of the regional average (regional average is 1.1 person per acre).
People in Poverty	The census tracts which are above the regional rate for low-income households (28.5%) AND the census tract has twice (2x) the population density of the regional average (regional average is 1.1 person per acre).
People with Limited English Proficiency	The census tracts which are above the regional rate for limited English proficiency speakers (7.9%) AND the census tract has twice (2x) the population density of the regional average (regional average is .3 person per acre).

Source: Metro, 2018 RTP transportation equity work group

Figure 9 RTP Equity Focus Areas



Job Access (Auto) – Equity Considerations

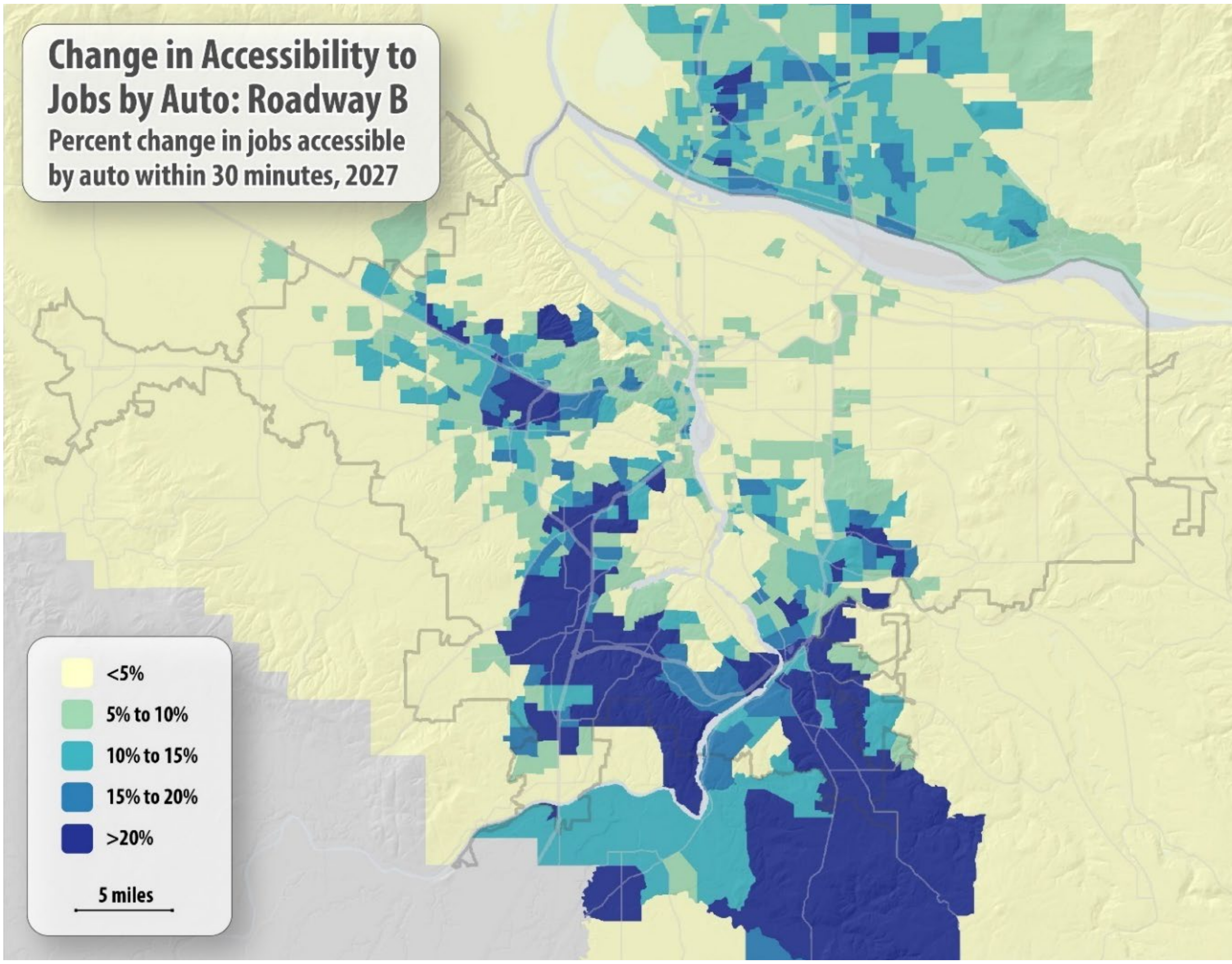
The Metro RCPS analyzed eight different pricing scenarios. To understand impacts and benefits from the scenarios the project team mapped the changes in access to jobs and cost to travel by Transportation Analysis Zone (TAZ). These data where then combined in a third bivariate map to demonstrate how benefits and costs are distributed across the Metropolitan Planning Area. In addition, equity focus areas were overlaid on the bivariate maps to understand the potential impacts to some equity populations.

This section provides an example of a detailed equity analysis based on the modeling results. This example is for the Roadway B scenario, in which all freeways and limited-access highways within the Metropolitan Planning Area were tolled. The full set of maps for the other scenarios is included as Appendix D.

- Access to jobs by auto generally improved in areas close to the tolled throughways. The Access to Jobs by Auto map (Figure 10) reflects the change in the number of jobs that *could* be accessed by drivers by geographic area due purely to travel time changes on roadways.

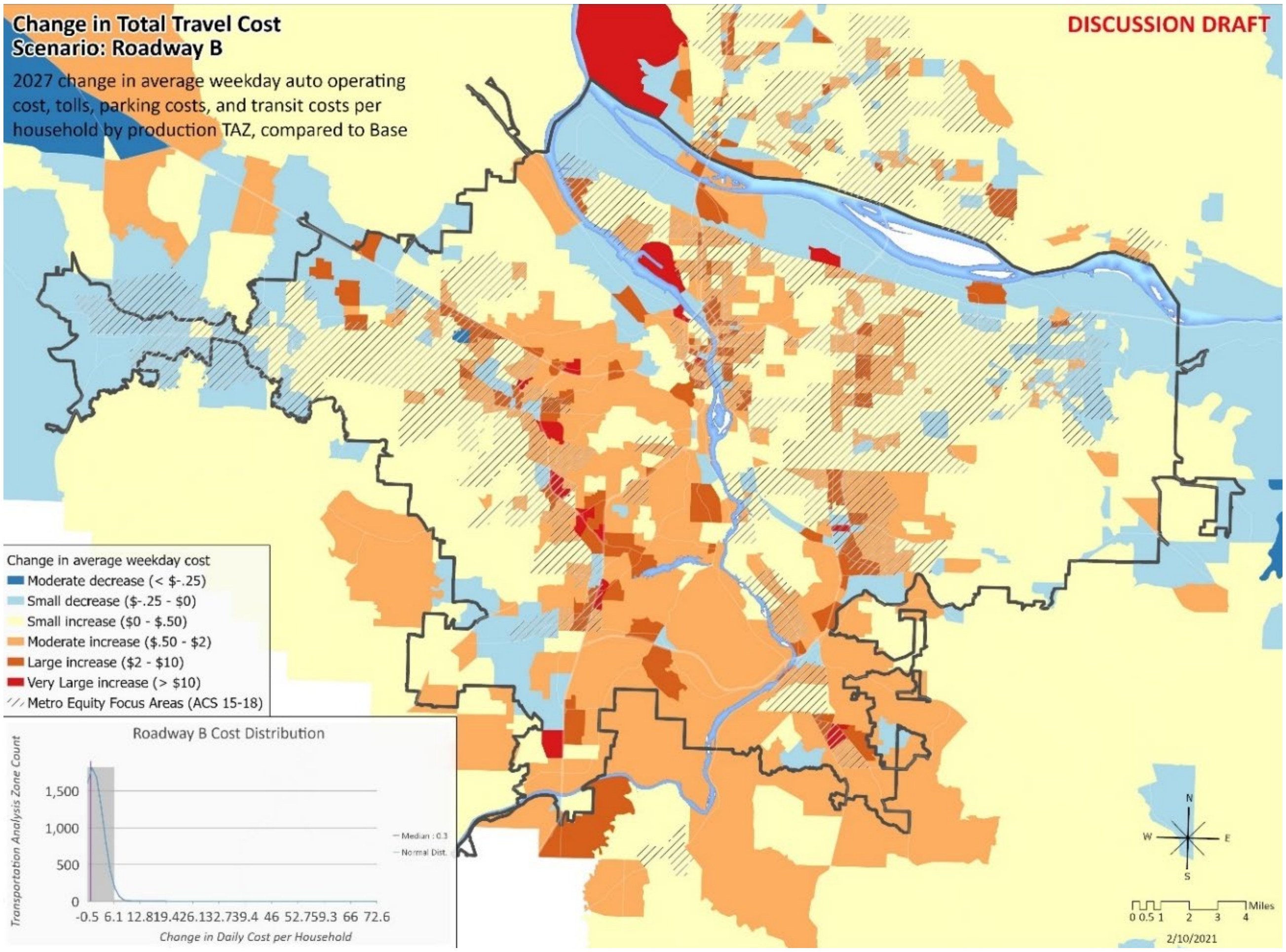
- Due to the *cost* of travel on the tolled roadways some commuters would choose not to take the fastest route. Modelled tolls on throughways caused a reduction of auto volumes on those roads as some drivers changed their routes, chose different modes, or chose different destinations to avoid tolls.
- Areas along US-26, OR-217, I-5 south of downtown Portland and I-205 showed improved access to jobs, as did Clark County, where access to jobs in Portland improved with faster travel on I-5 and I-205.
- Areas near I-5 in Oregon north of downtown Portland and near I-84 showed minimal change despite their proximity to tolled freeways. These areas already had good access to many jobs in multiple directions—although the faster travel times on throughways increased the number of jobs available to drivers here, the *percentage* changed was not particularly high. These areas include many EFAs.
- Overall, Equity Focus Areas did not benefit as much from improved auto access compared to non-EFA's from every pricing scenario studied, including the Roadway B scenario.
- Areas further from tolled throughways tended to experience worse access to jobs by auto, which include some EFA areas. With fewer options of using the faster tolled roadways and competing with traffic on arterials that diverted from those tolled roadways, commuters here experienced somewhat slower travel by autos and transit.
- A clear exception is in the area southeast of Oregon City, which showed high increases in jobs accessibility. This indicates that – while not near a large number of jobs – most of the jobs accessed from here are reached by freeway, so improvements in travel time on freeways result in a larger than average increase in the percent of jobs accessible.

Figure 10 Jobs Accessible by Auto



Similarly, the costs were also higher for commuters in areas nearest the freeways. The Change in Total Travel Costs map (Figure 11) reflects the travel choices made by modeled commuters, accounting for travel time *and* cost. In areas near tolled throughways, commuters tended to choose driving and paying a toll to benefit from the faster freeway travel times. This pattern is most evident along OR-217, US 26, I-5, and I-205. Commuters in areas further away from the tolled facilities would have fewer opportunities to benefit from faster throughways but would still have to contend with more traffic on arterials due to diversion from throughways, slowing their commutes and increasing their auto operating costs. These commuters also tended to have the fewest transportation alternatives.

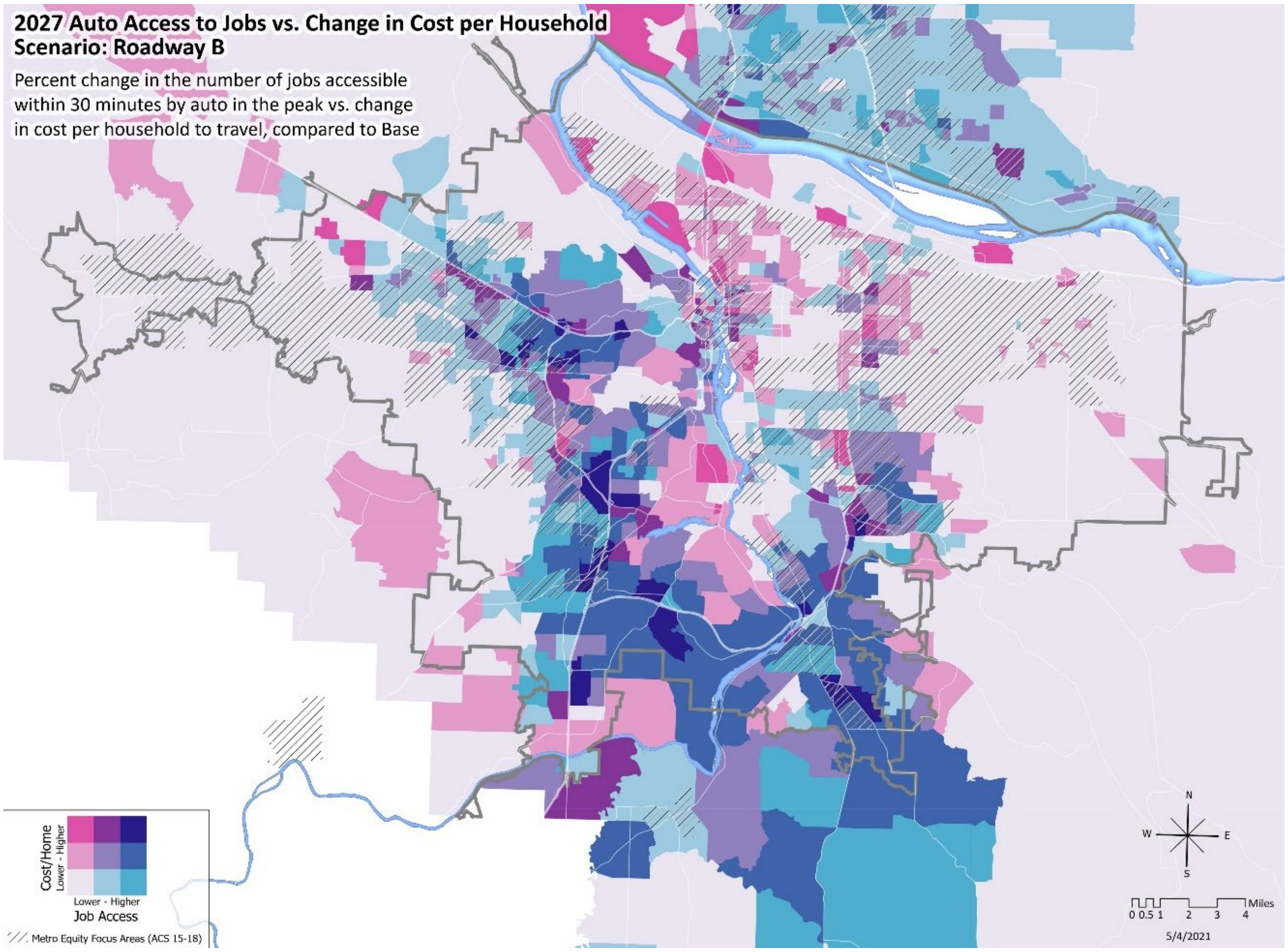
Figure 11 Change in Total Travel Cost



Auto Access to Jobs vs Change in Cost per Household

The map in Figure 12 combines the modelled access to jobs by auto with the total travel costs for Roadway B. Areas with higher costs and the most improvement in jobs accessibility were again generally along throughways—especially along US 26, OR-217, I-5 south of Portland, I-205, and in Clark County. Commuters in areas away from freeways experienced a combination of higher costs and less improvement in jobs access by auto, as they didn't benefit as much from the faster travel on tolled roads but endured higher traffic from diversion that slowed their routes on arterials. These areas also tended to be further away from jobs and had fewer alternatives to driving. Commuters in areas in North and Northeast Portland and the east Multnomah County, despite their proximity to tolled throughways, experienced higher costs without high improvements in auto accessibility to jobs, again likely due to the already high number of jobs available to them before tolling.

Figure 12 Auto Access to Jobs vs Costs



Freeway and highway toll implementation requires special consideration to areas where commuters experience a combination of little travel time benefit and higher costs, yet who also have fewer choices and live further from jobs. Commuters in these areas could be assisted by improvements in the bus network, such as bus only lanes on busy arterials or increased transit frequencies, though these are often the locations where expansion of transit is most costly and difficult. Further exploration of origin-destination jobs data could provide an understanding of where commuters in these areas work and allow for more targeted transit investments and other efficient and affordable mobility strategies. Low-income commuters in these areas could also be provided with discounts or exemptions to mitigate these impacts. Additionally, a tolling program could be designed with variable pricing, where trips made off-peak have lower or no tolls, while trips during the peak experience higher tolls. Particularly in east Multnomah County and Clackamas County, census data shows that a higher proportion of the population commutes outside of traditional peak hours; a lower off-peak toll would mean that these commuters might not be as negatively impacted by a tolling program.

Summary of Other Pricing Scenarios

VMT Scenarios: Costs were higher in every area of the region as all auto trips were charged, and especially higher in more rural areas where trips were longer and where there were fewer alternatives to driving available. Access to jobs improved for all areas as well, with the highest percentage increase south and west of downtown Portland. In East Portland and eastern Multnomah County, the percent increases were less as jobs accessibility was high to begin with. As a result, these areas experienced a combination of higher costs without significant improvement in jobs access, especially concerning because some of these areas encompass many equity focus areas.

Cordon Scenarios: Areas inside the cordon boundary experienced lower costs and higher jobs access because of the decreasing traffic within the cordon as drivers avoided through trips and diverted to throughways and arterials adjacent to the corridor. This diversion slowed traffic in areas just outside of the cordon, causing higher costs and lower jobs accessibility. A few scattered areas away from the cordon, mainly along throughways such as Highway 217, US 26, and I-5, experienced higher costs and less jobs accessibility, suggesting many drivers here chose to pay the fee to enter the cordon, or travel the more congested freeways near or across downtown, resulting in higher operating costs.

Parking Scenarios: Parking Scenario A showed very little change in jobs accessibility or costs throughout the region. Parking Scenario B showed little change in jobs accessibility as travel times to employment areas were not significantly impacted with increased parking charges but showed some improvement in costs in downtown Portland and nearby surrounding areas. These locations have good transit service, so parking charges could be easily avoided. Of all scenarios, Parking B had the largest increase in transit ridership. In eastern Multnomah County, and areas of Washington and Clackamas Counties west and southwest of downtown, costs rose, suggesting that fewer drivers who pay to park switched to transit. Transit service that serves employment areas may not be as easy to access for people living in these locations. Equity focus areas did not benefit as much as non-equity focus areas. Equity focus areas showed a smaller percent increase in jobs accessible by auto than non-equity focus areas.

Considerations

This mapping exercise demonstrates the importance for projects and programs to thoroughly analyze data to understand where the benefits (like access and travel time improvements) and costs (like financial costs and increased traffic congestion on nearby streets) are concentrated. This will allow a project to:

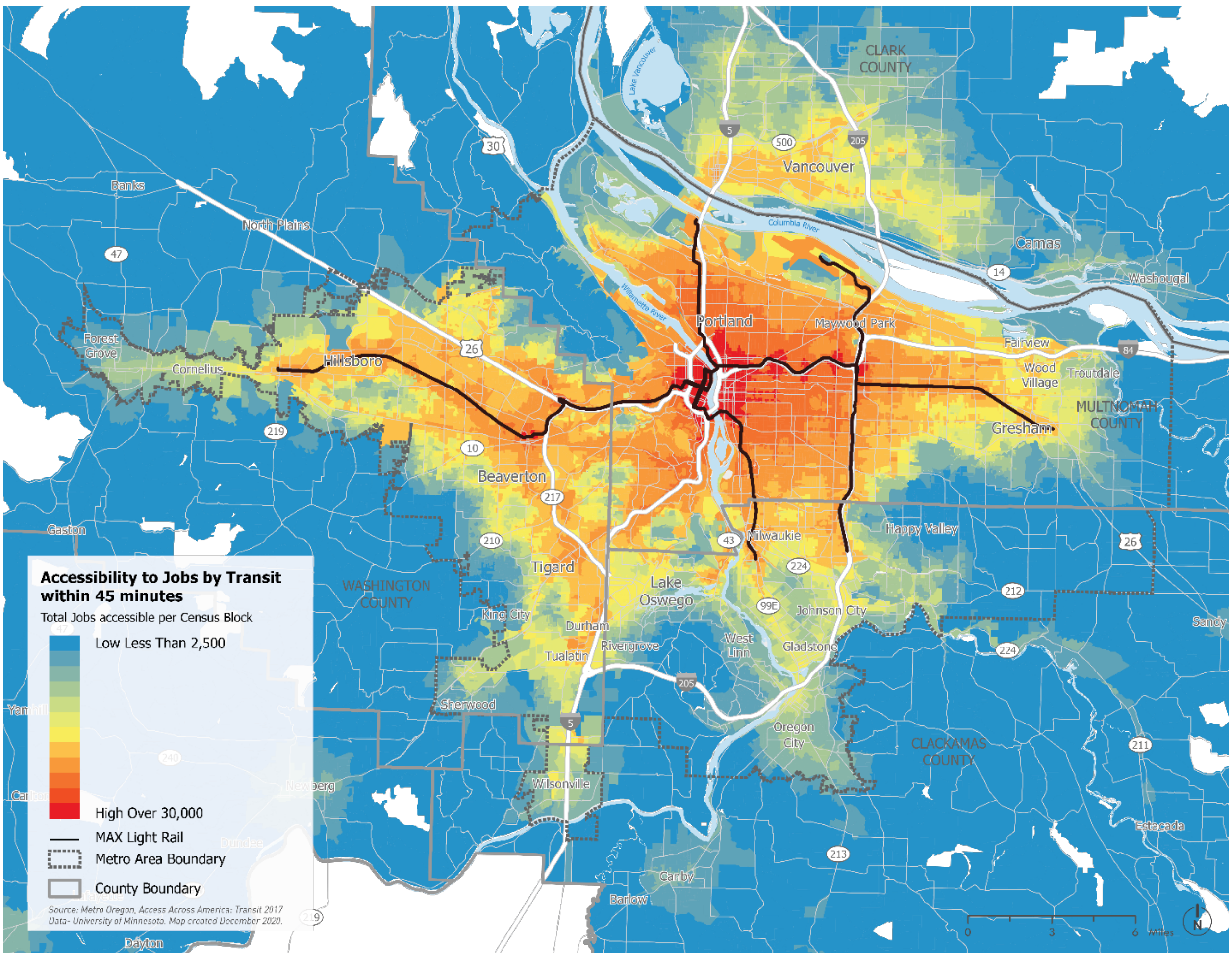
- Adjust the project design to maximize benefits and minimize impacts
- Identify geographic distribution of benefits, impacts, and costs (who is affected? Where are there impacts?) Benefits can be targeted to areas that have been disadvantaged
- Address costs and impacts
- Build affordability into the program --discounts or caps to vulnerable groups or impacted areas

Revenue can be focused on equity and addressing impacts. For example, diversion onto nearby streets resulting in more traffic could be addressed with safety improvements or transit improvements.

Job Access (Transit) – Equity Considerations

Access to jobs via transit is one of the best ways to understand overall economic access and ability to rely on transit as the main means of mobility[7]. The number of accessible jobs within a set time frame also measures the strength of the transit network at any given location. This is because it measures the speed of transit as well as where transit services from that area go, and which other services are accessible via transferring. Transit access to jobs with 45 minutes during the A.M. peak correlates directly with access to the MAX Light Rail (see Figure 13). Because the light rail network is fast, frequent, and oriented to Downtown Portland (which is both the region's major job center and where transfer opportunities are highest), areas adjacent to this network have the highest job access via transit. Figure 13 displays 2017 data and is a product of the University of Minnesota Accessibility Observatory, which collects data about transit access for the 50 largest metropolitan areas in the U.S.[8]

Figure 13 Accessibility to Jobs by Transit (2017)



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[7] Community places include hospitals and other medical services, civic places such as post offices, churches, social services, libraries, schools and colleges, financial institutions, grocery stores, and essential retail services such as hardware stores, pharmacies, and laundry services.

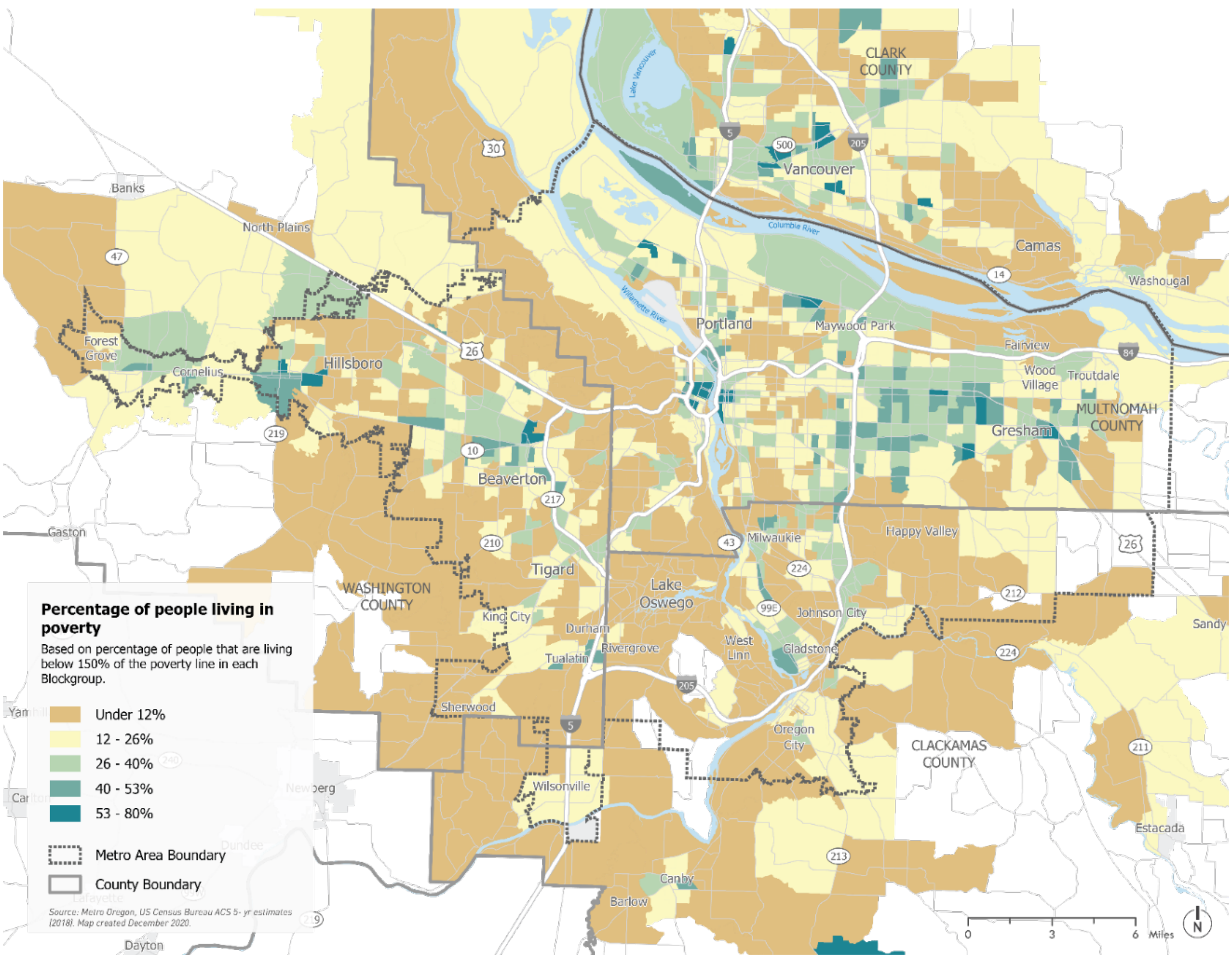
[8] Owen, Andrew; Murphy, Brendan. (2020). Access Across America: Transit 2018 Data. Retrieved from the Data Repository for the University of Minnesota, https://doi.org/10.13020/jnek-yh07.

Low-Income Residents

Low-income residents are one of the three populations used to identify EFAs. They merit particular consideration with congestion pricing because they have fewer resources to put toward transportation-related costs. Figure 14 displays the percentage of people living in poverty (at or below 150% of the poverty line) according to the 2015-2019 ACS. All areas in blue have poverty rates above the area mean. Areas with high poverty rates include:

- Downtown Portland
- North Portland
- Outer East Side and Gresham
- Beaverton
- Hillsdale
- Hillsboro
- Vancouver
- Clackamas County

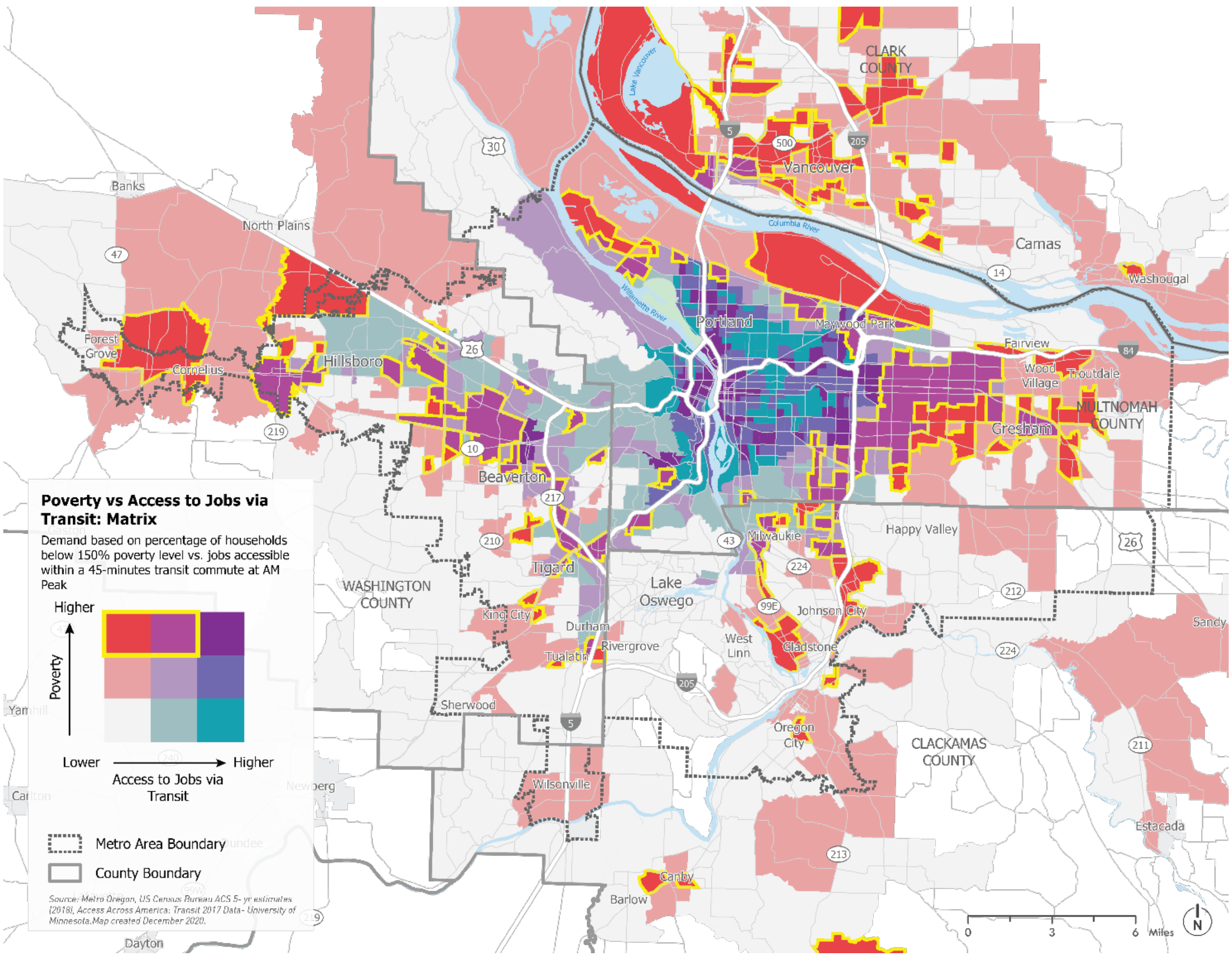
Figure 14 Percentage of People Living in Poverty (2018)



Poverty Versus Access to Jobs via Transit

Comparing the number of jobs accessible within 45 minutes by transit to areas with high proportions of low-income residents reveals where residents with high transit needs are underserved compared to the region (see Figure 15). While downtown Portland, north Portland, and parts of east Portland have high poverty rates, they also have high levels of transit access. Areas in red and purple outlined by yellow are where transit access is low or moderate and poverty levels are high, which appear mainly in outer east Portland, Gresham, Beaverton, Vancouver, and Clackamas County. The areas that are grey or light blue have lower transit access, but also lower rates of poverty, meaning residents are more likely to have resources to put toward transportation. Targeted efforts to increase transit access in areas with high poverty rates and low transit access could greatly improve the economic integration of these areas.

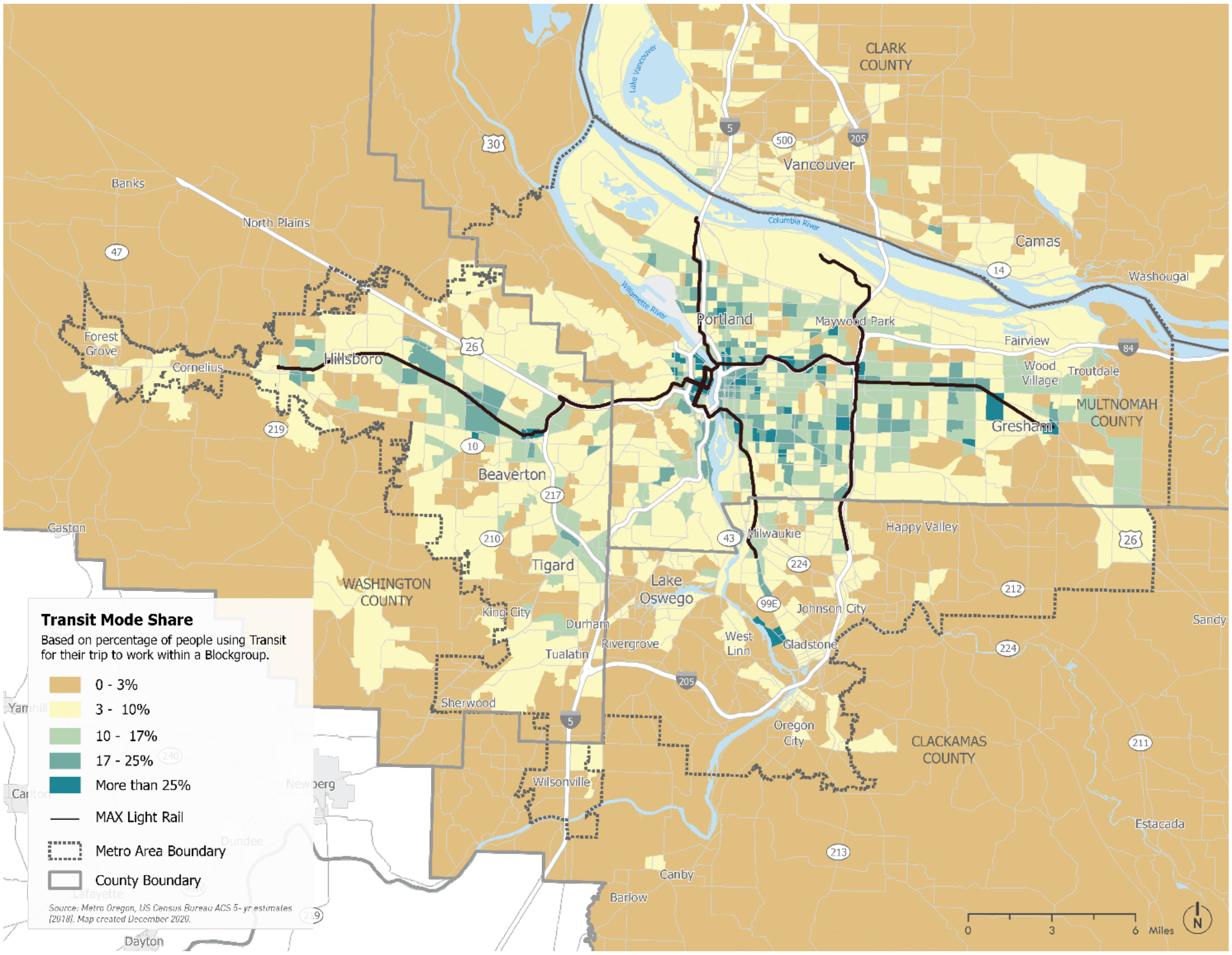
Figure 15 Poverty vs Access to Jobs via Transit: Matrix



Transit Mode Share

The percentage of transit commuters varies broadly across the study area (see Figure 16). Similar to most major cities in the United States, transit mode share is highest in downtown and the surrounding areas. This is due to both appropriate land use for high transit ridership and high transit access. Transit use is also above average (represented by blue areas on the map) in north Portland, outer east Portland, Gresham, Beaverton, and Hillsboro.

Figure 16 Transit Mode Share (2018)

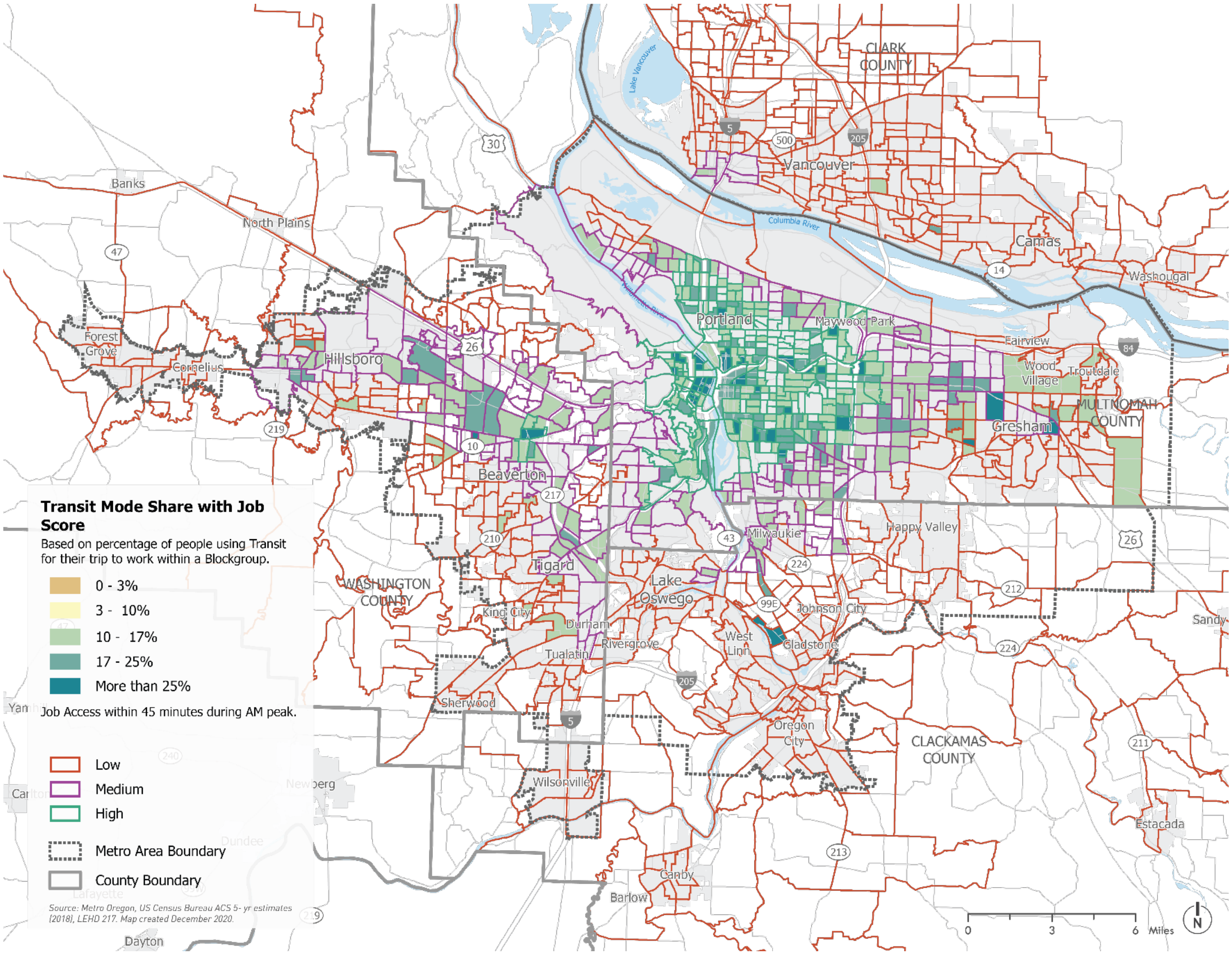


Transit Mode Share with Job Score

Figure 17 displays areas with higher-than-average transit mode shares in blue. This is directly compared to job accessibility within 45 minutes broken into high, medium, and low based on the difference from the average (standard deviation). Most of the areas with high transit access (green outlines) also have above average transit mode share for commuters. This correlation indicates that where transit is best, high rates of commuters are using it. However, there are some areas in the region that have medium or low transit access and still have higher than average transit mode share. These include parts of outer east Portland, Gresham, Beaverton, and Hillsboro.

All the listed areas were also shown to have higher than average levels of poverty. This indicates that the high levels of transit use in these areas is due to transit need, not transit quality. This analysis could be used to help to prioritize transit improvements that help those riders who need it most, but currently have poorer access to transit.

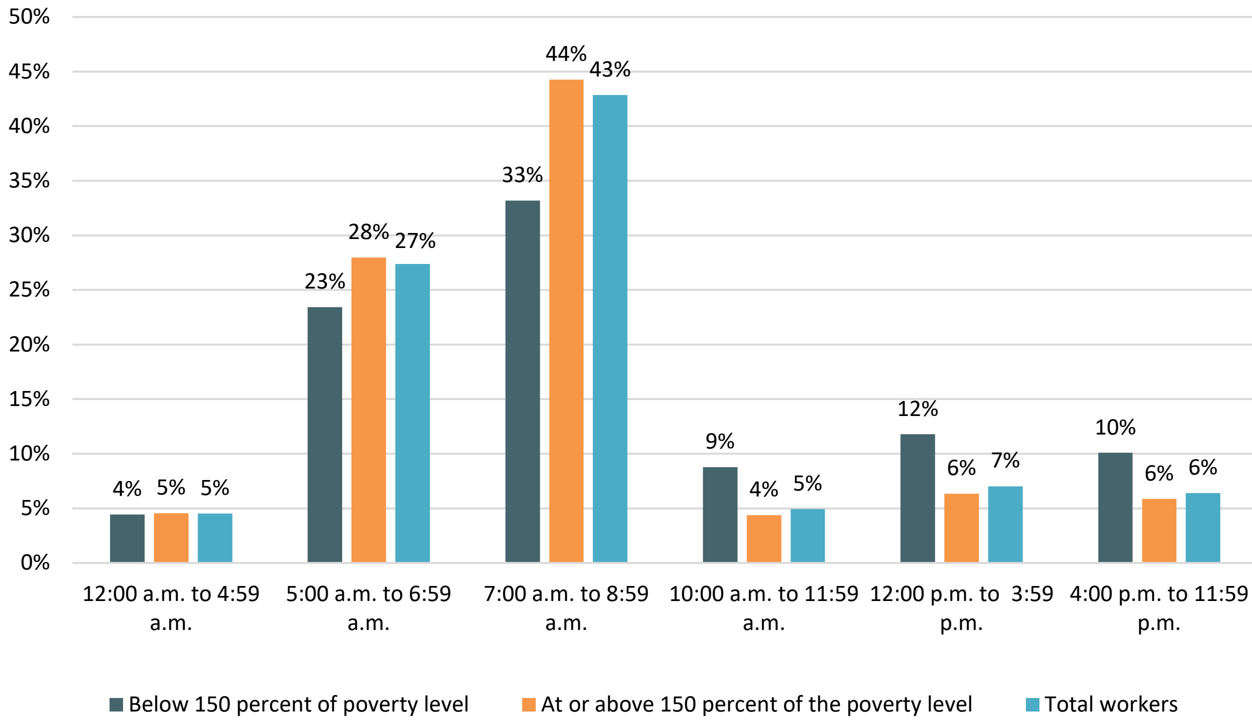
Figure 17 Transit Mode Share (2018) with Job Score



Time Leaving for Work

More frequent transit service is generally offered during traditional peak periods (7:00am - 9:00am and 4:00pm - 6:00pm) than off-peak periods. In the Metro area, 56% of transit routes have higher frequencies in the peak than during the off-peak period, or only run during peak periods. The remaining 44% of routes have the same frequencies during both peak and off-peak periods. Figure 18 shows that 43% of workers leave for work between 7:00am and 9:00am. This means 57% of workers do not benefit from the highest quality transit going both to and from work, assuming a 6–9-hour workday. Workers who commute outside of traditional peak periods are more likely to be low-income, partially because of the types of jobs low-income residents are more likely to work, like service jobs which don't usually conform to a traditional "9 to 5" schedule (see Figure 18). They are also more likely to have varying shifts that change day-to-day and week-to-week. This means they likely have variable transit travel times and service availability and can have more difficulty planning a reliable transit commute.

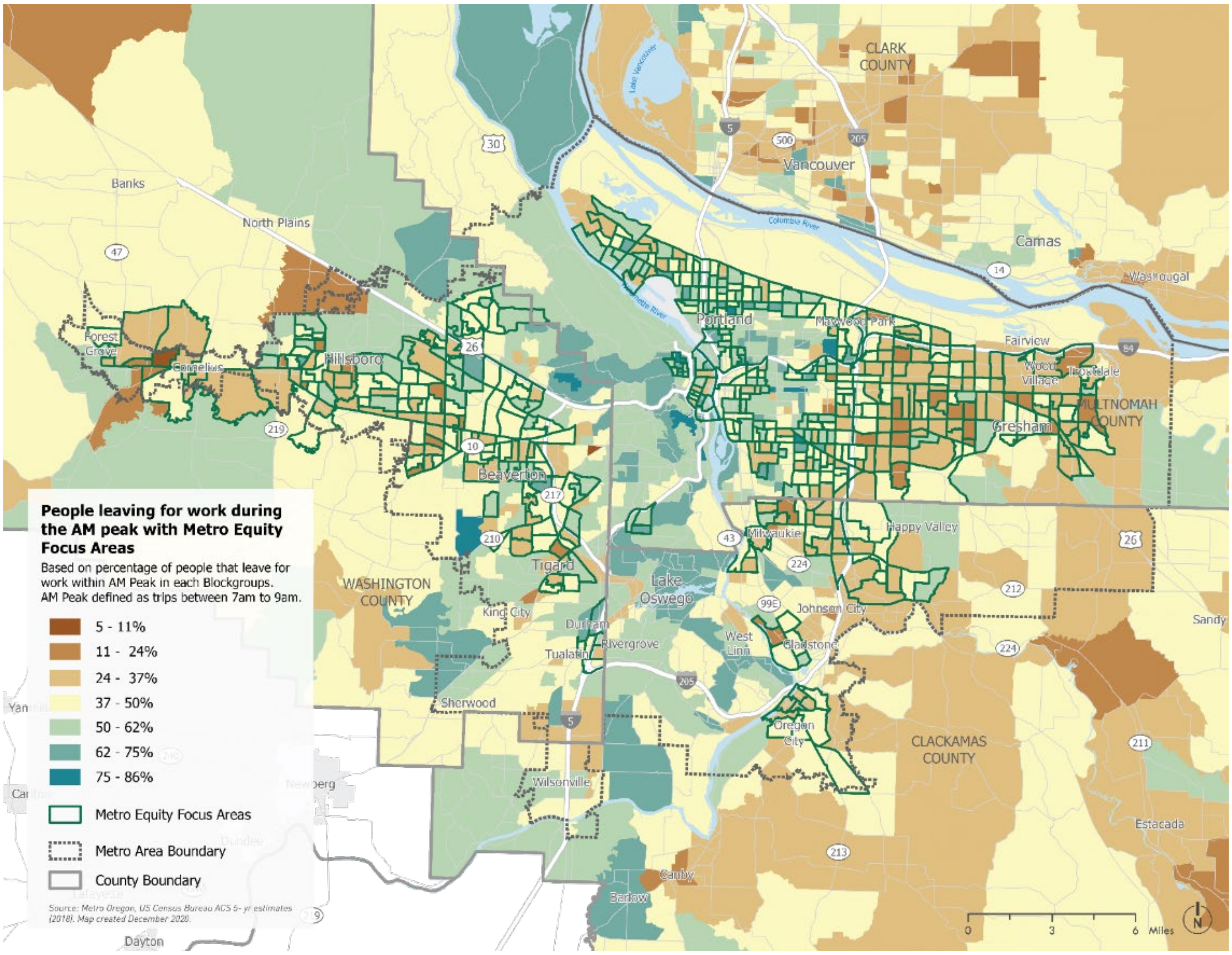
Figure 18 Time Leaving for Work by Poverty Level in Metro Area (2016)



U.S. Census Bureau CTPP 5-Year Estimates 2016 - Table A104200 Poverty Status by Time leaving home

When residents leave for work also varies largely by geography (see Figure 19). Areas in outer east Portland, Gresham, parts of Beaverton, Hillsboro, Clackamas County, and Vancouver all have low proportions of workers who leave during the AM peak, with some areas as low as 5 – 11%. Many of Metro's EFAs have high concentrations of workers who leave outside of the AM peak. This relationship highlights that off-peak service quality is an equity concern.

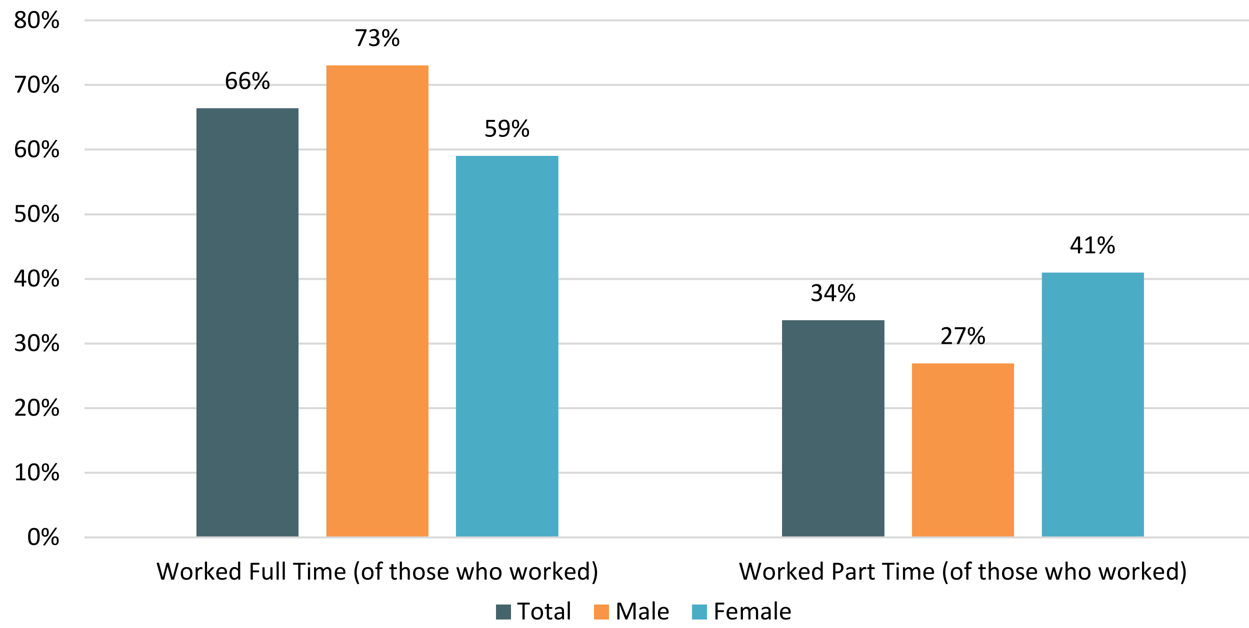
Figure 19 People leaving for work during the AM peak with Metro Equity Focus Areas



Because peak-period transit service is meant to accommodate an approximately eight-hour workday, it may pose challenges for part-time workers. Women are much more likely to work part-time than men and may be more negatively impacted by infrequent midday service (Figure 20). Women are also more likely to trip-chain, dropping off children at school, grocery shopping after work, or taking family members to medical appointments[9]. This means that non-work trips make up a greater proportion of women's trips overall, so travel outside of peak periods that is not work related is also impacted by lower frequencies.

[9] The Pink Tax on Transportation: Women's Challenges in Mobility (2018).

Figure 20 Full Time Work Status in the Last 12 Months[10] (2018)



U.S. Census Bureau ACS 5-Year Estimates 2018 - Table S2303 Work Status in the Past 12 Months

[10] The American Community Survey only recognizes two genders (known in this dataset as sex). The display of these data according to a gender binary is not meant to exclude other genders but reflects these data limitations.

4 METHODOLOGY

Metro conducted in depth modeling and analysis to understand the potential performance of different types of pricing tools (VMT, cordon, parking, roadway) described below. Each phase of analysis documented the potential impact or benefit of the congestion pricing tools related to congestion, greenhouse gas emissions, equity considerations, and program implementation feasibility. While safety is a RTP priority, best practices and modeling tools indicate that addressing safety impacts should occur at a project scale based on a detailed analysis to understand where investments in safety improvements would be necessary to address any project-related safety concerns.

Methods included:

- Modeling and analysis (discussed in depth in Sections 4.1 and Chapter 5)
- Mapping the existing transportation conditions to demonstrate current issues with access and equity
- Research into the current transportation funding system, best practices for developing pricing program that addresses community needs; funding and implementation considerations for different types of pricing (Appendix A: Implementation Technical Paper)
- Gathering feedback from experts working on pricing projects throughout North America and Europe on the RCPS methods and findings, and lessons from their work (Appendix B: Summary of Expert Review Panel)
- Gathering feedback from equity experts on methods and measures for equity and how to best engage communities in the region in future phases of study (Chapter 1)

The technical findings are primarily documented in charts, maps, and tables using data derived from the Metro Travel Demand Model and Metro's Multi-Criterion Evaluation tool, which are described below. In some cases, data was analyzed in the context of Metro's EFAs, which are described in Section 4.2.

4.1 Modeling and Technical Analysis

Metro's travel demand model was used to evaluate the performance of different congestion pricing scenarios. This model is used in developing the RTP, other local transportation plans, and transit and traffic studies throughout the region. It is regularly reviewed by the Federal Highway Administration and the Federal Transit Administration to ensure it meets federal guidelines. This model uses information from Metro's Household Travel Behavior Study to understand how and why people travel, and applies those behaviors to expected future projected conditions, including projected population and employment, road networks, and transit networks and service.

Additionally, Metro's Multi-Criterion Evaluation (MCE) Tool was used to project the reduction of greenhouse gas emissions. The MCE Tool applies unit costs to motor vehicle emissions, which are derived by applying the Environmental Protection Agency's MOVES model rates for facility type, speed bin, pollutant, and year to the number of vehicle miles traveled (VMT) output produced by the travel demand model for each scenario.

4.2 Study Evaluation Criteria

Congestion pricing tools were evaluated based on whether they could help the region achieve its transportation priorities as laid out in the region's 2018 RTP. The 2018 RTP's four priorities are:

- Congestion – improve mobility
- Climate Change – reduce GHG emissions
- Equity – reduce disparity
- Safety – make progress toward Vision Zero

The travel demand model outputs address three of these priorities: equity, climate change, and congestion. However, this technical analysis does not directly address safety since the model does not project crashes. Instead, the study reviews safety in the context of revenue reinvestment and mitigations (see Chapter 6: Feasibility and Implementation Considerations). Table 5 shows the performance measures used to assess the other three RTP priorities.

Table 5 Regional Congestion Pricing Performance Measures

2018 RTP Priority	Performance Measure	Description
Equity	Job Access (Auto)	Number of jobs accessible by auto in a typical commute time (30 minutes) during the 2-hour PM peak
Equity	Job Access (Transit)	Number of jobs accessible by transit in a typical commute time (45 minutes) during the 2-hour PM peak
Equity	Access to Community Places (Auto)	Number of community places[1] accessible by auto in typical travel time (20 minutes) during the 2-hour PM peak
Equity	Access to Community Places (Transit)	Number of community places[1] accessible by transit in typical travel time (30 minutes) during the 2-hour PM peak
Equity & Congestion	Travel Time	Peak period travel time between select zone pairs
Climate	Percent Reduction of emissions	Reduction in tons of CO2e, PM2.5, PM10, NOx, and VOC
Climate & Congestion	Daily VMT	Vehicle miles traveled (daily)
Climate & Congestion	Drive Alone Rate	Percentage of total daily trips undertaken by drivers without passengers
Climate & Congestion	Daily Transit Trips	Number of total transit trips (daily)
Climate & Congestion	PM 2-Hour Peak Vehicle Hours of Delay	The total time accrued by all vehicles traveling on model links with volume-to-capacity ratio over 0.9 during PM peak, also reported separately for freeways and arterials

[1] Community places include hospitals and other medical services, civic places such as post offices, churches, social services, libraries, schools and colleges, financial institutions, grocery stores, and essential retail services such as hardware stores, pharmacies, and laundry services

4.3 Types of Congestion Pricing

This study assessed four congestion pricing tools, with multiple possible program designs:

- Vehicle Miles Traveled (VMT) – drivers pay for every mile traveled (often called a road user charge)
- Cordon Pricing (COR)– drivers pay to enter a designated area
- Parking Pricing (PARK) – drivers pay to park in certain areas
- Roadway Pricing (RD) – drivers pay to drive on a particular roadway

4.4 Scenario Assumptions

Modeling results for each scenario were compared to a single, consistent "Base scenario". The 2018 RTP 2027 Financially Constrained scenario was used as the RCPS Base scenario to compare and contrast the performance of the four pricing tools. This scenario includes roadway and transit projects that were expected to be completed by 2027 and assumes a higher level of transit service compared to today. (Appendix C describes the assumptions in the Base scenario.)

The pricing scenarios either increased operating costs (VMT), added tolls (Cordon and Roadway), or increased parking costs (Parking) compared to the Base scenario. No scenario included multiple types of pricing, and no pricing scenario assumed any changes to the Base scenario network, or to costs, aside from the specific pricing changes described below in Table 6.

The model results reflected pricing changes assumed to have been in place long enough for travelers to have adjusted to them. Compared to the Base scenario, modeled traveler responses to a pricing scenario could include changing their destination, changing their travel route, or changing their mode of travel. The model does not allow a traveler to choose to make the trip during a different time-period, or to choose not to make a trip at all.

The model results provide a general assessment of how congestion pricing could perform with our land use and transportation system. The scenarios were not iterative. That means, initial findings stood, and Metro did not try to adjust the scenario to minimize any issues seen in the initial modeling results. Instead, the results may indicate what types of reinvestments of revenue, discounts, or other mitigations would benefit each scenario. There is currently no roadway pricing in the Portland region, so impacts of pricing were derived from surveys and not from observed data. Survey and traffic data were also pre-COVID-19, so outputs assumed an eventual return to "normal" travel behaviors and traffic conditions in the future. Finally, the travel demand model produces static assignments at a regional level—the analysis focused largely on regional and sub-regional trends, and minimally on road-specific impacts.

Table 6 displays the assumptions for each modeled scenario. For each pricing scenario, pricing charges were assessed only within the region's Metropolitan Planning Area (MPA) boundaries; see Figure 21. Pricing charges were assessed in addition to the cost of driving in the Base scenario which assumed vehicle operating costs of $0.211/mile. All costs are assessed in 2010$. Maps providing additional geographical context for each pricing scenario are provided in Figure 22 to Figure 25 over the next several pages.

Table 6 Overview of Congestion Pricing Scenarios

Scenario	Pricing Charge	Type of Charge	Additional Details
VMT B	$0.0685/mile	Charge per mile driven	32% increase over Base scenario
VMT C	$0.132/mile	Charge per mile driven	Charge is approximately doubled compared to VMT B; 63% increase over Base scenario
COR A	$5.63	Charge to enter cordon area	Higher end of price range based on other cities
COR B	$5.63	Charge to enter cordon area	Higher end of price range based on other cities; cordon boundaries are larger compared to Cordon A
PARK A	Varies	Charge to park vehicle	Parking assumptions drawn from 2018 RTP's 2040 Financially Constrained scenario
PARK B	Varies	Charge to park vehicle	Parking assumptions are doubled compared to Parking A
RD A	$0.132/mile	Charge per mile driven on highways	Charge on throughways[1] equivalent to the VMT C per mile charge
RD B	$0.264/mile	Charge per mile driven on highways	Charge on throughways[1] is doubled compared to Roadway A

[1] Throughways include major freeways and highways with limited access.

Additional context is provided for each scenario type below:

- **VMT Scenarios:** The study also completed modeling for an additional VMT scenario (VMT A) that was not included in this final report. The VMT A scenario assumed a per-mile charge that was nearly equivalent to the current gas tax. This resulted in a cost of $0.216/mile, compared to the cost of $0.211/mile in the Base scenario. As expected, results were not meaningfully different from the Base scenario. Therefore, the study did not perform further analysis of this scenario. Figure 21 displays the MPA boundary for the region. For the two VMT scenarios, a per-mile charge was assessed for every mile driven within the MPA boundary. Miles driven outside of the MPA boundary were not assessed a charge.

- **Cordon Scenarios:** Figure 22 and Figure 23 display the boundaries of the two Cordon scenarios. Cordon A encompassed downtown Portland, South Waterfront, and parts of Northwest Portland. Cordon B's area included the entirety of Cordon A, as well as the Central Eastside Industrial District and the Lloyd District. A flat rate charge was assessed to drivers who entered the cordon area. Drivers who traveled through the cordon area, but remained on the freeways or highways, were not assessed a charge. For example, a driver traveling from US-26 to the Ross Island Bridge was not assessed a charge, nor was a driver who remained on I-5 or I-405 through downtown Portland and did not exit onto local streets within the cordon area.

- **Parking Scenarios:** Figure 24 displays the locations where short- and long-term parking charges were assessed, as well as the pricing charges assumed per trip. The Base scenario used the 2018 RTP 2027 Financially Constrained Scenario parking factors, and the Parking A scenario used the RTP 2040 Financially Constrained Scenario factors. The Parking B scenario doubled the factors from Parking A.

- **Roadway Scenarios:** Figure 25 displays the throughways charged under the Roadway scenarios. These throughways were identified in the 2018 RTP and are generally the region's freeways and limited-access highways. Drivers were assessed a charge in the two Roadway scenarios for each mile driven on the throughways within the MPA boundary.

Figure 21 Metropolitan Planning Area Boundary

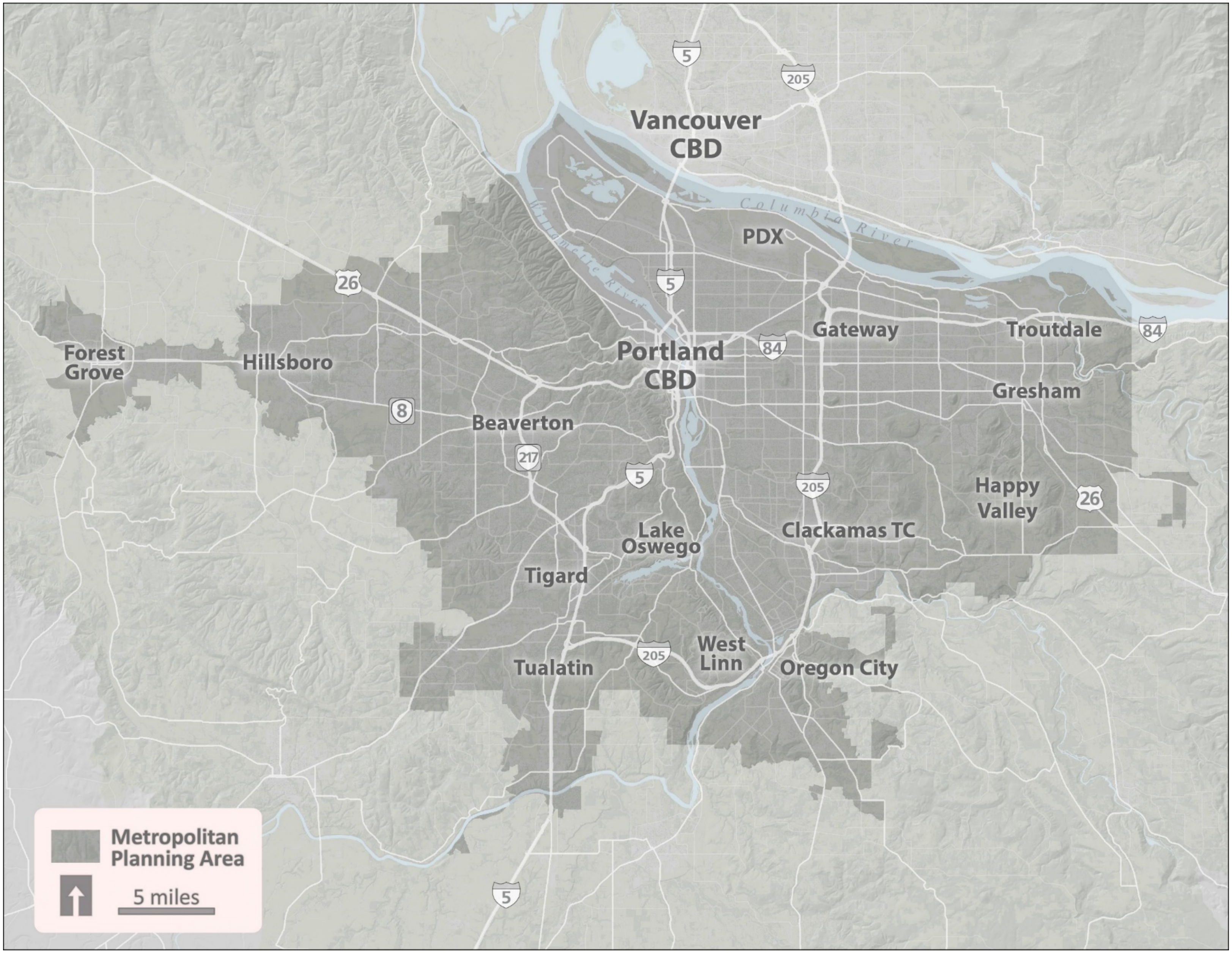


Figure 22 Cordon A Boundary

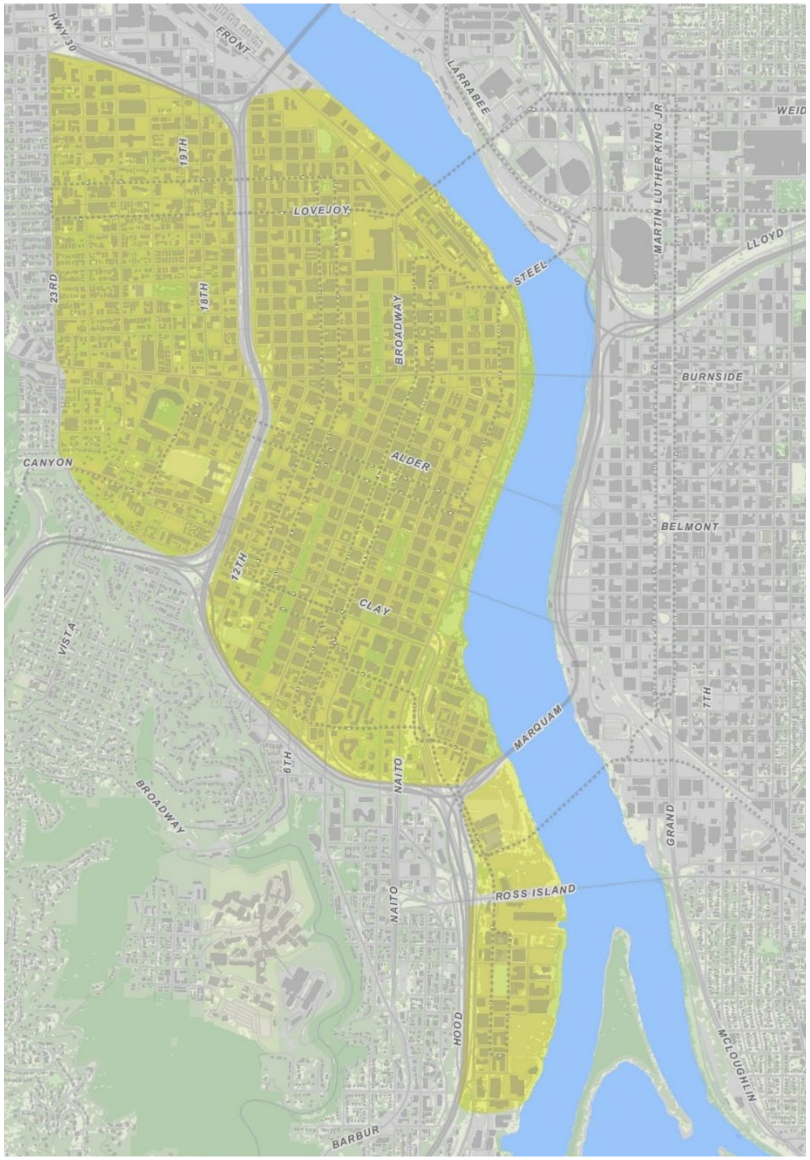


Figure 23 Cordon B Boundary

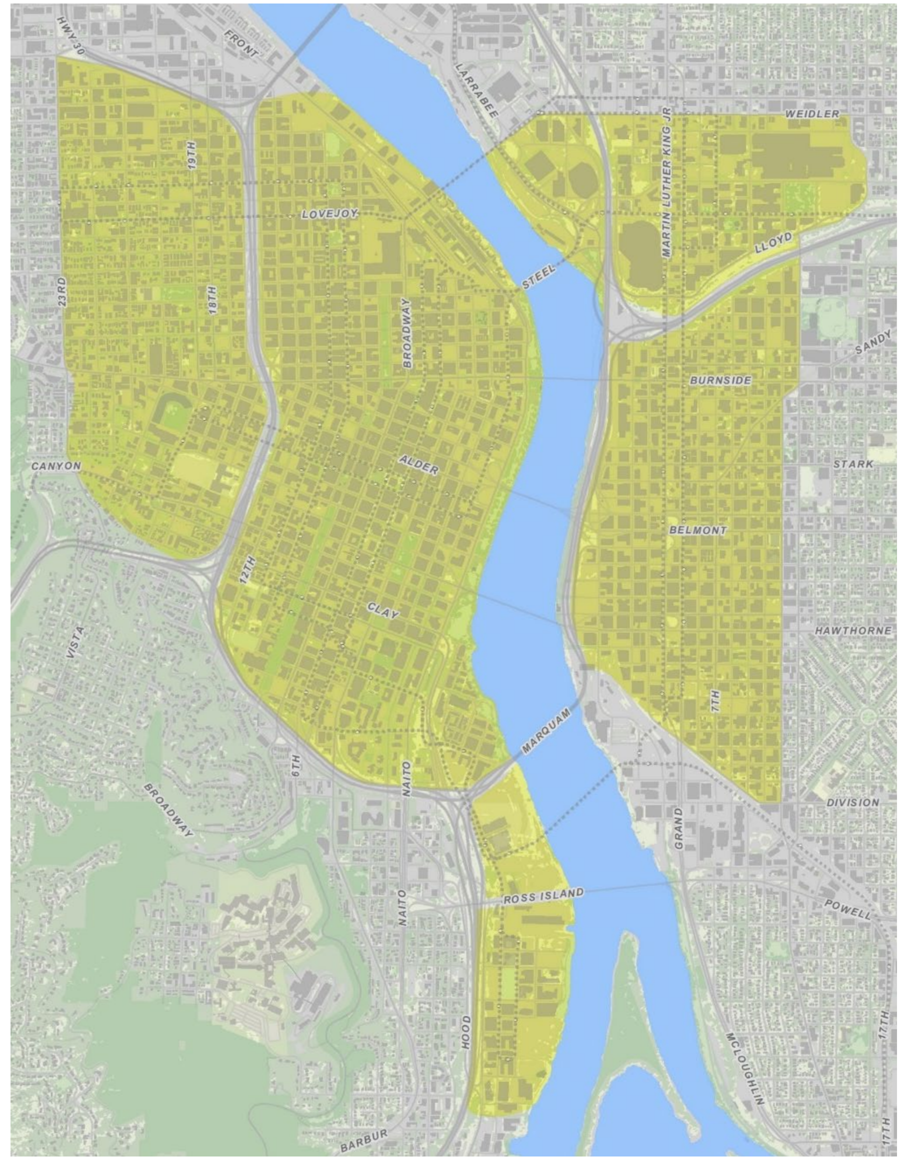
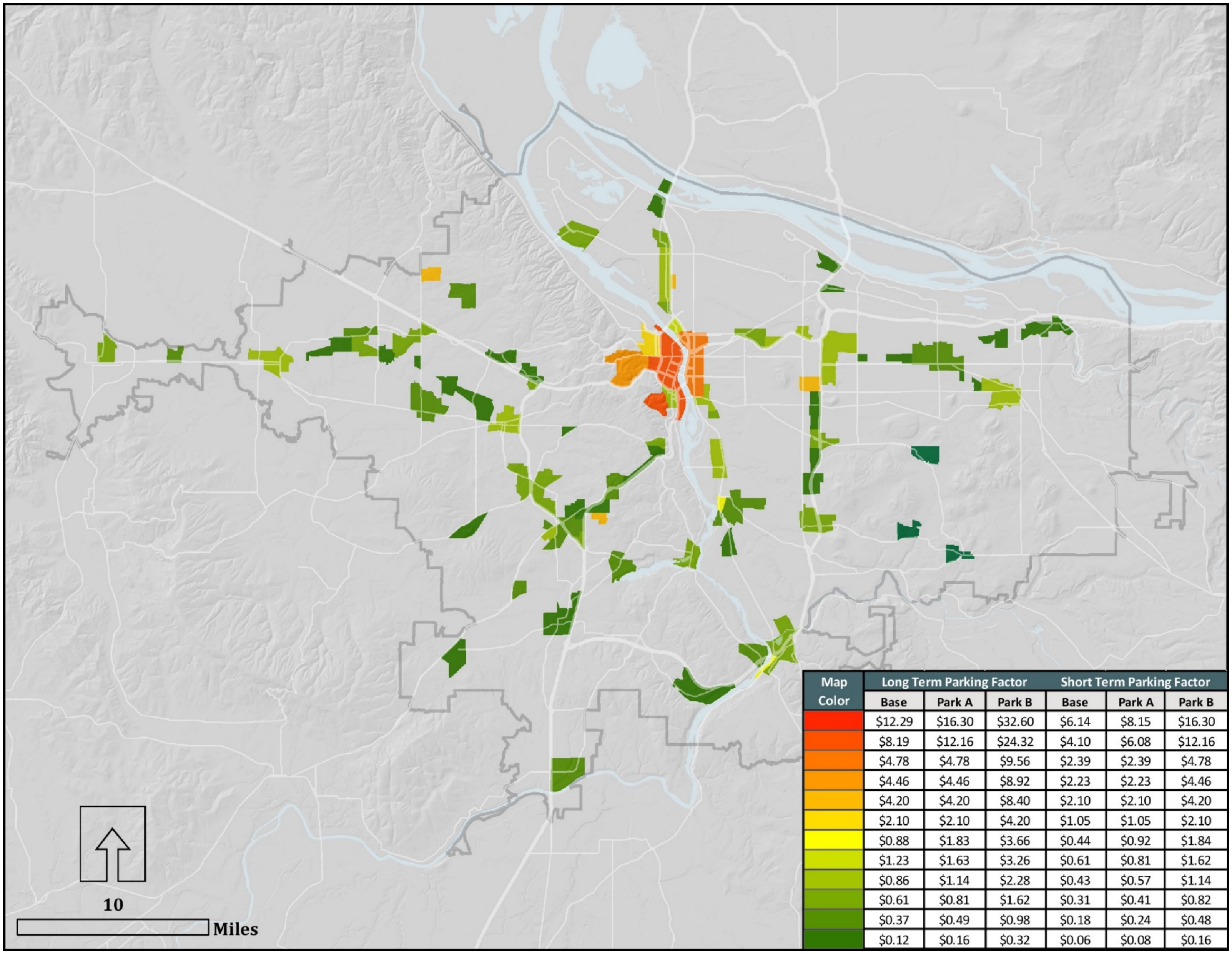
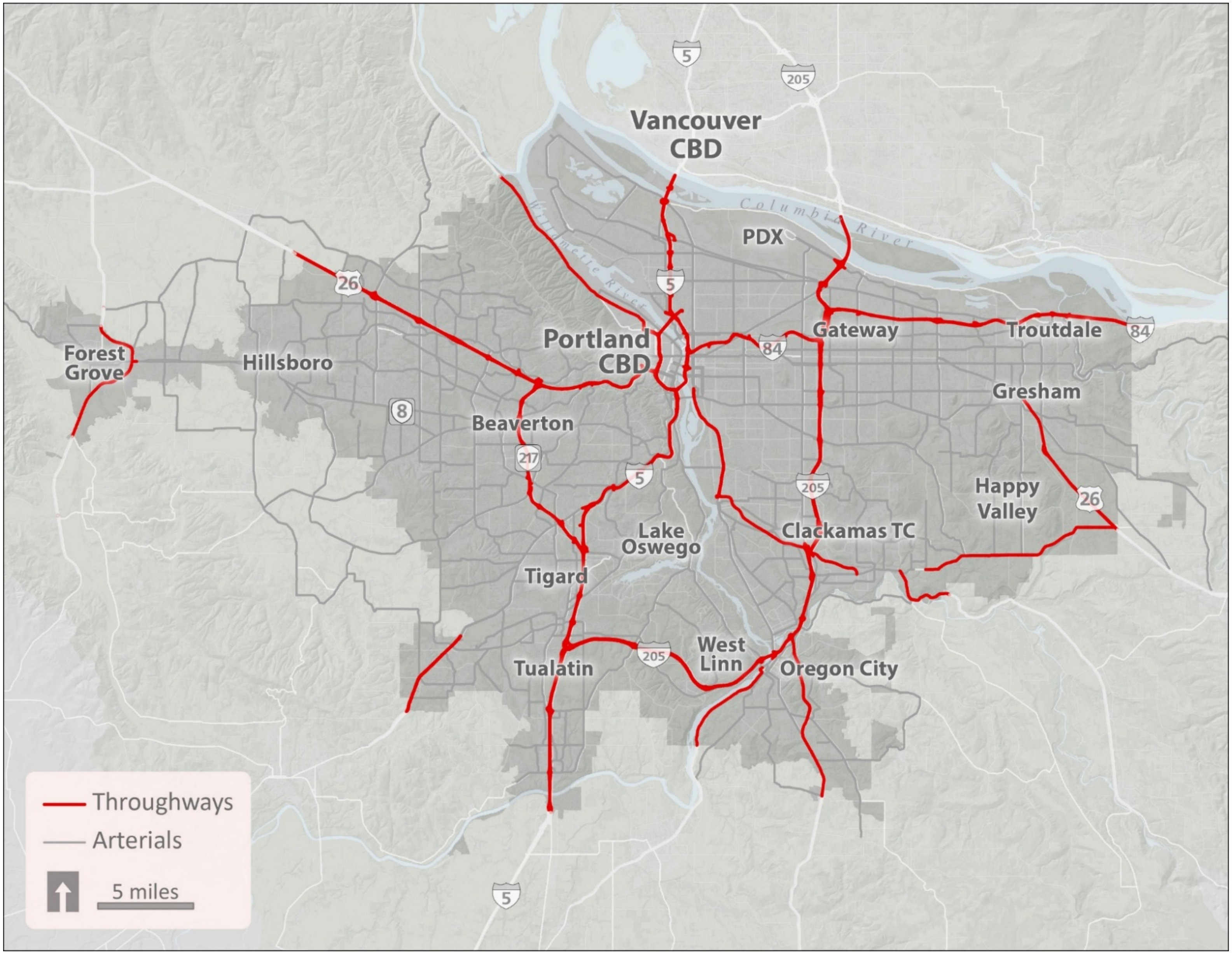


Figure 24 Parking Scenario Charges per Trip and Locations (2010$)



Map Color	Long Term Parking Factor			Short Term Parking Factor		
	Base	Park A	Park B	Base	Park A	Park B
(red)	$12.29	$16.30	$32.60	$6.14	$8.15	$16.30
(red-orange)	$8.19	$12.16	$24.32	$4.10	$6.08	$12.16
(orange)	$4.78	$4.78	$9.56	$2.39	$2.39	$4.78
(light orange)	$4.46	$4.46	$8.92	$2.23	$2.23	$4.46
(amber)	$4.20	$4.20	$8.40	$2.10	$2.10	$4.20
(gold)	$2.10	$2.10	$4.20	$1.05	$1.05	$2.10
(yellow)	$0.88	$1.83	$3.66	$0.44	$0.92	$1.84
(yellow-green)	$1.23	$1.63	$3.26	$0.61	$0.81	$1.62
(light green)	$0.86	$1.14	$2.28	$0.43	$0.57	$1.14
(green)	$0.61	$0.81	$1.62	$0.31	$0.41	$0.82
(medium green)	$0.37	$0.49	$0.98	$0.18	$0.24	$0.48
(dark green)	$0.12	$0.16	$0.32	$0.06	$0.08	$0.16

Figure 25 Throughways Charged Under the Roadway Scenarios



5 SCENARIO MODELING OVERVIEW & FINDINGS

This chapter provides the study's high-level findings, detailed analysis results, travel costs, and a summary of the findings by type of pricing scenario.

5.1 High-Level Findings

Table 7 provides the study's high-level findings. Results for each scenario are measured as a percentage change against the Base scenario. The modeling results were compared to results from Metro's 2018 Regional Transportation Plan to determine approximate benchmarks to indicate positive or negative impacts for each metric in terms of progress toward regional goals. Table 7 displays how each scenario performs against those benchmarks and allows for a simple comparison of different scenarios in a visual format. Definitions of each metric are provided at the end of this section. The results shown in Table 7 reflect only the effects of pricing drivers under different scenarios; implementation of mitigations, discounts, or other changes to policies could result in changes to the performance of a scenario but were not modeled in this study.

Key takeaways:

- All eight scenarios provided at least a small reduction in drive alone rate and emissions, while seven of the eight scenarios provided at least a small reduction in daily VMT and an increase in daily transit trips.
- The two VMT scenarios and the Parking B scenario had positive regional results across all metrics, while the Parking A scenario had mostly positive results, but also minimal changes for job access via transit.
- The two Cordon scenarios and the two Roadway scenarios had more mixed results. Both Cordon scenarios had small to moderate increases in delay and decreases in job access via auto. These appear to be the result of drivers seeking to avoid the charge in the cordon area and remaining on highways or nearby arterials instead of utilizing surface streets within the cordon boundaries.
- The two Roadway scenarios saw moderate to large increases in arterial delay, as well as minimal change to small increases in job access via transit. These appear to be the result of drivers seeking to avoid the charge on the highways and diverting to arterial streets near the charged roadways.
- The two Parking scenarios resulted in the lowest total regional travel cost, as the parking charges were assessed to a relatively small number of drivers within the region.[11]
- The two VMT scenarios resulted in the highest regional travel cost, as every driver was charged for every mile driven within the MPA boundary, even though the cost per trip was relatively low compared to the other scenario types. As noted above, a specific congestion pricing program

[11] The total regional travel cost includes auto operating costs, tolls, parking costs, and transit fares paid.

could be designed and implemented in a way that could mitigate these negative changes; however, this study did not model the effects of any such mitigations.

Table 7 Regional Congestion Pricing Study High-Level Findings

RTP Goal	Metrics	VMT B	VMT C	COR A	COR B	PARK A	PARK B	RD A	RD B
Congestion & Climate	Daily VMT								
	Drive Alone Rate								
	Daily Transit Trips								
	2HR Freeway VHD								
	2HR Arterial VHD								
Climate	Emissions								
Equity	Job Access (Auto)								
	Job Access (Transit)								
Total Regional Travel Cost		**Med-High**	**High**	**Med-Low**	**Med-Low**	**Low**	**Low**	**Med**	**Med**

Note: Dark blue indicates better alignment with regional goals when compared to the Base scenario

Legend		Daily VMT	Drive Alone Rate	Job Access (Auto)	Job Access (Transit)	Daily Transit Trips	2HR Freeway VHD	2HR Arterial VHD	Emissions
	Large Positive Change	-5% or more	-5% or more	10% or more	5% or more	10% or more	-10% or more	-10% or more	-5% or more
	Moderate Positive Change	-2% to -5%	-2% to -5%	5% to 10%	2% to 5%	5% to 10%	-5% to -10%	-5% to -10%	-2% to -5%
	Small Positive Change	-0.5% to -2%	-0.5% to -2%	1% to 5%	0.5% to 2%	1% to 5%	-1% to -5%	-1% to -5%	-0.5% to -2%
	Minimal Change	0.5% to -0.5%	0.5% to -0.5%	1% to -1%	0.5% to -0.5%	1% to -1%	1% to -1%	1% to -1%	0.5% to -0.5%
	Small Negative Change	0.5% to 2%	0.5% to 2%	-1% to -5%	-0.5% to -2%	-1% to -5%	1% to 5%	1% to 5%	0.5% to 2%
	Moderate Negative Change	2% to 5%	2% to 5%	-5% to -10%	-2% to -5%	-5% to -10%	5% to 10%	5% to 10%	2% to 5%
	Large Negative Change	5% or more	5% or more	-10% or more	-5% or more	-10% or more	10% or more	10% or more	5% or more

Note: "Positive" and "Negative" refer to progress toward regional goals, and not to numerical values (i.e., a reduction in VMT is "positive")

5.2 Analysis Results

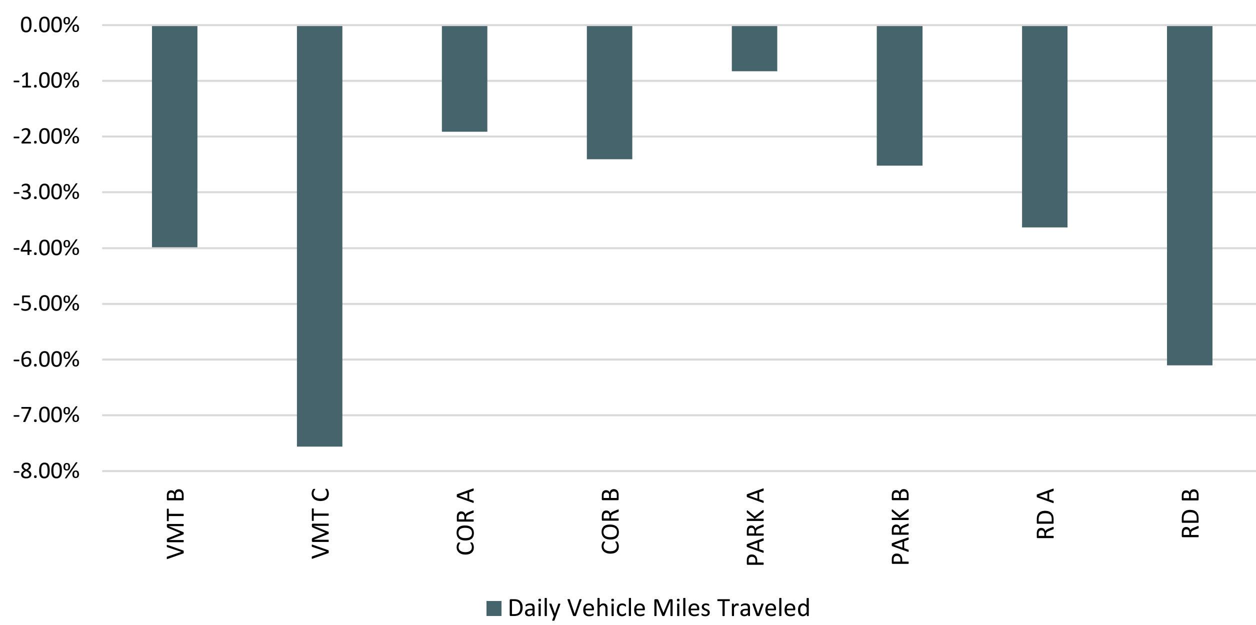
This section includes a detailed review of the model results for each pricing scenario relative to the metrics described in 4.2 Study Evaluation Criteria. Analysis was targeted to the MPA level where possible, to best illustrate impacts and benefits within Metro's planning area.

Daily Vehicle Miles Traveled

Figure 26 displays the percent change in daily vehicle miles traveled for each pricing scenario compared to the Base scenario. Appendix D includes additional figures documenting changes in total miles traveled and transit miles traveled.

All eight pricing scenarios reduced daily vehicle miles traveled. The VMT C scenario provided the greatest reduction (approximately 7.5%), while the Parking A scenario showed the smallest reduction (approximately 0.9%). These results are likely due to the VMT C scenario involving a larger per-mile charge that applied to every driver within the MPA, while the Parking A scenario had a relatively small change to parking costs in the MPA, which affected a much smaller number of drivers.

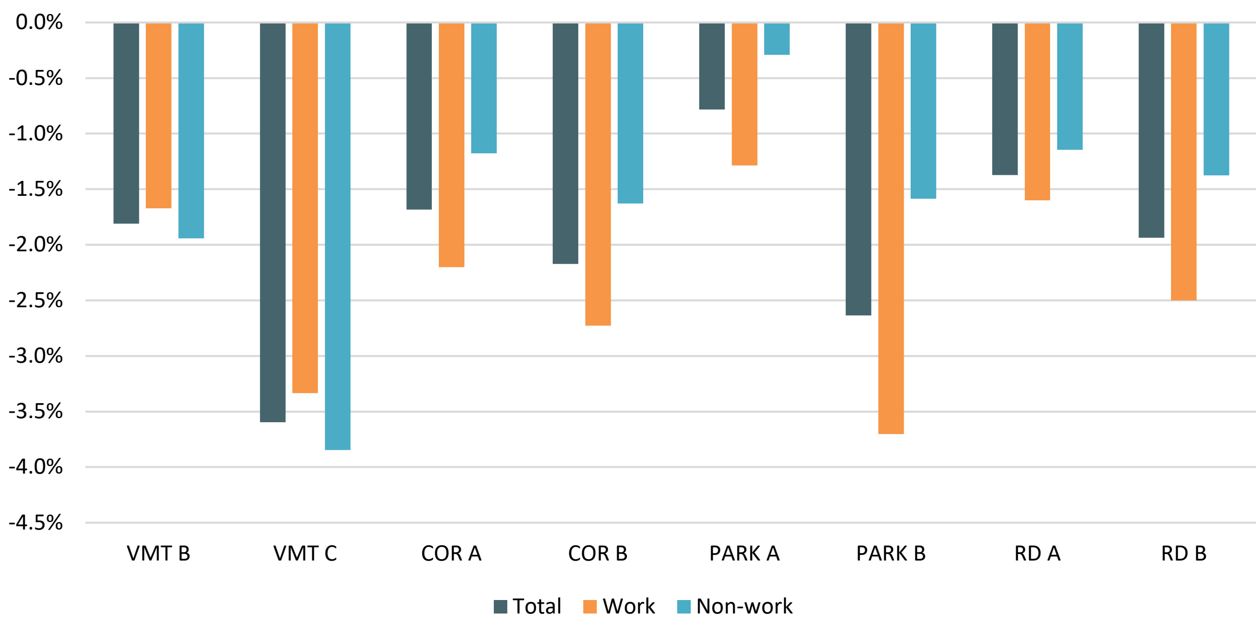
Figure 26 Percent Change in Daily Vehicle Miles Traveled – MPA



Drive Alone Rate

Figure 27 displays the percent change in drive alone rate for all trips, as well as for work trips and non-work trips, for each pricing scenario, compared to the Base scenario. Appendix D includes additional tables documenting the change in mode share by other modes.

Figure 27 Percent Change in Drive Alone Rate - MPA

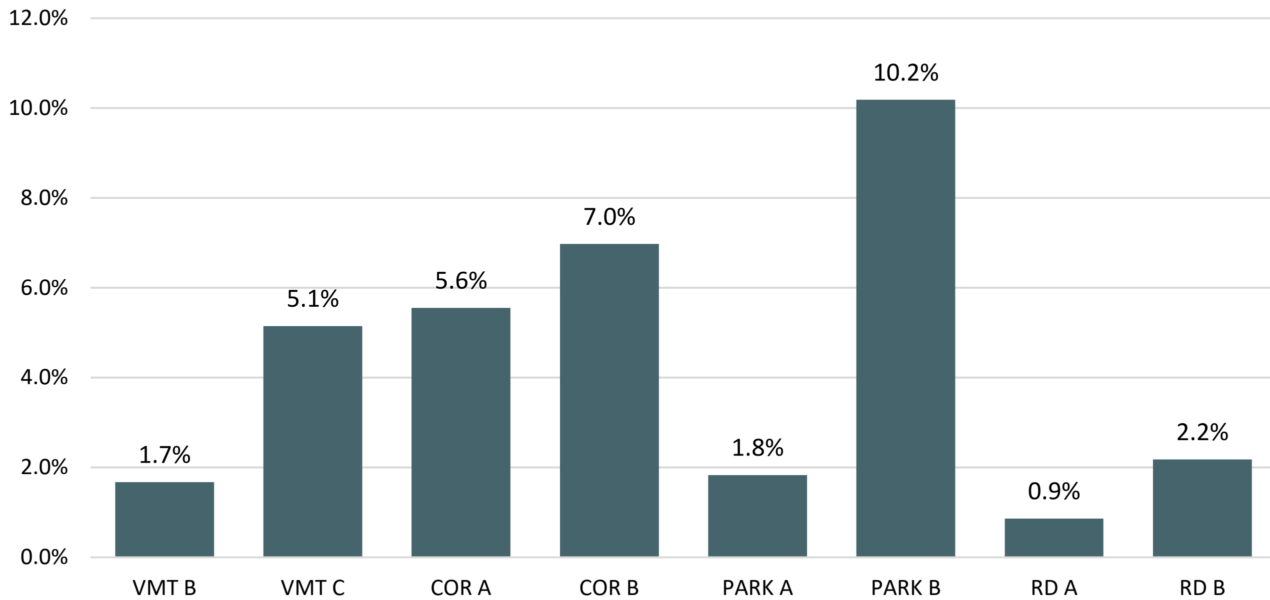


All eight pricing scenarios reduced the drive alone rate for both work trips and non-work trips. The VMT C scenario provided the greatest overall reduction (approximately 3.6%), while the Parking A scenario showed the smallest reduction (approximately 0.8%). The Parking B scenario showed the greatest reduction for work trips (approximately 3.7%). This larger reduction for work trips with Parking B was likely due to substantially higher parking charges in job centers, which tend to have better access to transit alternatives to driving than other parts of the region; the Parking B scenario showed work transit trips increasing by over 17%. The overall large decrease for VMT C was the result of a significant increase in shared ride trips, as well as large increases in transit, walking, and biking trips. The increase in walking and biking trips was likely due to shifting of trips to closer destinations.

Daily Transit Trips

Figure 28 displays the percent change in daily transit trips for each pricing scenario, compared to the Base scenario.

Figure 28 Percent Change in Total Daily Transit Trips - Region



All eight pricing scenarios increased daily transit trips. The Parking B scenario provided the greatest overall increase (approximately 10%), while the Roadway A scenario showed the smallest increase (approximately 0.9%). As mentioned in the previous section on drive alone rates, the Parking B scenario's large increase in transit trips was largely the result of a shift in work trips from drive alone to transit. By contrast, relatively few travelers shifted from drive alone trips to transit trips with the VMT B, Parking A, and Roadway A scenarios; as a result, these scenarios did not show a similarly large increase in transit trips. The Cordon A, Cordon B, and Parking B scenarios all assessed a higher charge in areas that generally have good transit accessibility; in these areas, drivers would be more likely to switch to transit when faced with a new charge. This also could indicate that a pricing strategy that adds charges for drivers in areas that do not have good transit service should consider investments to improve transit options.

Vehicle Hours of Delay and Vehicle Volumes

Figure 29 displays the percent change in PM 2-hour peak passenger vehicle hours of delay for each pricing scenario, compared to the Base scenario.

Figure 29 Percent Change in Vehicle Hours of Delay – Region (2-Hour PM Peak)

Six of the eight pricing scenarios showed a decrease in total vehicle hours of delay (approximately 7% to 39%). The two Cordon scenarios showed increases (approximately 5% to 7%). While the two Roadway scenarios showed the greatest decrease in freeway vehicle hours of delay (approximately 35% to 38%), they both also showed an increase in arterial vehicle hours of delay (approximately 6% to 29%).

The increase in delay for the two Cordon scenarios was likely due to increased diversion, from streets within the cordon boundaries to the freeways and arterials that offer alternatives through and around the cordon without being charged. This delay occurred primarily on the throughways in and near downtown (including I-5, I-405, I-84, US-26, US-30), but also to a lesser extent along primarily north-south routes such as NE/SE MLK Boulevard and NE/SE Grand Avenue, NE/SE 11th Avenue and NE/SE 12th Avenue, and NE/SE Cesar Chavez Boulevard.

The increase in arterial delay for the two Roadway scenarios was likely the result of increased diversion from the freeway network onto arterials as drivers sought to avoid paying a charge. As the charge on the freeways doubled from Roadway A to Roadway B, the vehicle hours of delay overall decreased by 6% as flow on freeways improved, but vehicle hours of delay on arterials increased by 22%.

Figure 30 to Figure 33 show the change in vehicle volumes at the link level for the two Cordon scenarios and the two Roadway scenarios. Appendix D includes additional figures showing the change in vehicle volumes for the two VMT scenarios and the two Parking scenarios.

For the two Cordon scenarios, changes in vehicle volumes were most notable in and around the downtown Portland core, where the two cordon boundaries were assumed. Large reductions in volumes occurred within the cordon boundaries as fewer drivers entered the area, but moderate to large increases occurred on roads around the cordon, including the freeways and state highways in and around downtown Portland. Volume changes were less noticeable as distance from downtown Portland increased, and many streets further from the cordon were not impacted at all.

Vehicle volumes for the two Roadway scenarios noticeably decreased on the charged throughways. The decrease was higher with the higher charge (Roadway B). Alternately, the arterials, particularly those that offer parallel routes to the throughways, saw increases in volumes under both Roadway scenarios. In the Roadway B scenario with the higher charge, the diversion increased, with greater volumes moving to additional roadways. In the Roadway B scenario, most arterials saw at least a moderate increase in volumes due to diversion from the throughways.

Figure 30 Change in 2027 PM Peak Vehicle Volumes – Region – Cordon A

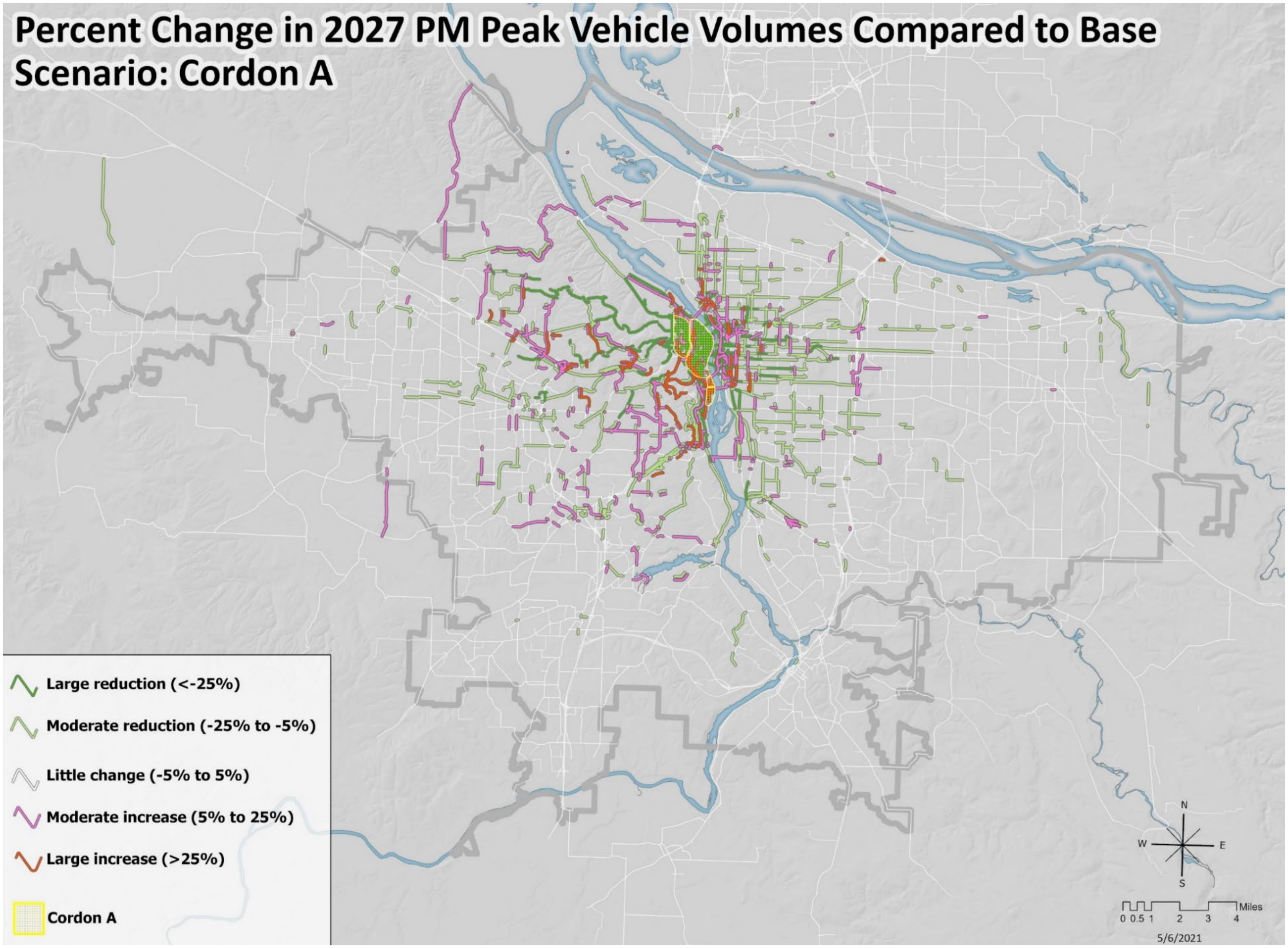


Figure 31 Change in 2027 PM Peak Vehicle Volumes - Region – Cordon B

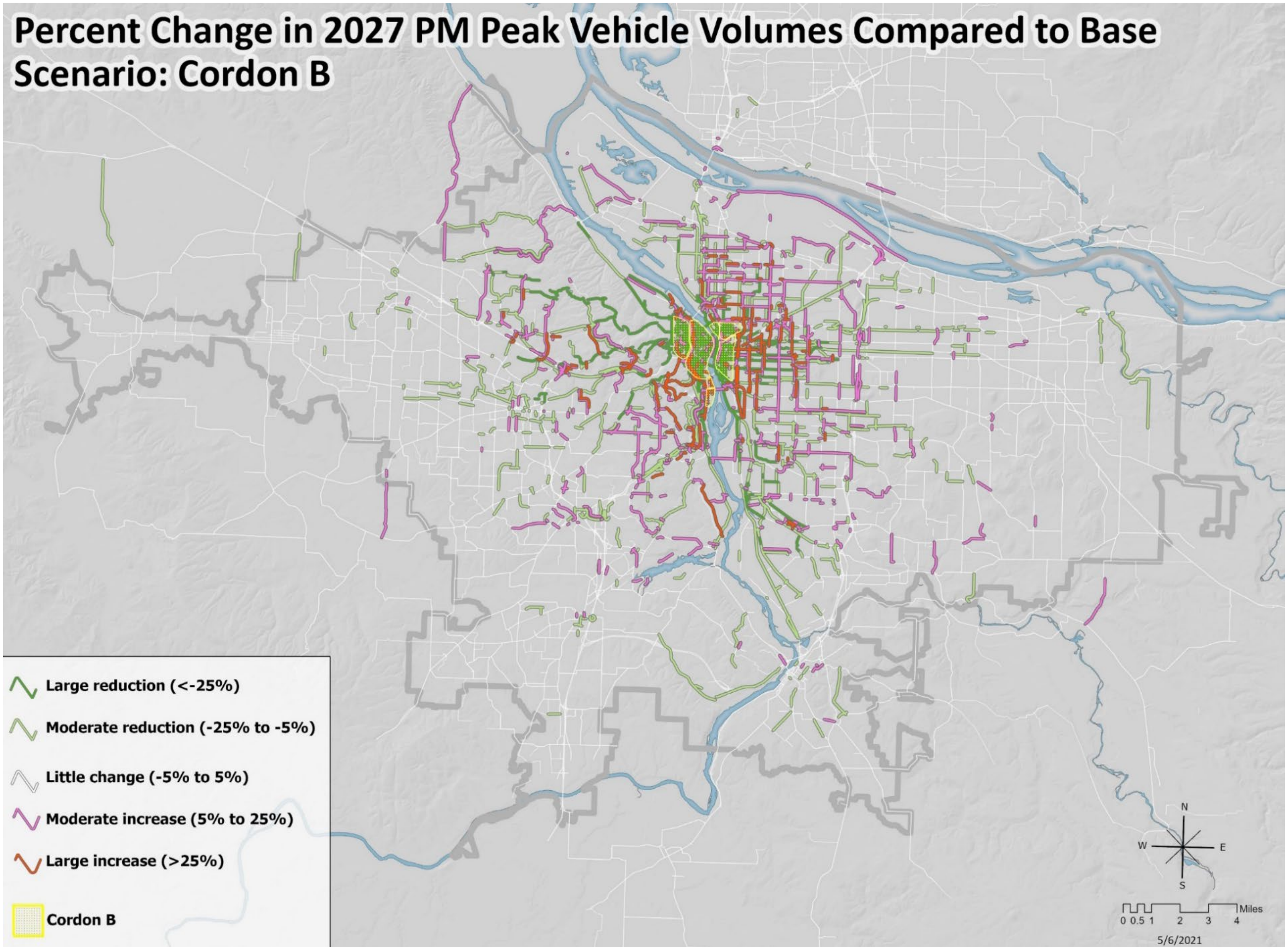


Figure 32 Change in 2027 PM Peak Vehicle Volumes - Region – Roadway A

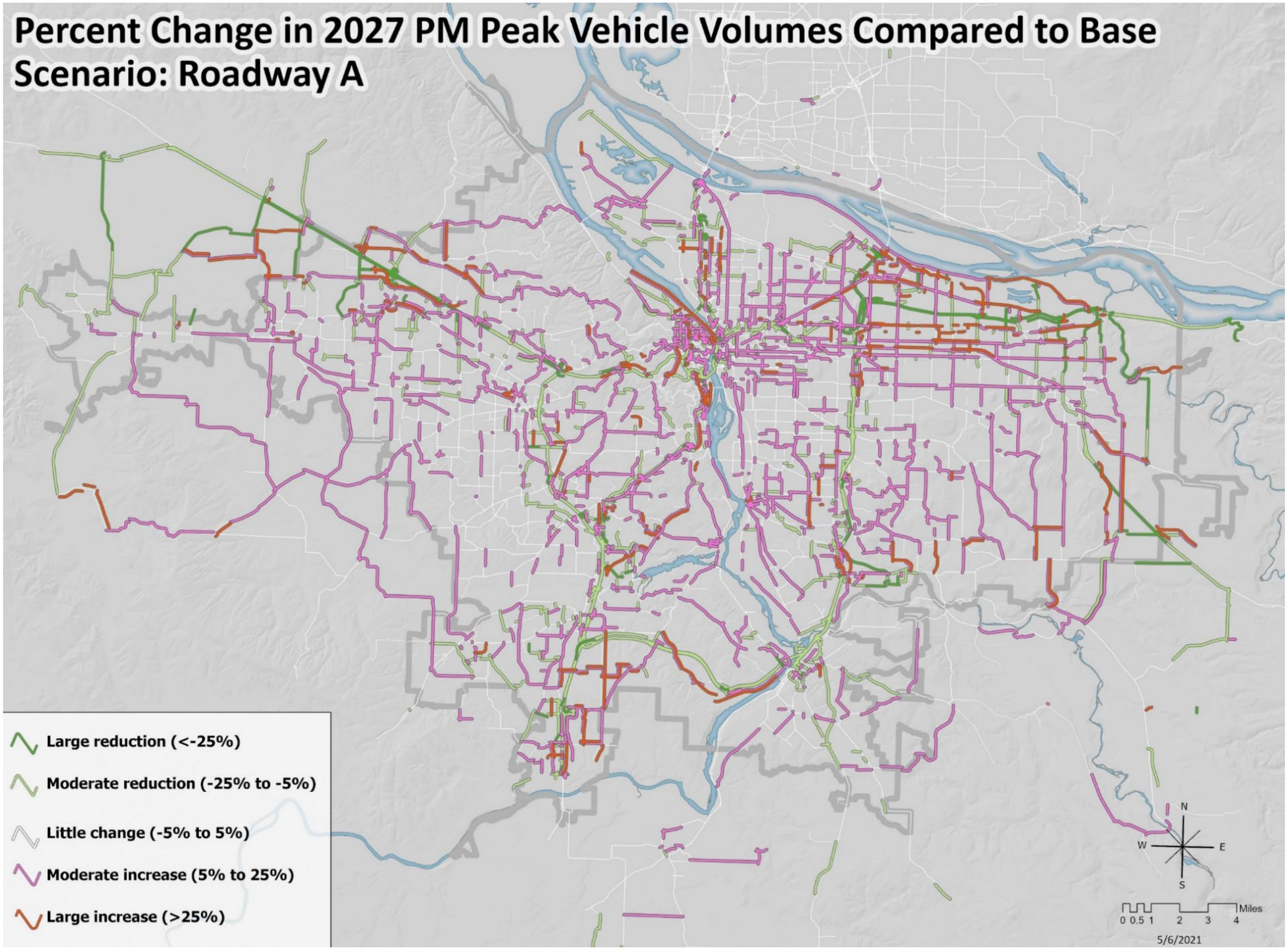
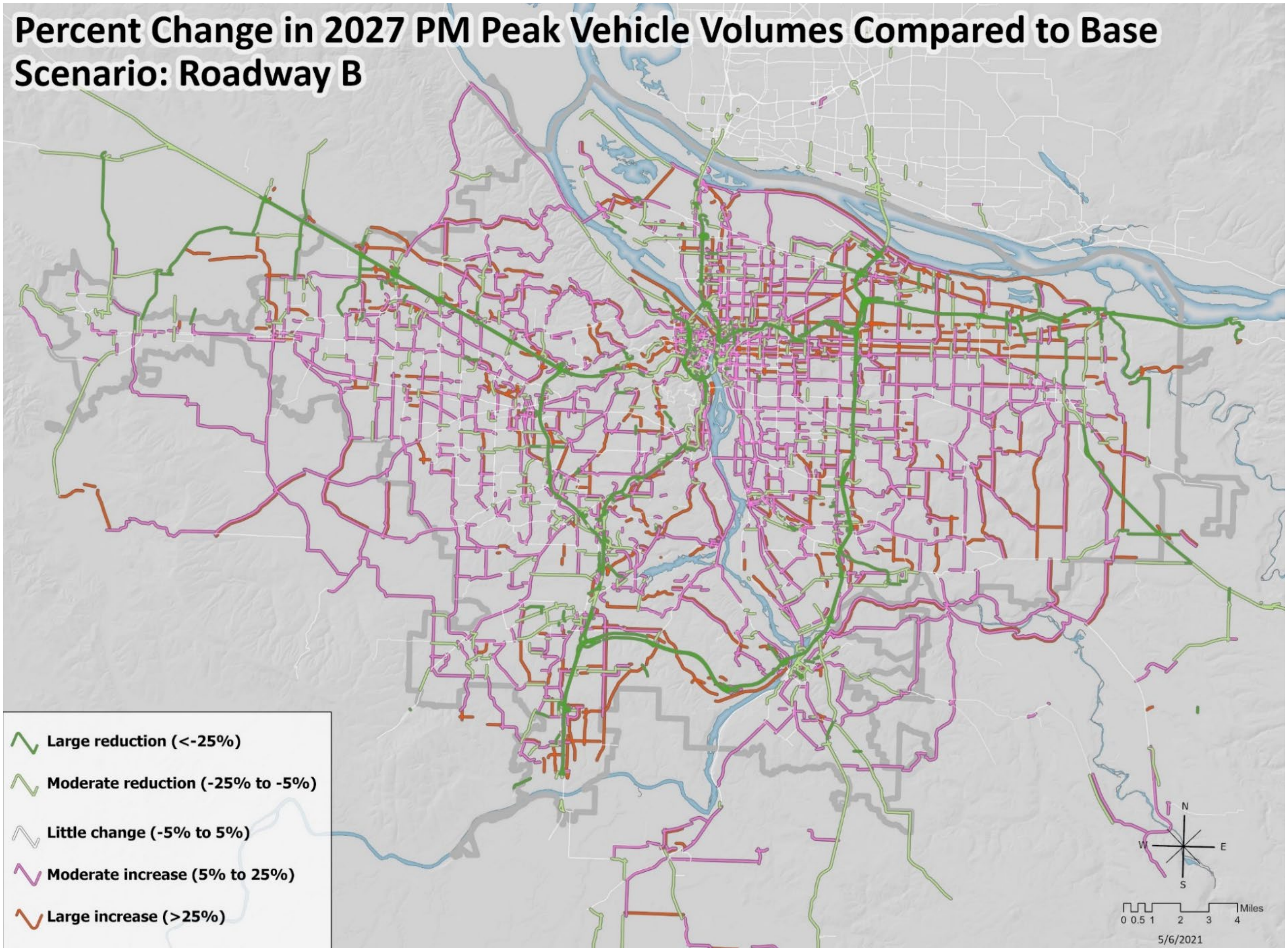


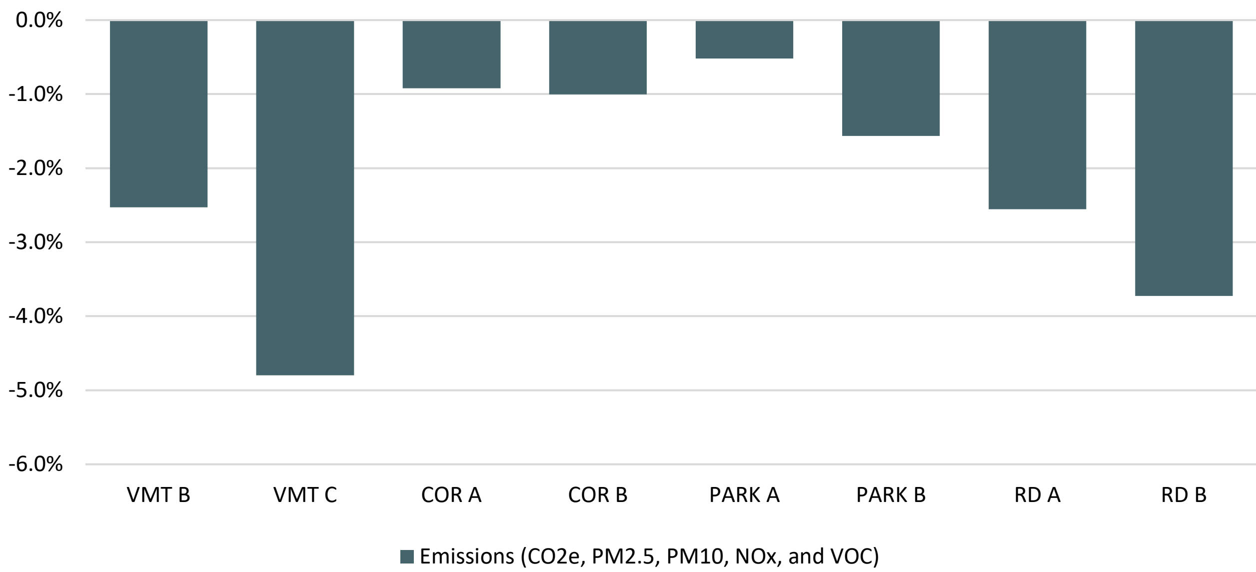
Figure 33 Change in 2027 PM Peak Vehicle Volumes - Region – Roadway B



Emissions

The change in emissions was evaluated using Metro's MCE Tool. The MCE Tool applies unit costs to motor vehicle emissions, which are derived by applying the Environmental Protection Agency's MOVES model rates for facility type, speed bin, pollutant, and year, to the VMT output produced by the travel demand model for each scenario. Figure 34 displays the percent change in emissions for each pricing scenario, compared to the Base scenario.

Figure 34 Percent Change in Emissions – Region



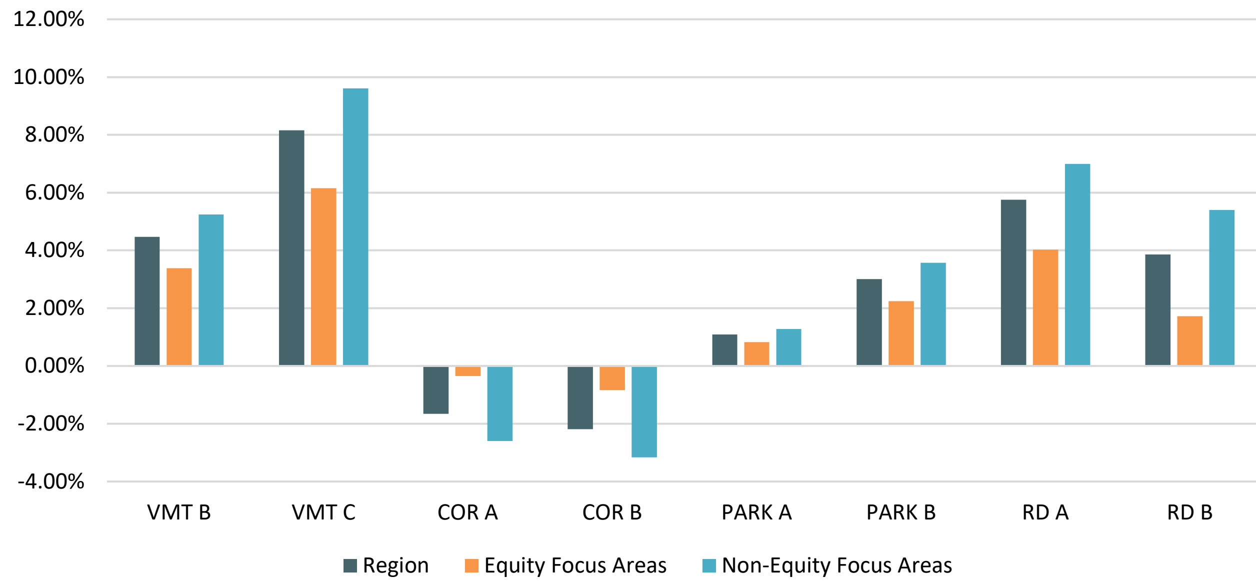
As expected, because the MCE Tool relies on the travel demand model's VMT output for its calculations, the emissions reductions were generally comparable to the VMT reductions for each pricing scenario. All eight pricing scenarios showed a reduction in emissions at the regional level. The VMT C scenario showed the largest reduction in emissions (4.8%) while the Parking A scenario showed the smallest reduction (0.5%).

The MCE tool did not evaluate the geographic distribution of changes in emissions. However, emissions would generally be expected to decrease in areas where traffic volumes decrease. For example, the two Cordon scenarios would likely see emissions decrease within the cordon boundaries, as the model results showed a substantial reduction in vehicle volumes within the cordons. This result would be consistent with findings in Stockholm where the cordoned zone has experienced improvements in air quality.

Jobs Access (Auto)

Figure 35 displays the percent change in jobs accessible within 30 minutes by auto during the 2-hour PM peak for each pricing scenario, compared to the Base scenario. These are broken out by trips from the entire region, from equity focus areas, and from non-equity focus areas.

Figure 35 Percent Change in Jobs Accessible by Auto

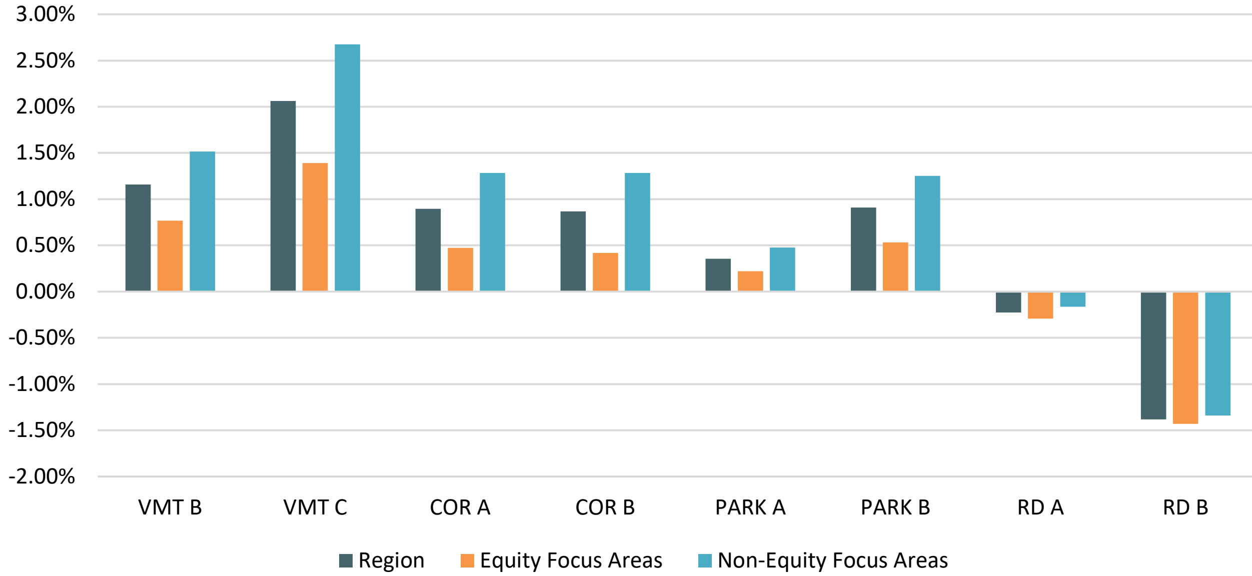


Six of the eight pricing scenarios showed an increase in the number of jobs accessible by auto at the regional level (approximately 1.1% to 8.2%), while the two Cordon scenarios showed decreases (approximately 1.7% to 2.2%). The VMT C scenario resulted in the greatest increase (8.2%). While the equity focus areas see an increase in percent change of jobs accessible by auto in six of the eight scenarios, they benefit less than non-equity focus areas across the board. The decrease for the Cordon scenarios is likely explained by the increasing vehicle hours of delay and vehicle volumes surrounding the cordon areas, as described earlier in this chapter. Similarly, the increase for the VMT C scenario is likely explained by the reduction in vehicle hours of delay and vehicle volumes throughout the region under that pricing scenario.

Jobs Access (Transit)

Figure 36 displays the percent change in jobs accessible within 45 minutes by transit in the 2-hour PM peak for each pricing scenario, compared to the Base scenario.

Figure 36 Percent Change in Jobs Accessible by Transit



Six of the eight pricing scenarios showed an increase in the number of jobs accessible by transit at the regional level (approximately 0.4% to 2.1%), while the two Roadway scenarios showed decreases (approximately 0.2% to 1.4%). The percent reduction of jobs accessible by transit was largest for equity focus areas in the two Roadway scenarios compared to the region and non-equity focus areas. The scale of change for jobs accessible by transit was significantly smaller than for jobs accessible by auto. The VMT C scenario resulted in the greatest increase (2.1%). The decreases for the Roadway scenarios are likely explained by the increasing arterial vehicle hours of delay and diversion of vehicle volumes from freeways to arterials, where buses generally operate. The increases for the VMT C scenario are likely explained by the reduction in vehicle hours of delay and vehicle volumes throughout the region under that pricing scenario causing overall less reduction and delay on arterial streets.

Community Places Access (Auto and Transit)

Another measure for equity is access to community places that provide key services and/or daily needs for people in the region. Figure 37 displays the percent change in community places accessible within 20 minutes by auto in the 2-hour PM peak for each pricing scenario, compared to the Base scenario. Figure 38 displays the percent change in community places accessible within 30 minutes by transit in the 2-hour PM peak for each pricing scenario, compared to the Base scenario.

Figure 37 Percent Change in Community Places Accessible by Auto

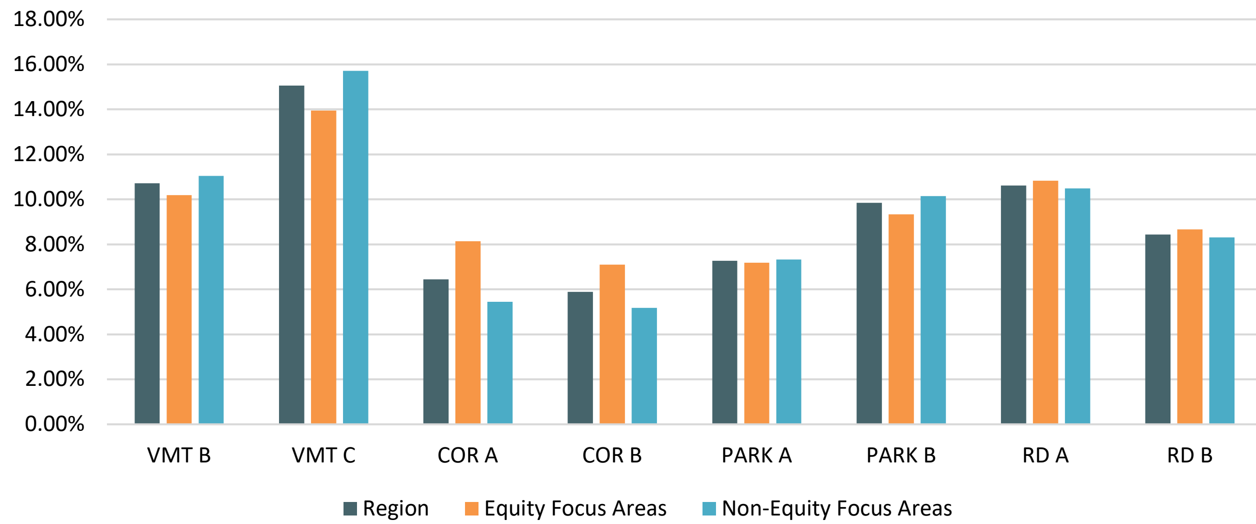
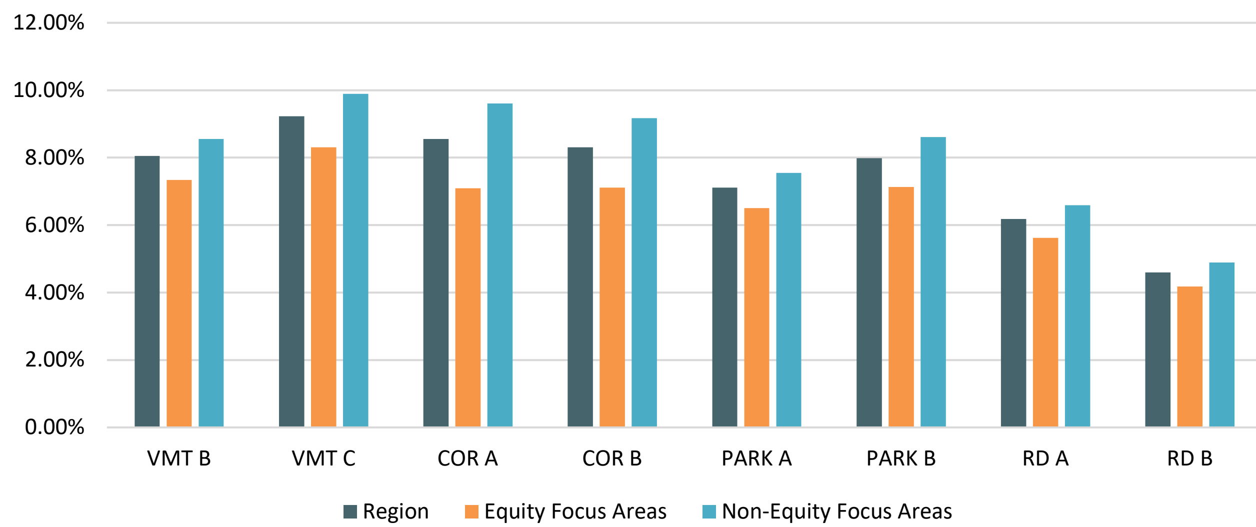


Figure 38 Percent Change in Community Places Accessible by Transit



For both auto and transit trips, access to community places increased with all eight pricing scenarios. The VMT C scenario showed the greatest increase in access to community places for both auto and transit. The two Cordon scenarios showed the smallest increase in community places accessible by auto, while the two Roadway scenarios showed the smallest increase in community places accessible by transit. These results were likely due to the changes in delay for those scenarios as discussed under the Job Access sections above.

All eight pricing scenarios showed an increase in the number of community places accessible by auto and by transit (approximately 5.9% to 15%, for auto, 4.6% to 9.2% for transit). The VMT C scenario resulted in the largest increase for both auto and transit, while the Cordon B scenario resulted in the lowest increase for auto and the Roadway B scenario resulted in the lowest increase for transit.

Compared to the number of jobs in the region, the number of community places is much smaller. Each pricing scenario results in increased access community places for equity focus areas and non-equity focus areas. Equity focus areas benefit more than non-equity focus areas for accessibility by auto for the cordon scenarios and the roadway scenarios. When it comes to change in access to community places by transit, the benefit to non-equity focus areas exceeds the benefit to equity focus areas for all scenarios.

Travel Times

The study analyzed auto travel times between selected centers throughout the region. The VMT scenarios showed faster travel times between all centers as people chose closer destinations or alternative modes to driving in response to the per-mile charge. With the Cordon scenarios, auto travel times improved to and from the Portland Central Business District (inside the cordon) and worsened slightly between areas on opposite sides of the cordon (likely due to traffic diversion to roadways adjacent to the cordon). The Parking scenarios resulted in slightly faster travel times to areas where parking was charged because fewer autos accessed those places to avoid the charges. The Roadway scenarios showed improved auto travel times between locations where most of the trip could be taken on charged roadways, and worse auto travel times where the trip required travel on arterials. This was likely due to the shifting of traffic from freeways to arterials to avoid the charge. Appendix D includes matrices for each scenario showing the change in travel time from the Base scenario between the selected centers.

Travel Costs

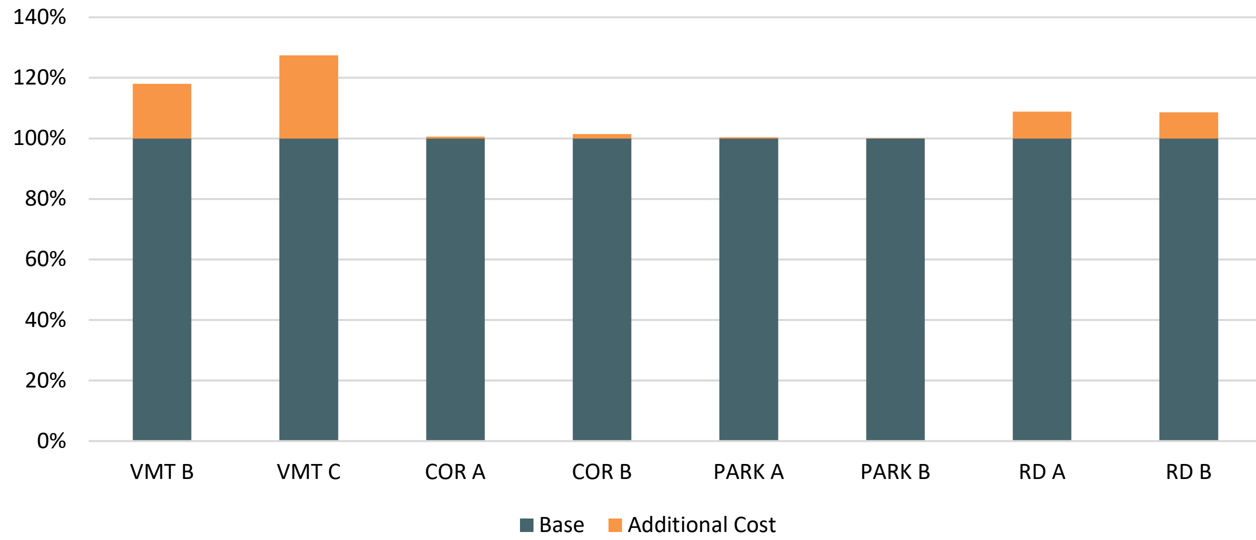
This study evaluated travel costs from two perspectives: total travel costs to the region, and individual traveler costs.

Total Travel Costs

The total travel cost is the combination of total money paid on an average weekday for auto operating costs, tolls, parking, and transit fares, for all drivers in the region. Figure 39 shows the change in total travel cost for each pricing scenario, compared to the Base scenario, while Figure 40 shows the same change in total travel cost, but as an increase on top of the cost in the Base scenario.

Figure 39 Total Travel Cost, Change from Base

Figure 40 Total Travel Cost, Increase over Base



The two VMT scenarios resulted in the largest increase in total travel cost compared to the Base scenario (18% to 27%), while the Cordon and Parking scenarios resulted in a relatively minimal increase (0% to 1%). For the VMT scenarios, this increase resulted from the new per-mile charges assessed to every driver for every mile driven within the MPA. Comparatively, because the Roadway scenarios only charged for miles driven on the freeways, they affected a smaller number of drivers and miles, and only showed an increase of approximately 9%. Even fewer individuals were charged under either the Cordon or Parking scenarios, so their total travel costs were less. For the Cordon scenarios, an increase in costs resulting from drivers paying the cordon charge was offset by lower vehicle operating costs and lower parking costs, as some drivers changed modes or chose a different destination with lower or no parking costs outside of the cordon area. For the Parking scenarios, higher parking charges were similarly offset by some drivers changing modes or choosing a different destination with lower or no parking costs.

As Figure 40 shows, these additional pricing scenario costs represent a relatively small increase over the total Base scenario travel cost. In particular, at a regional level, total travel costs for the Cordon and Parking scenarios barely changed in relation to the Base scenario travel cost. However, while the regional total travel cost increases seem small, these costs were unevenly distributed, as the next section will describe.

Individual Travel Costs

It is important to consider not just the regional travel cost, but also how different scenarios could impact various populations and trips. While there is not an easy way to represent each of the many different trips within the region, the following analysis highlights some examples of varying origins, destinations, and modes to illustrate some ways in which individuals may be charged under each of the pricing scenarios.

Table 8 displays the additional round trip costs for various driving trips compared to the Base scenario. The origin and destination are shown on the left, followed by the total round-trip distance and total round trip freeway distance (assuming the most efficient route). The additional round trip cost for each scenario is shown on the right half of the figure, and on the far right, the base cost of the trip under the Base scenario. These examples assumed that drivers continue to use the most efficient path regardless of the charge, and that they would not change their mode or destination.

As Table 8 shows, many trips in the region would not pass through or end in either cordon boundary, or many trips in the region would not end in a charged parking zone. However, all driving trips would incur a charge under the two VMT scenarios, and many trips in the region included at least a portion of their trip on the freeways, if using the most efficient path. Many drivers could avoid all or part of the charges under the Roadway scenarios by diverting to arterials. For the Cordon and Parking scenarios, drivers would need to change either their destination or their mode to avoid or reduce the charge.

Table 8 Example Cost Changes Compared to Base for Various Trips

From	To	Distance (miles)	VMT B	VMT C	COR A	COR B	PARK A	PARK B	ROAD A	ROAD B	Base Total
Troutdale Airport	Hillsboro Intel Campus	62.8	$4.30	$8.29	$ -	$ -	$ -	$ -	$7.66	$15.31	$13.25
Portland Airport	Bridgeport Village	44.6	$3.06	$5.89	$ -	$ -	$ -	$ -	$5.28	$10.56	$9.41
Downtown Beaverton	Oregon City	37.2	$2.55	$4.91	$ -	$ -	$ -	$4.46	$4.75	$9.50	$9.95
Clackamas Town Center	Gateway	15.4	$1.05	$2.03	$ -	$ -	$0.40	$2.03	$1.85	$3.70	$4.48
Gateway	Montgomery Park	18.8	$1.29	$2.48	$ -	$ -	$ -	$ -	$2.38	$4.75	$3.97
Adidas Headquarters	Nike Headquarters	24.4	$1.67	$3.22	$ -	$ -	$ -	$ -	$2.64	$5.28	$5.15
Downtown Gresham	Lloyd District	29.6	$2.03	$3.91	$ -	$5.63	$3.97	$16.13	$3.17	$6.34	$14.44

*For RD A and RD B, trips are assumed to utilize the freeways.

*For COR A and COR B, trips not ending in downtown Portland are assumed to remain on the throughways.

As an example, in Table 8, a round-trip from Troutdale Airport to the Hillsboro Intel Campus would be approximately 63 miles. This trip would see no change in costs from either the Cordon or Parking scenarios, as it would not pass through the Cordon boundaries or end in a charged parking zone. However, because it is a long-distance trip, it would see relatively higher charges under the VMT scenarios, and because most of the trip would be on the freeways, it would see substantially higher charges under the Roadway scenarios. However, this trip could avoid some or all the charges under the Roadway scenario by diverting to arterial streets.

As a second example from Table 8, consider the trip from Downtown Gresham to the Lloyd District. This is a shorter trip (approximately 30 miles round-trip), with less distance traveled on the freeways, so this trip would cost less than the previous example for both the VMT and Roadway scenarios. However, the Lloyd District is located within the Cordon B boundaries and is also located in a high-cost parking area. Because of this, while this trip would also not be charged under the Cordon A scenario, it would accrue a charge under the Cordon B scenario, and it would face higher parking costs in both Parking scenarios, including a substantially higher cost under the Parking B scenario. Interestingly, even though this is a shorter trip than the previous example, the Base cost of this trip is higher because of the high cost of parking in the Lloyd District even in the Base scenario.

Table 9 to Table 10 show further examples of individual trips. For these examples, the change in costs is compared to the change in travel time to provide some context as to the benefits that might (or might not) come from paying a higher charge. Appendix D provides additional example trips.

Example Trip: Sally

Sally lives in Oregon City and drives to work on Swan Island. Table 9 shows how much travel time Sally could save under each pricing scenario, and how much her total auto costs would increase. Sally would pay a charge under five of the eight pricing scenarios, but she would also see travel time benefits under all eight pricing scenarios. In the Cordon B scenario, Sally would pay the Cordon charge twice because she would drive through the Cordon in each direction of her commute; paying the charge saves her 10 minutes of travel time each day. For the two Roadway scenarios, Sally would save 7 to 16 minutes each day, and would pay $7.50 (Roadway A) or $12.50 (Roadway B).

Table 9 Example Trip (Sally) Change in Travel Time and Total Auto Costs – Fastest Trip

	VMT B	VMT C	COR A	COR B	PARK A	PARK B	RD A	RD B
Improvement in Travel Time (Minutes)	2.0	4.0	2.0	10.0	1.5	3.5	7.0	16.0
Increase in Total Auto Costs	$2.50	$4.50	$0.00	$11.50	$0.00	$0.00	$7.50	$12.50

Sally could also take a different route to avoid the Cordon and Roadway charges. Table 10 shows how her costs and travel times change if she were to choose to avoid these charges. In all three instances, Sally can avoid some or all the charge. However, her total travel costs still increase under all three pricing scenarios, because in the Cordon scenario, her auto operating costs increase due to taking a longer driving route, and in the Roadway scenarios, Sally still pays a charge for a portion of her trip. Also, by avoiding the charge, Sally's travel times actually increase compared to the Base Scenario, by 0.5 to 5.5 minutes.

Table 10 Example Trip (Sally) Change in Travel Time and Total Auto Costs – Charged Trip vs Avoiding Charges

	COR B		RD A		RD B	
	Charge	Avoid	Charge	Avoid	Charge	Avoid
Improvement in Travel Time (Minutes)	10.0	-5.5	7	-0.5	16.0	-2.0
Increase in Total Auto Costs	$11.50	$2.00	$7.50	$0.50	$12.50	$1.00

Example Trip: Roberto

Roberto lives in Woodstock and drives to work in downtown Portland. Table 11 shows how Roberto's travel time changes under each pricing scenario, and how much his total auto costs would increase. Roberto would pay a charge under six of the eight pricing scenarios, but he would also see travel time benefits under those pricing scenarios. In the Parking B scenario, Roberto would pay significantly more to park in downtown Portland, but he would see minimal improvements in travel time; under this scenario, Roberto might consider changing modes to avoid the larger parking charge. For the two Roadway scenarios, Roberto's trip would be slightly slower as diversion from the freeways onto the arterials causes delays for his drive.

Table 11 Example Trip (Roberto) Change in Travel Time and Total Auto Costs

	VMT B	VMT C	COR A	COR B	PARK A	PARK B	RD A	RD B
Improvement in Travel Time (Minutes)	1.0	2.0	2.5	5.0	1.0	2.0	-0.5	-1.5
Increase in Total Auto Costs	$1.00	$1.50	$5.50	$5.50	$4.00	$20.50	$0.00	$0.00

Example Trip: Sarah

Sarah lives in Lake Oswego and takes the bus to her doctor at St. Vincent's on Barnes Road. Table 12 shows that Sarah sees minor changes in travel time under each of the pricing scenarios. For most scenarios, she sees a slightly faster trip, though with the Roadway scenarios, she sees a slightly slower trip as diversion from the freeways onto the arterials causes delays for the bus. In all scenarios, her costs do not change, because the pricing scenarios do not assume any changes to TriMet fares.

Table 12 Example Trip (Sarah) Change in Travel Time and Total Auto Costs

	VMT B	VMT C	COR A	COR B	PARK A	PARK B	RD A	RD B
Improvement in Travel Time (Minutes)	1.0	2.0	1.5	1.5	0.5	1.5	-0.5	-1.0
Increase in Total Auto Costs	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00

Example Trip: Ben

Ben lives in Gresham and takes MAX to Gateway. Table 13 shows that Ben does not see any change in travel time or cost under any of the pricing scenarios. This is because MAX trains use dedicated right of way and are not impacted by changes in traffic volumes or delay, and because the pricing scenarios do not assume any changes to TriMet fares.

Table 13 Example Trip (Ben) Change in Travel Time and Total Auto Costs

	VMT B	VMT C	COR A	COR B	PARK A	PARK B	RD A	RD B
Improvement in Travel Time (Minutes)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Increase in Total Auto Costs	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00

5.3 Summary by Pricing Scenario Family

In this section, the results described above are summarized by pricing scenario family to illustrate the relative tradeoffs by type of pricing scenario.

VMT Pricing Family

Table 14 below summarizes the high-level findings for the VMT pricing scenarios.

Table 14 VMT Scenario High-Level Findings

RTP Goal	Metrics	VMT B	VMT C
Congestion & Climate	Daily VMT		
	Drive Alone Rate		
	Daily Transit Trips		
	2HR Freeway VHD		
	2HR Arterial VHD		
Climate	Emissions		
Equity	Job Access (Auto)		
	Job Access (Transit)		
	Total Regional Travel Cost	**Medium-High**	**High**

Note: Green indicates better alignment with regional goals when compared to the Base scenario

Legend	
	Large Positive Change
	Moderate Positive Change
	Small Positive Change
	Minimal Change
	Small Negative Change
	Moderate Negative Change
	Large Negative Change

Note: “Positive” and “Negative” refer to progress toward regional goals, and not to numerical values (i.e., a reduction in VMT is “positive”)

The two VMT scenarios showed improvements relative to the Base scenario (positive changes) at the regional scale for all studied metrics. Both VMT scenarios showed changes to driver behavior by:

- Reducing daily vehicle miles traveled
- Reducing the drive alone rate
- Increasing daily transit trips
- Reducing vehicle hours of delay on both freeways and arterials
- Reducing emissions
- Increasing job access via both auto and transit

The VMT C scenario performed best among all tested scenarios in reducing daily vehicle miles traveled, reducing the drive alone rate, increasing job access via both auto and transit, reducing vehicle hours of delay on arterials, and reducing emissions, and performed second best in reducing overall vehicle hours of delay. However, the VMT C scenario also had the highest regional travel cost of all tested scenarios. It also resulted in higher costs for individual drivers compared to the VMT B scenario, and drivers could not avoid a charge without changing their destination or mode.

Additionally, from a geographic perspective the benefits of the VMT scenario were not evenly distributed. Costs tended to be higher for drivers who live further away from downtown Portland and who have fewer convenient or useful non-driving alternatives. At the same time, these drivers generally saw fewer improvements to the number of jobs they were able to access by transit or auto in a typical commute time. Additionally, drivers who work two jobs and may not be able to easily use alternative modes to commute may be disproportionately impacted. Appendix D contains additional figures documenting the change in cost compared to the change in job access via auto for the VMT scenarios.

Considerations

The two VMT scenarios performed well on all metrics at a regional scale, largely because all driving trips within the MPA would be charged. Total travel cost would be the highest among the pricing tools studied, but those costs would be the most widely distributed compared to other pricing options. A VMT pricing program, however, should consider whether drivers that would pay more have viable alternatives to driving, and could focus on investments (transit, pedestrian, or bicycling infrastructure) or provide discounts or caps on charges for groups that would be disproportionately impacted, either because of where they live or their ability to pay.

Cordon Pricing Family

Table 15 below summarizes the overall results for the Cordon pricing scenarios.

Table 15 Cordon Scenario High-Level Findings

RTP Goal	Metrics	COR A	COR B
Congestion & Climate	Daily VMT		
	Drive Alone Rate		
	Daily Transit Trips		
	2HR Freeway VHD		
	2HR Arterial VHD		
Climate	Emissions		
Equity	Job Access (Auto)		
	Job Access (Transit)		
	Total Regional Travel Cost	**Medium-Low**	**Medium-Low**

Note: Green indicates better alignment with regional goals when compared to the Base scenario

Legend	
	Large Positive Change
	Moderate Positive Change
	Small Positive Change
	Minimal Change
	Small Negative Change
	Moderate Negative Change
	Large Negative Change

Note: “Positive” and “Negative” refer to progress toward regional goals, and not to numerical values (i.e., a reduction in VMT is “positive”)

The two Cordon scenarios showed improvements relative to the Base scenario (positive changes) at the regional scale for five of the studied metrics. Both Cordon scenarios showed changes to driver behavior by:

- Reducing daily vehicle miles traveled
- Reducing the drive alone rate
- Increasing daily transit trips
- Reducing emissions
- Increasing job access via transit

The Cordon B scenario performed second best among all tested scenarios in increasing daily transit trips. However, the two Cordon scenarios showed negative changes relative to the Base scenario at the regional scale for two of the studied metrics:

- Increasing vehicle hours of delay on both freeways and arterials
- Reducing job access via auto

The Cordon B scenario implemented a charge within a larger area than the Cordon A scenario, which resulted in greater positive changes. However, the Cordon B scenario also resulted in charges for more individual drivers, and drivers could not avoid a charge without changing their destination or mode if their destination were within the cordon boundaries.

Additionally, from a geographic perspective the benefits and costs of the Cordon scenario were not evenly distributed. Costs tended to be higher for drivers living further away from downtown Portland and with fewer good non-driving alternatives. At the same time, due to increased congestion on regional highways in and around downtown Portland, these drivers generally saw more negative impacts to the number of jobs they could access by auto in a typical commute time. On the other hand, trips that did not require driving in or near the cordon area were minimally affected, as increased delay and vehicle volumes were concentrated in and around the cordon area. Additionally, those who did rely on transit generally benefited from the cordon scenarios, as buses experienced fewer delays within the cordon and the number of jobs accessible via transit in a typical commute increased. Appendix D contains additional figures documenting the change in cost compared to the change in job access via auto for the Cordon scenarios.

Considerations

The two Cordon scenarios demonstrated mixed results at a regional level. The relatively high mode shift to transit indicates that adding a charge for drivers in areas with good transit infrastructure could successfully shift travel modes. However, the diversion onto the nearby uncharged facilities that increased vehicle delay and decreased job access by transit would need to be explored in greater depth. Cordon design considerations could include expanding the cordon area to encompass more origins and destinations, pairing cordon pricing with roadway pricing on key facilities near the cordon, providing a time-of-day charge, or providing discounts or exemptions for groups that would be disproportionately impacted. Improvements to arterials near the cordon to speed transit (such as bus only lanes) could also be considered.

Parking Pricing Family

Table 16 below summarizes the overall results for the Parking pricing scenarios.

Table 16 Parking Scenario High-Level Findings

RTP Goal	Metrics	PARKING A	PARKING B
Congestion & Climate	Daily VMT		
	Drive Alone Rate		
	Daily Transit Trips		
	2HR Freeway VHD		
	2HR Arterial VHD		
Climate	Emissions		
Equity	Job Access (Auto)		
	Job Access (Transit)		
	Total Regional Travel Cost	**Low**	**Low**

Note: Green indicates better alignment with regional goals when compared to the Base scenario

Legend	
	Large Positive Change
	Moderate Positive Change
	Small Positive Change
	Minimal Change
	Small Negative Change
	Moderate Negative Change
	Large Negative Change

Note: "Positive" and "Negative" refer to progress toward regional goals, and not to numerical values (i.e., a reduction in VMT is "positive")

The two Parking scenarios showed improvements relative to the Base scenario (positive changes) at the regional scale for all the studied metrics (for the Parking A scenario, the change in job access via transit was minimal, but still in the positive direction). Both Parking scenarios showed changes to driver behavior by:

- Reducing daily vehicle miles traveled
- Reducing the drive alone rate
- Increasing daily transit trips
- Reducing vehicle hours of delay on both freeways and arterials
- Reducing emissions
- Increasing job access via both auto and transit

The Parking B scenario performed best among all tested scenarios in increasing daily transit trips and performed second best in reducing the drive alone rate. The Parking B scenario also implemented significantly higher parking charges, which resulted in greater positive changes compared to the Parking A scenario. However, the Parking B scenario also resulted in significantly higher charges for individual drivers who parked in paid parking areas, and drivers could not avoid a charge without changing their destination or mode if their destination were within a paid parking area.

Additionally, from a geographic perspective the benefits and costs of the Parking scenario are not evenly distributed. Costs tended to be higher for drivers living further away from downtown Portland and with fewer good non-driving alternatives. At the same time, these drivers generally saw less benefit in terms of increased job access in a typical commute time. Additionally, those who did rely on transit generally benefited from the parking scenarios, as buses experienced fewer delays due to reduced volumes in the downtown Portland core and the number of jobs accessible via transit in a typical commute increased. Appendix D contains additional figures documenting the change in cost compared to the change in job access via auto for the Parking scenarios.

Considerations

The two Parking scenarios were effective for all metrics at a regional level. The increase in transit ridership was likely a direct result of where the charges were assessed (areas with good transit service). Charges were concentrated on fewer travelers compared to the VMT scenarios, so while the total travel cost was low compared to other pricing scenarios, the cost to the individual drivers who parked would be relatively high. The impacts to vulnerable populations should be carefully considered by a parking program, which could focus on discounts or caps on charges for key groups or reinvest revenues in improving transit service.

Roadway Pricing Family

Table 17 below summarizes the overall results for the Roadway pricing scenarios.

Table 17 Roadway Scenario High-Level Findings

RTP Goal	Metrics	ROADWAY A	ROADWAY B
Congestion & Climate	Daily VMT	[Moderate Positive Change]	[Large Positive Change]
	Drive Alone Rate	[Small Positive Change]	[Small Positive Change]
	Daily Transit Trips	[Minimal Change]	[Small Positive Change]
	2HR Freeway VHD	[Large Positive Change]	[Large Positive Change]
	2HR Arterial VHD	[Small Negative Change]	[Large Negative Change]
Climate	Emissions	[Moderate Positive Change]	[Moderate Positive Change]
Equity	Job Access (Auto)	[Moderate Positive Change]	[Small Positive Change]
	Job Access (Transit)	[Minimal Change]	[Small Negative Change]
Total Regional Travel Cost		**Medium**	**Medium**

Note: Green indicates better alignment with regional goals when compared to the Base scenario

Legend	
	Large Positive Change
	Moderate Positive Change
	Small Positive Change
	Minimal Change
	Small Negative Change
	Moderate Negative Change
	Large Negative Change

Note: “Positive” and “Negative” refer to progress toward regional goals, and not to numerical values (i.e., a reduction in VMT is “positive”)

The two Roadway scenarios showed improvements relative to the Base scenario (positive changes) at the regional scale for six of the studied metrics (for Roadway A, the change in daily transit trips was minimal, but still in the positive direction). Both Roadway scenarios showed changes to driver behavior by:

- Reducing daily vehicle miles traveled
- Reducing the drive alone rate
- Increasing daily transit trips
- Reducing vehicle hours of delay on freeways
- Reducing emissions
- Increasing job access via auto

The Roadway B scenario performed best among all tested scenarios in reducing both overall and freeway vehicle hours of delay and performed second best in reducing daily vehicle miles traveled. Interestingly, the Roadway A scenario performed second best among all tested scenarios at improving job access via auto; with a larger charge to drive on the throughways, the Roadway B scenario was less effective at improving job access via auto.

However, the two Roadway scenarios showed negative changes relative to the Base scenario at the regional scale for two of the studied metrics (for Roadway A, the change in job access via transit was minimal, but still in the negative direction):

- Increasing vehicle hours of delay on arterials
- Reducing job access via transit

Most significantly, the two Roadway scenarios both showed diversion of traffic volumes from the freeway network to the arterials as drivers seek to avoid a charge. The effect is magnified with Roadway B - with the charge doubled compared to Roadway A, the arterial vehicle hours of delay increase.

Additionally, from a geographic perspective the benefits and costs of the Roadway scenario were not evenly distributed. Costs tended to be higher for drivers living closer to a freeway or highway. At the same time, these drivers generally saw more of an increase in the number of jobs they were able to access by auto in a typical commute time, due to decreased congestion on those freeways and highways. On the other hand, drivers living farther from a freeway or highway but who still drove longer distances were most negatively affected, as they saw less of an increase in job access via auto due to higher volumes and delay on arterial streets that they traveled to reach the freeways. Additionally, those who did rely on transit were generally negatively impacted by the Roadway scenarios, as buses primarily traveled on arterial roads, which became congested in the Roadway A scenario and substantially more congested in the Roadway B scenario, resulting in slower transit and a decrease in the number of jobs accessible via transit in a typical commute. Appendix D contains additional figures documenting the change in cost compared to the change in job access via auto for the Roadway scenarios.

Considerations

The two Roadway scenarios had mixed results at a regional level, with improvements on reductions in VMT and reduced delay on the charged roadways coupled with increased delay to nearby non-charged roadways. Burdens and benefits were not uniformly distributed and could disproportionately impact travelers that live on the outskirts of the region.

The complexity of these findings indicate that a roadway pricing program should focus not only on the impacts to delay on the throughways charged, but the impacts to nearby non-charged roadways. Impacts at a localized scale would need to be examined to understand if there were investments (such as transit, bike, or pedestrian improvements) that could improve overall performance. In addition, the impacts to travel costs should be assessed at a granular scale to understand the impact on vulnerable groups.

6 FEASIBILITY AND IMPLEMENTATION CONSIDERATIONS

Metro's analysis of the four types of pricing showed that they all have the potential to help reduce congestion and lower greenhouse gas emissions, with varying degrees of success. The equity and best practices discussions yielded agreement that congestion pricing tools can also address equity concerns and decisions about how to spend revenue can also address safety concerns. Any one of these four pricing tools could be implemented separately or in some combination.

A major consideration in addition to performance is how easy or difficult a pricing tool would be to implement. This section provides an overview of the feasibility considerations, including: a review of public acceptance, technology, enforcement, cost to implement, legal and policy considerations, and ease of implementation. A more detailed discussion on implementation considerations is found in Appendix A.

6.1 Technology Considerations

The four congestion pricing tools analyzed rely on different types of enabling technologies for implementation.

- **Tolling Technologies** – Modern electronic toll collection systems use Automatic Vehicle Identification (AVI) and Automatic License Plate Reader (ALPR) technologies, which identify vehicles without impeding traffic flow. Both collection systems use transponders to identify vehicles with pre-paid toll accounts to charge vehicles. Those without transponders have the option of paying by mail. (*Applies to cordon pricing and roadway pricing scenarios)*

- **Mobile Applications** – Several companies are using cell phone-based technologies, such as GPS and 5G wireless positioning features, to determine vehicle location and assess tolls. (*Applies to cordon pricing and roadway pricing scenarios)*

- **Connected Vehicles** (V2X) – Installation of Dedicated Short-Range Communications (DSRC) in new vehicles (e.g., 5G wireless network communication). This allows for new vehicles to communicate with toll infrastructure and automatically charge vehicles. These connected vehicles present opportunities to leverage their communications capabilities to automatically toll vehicles. (*Applies to cordon pricing and roadway pricing scenarios)*

- **OReGO[12] Technologies** – Uses devices that connect into a vehicle's On-Board Diagnostic (OBD)-II ports to get vehicle information and odometer reads, then transmit it wirelessly back to the VMT account manager. (*Applies to VMT scenarios)*

- **Self-Reporting** – Vehicle owners manually logging mileage online periodically. These self-reporting methods are being trialed in various states that are piloting VMT programs. *(Applies to VMT scenarios)*

[12] OReGO participants pay 1.8 cents for each mile they drive on Oregon roads. That money goes into the State Highway Fund for construction, maintenance, and preservation of roads and bridges. See https://www.myorego.org/ for more information.

- **Parking Payment Systems** – Mobile payment apps and smart sensors have revolutionized the ability for parking operators to dynamically price and manage parking inventory. In general, parking payment systems have largely automated how parking operators can collect payments. This growth in payment systems coupled with existing taxing ability for government entities to collect from parking operators would allow agencies to impose and collect congestion pricing fees more easily. (*Applies to parking pricing scenarios)*

6.2 Implementation Considerations

Implementation considerations of each technology is critical to further understand the feasibility of the four congestion pricing tools. This section addresses the implementation of technology, enforcement, cost, policies/legal, and ease of use for the public. A summary matrix is included to assess how these implementation topics relate to each congestion pricing tool.

1. **Technology:** Several considerations are vital to implementation of technology.
    - **Technology Maturity.** Deploying existing technologies will likely be less expensive to implement and reduce scheduling risks compared to deploying emerging or in-development technologies. Implementing existing technologies does need to be weighed against the risk of the technology becoming obsolete in the near future or being vulnerable to future market disruptors.
    - **Physical Roadside Presence.** The physical footprint of technologies will be important in urban environments where space and visual aesthetics are at premium. For instance, a typical tolling system requires overhead mounted antennas that effectively read transponders and capture license plates to be installed throughout the corridors to provide effective compliance. Some of this infrastructure might not be allowed in certain parts of the city (for example, within an historical district) or require design commission approval.
    - **Intrusiveness.** The more the technology requires the public to take an action, the more difficult it will be for the technology be adopted and for pricing to be applied accurately and reliably. For instance, a technology that requires customers to download an app and track mileage manually would be less effective than a technology that captures license plates and automatically sends a bill to a customer.
    - **Compatibility with Other Pricing Programs**. Keeping in mind coordination with other pricing programs will go a long way towards creating a more seamless customer experience for travelers. In particular, ODOT is planning to implement tolling on Interstates in the Portland region, so adopting common technologies and payment systems may be advantageous in order to reduce duplicative efforts and provide savings through economies of scale. The Hop regional transit fare program and various private parking payment systems are other programs that a pricing program could coordinate with.
2. **Equity**: Selection of particular technologies and methodologies for pricing should consider impacts on different demographic and income groups in the region. Expensive or complex pricing methods may not only unfairly burden transportation disadvantaged travelers and create barriers to entry for them but could also cause these groups to be punitively treated as violators due to their lack of

access to the proper technologies. The overall customer experience of how travelers enroll, pay, and use priced facilities should also be carefully considered and steps taken to reduce undue impacts. For example, paying tolls should allow those without access to traditional banking services to be able to use alternative payment methods, such as cash payment kiosks at local stores, or to preload a pass account at a retail location. The TriMet Hop Fastpass fare card system has explored methods to improve access for the unbanked and underbanked population that could provide some lessons to congestion pricing[13].

3. **Enforcement**: Enforcement entails balancing revenues lost due to scofflaws, perception of enforcement effectiveness by the public, and the cost of the enforcement itself. Striving for 100% enforcement may be cost prohibitive, but not investing enough would upset paying customers and reduce revenues. In addition, some pricing methods, such as mobile apps, are great for paying customers, but do nothing for catching and charging drivers without the apps. A layered, multiple technology approach to enforcement may be needed.
4. **Cost:** Selection of pricing scenarios and technologies should also take into consideration both the upfront capital cost of implementation and ongoing operational costs to evaluate overall lifecycle costs. Cost should also be examined in context of potential revenues raised. In addition, funding sources for capital and operational costs could also influence the pricing technology and delivery method selected. For example, the region could consider a Public Private Partnership (PPP) delivery method to take advantage of private financing. Any consideration of PPP would need to be done thoughtfully and with the unique context of Portland's needs in mind.
5. **Policies/Legal:** Consideration must be made for the need to secure authorization to implement any congestion pricing program, specifically the powers to impose a price and to enforce it. A more thorough legal review would be needed beyond these insights:
    - **VMT authority**. The current OReGo program's authority is covered under ORS 319.883-.947. Privacy of customer data is also explicitly protected under ORS 319.915. However, the regulations only make VMT voluntary and do not allow imposing a mandate. Therefore, violation regulations only cover misreporting of mileage by voluntary VMT program participants.
    - **Tolling/Cordon authority**. At the State level, tolling of roadways are covered where the Oregon Transportation Commission has the power to approve toll on any "highway" in Oregon (all public roads in Oregon). At the Federal level, 23 U.S.C. 129 stipulates tolling of Interstates is limited to new highways and new lanes added to existing Interstate highways, provided the number of toll-free lanes are maintained, or to reconstruction or replacement of a toll-free bridge or tunnel and conversion of the bridge or tunnel to a toll facility.[14]

[13] More information on TriMet's Hop Fastpass program can be found at https://myhopcard.com/home/ (last accessed May 16, 2021).

[14] Oregon is a participant in the FHWA Value Pricing Pilot Program (VPPP). The VPPP was established in 1991 (as the Congestion Pricing Pilot Program) to encourage implementation and evaluation of value pricing pilot projects to manage congestion on highways through tolling and other pricing mechanisms. While the program no longer actively solicits projects, it can still provide tolling authority to State, regional or local governments to implement congestion pricing applications. See https://ops.fhwa.dot.gov/congestionpricing/value_pricing/ for more detail.

- **Parking pricing**. The ability to raise parking fees for congestion pricing purposes is assumed to need authorization from local jurisdictions.

Table 18 Ease of Implementation of the Four Pricing Scenarios under Consideration

Scenarios	Method of Pricing	Technology	Enforcement	Cost	Policies/ Legal	Ease of Use
VMT	OReGo OBDII port technologies	Existing technology	Cannot enforce with out-of-state drivers	Need to deploy on all vehicles	Need to mandate VMT for all OR vehicles, privacy concern	Already deployed
	Self-reporting	Need to develop self-reporting system	Relies on honor system, cannot enforce with out of state drivers	Cost of developing self-reporting system and ongoing administrative costs	Need to mandate VMT for all OR vehicles	Depends on complexity and frequency of self-reporting
Cordon Pricing	Tolling technology	Existing technology	Pursuit registered owner with license plate	Upfront construction costs	Need tolling authority	Requires setting up toll accounts
	Mobile apps	Existing technology	Needs to be coupled with roadside enforcement	Minimal development costs, operational costs depend on enforcement approach	Need tolling authority, privacy concerns	Minimal effort to download and sign up
	Connected vehicles	Not universally available nor installed	Needs to be coupled with roadside enforcement	Require new infrastructure to support	Need tolling authority, privacy concerns	Requires setting up toll accounts
Parking Pricing	Raise prices using existing paid parking systems	Existing technology	Using existing means of parking enforcement	Mainly administrative costs	Leverage existing parking fee/taxation frameworks	No change in paying method
Roadway Pricing	Tolling technology	Existing technology	Hard to enforce on arterial roads	Significant infrastructure cost due to frequency of tolling locations needed	Need tolling authority	Requires setting up toll accounts
	Mobile apps	Existing technology	Needs to be coupled with roadside enforcement	Significant infrastructure cost	Need tolling authority, privacy concerns	Minimal effort to download and sign up
	Connected vehicles	Not universally available nor installed	Needs to be coupled with roadside enforcement	Require new infrastructure to support	Need tolling authority, privacy concerns	Requires setting up toll accounts

Legend:	Easy	Moderate	Difficult

Note: cell shading indicates ease. VMT/OReGo: Method Difficult, Technology Easy, Enforcement Difficult, Cost Moderate, Policies Difficult, Ease of Use Easy. VMT/Self-reporting: Difficult, Moderate, Difficult, Moderate, Difficult, Difficult. Cordon/Tolling: Moderate, Easy, Easy, Moderate, Moderate, Moderate. Cordon/Mobile apps: Moderate, Easy, Moderate, Easy, Moderate, Easy. Cordon/Connected vehicles: Difficult, Difficult, Moderate, Difficult, Moderate, Moderate. Parking: all Easy. Roadway/Tolling: Difficult, Easy, Moderate, Difficult, Moderate, Moderate. Roadway/Mobile apps: Difficult, Easy, Moderate, Difficult, Moderate, Easy. Roadway/Connected vehicles: Difficult, Difficult, Moderate, Difficult, Moderate, Moderate.

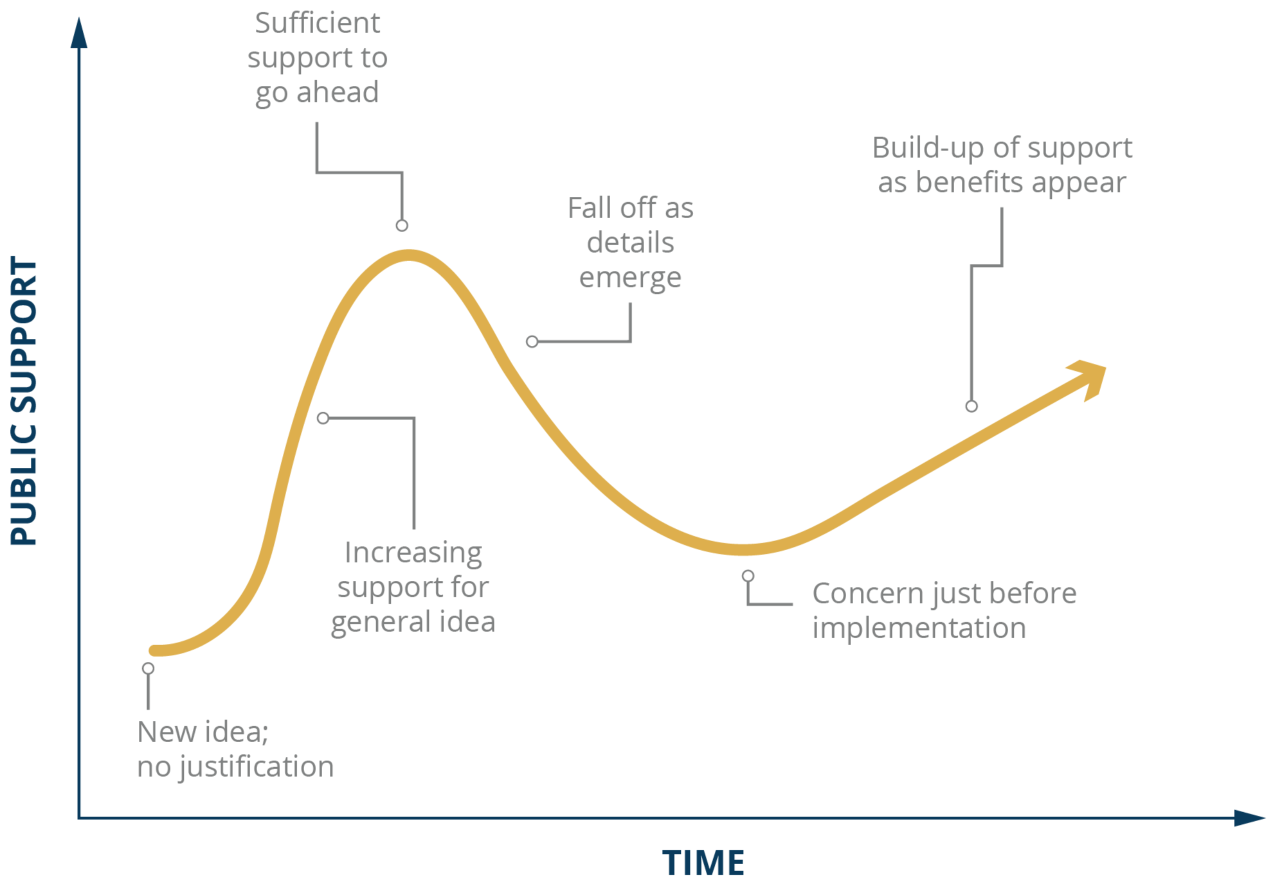
6. **Customer Ease of Use:** Widespread adoption of technologies in already deployed in the region, such as the OReGO program, could reduce costs and increase customer convenience. The more automated payments and streamlined business rules are made, the easier it is for the public to participate, contrasting to methods that require more frequent inputs such as manually tracking mileages which would make compliance more difficult.

6.3 Key Insights

The ease of implementation summarized in Table 18 presents a high-level screening which considers broad issues. As implementing agencies fine tune pricing scenarios, implementation details will also become clearer, and solutions refined. Key insights of implementation at this stage:

- Public acceptance: all pricing programs are likely to struggle with public acceptance. There is a common perception that pricing is likely to hurt transportation disadvantaged populations and that people will pay more for something without seeing a benefit. Case studies have shown acceptance grows after a pricing program is implemented, as shown in Figure 41 below. A concerted public engagement and marketing effort would likely be needed to garner acceptance of a congestion pricing project or program.
- Parking pricing is the easiest of the tools to implement since it leverages existing infrastructure and processes to introduce congestion pricing.
- Cordon pricing can leverage state of the art tolling and enforcement technologies, making implementation moderately difficult to implement.
- Although roadway pricing can leverage many tolling methods, enforcement can be difficult. Also, tolling roadways that are not limited access could be cost prohibitive, reflecting why arterial tolling is not typically priced.
- A VMT program could build off of the OReGO pilot but a major implementation barrier is enforcement and mandating vehicles to participate.
- A pilot phase might make sense for the Portland region to trial one or more technologies before scaling up to a region-wide system.

Figure 41 Public Acceptance of Congestion Pricing Changes Over Time



Source: Adapted from Centre for Transport Studies Stockholm

7 COMPLEXITY OF REVENUE

Cost and revenue potential of pricing varies by the type of congestion pricing. The amount charged must be balanced against the cost to deploy and operate a pricing program, including both capital and operating costs.

The cost estimation of a congestion pricing scenario is dependent on which method of applying pricing is employed. The first component of cost estimation, **capital cost**, entails the cost to initially implement a scenario's method of pricing and is heavily influenced by the maturity of technology available, the ability to leverage an existing pricing program, and the physical footprint of equipment that needs to be deployed. The second component of cost estimation is **operating cost**, the ongoing cost to administer and maintain the scenario's method of pricing. Operating costs are dependent on the ability to leverage an existing pricing program (if available), the cost of handling transactions, and the volume of transactions generated. Revenues generated by the congestion pricing program must be high enough to pay for implementation and operation of a program or project; and to address equity and safety impacts that may be introduced.

Therefore, cost estimations range considerably for the congestion pricing scenarios and their specific methods of pricing. Considerations are summarized in Table 19. The following is a summary of scenarios from the least expensive to the most expensive.

- **Parking Pricing –** Parking pricing scenarios are the least expensive to deploy and operate since they can readily leverage existing priced parking technology in use. As long as the parking rate structure is simple (and not dynamically set), most of the cost of implementing this family of scenarios is in the form of staffing to ensure fees are correctly administered and collected. Although implementation costs are low, these scenarios hold low revenue potential as well.

- **VMT –** Moderately costly to implement, the VMT scenario benefits from the ability to build on Oregon DOT's existing OReGO road user charge program. Technology and administration have already been deployed to collect fees, and that technology could be scaled up to expand VMT to the entire region. The main cost for VMT is equipping vehicles and administering the program. VMT scenarios have a high potential for revenue generation, and costs are shared among all drivers of the region.

- **Cordon Pricing** – Depending on the method of tolling and enforcement employed, cordon pricing can range from moderately expensive to most expensive. On the lower end of the cost scale is deploying app-based technology with selective enforcement, which could lower equipment costs, but results in lower potential revenues and reduce pricing's effectiveness. On the other hand, a robust implementation of tolling equipment around the cordon's boundary would reduce revenue leakage, but significantly raise construction and operational costs.

- **Roadways** – Tolling of Portland's throughway network would be the most expensive due to the network's extensive geographical footprint. Even if utilizing technologies that make it relatively easier for customers to pay a toll (such as mobile apps), and with a minimal number of toll gantries needed for enforcement, roadway pricing is expected to be costly to implement and to generate vast numbers of transactions to process, requiring high administrative and operating cost expenditures.

These scenarios vary in their revenue generation potential.

Table 19 Cost Estimations by Scenario

Scenarios	Method of Pricing	Capital Costs	Operating Costs	Revenue Potential
VMT	OReGo OBDII port technologies			**$$$$**
	Self-reporting			
Cordon Pricing	Tolling technology			**$**
	Mobile apps			
	Connected vehicles			
Parking Pricing	Raise prices using existing paid parking systems			**$**
Roadway Pricing	Tolling technology			**$$**
	Mobile apps			
	Connected vehicles			

Legend:	Least Expensive	Moderately Expensive	Most Expensive

NOTE: The table above summarizes order of magnitude cost and revenue for scenarios modeled as part of this study. Specific cost and revenue analysis would be needed as part of any specific pricing project.

8 CONCLUSIONS & RECOMMENDATIONS

This study explored the potential for different types of congestion pricing to help the Portland Metropolitan Region meet the four regional transportation priorities adopted in the 2018 Regional Transportation Plan. Project staff relied on several key resources to guide the work, including Metro's Regional Travel Demand Model; guidance from congestion pricing experts around the country; and engagement with equity experts local to this region, including CORE, EMAC, and the POEM Task Force. In documenting the main findings from this study, we have gleaned several that we believe will be particularly helpful to policy makers and project sponsors going forward.

8.1 Peer Evidence and Support

Portland is not the first metropolitan region to consider pricing strategies to support community goals. Many cities nationally and across the globe have implemented pricing strategies and realized significant benefits. For example:

- **Stockholm:** The congestion pricing program has reduced traffic by 22% and greenhouse gas emissions by 14%. Program revenues have funded 18 new regional bus lines and 2,800 new regional park-and-ride spaces.[15] After congestion pricing was implemented, the number of acute asthma cases in young children dropped by about 50%.[16]

- **London:** Prior to congestion pricing, traffic in central London averaged 2-5 mph. Since implementation, the average traffic speed has increased to 10 mph.[17] London increased bus service in the pricing zone by 27%, improving transit reliability and travel times. As a result, bus ridership increased 38% in two years.[18]

Many North American cities also have studies underway or are near implementation. A few examples are provided below:

- **New York City:** In 2019, New York City implemented a congestion zone surcharge on for-hire vehicles (like taxis, Uber and Lyft) in Manhattan as part of its phased approach to pricing. Future phases, planned for implementation in 2021, include a vehicle fee for crossing into a specified zone. Revenues collected from the program will be reinvested into capital transit projects, particularly in the city's subway system.

- **San Francisco:** In 2019, the San Francisco County Transportation Authority (SFCTA) began to explore how a fee to drive downtown could achieve congestion, climate, equity, and safety goals. The study builds on a 2010 Study, which evaluated the applicability of congestion pricing to San Francisco.

[15] SFCTA, *Mobility, Access, and Pricing Study: Case Studies: Stockholm and London*, 2010.
[16] *Simeonova, E, et al., Congestion Pricing, Air Pollution and Children's Health, 2018.*
[17] *SFCTA, Mobility, Access, and Pricing Study: Case Studies: Stockholm and London, 2010.*
[18] *Congestion Charging Central London, Impacts Monitoring Second Annual Report, 2004.*

- **Vancouver, B.C.:** A 2018 study considered how congestion pricing could reduce traffic congestion, promote fairness, and support transportation investment. A second phase of study is developing a more detailed approach to a pricing program.

8.2 Key Takeaways

Congestion pricing has the potential to help the greater Portland region meet the priorities outlined in its 2018 Regional Transportation Plan, including reducing congestion and improving mobility, reducing greenhouse gas emissions, and improving equity and safety outcomes. However, it depends how pricing is implemented in the region.

VMT

VMT scenarios performed well on all metrics at a regional scale, largely because all driving trips within the MPA would be charged. Total travel cost would be the highest among the pricing tools studied, but those costs would be the most widely distributed compared to other pricing options. A VMT pricing program should consider whether drivers who would pay more have viable alternatives to driving, and could focus on investments (transit, pedestrian, or bicycling infrastructure) or provide discounts or caps on charges for groups that would be disproportionately impacted, either because of where they live or their ability to pay.

Cordon

The cordon analysis demonstrated mixed results at a regional level. The cordons studied resulted in relatively high mode shift to transit, indicating that adding a charge for drivers in areas with good transit infrastructure could successfully shift travel modes. However, the diversion onto the nearby uncharged facilities that increased vehicle delay and decreased job access by transit would need to be explored in greater depth. Cordon design considerations could include expanding the cordon area to encompass more origins and destinations, pairing cordon pricing with roadway pricing on key facilities near the cordon, providing a time-of-day charge, or providing discounts or exemptions for groups that would be disproportionately impacted. Improvements to arterials near the cordon to speed transit (such as bus only lanes) could also be considered.

Parking

Overall, parking charging demonstrated positive results for all metrics at a regional level. The analysis shows that charging for parking could increase transit ridership – likely a direct result of where the charges were assessed (areas with good transit service). Charges were concentrated on fewer travelers compared to the VMT scenarios, so while the total travel cost was low compared to other pricing scenarios, the cost to the individual drivers who parked was relatively high. The impacts to vulnerable populations should be carefully considered in a parking program, which could focus on discounts or caps on charges for key groups or revenue reinvestment to improve transit service.

Roadway

The two Roadway scenarios had mixed results at a regional level, with reductions in VMT and reduced delay on the charged roadways coupled with increased delay to nearby non-charged roadways. Burdens and benefits were not uniformly distributed and could disproportionately impact travelers that live on the outskirts of the region.

The complexity of these findings indicates that a roadway pricing program should focus not only on the impacts to delay on the throughways charged, but the impacts to nearby non-charged roadways. Impacts at a localized scale would need to be examined to understand if there were investments (such as transit, bike, or pedestrian improvements) that could improve overall performance. In addition, the travel costs should be assessed at a granular scale to understand the impact on vulnerable groups.

Equity Considerations

While the equity focus areas see an increase in percent change of jobs accessible by auto in six of the eight scenarios, they benefit less than non-equity focus areas across the board. Related to access to community places, each pricing scenario results in increased access for equity focus areas and non-equity focus areas. Equity focus areas benefit more than non-equity focus areas for accessibility by auto for the cordon scenarios and the roadway scenarios. When it comes to change in access to community places by transit, the benefit to non-equity focus areas exceeds the benefit to equity focus areas for all scenarios.

8.3 Recommendations

Below are general recommended considerations for both policymakers and future project owners and operators, as well as specific recommendations that would apply to each group.

- Congestion pricing can be used to improve mobility and reduce emissions. This study demonstrated how these tools could work with the region's land use and transportation system.
- Define clear goals and outcomes from the beginning of a pricing program. The program priorities such as mobility, revenues, or equity should inform the program design and implementation strategies. Optimizing for one priority over another can lead to different outcomes.
- Recognize that benefits and impacts of pricing programs will vary across geographies. These variations should inform decisions about where a program should target investments and affordability strategies and in depth outreach.
- Carefully consider how the benefits and costs of congestion pricing impact different geographic and demographic groups. In particular, projects and programs need to conduct detailed analysis to show how to:
    - maximize benefits (mobility, shift to transit, less emissions, better access to jobs and community places, affordability, and safety) and
    - address negative impacts (diversion and related congestion on nearby routes, slowing of buses, potential safety issues, costs to low-income travelers, and equity issues).

- Congestion pricing can benefit communities that have been harmed in the past, providing meaningful equity benefits to the region. However, if not done thoughtfully, congestion pricing could harm BIPOC and low-income communities, compounding past injustices.
- Conversations around congestion pricing costs, revenues, and reinvestment decisions should happen at the local, regional, and when appropriate the state scale, depending on the distribution of benefits and impacts for the specific policy, project, or program being implemented.

Specifically For Policy Makers

- Congestion pricing has a strong potential to help the greater Portland region meet the priorities outlined in its 2018 Regional Transportation Plan, specifically addressing congestion and mobility; climate; equity; and safety.
    - Technical analysis showed that all four types of pricing analyzed improved performance in these categories;
    - Best practices research and input from experts showed there are tools for maximizing performance and addressing unintended consequences.
- Given the importance of pricing as a tool for the region's transportation system, policy makers should include pricing policy development and refinement as part of the next update of the Regional Transportation Plan in 2023, including consideration of other pricing programs being studied or implemented in the region.

Specifically For Future Project Owners/Operators

- The success of a specific project or program is largely based on **how** it is developed and implemented requiring detailed analysis, outreach, monitoring, and incorporation of best practices.
- Coordinate with other pricing programs, including analysis of cumulative impacts and consideration of shared payment technologies, to reduce user confusion and ensure success of a program.
- Conduct meaningful engagement and an extensive outreach campaign, including with those who would be most impacted by congestion pricing, to develop a project that works and will gain public and political acceptance.
- Build equity, safety, and affordability into the project definition so a holistic project that meets the need of the community is developed rather than adding "mitigations" later.
- Establish a process for ongoing monitoring of performance, in order to adjust and optimize a program once implemented.

8.4 Next Steps

Since its identification as a high priority, high impact strategy in the 2018 RTP, Metro staff and leaders endeavor to better understand how our region could use congestion pricing to manage traffic demand to meet climate goals without adversely impacting safety or equity. This study delineates the impacts pricing could have in helping the region:

- Reduce traffic congestion;

- Improve equity by reducing disparity;
- Enhance safety by getting to Vision Zero; and
- Support the climate by reducing greenhouse gas emissions.

The study's Expert Review Panel demonstrated that congestion pricing is effective in encouraging drivers to change their behavior (using more sustainable travel modes like transit, walking, or biking; driving less; and driving at different times) and reducing congestion and greenhouse gas emissions.

Leaders around the region may use the findings from this study to inform policies, including the development of the 2023 RTP and other transportation projects that may include congestion pricing in the future. We expect this study will inform the work of implementing agencies as they propose new congestion pricing projects at the local level.

APPENDIX A: IMPLEMENTATION CONSIDERATIONS TECHNICAL PAPER

APPENDIX A: IMPLEMENTATION CONSIDERATIONS TECHNICAL PAPER

Introduction

With a transportation network already stressed and congested, the Portland region is anticipating worsening mobility conditions in the coming years with the projected economic and population growth. The region has long recognized that traditional strategies to "build" its way out of congestion will not be effective. Therefore, Metro is examining the feasibility of using congestion pricing as a potential *new* strategy to improve mobility with the goals of addressing congestion, climate change, equity, and safety.

Pricing Scenarios

Four congestion pricing scenarios are being analyzed as part of the Metro Congestion Pricing Study. Each of the four have benefits and disbenefits, and all are likely to reduce congestion, with varying degrees of success and acceptance by the public. Any one of these four scenarios could be implemented separately or in some combination.

1. Vehicle Miles Traveled (VMT)
2. Cordon Pricing
3. Parking Pricing
4. Roadway Corridor Pricing

Pricing Technologies

There are a range of enabling technologies that could support the scenarios above.

1. **Tolling technologies** – Modern electronic toll collection systems used on toll roads are highly automated using Automatic Vehicle Identification (AVI) and Automatic License Plate Reader (ALPR) technologies, which identify vehicles without impeding traffic flow. Typically, AVI antennas mounted over roadways read transponders in vehicles to identify those with pre-paid toll accounts. ALPR cameras mounted overhead capture images of vehicle license plates to identify those without a transponder. The toll system uses the images to match a vehicle to a pre-paid account and charge the proper toll or, in the event no account is detected, send the vehicle owner a post-paid invoice or a violation notice.
   Applies to cordon pricing and roadway pricing scenarios

2. **Mobile apps** – Several companies are using cell phone-based technologies, such as GPS and 5G wireless positioning features, to determine vehicle location and assess tolls. Apps on cell phones can send a vehicle license plate number to reconcile the vehicle with the toll due that is captured by a roadside toll system. In addition, cell phone apps can also provide travelers with pricing information and reduce the need for electronic signs.
   Applies to cordon pricing and roadway pricing scenarios

3. **Connected Vehicles** (V2X)– Despite the lack of a Federal mandates for the installation of Dedicated Short-Range Communications (DSRC) in new vehicles, many vehicle manufacturers are pressing ahead with technologies to let their vehicles communicate directly with other vehicles and roadside infrastructure. For instance, Ford is planning to equip all of their 2022 vehicles with 5G network communication. Existing vehicles without built-in connectivity could be equipped with retrofit kits. These connected vehicles present opportunities to leverage their communications capabilities to automatically toll vehicles.
   Applies to cordon pricing and roadway pricing scenarios

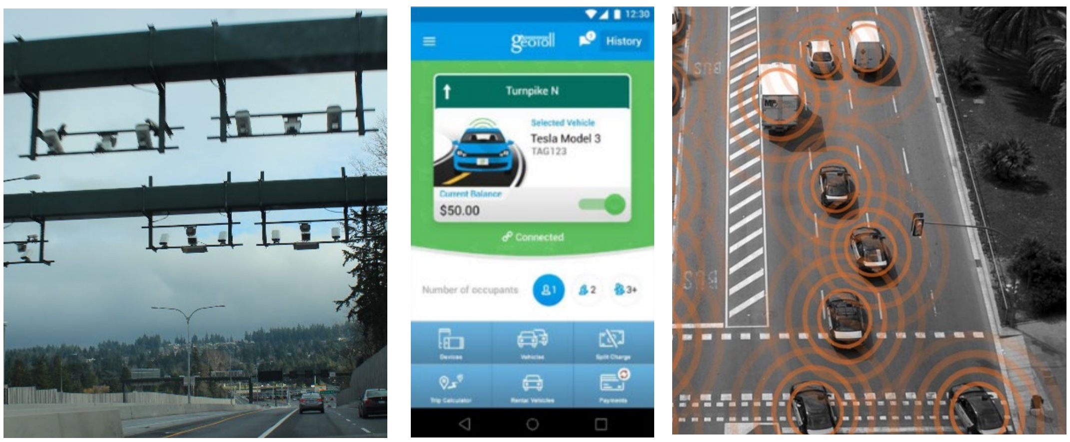


Figure 1 Overhead transponder reader antennas and ALPR cameras at a toll gantry (left), example of a toll payment app (center), connect vehicles can communicate with other connect vehicles and roadside infrastructure (right).

4. **OReGO Technologies** –OReGO currently uses devices that connect into a vehicle's On-Board Diagnostic (OBD)-II ports to get vehicle information and odometer reads, then transmit it wirelessly back to the VMT account manager. Customers can choose between GPS enabled OBD-II device, which provide value added features, or a non-GPS version to alleviate tracking privacy concerns.
   Applies to VMT scenarios

5. **Self-reporting** – Alternative methods are being developed for capturing odometer data from vehicles without the need of an OBD-II device, especially since some electric vehicles no longer have them. New technologies include using Odometer Image Capture (OIC), where cell apps can capture vehicle odometer reads through a picture. Other methods rely on vehicle owners manually logging mileage online periodically. These self-reporting methods are being trialed in various states that are piloting VMT programs.
   Applies to VMT scenarios

6. **Parking Payment Systems** – Advancement in on-street and off-street parking payment technologies has improved significantly within the past decade. Mobile payment apps and smart sensors have revolutionized the ability for parking operators to dynamically price and manage parking inventory. In general, parking payment systems have largely automated how parking operators can collect payments. This growth in payment systems coupled with existing taxing ability for government entities to collect

from parking operators will allow Metro to more easily impose and collect congestion pricing fees.
Applies to parking pricing scenarios

Implementation Considerations

Implementation is key to feasibility – we need to understand the implementation considerations of each technology as a way to further understand the feasibility of the four congestion pricing scenarios. In the following sections, we address the implementation of technology, enforcement, cost, policies/legal, and ease of use for the public. A summary matrix is included to assess how these implementation topics relate to Metro's four scenarios.

1. **Technology** – Several considerations are vital to implementation of technology.
    a. *Technology Maturity* - Deploying existing technologies will likely be less expensive to implement and reduce scheduling risks compared to deploying emerging or in-development technologies. Implementing existing technologies does need to be weighed against the risk of the technology becoming obsolete in the near future or being vulnerable to future market disruptors.
    b. *Physical Roadside Presence* – The physical footprint of technologies will be important in urban environments where space and visual aesthetics are at premium. For instance, a typical tolling system requires overhead mounted antennas to effectively read transponders and to capture license plates would need to be installed throughout the corridors to provide effective compliance.
    c. *Intrusiveness* – The more the technology requires the public to do something the more difficult it will be for the technology be adopted and for pricing to be applied accurately and reliably. For instance, a technology that requires customers to download an app and track mileage manually would be less effective than a technology that captures license plates and automatically sends a bill to a customer.
    d. *Compatibility with Other Pricing Programs* – Keeping in mind coordination with other pricing programs will go a long way towards creating a more seamless customer experience for travelers. In particular, ODOT is implementing tolling on Interstates in the Portland regions so adopting common technologies and payment system may be advantageous to reduce duplicative efforts and provide savings through economies of scales. The Hop regional transit fare program and various private parking payment systems are other programs that need to be kept in mind.
2. **Equity** – Selection of particular technologies and methodologies for pricing should take into account impacts on different demographic and income groups in the region. Expensive or complex pricing methods may not only unfairly burden lower income travelers and create barriers to entry for them, but could also cause these groups to be punitively treated as violators due to their lack of access to the proper technologies. The overall customer experience from how travelers enroll, pay, and use priced facilities should also be carefully considered and steps taken to reduce undue impacts. For example, paying tolls should allow those without access to traditional banking services to be able to use alternative payment methods, such as cash payment kiosks at local stores.
3. **Enforcement** – Enforcement entails balancing revenues lost due to scofflaws, perception of enforcement effectiveness by the public, and the cost of the enforcement itself. Striving for 100% enforcement may be cost prohibitive, but not investing enough

would upset paying customers and reduce revenues. In addition some pricing methods, such as mobile apps are great for paying customers, but do nothing for catching and charging drivers without the apps. So, a layered, multiple technology approach to enforcement may be needed.

4. **Cost** – Selection of pricing scenarios and technologies should also take into consideration both the upfront capital cost of implementation and ongoing operational costs to evaluate overall lifecycle costs. Cost should also be examined in context of potential revenues raised. In addition, funding sources for capital and operational costs could also influence the pricing technology and delivery method selected. For example, the region may consider a Public Private Partnership delivery method to take advantage of private financing.
5. **Policies/Legal** – Consideration must be made for the need to secure authorization to implement any congestion pricing program, specifically the powers to impose a price and to enforce it. A more thorough legal is needed beyond these insights:
    a. *VMT authority* – The current OReGo program's authority is covered under ORS 319.883-.947. Privacy of customer data is also explicitly protected under ORS 319.915. However, the regulations only make VMT voluntary and does not allow imposing a mandate. Therefore, violation regulations only cover misreporting of mileage by voluntary VMT program participants.
    b. *Tolling/Cordon authority* – At the State level, tolling of roadways are covered in ORS 383.001-.075, where the Oregon Transportation Commission has the power to approve toll on any "highway" in Oregon, per ORS 801.305 (all public roads in Oregon). Privacy of customer data is also explicitly protected under ORS 383.075. Oregon regulations does specifies the need for tolling compatibility between Oregon and Washington (ORS 383.014). At the Federal level, 23 U.S.C. 129 stipulates tolling of Interstates is limited to new highways and new lanes added to existing Interstate highways, provided the number of toll-free lanes are maintained, or to reconstruction or replacement of a toll-free bridge or tunnel and conversion of the bridge or tunnel to a toll facility. However, the opportunity to toll can be granted as exceptions under the Interstate System Reconstruction and Rehabilitation Pilot Program (ISRRPP)(FAST Act Section 1411 (c)).
    c. *Parking pricing* – The ability to raise parking fees for congestion pricing purposes is assumed to need authorization from local jurisdictions.
6. **Customer Ease of Use** – Widespread adoption of technologies in already deployed in the region, such as the OReGO program, could reduce costs and increase customer convenience. The more automated payments and streamline business rules are made the easier it is for the public to participate, contrasting to methods that require more frequent inputs such as manually tracking mileages which would make compliance more difficult.

Table 1. Ease of implementation of the four pricing scenarios under consideration

Scenarios	Method of Pricing	Technology	Enforcement	Cost	Policies/Legal	Ease of Use
VMT	• OReGo OBDII port technologies	Existing technology	Cannot enforce with out of state drivers	Need to deploy on all vehicles	Need to mandate VMT for all OR vehicles, privacy concern	Already deployed
	• Self-reporting	Need to develop self-reporting system	Relies on honor system, cannot enforce with out of state drivers	Cost of developing self-reporting system and ongoing administrative costs	Need to mandate VMT for all OR vehicles	Depends on complexity and frequency of self-reporting
Cordon Pricing	• Tolling technology	Existing technology	Pursuit registered owner with license plate	Upfront construction costs	Need tolling authority	Requires setting up toll accounts
	• Mobile apps	Existing technology	Needs to be coupled with roadside enforcement	Minimal development costs, operational costs depend on enforcement approach	Need tolling authority, privacy concerns	Minimal effort to download and sign up
	• Connected vehicles	Not universally available nor installed	Needs to be coupled with roadside enforcement	Require new infrastructure to support	Need tolling authority, privacy concerns	Requires setting up toll accounts
Parking Pricing	• Raise prices using existing paid parking systems	Existing technology	Using existing means of parking enforcement	Mainly administrative costs	Leverage existing parking fee/taxation frameworks	No change in paying method
Roadway Pricing	• Tolling technology	Existing technology	Hard to enforce on arterial roads	Significant infrastructure cost due to frequency of tolling locations needed	Need tolling authority	Requires setting up toll accounts
	• Mobile apps	Existing technology	Needs to be coupled with roadside enforcement	Significant infrastructure cost	Need tolling authority, privacy concerns	Minimal effort to download and sign up
	• Connected vehicles	Not universally available nor installed	Needs to be coupled with roadside enforcement	Require new infrastructure to support	Need tolling authority, privacy concerns	Requires setting up toll accounts
	Legend:	**Easy**	**Moderate**	**Difficult**		

Cost and Revenue Considerations

The cost estimation of a congestion pricing scenario is dependent on which method of applying pricing is employed. The first component of cost estimation, Capital Expenditures (CapEx), entails the cost to initially implement a scenario's method of pricing. CapEx is heavily influenced by the maturity of technology available, the ability to leverage an existing pricing program (i.e. ODOT's OReGo Road User Charging), and the physical footprint of equipment that needs to be deployed. The second component of cost estimation is Operational Expenditure (OpEx), the ongoing cost to administer and maintain the scenario's method of pricing. OpEx is dependent on the ability to leverage an existing pricing program if available, the cost of handling transactions, and the volume of transactions generated.

Therefore, cost estimations range considerably for the congestion pricing scenarios and their specific methods of pricing. The following is a summary of scenarios from the least expensive to the most expensive.

- **Parking Pricing –** Least expensive to deploy and operate since it can readily leverage existing priced parking technology in use. As long as the congesting parking rates structures are simple and not dynamically set, most of the cost will be staffing to ensure fees are correctly administered and collected. Although costs are low, it is also a scenario with low revenue potential as well.
- **VMT –** Moderately costly, the VMT scenario benefits from the ability to build on Oregon DOT's existing OReGO road user charge program. Technology and administration has already been deployed to collect fees and that technology could be scaled up to expand VMT to the entire region. The main cost for VMT is equipping vehicles and administering the program.
- **Cordon Pricing** – Depending on the method of tolling and enforcement employed, cordon pricing can range from moderately expensive to most expensive. On the lower end of the cost scale is deploying app-based technology with selective enforcement, which could lower equipment CapEx, but results in lower potential revenues and reduce pricing's effectiveness. On the other hand, a robust implementation of tolling equipment around the cordon's boundary would reduce revenue leakage, but significantly raise construction and operational costs.
- **Roadways** – Tolling of the Portland's throughway network will be the most expensive due to the network's extensive geographical footprint. Even by selecting technologies to make it easier for customers to pay a toll, such as mobile apps, and with a minimal number of toll gantries needed for enforcement, roadway pricing will be costly to construct and will generate vast number of transactions to process.

Scenarios	Method of Pricing	CapEx	OpEx	Revenue Potential
VMT	• OReGo OBDII port technologies	**Moderately Expensive**	**Moderately Expensive**	**$$$$**
	• Self-reporting	**Moderately Expensive**	**Most Expensive**	
Cordon Pricing	• Tolling technology	**Most Expensive**	**Moderately Expensive**	**$**
	• Mobile apps	**Least Expensive**	**Moderately Expensive**	

	• Connected vehicles	Most Expensive	Moderately Expensive	
Parking Pricing	• Raise prices using existing paid parking systems	Least Expensive	Least Expensive	$
Roadway Pricing	• Tolling technology	Most Expensive	Most Expensive	$$
	• Mobile apps	Most Expensive	Most Expensive	
	• Connected vehicles	Most Expensive	Most Expensive	

Legend:			
Legend:	Least Expensive	Moderately Expensive	Most Expensive

The following section provides a more detailed explanation of each pricing scenario's method of pricing.

- **VMT OReGo/OBDII** – Leveraging and expanding ODOT's OReGO road user charge program, the CapEx would entail expanding agency and vendor systems to support administering the program and equipping vehicles with on-board units (OBU) connected to vehicle OBDII ports to collect mileage information. OpEx includes cost for processing the millions of transactions, managing and supporting customer accounts, and program oversight
- **VMT OReGo/Self-Reporting** – Also assuming the OReGo program can be utilized, the CapEx would entail expanding agency and vendor systems to support administering the program and equipping stations and technologies to verify driver self-reported mileage. OpEx includes more substantial cost for processing the millions of transactions, managing and supporting customer accounts, and program oversight.
- **Cordon Pricing Tolling Technology** – Without an existing toll program to utilize, the CapEx to equip 40 to 63 potential intersections with tolling equipment to capture vehicles entering the Zone and developing a new system to support transaction processing and customer support would be relatively expensive. OpEx includes more substantial cost for processing transactions (including cost to manually review license plates of violators), managing and supporting customer accounts, and program oversight.
- **Cordon Pricing Mobile Apps** – Without an existing toll program to utilize, the CapEx would need to develop a new system to support transaction processing and customer support. Although a mobile app-based approach would significantly reduce the need to install tolling equipment at all intersections on the cordon's boundary, tolling equipment for enforcement at key intersections would be highly recommended. OpEx includes more significant cost for in-road enforcement, processing transactions, managing and supporting customer accounts, and program oversight. Implementation and operational cost savings would potential be offset by losses in revenues from less effective enforcement of toll payments.
- **Cordon Pricing Connected Vehicles** – Auto manufacturers are increasingly equipping their vehicle model ranges with vehicle-to-vehicle and vehicle-to-roadside communication capabilities. The Society of Automotive Engineering (SAE) is working with Original Equipment Manufactures on tolling standards for connected vehicles to be adopted this year. Therefore, connected vehicles can potentially reduce the need to deploy as much roadside tolling equipment thus reducing those associated CapEx costs. However, any CapEx cost savings from

reduction in tolling roadside equipment would be offset in the near term by significantly higher cost to develop connected tolling technologies and to support vehicles without the latest connected technology. OpEx includes more substantial cost for processing transactions, managing and supporting customer accounts, and program oversight.

- **Parking Pricing** – Since public paid parking programs are being utilized for congestion pricing, CapEx cost would be limited to altering existing systems to support the added congestion fee. OpEx would likewise be limited to accounting for the congestion fees collected alongside parking fees already being processed. Although costs are low, revenue from parking pricing is also likely to be low.
- **Roadway Pricing Tolling** – Without an existing toll program to utilize, the CapEx to equip all of Portland's 235 center lane miles of throughways with tolling equipment and developing a new system to support transaction processing and customer support would be significantly expensive and the first in the United States for a metro region. Toll gantries spanning all highway lanes would need to be spaced at regular intervals to capture all vehicles. Some cost savings could be obtained by strategically locating toll gantries at highest volume/congested locations, but this would reduce revenue, pricing's effectiveness to manage traffic, and create public perception that pricing is not applied/enforced consistently. OpEx includes more significant cost for processing millions of transactions (including cost to manually review license plates of violators), managing and supporting customer accounts, and program oversight.
- **Roadway Mobile App** – Similar to the cordon pricing mobile-app approach, mobile app-based tolling could reduce the amount of roadside tolling equipment needed; however, given Portland's vast throughway network and need to deploy toll gantries to enforce payment of vehicles that do not have the payment apps, any cost savings would likely be offset by revenue loss from less effective payment enforcement. OpEx includes more significant costs for processing millions of transactions, managing and supporting customer accounts, and program oversight.
- **Roadway Pricing Connected Vehicles** – Similar to the cordon pricing connected vehicle approach, connected vehicle for roadway tolling could revolutionize tolling field equipment needs; however, connected vehicle technologies is not mature enough, nor widely available in the region's fleet of vehicle to currently make it a viable, cost-effective solution. CapEx to develop the technology and equipment vehicles are significant. OpEx includes more significant cost for processing millions of transactions, managing and supporting customer accounts, and program oversight.

Summary

The ease of implementation summarized in Table 1 presents a high-level screening which takes into account broad issues. As Metro fine tunes pricing scenarios, implementation details will also become more clear and solutions refined. Key insights of implementation at this stage:

1. **Parking pricing is** the easiest to implement since it leverages existing infrastructure and processes to introduce congestion pricing.
2. **Cordon pricing** can leverage state of the art tolling and enforcement technologies, making implementation moderate.

3. Although **roadway pricing** can leverage tolling methods, enforcement of tolling on major arterial roads could be cost prohibitive, reflecting why arterial tolling is not typically done.
4. **VMT** has the OReGO program it can build upon, but a major implementation barrier is enforcement and mandating vehicles to participate.

A pilot phase might make sense for the Portland region to trial one or more technologies before scaling up to a region-wide system.

APPENDIX B: SUMMARY OF THE EXPERT REVIEW PANEL EFFORT

METRO'S REGIONAL CONGESTION PRICING STUDY – CONGESTION PRICING EXPERT REVIEW PANEL

Summary Materials (Guide)

On April 22, 2021 Metro hosted an expert review panel made up of congestion pricing experts with diverse expertise in North America and Europe to provide input on the Regional Congestion Pricing Study methods and findings and to provide lessons learned from their experience elsewhere to policy makers and project implementers.

The full video recording has been provided on Metro's Regional Congestion Pricing Study website: https://www.oregonmetro.gov/regional-congestion-pricing-study

The following documents are intended to capture the information from the meeting and provide an easy guide for those interested in understanding who participated and what was learned. The following materials are attached.

1. Agenda with time stamps for the discussion
2. Meeting summaries
    a. High level summary – minutes
    b. More detailed summary from Nelson\Nygaard
3. A detailed list of attendees
4. List of questions that were posted in the Question and Answer

METRO CONGESTION PRICING STUDY

Expert Review Panel – Recording Guide

For a link to the Expert Review Panel, go to:
https://www.oregonmetro.gov/events/regional-congestion-pricing-study-expert-review-panel/2021-04-22

Welcome and Introductions

- **Timestamp 0:1:23:** Jennifer Wieland, Nelson\Nygaard, begins the webinar
- **Timestamp 0:5:00:** Council President Lynn Peterson sets the stage
- **Timestamp 0:8:00:** Elizabeth Mros O'Hara from Metro provides an overview of the Metro Congestion Pricing Project
- **Timestamp 0:21:28:** Panelists begin introductions and provide an overview of their congestion pricing experience around the world

Expert Review Panel Discussion

Jennifer Wieland begins a facilitated discussion with the Expert Review Panelists. The questions that the panelists answered are noted below.

- **Timestamp 41:45** Based on your experiences, did anything surprise you about our findings? Did any of the findings really resonate with you or align with what you've seen in other cities? And was there anything you expected to see but didn't encounter in our results?
- **Timestamp 01:10:00:** How have you approached setting priorities for revenue reinvestment? In your experience, what is the typical decision-making process that goes into allocating revenues raised by congestion pricing? Are there restrictions on how funds are used in the jurisdictions where you work? Who decides?
- **Timestamp 01:27:20:** Are there ways you have framed the messaging around congestion pricing for different audiences, beyond talking about congestion reduction (e.g., equity, economic development, quality of life, travel time savings or reliability)? How have you worked with businesses to explain potential benefits and impacts? What about BIPOC or low-income communities?

Metro Council/JPACT Discussion

Next, Metro Council and JPACT members asked questions of the panelists.

- **Timestamp 01:40:30** Council President Lynn Peterson: What's the best example of a clear purpose and need and how did they achieve consensus?

- **Timestamp 01:47:42** County Commissioner Paul Savas: What measures do you use to measure economic benefits (commerce and business)? How do you invest in suburban areas?
- **Timestamp 01:56:40:** How do we think about COVID in terms of travel behavior?
- **Timestamp 02:03:32** Metro Councilor Christine Lewis: From an academic perspective, how do you prevent diversion?
- **Timestamp 02:09:35** Mayor Steve Callaway: What mitigation strategies can be used to avoid equity and safety implications of diversion?

Expert Review Panel Final Thoughts & Closing

- **Timestamp 02:16:20:** Each panelist was asked to give their closing remarks.

Meeting: Expert Review Panel for the Regional Congestion Pricing Study
Date: Thursday, April 22, 2021
Time: 7:30 am – 10:00 am
Place: Zoom

HIGH-LEVEL SUMMARY / MINUTES

7:30-8:05 Welcome and Introduction

During the Expert Review Panel no decisions were made.

Metro Staff Elizabeth Mros-O'Hara provided an overview of Metro's Regional Congestion Pricing Study.

Panelists introduced themselves and briefly shared some of the congestion pricing work they are doing across the world.

8:05-9:05 Expert Review Panel Discussion

Many of the panelists noted that the results of the study were very similar to what they have seen in other cities they have worked in. In some panelists' experience, there are longer term effects that could be taken into consideration, like diversion decreasing over time and reinvestment of revenues to improve performance benefits.

It was emphasized that the best way to achieve equity is using a multi modal approach so that people have options. It is also important to think about how land use and housing policies affects transportation. Reducing auto use and vehicle miles traveled requires density around transit.

Mr. Firth made the point that it is important that the money raised from congestion pricing to be put towards the goals of the program. Another major point was that there are much better ways of raising revenue than congestion pricing.

In order to see a noticeable reduction in congestion there only needs to be about 5 to 10 percent fewer people on the road. Engagement is key for framing the discussion when bringing congestion pricing to the public. People seeing the results of congestion pricing often leads to more support for it.

9:05-9:10 Break

9:10-9:40 Metro Council/JPACT Discussion

Council President Lynn Peterson asked for a clear example of a region that created a program with very clear goals and how the achieved consensus around it.

Mr. Schwartz gave the example of New York as a system he would not have designed where the clear goal was to raise revenue.

Mr. Firth gave the example of London where the focus was very concentrated on congestion. There was agreement that congestion was the problem, even if congestion pricing was not initially seen as the solution.

Mr. Tomlinson agreed that defining the problem and getting people to understand it is important. He also emphasized engaging with many different groups.

Commissioner Paul Savas asked about investment in rural and suburban areas and what measures have been used to understand economic impacts of a transit system.

Ms. Cabansagan acknowledged that it is a new area for many to understand what it means to move people in suburban and rural areas. She stated there needs to be more investment in these areas and that it is also an opportunity to rethink transit systems as a whole.

Mr. Tomlinson noted that two strategies being used in the Atlanta are identifying new locations for park and ride lots near highways and discounting rideshares that started or ended at a transit point.

Ms. Hiatt listed measures used for understanding economic impact like hotel vacancy rates, sales taxes, and office vacancy rates.

Councilor Gerritt Rosenthal asked about the impacts of the COVID-19 pandemic on travel behavior.

Mr. Schwartz noted that people have been avoiding transit more during the pandemic. Nationally more people are driving than before and using less transit.

Mr. Firth agreed with Mr. Schwartz about what travel behavior looks like. Further, the impacts of the pandemic are highly unpredictable which makes a flexible tool like congestion pricing useful.

Councilor Christine Lewis expressed interest in equalizing pricing on all paths and asked where that stops.

Being able to understand what happens at multiple levels is important for deciding where to draw the line on pricing. The more localized level is important to understand the benefits and impacts of making that decision.

Mayor Steve Callaway asked what modeling level was being used and mitigation strategies to address unintended consequences in terms of equity.

A macroscopic approach was used. Mr. Schwartz described some of the challenges of addressing diversion from people trying to avoid tolls by using non-tolled streets in the city. Another factor is whether pricing is on an entire corridor or just a few lanes.

9:40-10:00 Expert Review Panel Final Thoughts & Closing

Pricing is a flexible tool that can be implanted differently in different contexts and to address different needs. The importance of revenue reinvestment as part of program design. Next steps should also include thinking about who is impacted and the importance of a multi-modal approach. Personalizing benefits so that people can better understand congestion pricing.

Advice for Metro included having very clear goals to try and achieve, acknowledging this is a part of a much larger regional plan, understanding and addressing how populations are disproportionately impacted by congestion pricing, understanding microtransit potential, bringing in stakeholders, and being careful about exemptions and discounts.

Adjourn at 10:00 AM

METRO CONGESTION PRICING STUDY

Expert Review Panel – Meeting Notes

When: April 22, 2021, 7:30 a.m. – 10:00 a.m. Pacific

Where: Zoom

Welcome and Introduction

Jennifer Wieland from Nelson\Nygaard welcomed everyone to provide an overview of the panel. Jennifer introduced Metro Council President, Lynn Peterson, who set the stage. President Peterson emphasized that this project highlights Metro's commitment to learning and exploration and a recognition that the region can't build itself out of congestion. She also highlighted Metro's commitment to bring a climate change and racial equity lens to all its work. Elizabeth Mros-O'Hara from Metro followed by giving a short presentation on the project. Jennifer then invited each panelist to introduce themselves.

Expert Review Panel Discussion

Jennifer facilitated a discussion with the Expert Review Panel. The questions and associated response of each panelist are documented below.

Based on your experiences, did anything surprise you about our findings? Did any of the findings really resonate with you or align with what you've seen in other cities? And was there anything you expected to see but didn't encounter in our results?

- Chris Tomlinson: Chris noted that the road pricing seemed to deliver a lot of results and minimized tradeoffs. He was surprised at the high level of diversion anticipated on non-tolled arterials. Diversion was experienced initially in Georgia, but it dissipated over time. The study can't predict how long that diversion would happen. Diversion may be shorter term impact. He emphasized that over time people get used to pricing.
- Rachel Hiatt: Rachel applauded Metro's approach to look at range of options. She felt that the results weren't surprising and were similar to findings in the Bay Area. For the Bay Area, parking pricing has diminishing returns because they've done so much already. She thought the demonstration of relative effects of different types of strategies was good. The next phase of this study should be to tackle the reinvestment of revenues. Demonstrating the reinvestment potential will add to the performance/benefits of the study and help demonstrate the magnitude of benefits from a pricing program. As a next step, Metro should do a targeted deeper dive into which travel markets are affected and the distribution of benefits and impacts. A targeted revenue reinvestment and targeted fee structure to optimize the distribution of benefits will demonstrate the full spectrum of

benefits of a pricing program. San Francisco has been able to incorporate the revenue reinvestment and look at how discounts and gradations in the fee structure can make a program more equitable and reduce negative effects.

- Daniel Firth: In London, the operators were pleased because their reliability was improved. We know pricing works. The challenge is how to make it fair and acceptable to people. There is a need for a detailed study to prove out concepts.
- Clarissa Cabansagan: Clarissa emphasized the need to put investments back into other modes. We need to incrementally get people used to the idea of pricing and fully understand the challenges for low income people (driving, transit, shared mobility). Need to study those who spend over 50% on transportation. H+T is real indicator to look for. The most important aspect to think about are the people that need access. We can manage congestion and auto throughput; but need to reduce auto ownership. How can Portland as a region encourage people to not own cars? Densify transit and consider land use. People want cash on their transit card. Subsidize the alternatives to driving.
- Sam Schwarz: Some low income people may be impacted, but the NY ratio was 38:1. The solution was to provide subsidized transit as a key part of pricing. Have these systems in place before programs are enacted.

How have you approached setting priorities for revenue reinvestment? In your experience, what is the typical decision-making process that goes into allocating revenues raised by congestion pricing? Are there restrictions on how funds are used in the jurisdictions where you work? Who decides?

- Daniel Firth: The single most important factor is to decide what to do with the revenue. Revenue generation shouldn't be the only reason you implement a pricing program. It also needs to be about congestion reduction, equity, and other community goals. Ask yourselves three questions:
  - What is the purpose? Why are you doing congestion pricing in the first place? Align revenue reinvestment to those goals.
  - Use equity as a lens to reinvest.
  - Use revenues to build acceptance by the people who are paying. London spent money on quick wins: bike paths (branded), sidewalks, new buses Stockholm spent money on heavy infrastructure approach, which was disconnected with what people are paying for; they couldn't see the benefits
- Rachel Hiatt: Co design/co creation process is important. Us it to help shape goals, metrics and what defines success. Ask people to help shape the policy options and use those to make decisions.
- Chris Tomlinson: The connection between pricing and transit can be hard. Funding at the federal level is also segregated. Take revenue to subsidize ongoing operations and maintenance of transit. Freight and logistics study committee is being formed. Can we design programs to accommodate a growing delivery culture?

- Clarissa Cabansagan: We can't mitigate our way out of an inequitable pricing program. Holidays with 5% less people on the road makes for free-flowing traffic. Are we aiming for free flowing traffic? Are we aiming to provide more options? Who is 5% that we need to shift? And how? Vanpools? Employer shuttles? Incentivizing transit? Last mile to the destination is often underfunded. Find key employment hubs that need last mile connection. Small investments for big return.

Are there ways you have framed the messaging around congestion pricing for different audiences, beyond talking about congestion reduction (e.g., equity, economic development, quality of life, travel time savings or reliability)? How have you worked with businesses to explain potential benefits and impacts? What about BIPOC or low-income communities?

- Sam Schwartz: Advocates and government were all talking to each other in NY. Framing it as "drivers pay" is a challenge. Need engagement to hear what people have to say.
- Daniel Firth: People ask, "What's in it for me?" Illustrate that a small change makes a big difference in people's lives. A 5% reduction on holidays feels like a 50% reduction. Find what options are needed to affect the 5%. Focus on reliability and predictability. Understand it's ok to not have full support off the bat. You need the demonstrated results to build the case.

Metro Council/JPACT Discussion

Metro Council and JPACT members asked questions of the panelists.

- Lynn Peterson: What's the best example of a clear purpose and need and how did they achieve consensus?
    - Sam Schwartz: NY's clear purpose was to raise revenue for transit ($1 billion a year or $15 billion total). Exemptions were the biggest hurdle. List of extensions extend beyond just disabled and low income.
    - Daniel Firth: London's focus was on congestion. Within the city, it was clear that congestion was a very big problem.
    - Chris Tomlinson: Atlanta framed it around growth. "The entire population of Metro Denver" will be added to the region. $11 billion capital program needed. Then focused on outcomes. Came up with analogies that non-transportation experts would be able to relate to. Go everywhere you can. Home owner's associations, stakeholders across the board.
- Paul Savas: Diversion impacts are less if there are transportation options. His county has transit deserts. What measures do you use to measure economic benefits (commerce and business)? How do you invest in suburban areas?

- Clarissa Cabansagan: TransForm is exploring how to retrofit the suburbs. Exploring opportunities to expand bike access in the suburbs. In light of the pandemic, transit agencies have pushed back service. How do you reinstate service to people in suburbs who used to live in the city? Need to double down on suburban and rural areas. Explore microtransit and clean mobility options.

- Chris Tomlinson: In the suburbs, the last mile is the last five miles. Need to strategically try to identify locations for park-and-rides as close to highway entrances as possible. Did a pilot project with Uber/Lyft if a ride started or ended at a transit station, it would be subsidized.

- Rachel Hiatt: SF studied the impacts to commerce and business economy. We want to bring the same number of people traveling to downtown. Want to see a shift in mode or time of day. Indicators include sales tax revenue, tourism metrics (hotel vacancy rates), trends in office vacancy, unemployment trends.

▪ How do we think about COVID in terms of travel behavior?

- Sam Schwartz: People have been shying away from transit. September study suggests no transmission on transit if people are masked. Nationally, transit is 20-60% of normal volumes; car volumes are in the 90% of normal. More people are driving.

- Daniel Firth: Medium term impacts of the pandemic are unpredictable. Need flexible tools to respond to unknowns; congestion pricing is one of those flexible tools. Pricing can be adjusted. More lanes on highways are not flexible.

- Rachel Hiatt: Trying to understand post COVID trips through their model. A wide range of recovery could unfold. The key is uncertainty. Higher congestion could prevail. Working from home, transit avoidance, delays, are all being looked at related to the future of work and congestion.

▪ Christine Lewis: Equalizing all paths along a corridor. But at what point do you stop? From an academic perspective, how do you prevent diversion? VMT model instead of a corridor model?

- Chris Tomlinson: Looking at what Virginia has done to provide commuter credits. But they haven't implemented discounts in Georgia yet because 70% of users are occasional users – three times a week or less. These aren't "Lexus lanes" – they're actually "Honda Accord lanes." The occasional use is common.

- Daniel Firth: This study needs to look at lots of different scales – the regional and local scale. Zooming in and out shows different levels of impact. The Portland study primarily looks at the regional scale. Distance based charging at a regional scale performs really well, but it's harder to predict the burdens and benefits at the local level.

- Steven Callaway: What modeling has been used? Was it macroscopic or mesoscopic? Worried about unintended consequences to increase the inequities. If we toll all the roads on the freeway, I'm concerned about people using the local roads instead. Concerned about equity and safety implications of diversion. What mitigation strategies can be used?
    - Sam Schwartz: NY sees these diversion problems – air quality and safety problems are worse on city streets. It's counterintuitive to toll freeways through urban areas and not charge the urban streets. Strategies: slow streets, limit cars, diagonal diverters.
    - Chris Tomlinson: It comes back to if your pricing study does a whole corridor or specific lanes. There's another set of issues that comes with pricing interstates. If you have highway options that give you some lanes that are tolled and some lanes that aren't, that has a dramatic impact on arterials.

Expert Review Panel Final Thoughts & Closing

Jennifer concluded the discussion by asking the panelists to draw together a few key themes from the conversation. She began by summarizing a few key themes from the conversation:

- The importance of pricing as a flexible tool to meet the region's goals.
- The need to create options and a multimodal system to complement a pricing program.
- The importance of revenue reinvestment as a part of program design to create an equitable program.
- Explore the ways to link land use and housing to congestion pricing.
- A focus on how do we communicate the benefits at both an individual and regional level.

Jennifer then handed it over to the panelists to provide their final closing comments.

- Daniel Firth: This is a difficult topic; it will take time. Decide what you want to achieve. Be clear about goal(s) and then design a program that helps you reach them. This is only one part of the program of things the region needs to do. Childcare, affordable housing, and so many other topics are interwoven into the region's strategy.
- Clarissa Cabansagan: Don't just see travel costs in the aggregate. Directly solve for transportation needs of the people you want to shift. What can we do on

transit and prioritizing transit that we should be doing anyways and how can a congestion pricing program support that?

- Sam Schwartz: Take the next step; you have evidence that it's worth pursuing. Do it! Spend time with your likely opponents.
- Rachel Hiatt: This was technical study – to know whether there's merit to move forward. Now it's the time to launch the stakeholder engagement component.
- Chris Tomlinson: Be careful of exemptions; think through carefully. Gamify and get people interested. How can mobile phones complement what you implement?

Elizabeth Mros O'Hara concluded the meeting with an overview of next steps:

- Incorporate findings
- Document areas of concern
- Wrap up report this summer
- Create resolution for JPACT and Metro Council to accept the findings

Meeting: Expert Review Panel for the Regional Congestion Pricing Study
Date: Thursday, April 22, 2021
Time: 7:30 am – 10:00 am
Place: Zoom

ATTENDEES
Panelists: Chris Tomlinson, Clarrissa Cabansagan, Daniel Firth, Rachel Hiatt, Sam Schwartz, Jennifer Wieland (moderator)

Metro Councilors: Lynn Peterson, Bob Stacey, Christine Lewis, Gerritt Rosenthal, Juan Carlos Gonzalez, Mary Nolan, Shirley Craddick

JPACT Members and Alternates: Carley Francis, Curtis Robinhold, Jamie Kranz, JC Vannatta, Kathy Hyzy, Mark Shull, Nafisa Fai, Paul Savas, Scott Langer, Steve Callaway, Ty Stober

Others: Aaron Deas, Adam Argo, Alex Bettinardi, Alex Oreschak, Ally Holmqvist, Andrew Plambeck, Andy Cotugno, Andy Shaw, Anna Dearman, Anne Debbaut, Anneliese Koehler, Anthony Martin, Art Pearce, Becky Steckler, Ben Haines, Bill Holmstrom, Bob Hart, Bob Kellett, Bradley Perkins, Brendan Finn, Brett Morgan, Brie Becker, Caleb Winter, Carrie Leonard, Casey Liles, Cheryl Twete, Choya Renata, Chris Johnson, Chris Neamtzu, Chris Smith, Christina Deffebach, Craig Beebe, Daniel Eisenbeis, Dave Roth, David Aulwes, Derek Bradley, Don Odermott, Dwight Brashear, Elizabeth Mros-O'Hara, Emily Cline, Emma Sagor, Eric Hesse, Erin Doyle, Garet Prior, Gillian Garber-Yonts, Glen Bolen, Gordon Howard, Greg Dirks, Gregg Snyder, Gwenn Baldwin, Heather Wills, Jaimie Huff, Jamie Snook, Jane Stackhouse, Jason Gibbens, Jean Senechal Biggs, Jeanna Troha, Jeb Doran, Jeff Owen, Jeffrey Raker, Jennifer Dill, Jennifer Donnelly, Jennifer John, Jessica Berry, Jessica Martin, Jessica Stanton, John MacArthur, Joseph Iacobucci, Josh Channell, Karen Buehrig, Kari Schlosshauer, Kate Freitag, Kate Lyman, Kate Sargent, Katherine Kelly, Kathy Fitzpatrick, Kelsey Lewis, Kevin Young, Khoi Le, Kim Ellis, Lisa Hunrichs, Lori Stegmann, Lucinda Broussard, Lynda David, Maggie Derk, Malu Wilkinson, Mandy Putney, Margi Bradway, Marie Dodds, Mark Gamba, Mat Dolata, Matt Bihn, Matt Freitag, Matt Ransom, Michael Espinoza, Mike Bezner, Mike Bomar, Mike Coleman, Mike Mason, Mike McCarthy, Mona Schwartz, Nancy Kraushaar, Nathaniel Price, Naveen Abdulghani, Nick Fortey, Oregon Walks, Patrick Sweeney, Peter Hurley, Rachael Tupica, Rachel Dawson, Ramona Perrault, Randy Tucker, Rebecca Small, Rich Peppers, Robyn Stowers, Roseann O'Laughlin, Roxy Mayer, Sara Wright, Sarah Iannarone, Scott Turnoy, Shaneka Owens, Shannon Walton-Clark, Shoshana Cohen, Shreya Jain, Sorin Garber, Stacy Cowan, Stephen Roberts, Stephen Williams, Steve Kelley, Ted Reid, Theresa Carr, Timothy Rogers, Tom Goldstein, Tom Mills, Tova Peltz, Vee Paykar, Victor Sin, Vivian Satterfield, Will Farley, Yuliya Lee

Meeting: Expert Review Panel for the Regional Congestion Pricing Study
Date: Thursday, April 22, 2021
Time: 7:30 am – 10:00 am
Place: Zoom

Questions from RCPS Expert Review Panel webinar

The below questions were submitted using Zoom's Q&A function during the webinar. These questions were generally answered by panelists as part of the discussion. Please refer to the video recording of the panel for more information.

Alex Bettinardi

VMT charges seem to be the best option – at least that's what I saw in the report, but that doesn't seem to align with Metro's congestion pricing definition and desire for the public to see the charge (VMT charging is easier to fall into the background). I'm hoping you can address how each option would align with the definition/design hope that travelers see and feel the change (charge?)

Anonymous Attendee

Could panelists please address how transport or cargo (trucking, rail) factors into congestion planning scenarios?

Jeff Owen – TriMet

As transit is such a key piece to the multimodal picture regarding options when implementing congestion pricing – How do you account for the financing needed to run extra (or more) transit service on day 1 when the changing begins? (So that there are alternatives in place as soon as the charging begins?)

Sorin Garber

Can any of the panelists provide insight about the kind of engagement about congestion pricing that has worked well with the public and what type was not successful.

Anonymous Attendee

So far, it doesn't sound like Transport electrification (charging stations, EV-ready infrastructure) isn't integrated very much into cities' congestion pricing plans, despite the GHG reduction goals – mostly being dealt with by reducing VMT, presumably. Is electrification just on a different track? Missed opportunities?

Peter Hurley, City of Portland

A critical issue to successfully designing and implementing congestion pricing is governance. Highway agencies shown little interest in investing substantially in transit, bike, and ped facilities and subsidies. What are panelists' thoughts on how to create, or shift to, a truly multimodal governance structure for congestion pricing in the Portland region? I'm especially interested in the Atlanta and SF models.

Anonymous Attendee

I’m interested in Chris’ comment about how diversion dropped off after people adjusted in the Atlanta area – does he have any data to support that? The tolling programs on 205 seem likely to create a lot of diversion, without the authority to toll the whole area, like Sam suggested.

Jane Stackhouse MCAT
ODOT seems to have a plan for tolling to raise money for more roads and bridges. How can we interest ODOT in working with METRO to put the focus on congestion pricing before building more lanes to see if it reduces congestion?

Stephen Williams
Panelists – What is the best way to determine the geographic extent of the area in which congestion pricing is applied?

Anonymous Attendee
State legislators and the Oregon Transportation Commission are set on tolling to raise revenue in order to widen the region’s highways. This has become a political issue that appears to be going off the edge of a cliff. What is your advice to pull this back before it’s too late?

Anonymous Attendee
Greater Portland is considering two freeway expansions right now – the Rose Quarter expansion and the I-5 crossing over the Columbia River, a bridge replacement that adds many additional travel lanes. It’s been touched on, but I wonder if the panelists could address this directly – what is their advice to our leadership on the timing of these expansions vs implementing congestion pricing?

Caleb Winter
What is a typical budget for mitigations to add mobility options to supplement travel in a priced corridor? What regions exemplify good policy to reinvest in both in the priced corridor and region-wide needs?

Oregon Walks
In terms of active transportation, I believe there should be strong push to make pedestrian infrastructure age friendly, to take care of our most vulnerable users (Communities of color, seniors, youth, and people with physical and mental disabilities). How can we tie tolling back to building out this infrastructure in communities where it does not exist?

Jessica Stanton
Fabulous discussion Will you be creating a summary or providing a recording of the event? Thank you to your panelists, facilitator and Metro for this brilliant work.

Response: Yes, the meeting is being recorded and will be posted online afterward.

APPENDIX C: 2027 FINANCIALLY CONSTRAINED BASELINE ASSUMPTIONS

APPENDIX C: 2027 FINANCIALLY CONSTRAINED BASELINE ASSUMPTIONS

2027 Financially Constrained Network Land Use and Project Assumptions

- Assumes growth. The population and employment growth is a straight line interpolation from the base year (2015) to 2040.
- Assumes projects that may or may not be built before 2027. These include some major freeway widening, and a new LRT line. The 2027 Constrained Network includes around $7 billion in new capital projects and about $12 billion in operations and maintenance. Transit investments (primarily increasing frequency of existing services) increase total regional transit revenue hours by ~25% over today.
- Does not include ODOT tolling on I-5 and/or I-205 that is being explored by that agency.
- Does not include the Columbia River Crossing project (light rail, new bridge, freeway, and tolling)

2027 Constrained – Baseline for RCPS	
Throughways	• I-5 Rose Quarter • I-5 south and I-205 operational improvements • OR 217 NB and SB auxiliary lanes • I-205 auxiliary lane (in Portland) • I-205 SB widening to three lanes in each direction • I-205/Abernethy Bridge widening • OR 224 widening (third WB lane)
Transit	**High-Capacity Transit** • Southwest Corridor Project • Division Transit Project • Red Line Improvements Project • Central City Transit Capacity Analysis **Enhanced transit concept - hotspots** • Streetcar upgrades on Grand Avenue in Portland • Central City Portals (downtown Portland bridges) • 82nd Avenue ETC (NE Killingsworth Street to SE Clatsop Street) • Powell Boulevard ETC (SE Portland to I-205)

	Enhanced transit concept - corridors • 122nd Avenue ETC (Lents to Parkrose transit center) • Martin Luther King Jr. Blvd ETC (Portland Central City to N Vancouver Blvd) • Sandy Boulevard ETC (Portland Central City to Parkrose TC) • 82nd Avenue ETC (Swan Island to Clackamas town center) • Hawthorne Blvd/Foster Road ETC (downtown Portland to Lents town center) • Streetcar to Montgomery Park in NW Portland **Significant increases in frequency of transit service** • Total regional transit revenue hours increased ~25% over 2015.

Note: ETC investments are identified on existing and planned frequent service bus routes and will be further defined through the Enhanced Transit Concept (ETC) Pilot Program

APPENDIX D: ADDITIONAL FIGURES AND TABLES INCLUDED IN THE MODELING ANALYSIS

APPENDIX D: ADDITIONAL FIGURES AND TABLES FROM THE MODELING ANALYSIS

1. MODEL DATA SUMMARY

2. INDIVIDUAL TRIP EXAMPLES

3. EXAMPLE TRIP COSTS

4. CHANGE IN VEHICLE VOLUMES MAPS

5. CHANGE IN ACESSIBILITY TO JOBS BY AUTO MAPS

6. CHANGE IN ACESSIBILITY TO JOBS BY TRANSIT MAPS

7. CHANGE IN TOTAL TRAVEL COST MAPS

8. BIVARIATE MAPS: CHANGE IN ACCESSIBILITY TO JOBS BY AUTO AND CHANGE IN TOTAL TRAVEL COST

APPENDIX D.1: MODEL DATA SUMMARY

Congestion

2. multi-modal VMT - MPA	Base	VMT B	VMT C	COR A	COR B	PARK A	PARK B	RD A	RD B
Daily miles traveled	47,956,011	47,040,752	46,247,547	47,723,162	47,687,878	48,000,843	48,136,259	47,429,757	46,632,061
Daily vehicle miles traveled	32,555,812	31,259,360	30,093,933	31,932,333	31,772,862	32,286,442	31,735,890	31,374,156	30,568,603
Daily transit miles traveled	3,601,681	3,725,646	3,906,796	3,836,302	3,894,732	3,747,961	4,215,661	3,769,916	3,884,867

MPA - CHANGE FROM BASE		VMT B	VMT C	COR A	COR B	PARK A	PARK B	RD A	RD B
Daily miles traveled		-915,259	-1,708,464	-232,849	-268,133	44,832	180,248	-526,254	-1,323,950
Daily vehicle miles traveled		-1,296,452	-2,461,879	-623,479	-782,950	-269,370	-819,922	-1,181,656	-1,987,209
Daily transit miles traveled		123,965	305,115	234,621	293,051	146,280	613,980	168,235	283,186

MPA - CHANGE FROM BASE	VMT B	VMT C	COR A	COR B	PARK A	PARK B	RD A	RD B
Daily miles traveled	-1.91%	-3.56%	-0.49%	-0.56%	0.09%	0.38%	-1.10%	-2.76%
Daily vehicle miles traveled	-3.98%	-7.56%	-1.92%	-2.40%	-0.83%	-2.52%	-3.63%	-6.10%
Daily transit miles traveled	3.44%	8.47%	6.51%	8.14%	4.06%	17.05%	4.67%	7.86%

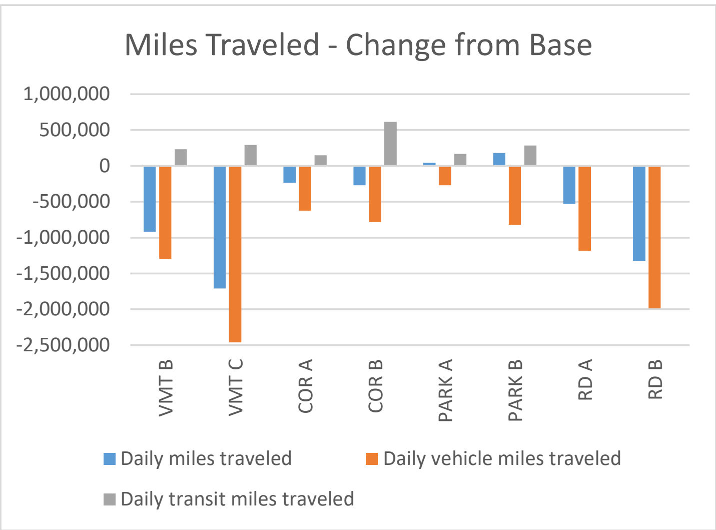
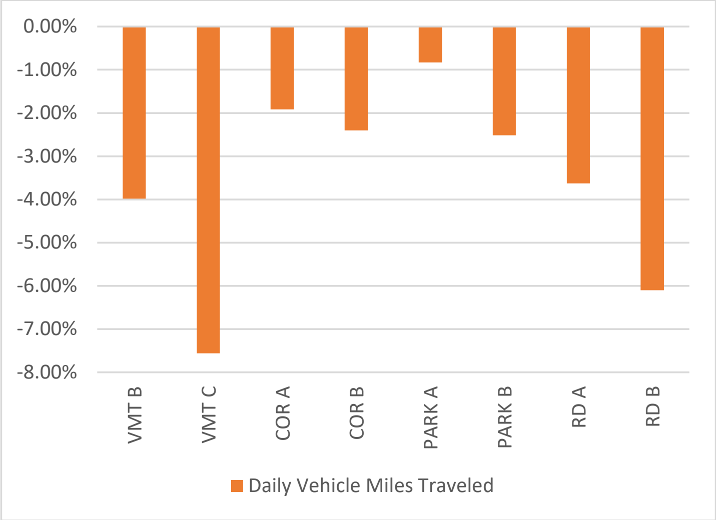


Figure 1.4-3. Change in Daily Vehicle miles Traveled - MPA



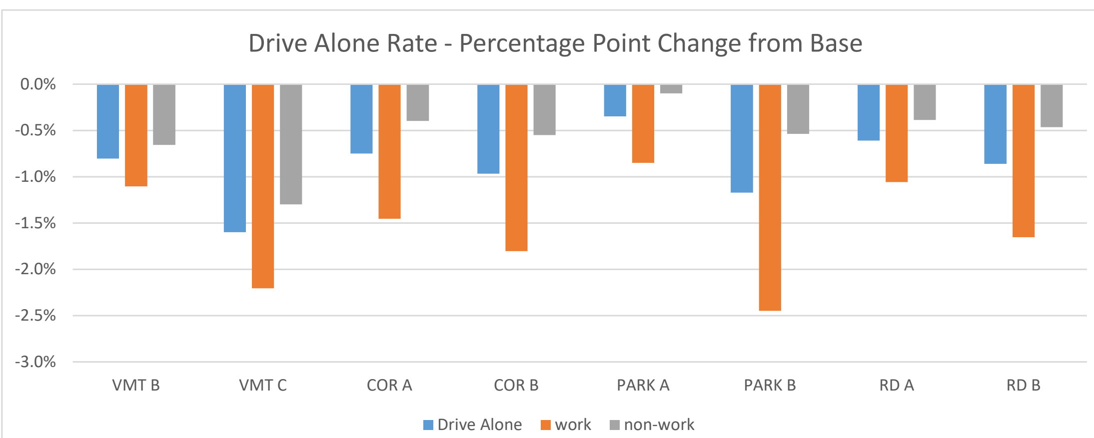
Appendix D.1 Model Data Summary - Mode Share outputs

AWD Trips by Mode

	Base	VMT B	VMT C	COR A	COR B	PARK A	PARK B	RD A	RD B
Drive Alone	44.5%	43.7%	42.9%	43.7%	43.5%	44.1%	43.3%	43.9%	43.6%
work	66.1%	65.0%	63.9%	64.6%	64.3%	65.3%	63.7%	65.0%	64.4%
non-work	33.8%	33.1%	32.5%	33.4%	33.2%	33.7%	33.2%	33.4%	33.3%
Shared Ride	36.8%	37.1%	37.4%	36.7%	36.7%	36.7%	36.7%	37.1%	37.0%
work	12.1%	12.4%	12.7%	12.1%	12.2%	12.0%	11.7%	12.6%	12.7%
non-work	49.1%	49.3%	49.6%	48.9%	48.9%	49.0%	49.0%	49.2%	49.1%
Transit	6.0%	6.1%	6.3%	6.3%	6.4%	6.1%	6.6%	6.0%	6.1%
work	9.8%	10.1%	10.5%	10.5%	10.6%	10.3%	11.5%	10.1%	10.3%
non-work	4.1%	4.1%	4.2%	4.2%	4.3%	4.0%	4.2%	4.0%	4.1%
Walk	6.9%	7.1%	7.3%	7.1%	7.1%	6.9%	7.1%	7.0%	7.1%
work	6.8%	7.0%	7.2%	7.1%	7.2%	6.8%	7.0%	6.9%	7.0%
non-work	6.9%	7.1%	7.3%	7.1%	7.1%	7.0%	7.1%	7.0%	7.1%
Bike	3.7%	3.8%	4.0%	3.9%	4.0%	3.8%	4.1%	3.8%	3.8%
work	5.3%	5.5%	5.7%	5.6%	5.7%	5.5%	6.1%	5.4%	5.5%
non-work	2.9%	3.0%	3.1%	3.0%	3.1%	3.0%	3.1%	3.0%	3.0%
Non-SOV trips	**54.6%**	**55.3%**	**56.1%**	**55.3%**	**55.5%**	**54.8%**	**55.7%**	**55.1%**	**55.4%**
Bike + Walk + Transit	**16.9%**	**17.4%**	**17.9%**	**17.7%**	**17.9%**	**17.2%**	**18.2%**	**17.2%**	**17.5%**
% PM-2hr Work Trips	**43.6%**	**43.6%**	**43.6%**	**43.6%**	**43.6%**	**43.6%**	**43.6%**	**43.6%**	**43.6%**
% PM-2hr Non-Work Trips	**56.4%**	**56.4%**	**56.4%**	**56.4%**	**56.4%**	**56.4%**	**56.4%**	**56.4%**	**56.4%**

AWD Trips by Mode - MPA

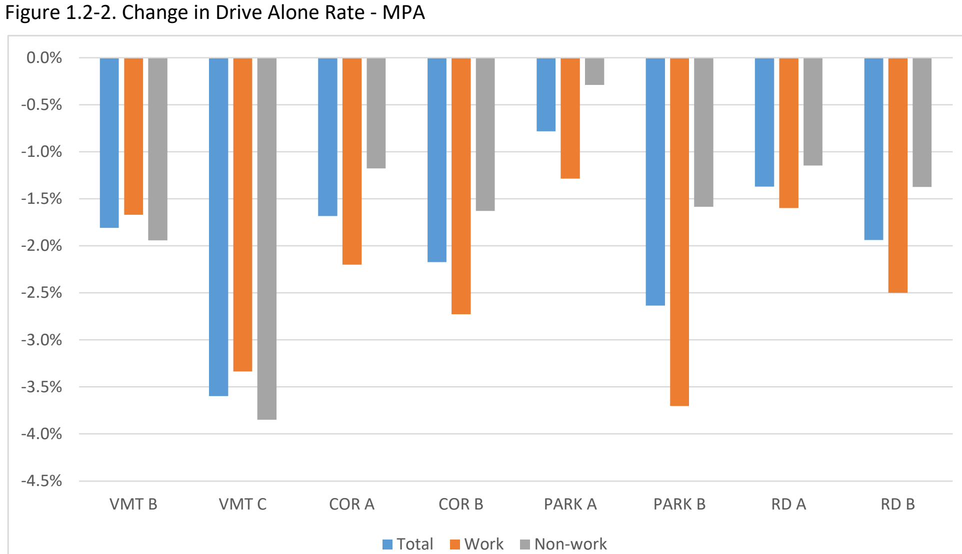
% POINT CHANGE from BASE	VMT B	VMT C	COR A	COR B	PARK A	PARK B	RD A	RD B
Drive Alone	-0.8%	-1.6%	-0.7%	-1.0%	-0.3%	-1.2%	-0.6%	-0.9%
work	-1.1%	-2.2%	-1.5%	-1.8%	-0.8%	-2.4%	-1.1%	-1.7%
non-work	-0.7%	-1.3%	-0.4%	-0.5%	-0.1%	-0.5%	-0.4%	-0.5%
Shared Ride	0.2%	0.5%	-0.1%	-0.1%	-0.1%	-0.2%	0.3%	0.2%
work	0.4%	0.7%	0.0%	0.1%	0.0%	-0.3%	0.5%	0.6%
non-work	0.2%	0.4%	-0.2%	-0.2%	-0.1%	-0.1%	0.1%	0.0%
Transit	0.1%	0.3%	0.3%	0.4%	0.1%	0.7%	0.1%	0.2%
work	0.3%	0.7%	0.7%	0.8%	0.5%	1.7%	0.3%	0.5%
non-work	0.0%	0.1%	0.1%	0.2%	-0.1%	0.2%	0.0%	0.0%
Walk	0.2%	0.4%	0.2%	0.3%	0.1%	0.2%	0.1%	0.2%
work	0.2%	0.4%	0.4%	0.4%	0.1%	0.2%	0.1%	0.2%
non-work	0.2%	0.4%	0.2%	0.2%	0.1%	0.2%	0.1%	0.2%
Bike	0.1%	0.3%	0.2%	0.3%	0.1%	0.4%	0.1%	0.1%
work	0.2%	0.4%	0.3%	0.4%	0.3%	0.8%	0.1%	0.3%
non-work	0.1%	0.2%	0.1%	0.2%	0.1%	0.2%	0.0%	0.1%
Non-SOV trips	**0.8%**	**1.6%**	**0.7%**	**0.9%**	**0.3%**	**1.2%**	**0.6%**	**0.8%**
Bike + Walk + Transit	**0.5%**	**1.0%**	**0.8%**	**1.0%**	**0.3%**	**1.3%**	**0.3%**	**0.5%**
% PM-2hr Work Trips	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
% PM-2hr Non-Work Trips	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**



AWD Trips by Mode - MPA

% CHANGE from BASE	VMT B	VMT C	COR A	COR B	PARK A	PARK B	RD A	RD B
Drive Alone	-1.8%	-3.6%	-1.7%	-2.2%	-0.8%	-2.6%	-1.4%	-1.9%
work	-1.7%	-3.3%	-2.2%	-2.7%	-1.3%	-3.7%	-1.6%	-2.5%
non-work	-1.9%	-3.8%	-1.2%	-1.6%	-0.3%	-1.6%	-1.1%	-1.4%
Shared Ride	0.6%	1.4%	-0.3%	-0.3%	-0.2%	-0.4%	0.7%	0.6%
work	3.0%	5.6%	0.4%	0.8%	-0.1%	-2.8%	4.5%	5.4%
non-work	0.3%	0.9%	-0.4%	-0.5%	-0.3%	-0.2%	0.2%	0.0%
Transit	1.5%	4.9%	5.6%	7.1%	2.2%	11.3%	1.2%	2.9%
work	3.2%	7.1%	7.4%	8.6%	5.6%	17.6%	3.1%	5.5%
non-work	-0.4%	2.4%	3.5%	5.3%	-1.9%	3.9%	-1.0%	-0.1%
Walk	2.9%	5.5%	3.3%	3.8%	0.8%	2.6%	1.1%	2.7%
work	3.1%	6.1%	5.3%	6.0%	0.8%	3.1%	1.1%	2.9%
non-work	2.7%	5.2%	2.3%	2.8%	0.8%	2.3%	1.1%	2.7%
Bike	3.8%	7.2%	5.1%	7.1%	3.3%	10.5%	2.0%	4.1%
work	4.2%	8.1%	6.1%	8.5%	4.9%	16.0%	2.5%	5.1%
non-work	3.5%	6.3%	4.2%	5.9%	1.8%	5.6%	1.6%	3.1%
Non-SOV trips	**1.4%**	**2.9%**	**1.3%**	**1.7%**	**0.5%**	**2.1%**	**1.0%**	**1.5%**
Bike + Walk + Transit	**2.8%**	**5.8%**	**4.7%**	**5.9%**	**2.0%**	**7.6%**	**1.5%**	**3.2%**
% PM-2hr Work Trips	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
% PM-2hr Non-Work Trips	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**

Figure 1.2-2. Change in Drive Alone Rate - MPA



Change in peak period travel times between select zone pairs. (Alternative - Baseline)

Green = improved travel times in Alternative. Red = worse travel times in Alternative.

All times in minutes.

VMT B - Auto

From	TAZ	Portland CBD	PDX	Gateway	Gresham	Oregon City	Clackamas TC	Tualatin	Beaverton	Hillsboro	Vancouver CBD
		To									
From	Portland CBD	0	-0.46	-0.57	-0.79	-1.16	-0.77	-0.97	-1.12	-1.61	-0.65
	PDX	-0.33	-0.01	-0.12	-0.24	-1.06	-0.42	-1.53	-1.57	-2.05	-0.4
	Gateway	-0.32	-0.04	0	-0.19	-1.06	-0.42	-1.61	-1.58	-2.05	-0.37
	Gresham	-0.47	-0.15	-0.12	0	-1.05	-0.42	-1.52	-1.73	-2.21	-0.55
	Oregon City	-0.83	-0.96	-0.89	-0.91	-0.05	-0.44	-0.72	-1.47	-1.68	-1.24
	Clackamas TC	-0.74	-0.53	-0.47	-0.39	-0.65	0.01	-1.1	-1.68	-2.36	-0.82
	Tualatin	-0.74	-1.42	-1.53	-1.6	-0.86	-1.12	0	-0.75	-0.93	-1.59
	Beaverton	-0.8	-1.46	-1.5	-1.73	-1.44	-1.46	-0.66	0	-0.41	-1.57
	Hillsboro	-1.3	-1.95	-2	-2.23	-1.5	-2.22	-0.85	-0.46	0	-2.06
	Vancouver CBD	-0.25	-0.06	-0.1	-0.3	-1.12	-0.48	-1.48	-1.51	-1.98	0

VMT B - Transit

From	TAZ	Portland CBD	PDX	Gateway	Gresham	Oregon City	Clackamas TC	Tualatin	Beaverton	Hillsboro	Vancouver CBD
		To									
From	Portland CBD	0	0	0	0	-1.22	0	0	0	0	-1.31
	PDX	0	0	0	0	-0.63	0	0	0	0	-1.3
	Gateway	0	0	0	0	-0.63	0	-0.02	0	0	-1.42
	Gresham	0	0	0	0	-0.63	0	0	0	0	-1.31
	Oregon City	0.59	-0.44	-0.44	-0.44	0	-0.43	-1.09	0.36	0.4	-0.75
	Clackamas TC	0	0	0	0	-0.63	0	-0.11	0	0	-1.42
	Tualatin	-0.04	-0.02	0.05	-0.02	-1.26	-0.1	0	0	0	-1.37
	Beaverton	0	0	0	0	-1.54	0	0	0	0	-1.31
	Hillsboro	0	0	0	0	-1.6	0	0	0	0	-1.31
	Vancouver CBD	-0.48	-0.29	-0.3	-0.29	3.44	-0.37	-0.61	-0.47	-0.47	0

Change in peak period travel times between select zone pairs. (Alternative - Baseline)

Green = improved travel times in Alternative. Red = worse travel times in Alternative.

All times in minutes.

VMT C- Auto

From \ To (TAZ)	Portland CBD	PDX	Gateway	Gresham	Oregon City	Clackamas TC	Tualatin	Beaverton	Hillsboro	Vancouver CBD
Portland CBD	0	-0.8	-0.98	-1.41	-1.95	-1.37	-1.71	-2.05	-2.87	-1.2
PDX	-0.64	-0.01	-0.21	-0.46	-1.76	-0.72	-2.75	-2.78	-3.59	-0.78
Gateway	-0.63	-0.07	0	-0.35	-1.72	-0.68	-2.85	-2.88	-3.69	-0.71
Gresham	-0.93	-0.23	-0.24	0	-1.72	-0.68	-2.51	-3.18	-3.99	-1.03
Oregon City	-1.46	-1.75	-1.62	-1.62	-0.08	-0.82	-1.31	-2.72	-3	-2.23
Clackamas TC	-1.3	-0.98	-0.86	-0.73	-1.05	0.01	-1.83	-3.03	-4.18	-1.47
Tualatin	-1.28	-2.52	-2.69	-2.69	-1.35	-1.88	0	-1.39	-1.65	-2.86
Beaverton	-1.34	-2.55	-2.56	-3	-2.41	-2.61	-1.13	0	-0.72	-2.79
Hillsboro	-2.26	-3.48	-3.48	-3.93	-2.54	-3.92	-1.48	-0.86	0	-3.7
Vancouver CBD	-0.44	-0.11	-0.17	-0.58	-1.88	-0.83	-2.57	-2.65	-3.46	0

VMT C - Transit

From \ To (TAZ)	Portland CBD	PDX	Gateway	Gresham	Oregon City	Clackamas TC	Tualatin	Beaverton	Hillsboro	Vancouver CBD
Portland CBD	0	0	0	0	-2.45	0	0	0	0	-2.26
PDX	0	0	0	0	-1.15	0	0	0	0	-2.26
Gateway	0	0	0	0	-1.15	0	-0.05	0	0	-2.47
Gresham	0	0	0	0	-1.15	0	0	0	0	-2.27
Oregon City	0.72	-0.76	-0.76	-0.76	0	-0.75	-2.1	0.38	0.4	-1.6
Clackamas TC	0	0	0	0	-1.14	0	-0.21	0	0	-2.47
Tualatin	-0.07	-0.03	0.01	-0.03	-2.22	-0.17	0	0	0	-2.36
Beaverton	0	0	0	0	-2.76	0	0	0	0	-2.26
Hillsboro	0	0	0	0	-2.8	0	0	0	0	-2.27
Vancouver CBD	-0.93	-0.6	-0.6	-0.6	1.76	-0.74	-1.19	-0.92	-0.93	0

Change in peak period travel times between select zone pairs. (Alternative - Baseline)

Green = improved travel times in Alternative. Red = worse travel times in Alternative.

All times in minutes.

COR A - Auto

From	TAZ	To: Portland CBD	PDX	Gateway	Gresham	Oregon City	Clackamas TC	Tualatin	Beaverton	Hillsboro	Vancouver CBD
From	Portland CBD	0	-1.32	-1.42	-1.59	-0.83	-0.78	-1.7	-2.73	-2.88	-0.58
	PDX	-0.35	-0.01	-0.07	-0.09	-0.04	-0.04	0.23	1.13	0.99	-0.16
	Gateway	-0.36	0	0	-0.07	-0.04	-0.05	0.2	0.89	0.75	-0.16
	Gresham	-0.42	-0.03	-0.02	0	-0.04	-0.05	0.23	0.83	0.69	-0.21
	Oregon City	-1.14	-0.09	-0.06	-0.03	0	0	0.28	0.45	0.36	-0.23
	Clackamas TC	-1.28	-0.1	-0.08	0	-0.01	0.01	0.27	0.74	1.75	-0.25
	Tualatin	-1.01	0.01	-0.09	0.06	0.04	0.09	0	0.17	0.09	-0.02
	Beaverton	-1.41	0.5	0.91	0.73	0.13	0.5	0.07	0	-0.15	0.45
	Hillsboro	-1.39	0.52	0.93	0.75	0.15	1.48	0.05	-0.13	0	0.49
	Vancouver CBD	-0.48	0.04	0.03	-0.07	-0.01	-0.01	0.09	1.02	0.88	0

COR A - Transit

From	TAZ	To: Portland CBD	PDX	Gateway	Gresham	Oregon City	Clackamas TC	Tualatin	Beaverton	Hillsboro	Vancouver CBD
From	Portland CBD	0	0	0	0	0.34	0	0	0	0	-0.65
	PDX	0	0	0	0	0.22	0	0	0	0	-0.65
	Gateway	0	0	0	0	0.22	0	0	0	0	-0.65
	Gresham	0	0	0	0	0.22	0	0	0	0	-0.66
	Oregon City	0.86	0.1	0.1	0.1	0	0.1	0.25	0.61	0.7	0.16
	Clackamas TC	0	0	0	0	0.2	0	-0.01	0	0	-0.65
	Tualatin	0.01	0.01	0.01	0.01	0.2	0.01	0	0	0	-0.65
	Beaverton	0	0	0	0	0.41	0	0	0	0	-0.65
	Hillsboro	0	0	0	0	0.4	0	0	0	0	-0.66
	Vancouver CBD	1.17	0.48	0.51	0.48	1.23	0.11	1.17	1.18	1.18	0

Change in peak period travel times between select zone pairs. (Alternative - Baseline)

Green = improved travel times in Alternative. Red = worse travel times in Alternative.

All times in minutes.

COR B- Auto

From	TAZ	To: Portland CBD	PDX	Gateway	Gresham	Oregon City	Clackamas TC	Tualatin	Beaverton	Hillsboro	Vancouver CBD
From	Portland CBD	0	-0.75	-1.08	-1.3	-4.2	-3.42	-1.62	-2.68	-2.87	-0.9
	PDX	-0.31	-0.01	0	-0.08	0.21	0.34	0.03	0.56	0.38	-0.24
	Gateway	-0.4	0	0.01	-0.11	0.04	0.17	-0.17	0.14	-0.04	-0.29
	Gresham	-0.5	-0.01	-0.03	0	-0.03	0.1	0.07	0.04	-0.14	-0.37
	Oregon City	-2.18	-0.04	0	-0.04	-0.05	-0.02	0.09	0.17	0	-0.29
	Clackamas TC	-2.09	-0.01	0.02	-0.02	-0.18	0	-0.08	0.14	0.68	-0.27
	Tualatin	-0.81	-0.16	-0.51	-0.46	-0.48	-0.42	0	-0.01	-0.08	-0.87
	Beaverton	-1.68	-0.08	0.11	-0.12	-0.53	-0.12	-0.08	0	-0.19	-0.45
	Hillsboro	-1.77	-0.17	0.01	-0.21	-0.42	0.16	-0.13	-0.19	0	-0.54
	Vancouver CBD	-0.7	0.06	0.05	-0.07	0.22	0.36	-0.75	0.28	0.09	0

COR B - Transit

From	TAZ	To: Portland CBD	PDX	Gateway	Gresham	Oregon City	Clackamas TC	Tualatin	Beaverton	Hillsboro	Vancouver CBD
From	Portland CBD	0	0	0	0	-0.42	0	0	0	0	-0.56
	PDX	0	0	0	0	0.22	0	0	0	0	-0.56
	Gateway	0	0	0	0	0.22	0	0	0	0	-0.4
	Gresham	0	0	0	0	0.22	0	0	0	0	-0.57
	Oregon City	0.72	0.2	0.2	0.2	0	0.2	0.01	0.45	0.5	0.1
	Clackamas TC	0	0	0	0	0.21	0	-0.03	0	0	-0.4
	Tualatin	0.01	0.01	0.02	0.01	0.08	0.02	0	0	0	-0.56
	Beaverton	0	0	0	0	-0.43	0	0	0	0	-0.56
	Hillsboro	0	0	0	0	-0.5	0	0	0	0	-0.57
	Vancouver CBD	0.25	0.04	0.05	0.04	-0.11	0.14	0.23	0.26	0.26	0

Change in peak period travel times between select zone pairs. (Alternative - Baseline)

Green = improved travel times in Alternative. Red = worse travel times in Alternative.
All times in minutes.

PARK A - Auto

From	TAZ	Portland CBD	PDX	Gateway	Gresham	Oregon City	Clackamas TC	Tualatin	Beaverton	Hillsboro	Vancouver CBD
From	Portland CBD	0	-0.46	-0.56	-0.62	-0.93	-0.63	-0.66	-0.64	-0.72	-0.39
	PDX	-0.13	0	-0.05	-0.04	-0.42	-0.14	-0.7	-0.71	-0.78	-0.06
	Gateway	-0.14	0	0	-0.07	-0.43	-0.16	-0.81	-0.76	-0.84	-0.08
	Gresham	-0.14	-0.01	0	0	-0.41	-0.13	-0.47	-0.77	-0.84	-0.07
	Oregon City	-0.25	-0.19	-0.17	-0.17	-0.02	-0.1	-0.11	-0.19	-0.29	-0.23
	Clackamas TC	-0.21	-0.09	-0.07	-0.09	-0.29	0.01	-0.34	-0.49	-0.93	-0.14
	Tualatin	-0.1	-0.55	-0.65	-0.54	-0.41	-0.46	0	-0.13	-0.17	-0.54
	Beaverton	-0.22	-0.58	-0.76	-0.83	-0.62	-0.63	-0.19	0	-0.1	-0.67
	Hillsboro	-0.24	-0.61	-0.78	-0.85	-0.44	-0.95	-0.13	-0.04	0	-0.68
	Vancouver CBD	-0.13	-0.02	-0.02	-0.07	-0.44	-0.16	-0.74	-0.73	-0.81	0

PARK A - Transit

From	TAZ	Portland CBD	PDX	Gateway	Gresham	Oregon City	Clackamas TC	Tualatin	Beaverton	Hillsboro	Vancouver CBD
From	Portland CBD	0	0	0	0	-0.32	0	0	0	0	-0.45
	PDX	0	0	0	0	-0.14	0	0	0	0	-0.44
	Gateway	0	0	0	0	-0.14	0	0	0	0	-0.41
	Gresham	0	0	0	0	-0.14	0	0	0	0	-0.45
	Oregon City	0.17	-0.06	-0.06	-0.06	0	-0.06	-0.12	0.12	0.2	-0.28
	Clackamas TC	0	0	0	0	-0.15	0	-0.03	0	0	-0.41
	Tualatin	0	0	0	0	-0.25	0	0	0	0	-0.45
	Beaverton	0	0	0	0	-0.64	0	0	0	0	-0.45
	Hillsboro	0	0	0	0	-0.7	0	0	0	0	-0.45
	Vancouver CBD	-0.16	-0.08	-0.08	-0.08	-0.32	-0.11	-0.18	-0.15	-0.15	0

Change in peak period travel times between select zone pairs. (Alternative - Baseline)

Green = improved travel times in Alternative. Red = worse travel times in Alternative.

All times in minutes.

PARK B - Auto

From \ To (TAZ)	Portland CBD	PDX	Gateway	Gresham	Oregon City	Clackamas TC	Tualatin	Beaverton	Hillsboro	Vancouver CBD
Portland CBD	0	-0.8	-1.01	-1.23	-2.04	-1.41	-1.36	-1.41	-1.69	-0.62
PDX	-0.24	0	-0.08	-0.16	-0.8	-0.26	-1.47	-1.47	-1.73	0
Gateway	-0.27	0.02	0	-0.17	-0.84	-0.3	-1.6	-1.58	-1.85	0.03
Gresham	-0.3	-0.03	-0.03	0	-0.8	-0.26	-0.97	-1.61	-1.87	-0.02
Oregon City	-0.58	-0.44	-0.44	-0.47	-0.05	-0.24	-0.28	-0.46	-0.66	-0.46
Clackamas TC	-0.49	-0.23	-0.24	-0.23	-0.57	0	-0.73	-1.1	-2.18	-0.25
Tualatin	-0.18	-1.12	-1.33	-0.95	-0.53	-0.71	0	-0.25	-0.38	-0.9
Beaverton	-0.26	-0.93	-1.4	-1.63	-0.86	-1.06	-0.32	0	-0.21	-1.05
Hillsboro	-0.31	-0.99	-1.45	-1.68	-0.67	-1.88	-0.28	-0.1	0	-1.09
Vancouver CBD	-0.29	-0.03	-0.04	-0.22	-0.86	-0.31	-1.47	-1.53	-1.8	0

PARK B - Transit

From \ To (TAZ)	Portland CBD	PDX	Gateway	Gresham	Oregon City	Clackamas TC	Tualatin	Beaverton	Hillsboro	Vancouver CBD
Portland CBD	0	0	0	0	-1.31	0	0	0	0	-0.91
PDX	0	0	0	0	-0.48	0	0	0	0	-0.91
Gateway	0	0	0	0	-0.48	0	-0.01	0	0	-0.91
Gresham	0	0	0	0	-0.48	0	0	0	0	-0.92
Oregon City	0.44	-0.21	-0.21	-0.21	0	-0.21	-0.45	0.28	0.3	-0.51
Clackamas TC	0	0	0	0	-0.48	0	-0.07	0	0	-0.91
Tualatin	0	0	0	0	-0.75	-0.01	0	0	0	-0.92
Beaverton	0	0	0	0	-1.62	0	0	0	0	-0.91
Hillsboro	0	0	0	0	-1.7	0	0	0	0	-0.92
Vancouver CBD	-0.44	-0.25	-0.25	-0.25	3.4	-0.33	-0.52	-0.43	-0.44	0

Change in peak period travel times between select zone pairs. (Alternative - Baseline)

Green = improved travel times in Alternative. Red = worse travel times in Alternative.

All times in minutes.

PARK B-R - Auto

From	TAZ	To: Portland CBD	PDX	Gateway	Gresham	Oregon City	Clackamas TC	Tualatin	Beaverton	Hillsboro	Vancouver CBD
From	Portland CBD	0	-0.75	-0.96	-1.18	-1.85	-1.31	-1.25	-1.27	-1.57	-0.67
	PDX	-0.21	0	-0.07	-0.18	-0.65	-0.23	-1.27	-1.3	-1.59	-0.07
	Gateway	-0.25	0.02	0	-0.17	-0.71	-0.28	-1.41	-1.43	-1.73	-0.04
	Gresham	-0.3	-0.03	-0.03	0	-0.65	-0.23	-0.83	-1.48	-1.77	-0.12
	Oregon City	-0.51	-0.41	-0.4	-0.42	-0.03	-0.22	-0.25	-0.41	-0.58	-0.49
	Clackamas TC	-0.43	-0.23	-0.23	-0.21	-0.46	0	-0.63	-0.94	-2.03	-0.32
	Tualatin	-0.06	-0.91	-1.11	-0.74	-0.31	-0.53	0	-0.22	-0.3	-0.78
	Beaverton	-0.09	-0.67	-1.17	-1.41	-0.54	-0.8	-0.24	0	-0.21	-0.89
	Hillsboro	-0.13	-0.71	-1.21	-1.45	-0.37	-1.61	-0.25	-0.06	0	-0.92
	Vancouver CBD	-0.32	-0.06	-0.07	-0.27	-0.74	-0.31	-1.34	-1.41	-1.7	0

PARK B-R - Transit

From	TAZ	To: Portland CBD	PDX	Gateway	Gresham	Oregon City	Clackamas TC	Tualatin	Beaverton	Hillsboro	Vancouver CBD
From	Portland CBD	0	0	0	0	-1.31	0	0	0	0	-1.22
	PDX	0	0	0	0	-0.45	0	0	0	0	-1.22
	Gateway	0	0	0	0	-0.45	0	-0.01	0	0	-1.26
	Gresham	0	0	0	0	-0.45	0	0	0	0	-1.23
	Oregon City	0.44	-0.21	-0.21	-0.21	0	-0.21	-0.45	0.28	0.3	-0.82
	Clackamas TC	0	0	0	0	-0.45	0	-0.07	0	0	-1.26
	Tualatin	0	0	0	0	-0.74	-0.01	0	0	0	-1.24
	Beaverton	0	0	0	0	-1.62	0	0	0	0	-1.22
	Hillsboro	0	0	0	0	-1.7	0	0	0	0	-1.23
	Vancouver CBD	-0.49	-0.3	-0.3	-0.3	3.34	-0.38	-0.57	-0.48	-0.49	0

Change in peak period travel times between select zone pairs. (Alternative - Baseline)

Green = improved travel times in Alternative. Red = worse travel times in Alternative.

All times in minutes.

RD A - Auto

From	TAZ	To: Portland CBD	PDX	Gateway	Gresham	Oregon City	Clackamas TC	Tualatin	Beaverton	Hillsboro	Vancouver CBD
From	Portland CBD	0	-0.95	-2.31	-2.67	0.45	0.39	-2.4	-0.85	-1.65	-1.63
	PDX	-0.49	0	-0.03	-1.8	-4.05	-2.25	-3.37	-1.72	-2.51	0.55
	Gateway	-1.54	0.09	0	0.53	-3.58	-1.78	-4.53	-3.27	-4.06	0.15
	Gresham	-0.49	0.38	0.84	0.01	0.15	-1.21	-2.05	-2.21	-3	-1.84
	Oregon City	0.51	-3.64	-3.08	-2.67	0.01	-0.93	-1.76	-4.76	-0.97	-3.95
	Clackamas TC	0.82	-2.25	-1.76	-1.02	-1.46	0	-2.99	0.91	-0.96	-2.63
	Tualatin	-2.1	-3.53	-4.89	-5.63	-2.98	-3.88	0	-2.49	0.54	-4.13
	Beaverton	-0.67	-2.44	-3.75	-4.13	-5.38	0.9	-2.45	0	0.52	-2.79
	Hillsboro	-2.27	-4.04	-5.35	-5.73	1.06	-2.23	0.49	0.31	0	-4.33
	Vancouver CBD	-0.8	0.19	0.04	1.34	-3.99	-2.17	-3.92	-2.61	-3.4	0

RD A - Transit

From	TAZ	To: Portland CBD	PDX	Gateway	Gresham	Oregon City	Clackamas TC	Tualatin	Beaverton	Hillsboro	Vancouver CBD
From	Portland CBD	0	0	0	0	0.21	0	0	0	0	-1.88
	PDX	0	0	0	0	-0.91	0	0	0	0	-1.88
	Gateway	0	0	0	0	-0.91	0	-0.01	0	0	-1.59
	Gresham	0	0	0	0	-0.91	0	0	0	0	-1.89
	Oregon City	-0.6	-0.2	-0.2	-0.2	0	-0.25	0.13	-0.82	-0.8	-2.63
	Clackamas TC	0	0	0	0	-0.9	0	-0.04	0	0	-1.59
	Tualatin	-0.03	-0.01	0.06	-0.01	0.08	-0.08	0	0	0	-1.93
	Beaverton	0	0	0	0	0.27	0	0	0	0	-1.88
	Hillsboro	0	0	0	0	0.2	0	0	0	0	-1.89
	Vancouver CBD	-1.88	-0.65	-0.69	-0.65	-1.92	-1.46	-1.92	-1.87	-1.88	0

Change in peak period travel times between select zone pairs. (Alternative - Baseline)

Green = improved travel times in Alternative. Red = worse travel times in Alternative.

All times in minutes.

RD B - Auto

From	TAZ	To: Portland CBD	PDX	Gateway	Gresham	Oregon City	Clackamas TC	Tualatin	Beaverton	Hillsboro	Vancouver CBD
From	Portland CBD	0	-1.67	-4.21	1.29	1.22	1.29	-3.99	-1.05	-3.17	-3.22
	PDX	-0.38	0.01	0.44	1.88	-6.33	-3.32	-5.59	-1.79	-3.9	0.97
	Gateway	-2.32	0.42	0	1.8	-5.62	-2.61	-7.63	-5.14	-7.26	0.61
	Gresham	3.17	0.64	1.45	0.01	0.68	1.28	-2.83	-3.43	-5.54	-1.98
	Oregon City	1.74	-5.28	-4.54	1.69	0.04	-1.36	1.03	-6.67	5.23	-6.19
	Clackamas TC	2.01	2.42	-2.44	1.42	-2.33	-0.01	-4.43	2.86	-1.39	-4.09
	Tualatin	-3.22	-5.9	-8.44	-3.09	-4.59	-6.13	0	-3.82	1.45	-7
	Beaverton	-0.64	-3.79	-6.39	-1.59	-8.38	2.63	-3.81	0	0.83	-5.3
	Hillsboro	-2.75	-5.87	-8.51	-3.71	3.75	-0.77	1.52	0.81	0	-7.21
	Vancouver CBD	-1.22	0.27	0.31	2.13	-6.26	-3.24	-6.71	-4.1	-6.21	0

RD B - Transit

From	TAZ	To: Portland CBD	PDX	Gateway	Gresham	Oregon City	Clackamas TC	Tualatin	Beaverton	Hillsboro	Vancouver CBD
From	Portland CBD	0	0	0	0	1.18	0	0	0	0	-3.32
	PDX	0	0	0	0	-1.07	0	0	0	0	-3.32
	Gateway	0	0	0	0	-1.07	0	0	0	0	-2.64
	Gresham	0	0	0	0	-1.07	0	0	0	0	-3.33
	Oregon City	-0.32	0.15	0.15	0.15	0	0.05	1.07	-1.14	-1.11	-3.8
	Clackamas TC	0	0	0	0	-1.09	0	-0.03	0	0	-2.64
	Tualatin	-0.01	0	-0.01	0	1.38	-0.03	0	0	0	-3.34
	Beaverton	0	0	0	0	1.45	0	0	0	0	-3.32
	Hillsboro	0	0	0	0	1.4	0	0	0	0	-3.32
	Vancouver CBD	-3.35	-1.8	-1.83	-1.8	-3.22	-2.46	-3.37	-3.34	-3.34	0

% change from Baseline in peak period travel times between select zone pairs

Green = improved travel times in Alternative. Red = worse travel times in Alternative.

VMT B - Auto

		To									
	TAZ	Portland CBD	PDX	Gateway	Gresham	Oregon City	Clackamas TC	Tualatin	Beaverton	Hillsboro	Vancouver CBD
From	Portland CBD	0%	-2%	-3%	-3%	-3%	-3%	-4%	-5%	-4%	-3%
	PDX	-2%	0%	-1%	-1%	-3%	-2%	-4%	-4%	-4%	-2%
	Gateway	-2%	0%	0%	-1%	-4%	-3%	-4%	-5%	-4%	-2%
	Gresham	-2%	-1%	-1%	0%	-3%	-2%	-3%	-4%	-3%	-2%
	Oregon City	-3%	-3%	-4%	-3%	-4%	-4%	-4%	-4%	-3%	-3%
	Clackamas TC	-3%	-2%	-3%	-2%	-4%	1%	-4%	-4%	-4%	-3%
	Tualatin	-3%	-3%	-4%	-3%	-4%	-4%	0%	-4%	-2%	-4%
	Beaverton	-4%	-4%	-4%	-4%	-4%	-3%	-3%	0%	-2%	-4%
	Hillsboro	-4%	-3%	-4%	-3%	-3%	-4%	-2%	-2%	0%	-4%
	Vancouver CBD	-1%	0%	-1%	-1%	-3%	-2%	-4%	-4%	-4%	0%

VMT B - Transit

		To									
	TAZ	Portland CBD	PDX	Gateway	Gresham	Oregon City	Clackamas TC	Tualatin	Beaverton	Hillsboro	Vancouver CBD
From	Portland CBD	--	0%	0%	0%	-2%	0%	0%	0%	0%	-5%
	PDX	0%	--	0%	0%	-1%	0%	0%	0%	0%	-2%
	Gateway	0%	0%	--	0%	-1%	0%	0%	0%	0%	-3%
	Gresham	0%	0%	0%	--	-1%	0%	0%	0%	0%	-2%
	Oregon City	1%	-1%	-1%	-1%	--	-2%	-2%	0%	0%	-1%
	Clackamas TC	0%	0%	0%	0%	-2%	--	0%	0%	0%	-2%
	Tualatin	0%	0%	0%	0%	-2%	0%	--	0%	0%	-2%
	Beaverton	0%	0%	0%	0%	-2%	0%	0%	--	0%	-3%
	Hillsboro	0%	0%	0%	0%	-1%	0%	0%	0%	--	-2%
	Vancouver CBD	-2%	0%	-1%	0%	5%	-1%	-1%	-1%	-1%	--

% change from Baseline in peak period travel times between select zone pairs

Green = improved travel times in Alternative. Red = worse travel times in Alternative.

VMT C - Auto

From \ To (TAZ)	Portland CBD	PDX	Gateway	Gresham	Oregon City	Clackamas TC	Tualatin	Beaverton	Hillsboro	Vancouver CBD
Portland CBD	0%	-3%	-6%	-5%	-5%	-5%	-7%	-9%	-8%	-5%
PDX	-3%	0%	-2%	-2%	-5%	-4%	-6%	-7%	-6%	-4%
Gateway	-4%	-1%	0%	-2%	-6%	-5%	-8%	-8%	-7%	-3%
Gresham	-3%	-1%	-2%	0%	-5%	-3%	-5%	-7%	-6%	-3%
Oregon City	-5%	-6%	-7%	-5%	-6%	-7%	-8%	-8%	-6%	-5%
Clackamas TC	-5%	-4%	-6%	-3%	-7%	1%	-7%	-7%	-7%	-5%
Tualatin	-6%	-6%	-7%	-6%	-7%	-7%	0%	-7%	-4%	-6%
Beaverton	-7%	-6%	-7%	-6%	-6%	-6%	-6%	0%	-3%	-7%
Hillsboro	-6%	-6%	-7%	-6%	-5%	-6%	-4%	-4%	0%	-6%
Vancouver CBD	-3%	-1%	-1%	-2%	-5%	-3%	-7%	-8%	-7%	0%

VMT C - Transit

From \ To (TAZ)	Portland CBD	PDX	Gateway	Gresham	Oregon City	Clackamas TC	Tualatin	Beaverton	Hillsboro	Vancouver CBD
Portland CBD	--	0%	0%	0%	-4%	0%	0%	0%	0%	-8%
PDX	0%	--	0%	0%	-2%	0%	0%	0%	0%	-3%
Gateway	0%	0%	--	0%	-3%	0%	0%	0%	0%	-6%
Gresham	0%	0%	0%	--	-2%	0%	0%	0%	0%	-3%
Oregon City	1%	-1%	-2%	-1%	--	-3%	-4%	0%	0%	-2%
Clackamas TC	0%	0%	0%	0%	-4%	--	0%	0%	0%	-4%
Tualatin	0%	0%	0%	0%	-4%	0%	--	0%	0%	-3%
Beaverton	0%	0%	0%	0%	-3%	0%	0%	--	0%	-4%
Hillsboro	0%	0%	0%	0%	-3%	0%	0%	0%	--	-3%
Vancouver CBD	-3%	-1%	-1%	-1%	3%	-1%	-2%	-2%	-1%	--

% change from Baseline in peak period travel times between select zone pairs

Green = improved travel times in Alternative. Red = worse travel times in Alternative.

COR A - Auto

	TAZ	To: Portland CBD	PDX	Gateway	Gresham	Oregon City	Clackamas TC	Tualatin	Beaverton	Hillsboro	Vancouver CBD
From	Portland CBD	0%	-6%	-8%	-5%	-2%	-3%	-7%	-13%	-8%	-2%
From	PDX	-2%	0%	-1%	0%	0%	0%	1%	3%	2%	-1%
From	Gateway	-2%	0%	0%	0%	0%	0%	1%	3%	1%	-1%
From	Gresham	-2%	0%	0%	0%	0%	0%	0%	2%	1%	-1%
From	Oregon City	-4%	0%	0%	0%	0%	0%	2%	1%	1%	-1%
From	Clackamas TC	-5%	0%	-1%	0%	0%	1%	1%	2%	3%	-1%
From	Tualatin	-4%	0%	0%	0%	0%	0%	0%	1%	0%	0%
From	Beaverton	-7%	1%	3%	1%	0%	1%	0%	0%	-1%	1%
From	Hillsboro	-4%	1%	2%	1%	0%	2%	0%	-1%	0%	1%
From	Vancouver CBD	-3%	0%	0%	0%	0%	0%	0%	3%	2%	0%

COR A - Transit

	TAZ	To: Portland CBD	PDX	Gateway	Gresham	Oregon City	Clackamas TC	Tualatin	Beaverton	Hillsboro	Vancouver CBD
From	Portland CBD	--	0%	0%	0%	1%	0%	0%	0%	0%	-2%
From	PDX	0%	--	0%	0%	0%	0%	0%	0%	0%	-1%
From	Gateway	0%	0%	--	0%	0%	0%	0%	0%	0%	-2%
From	Gresham	0%	0%	0%	--	0%	0%	0%	0%	0%	-1%
From	Oregon City	2%	0%	0%	0%	--	0%	0%	1%	1%	0%
From	Clackamas TC	0%	0%	0%	0%	1%	--	0%	0%	0%	-1%
From	Tualatin	0%	0%	0%	0%	0%	0%	--	0%	0%	-1%
From	Beaverton	0%	0%	0%	0%	1%	0%	0%	--	0%	-1%
From	Hillsboro	0%	0%	0%	0%	0%	0%	0%	0%	--	-1%
From	Vancouver CBD	4%	1%	1%	1%	2%	0%	2%	2%	2%	--

% change from Baseline in peak period travel times between select zone pairs

Green = improved travel times in Alternative. Red = worse travel times in Alternative.

COR B - Auto

	TAZ	To: Portland CBD	PDX	Gateway	Gresham	Oregon City	Clackamas TC	Tualatin	Beaverton	Hillsboro	Vancouver CBD
From	Portland CBD	0%	-3%	-6%	-4%	-12%	-12%	-6%	-12%	-8%	-4%
From	PDX	-1%	0%	0%	0%	1%	2%	0%	1%	1%	-1%
From	Gateway	-3%	0%	1%	-1%	0%	1%	0%	0%	0%	-1%
From	Gresham	-2%	0%	0%	0%	0%	0%	0%	0%	0%	-1%
From	Oregon City	-7%	0%	0%	0%	-4%	0%	1%	0%	0%	-1%
From	Clackamas TC	-9%	0%	0%	0%	-1%	0%	0%	0%	1%	-1%
From	Tualatin	-4%	0%	-1%	-1%	-2%	-2%	0%	0%	0%	-2%
From	Beaverton	-8%	0%	0%	0%	-1%	0%	0%	0%	-1%	-1%
From	Hillsboro	-5%	0%	0%	0%	-1%	0%	0%	-1%	0%	-1%
From	Vancouver CBD	-4%	0%	0%	0%	1%	1%	-2%	1%	0%	0%

COR B - Transit

	TAZ	To: Portland CBD	PDX	Gateway	Gresham	Oregon City	Clackamas TC	Tualatin	Beaverton	Hillsboro	Vancouver CBD
From	Portland CBD	--	0%	0%	0%	-1%	0%	0%	0%	0%	-2%
From	PDX	0%	--	0%	0%	0%	0%	0%	0%	0%	-1%
From	Gateway	0%	0%	--	0%	0%	0%	0%	0%	0%	-1%
From	Gresham	0%	0%	0%	--	0%	0%	0%	0%	0%	-1%
From	Oregon City	1%	0%	0%	0%	--	1%	0%	1%	0%	0%
From	Clackamas TC	0%	0%	0%	0%	1%	--	0%	0%	0%	-1%
From	Tualatin	0%	0%	0%	0%	0%	0%	--	0%	0%	-1%
From	Beaverton	0%	0%	0%	0%	-1%	0%	0%	--	0%	-1%
From	Hillsboro	0%	0%	0%	0%	0%	0%	0%	0%	--	-1%
From	Vancouver CBD	1%	0%	0%	0%	0%	0%	0%	1%	0%	--

% change from Baseline in peak period travel times between select zone pairs

Green = improved travel times in Alternative. Red = worse travel times in Alternative.

PARK A - Auto

From	To → TAZ	Portland CBD	PDX	Gateway	Gresham	Oregon City	Clackamas TC	Tualatin	Beaverton	Hillsboro	Vancouver CBD
From	Portland CBD	0%	-2%	-3%	-2%	-3%	-2%	-3%	-3%	-2%	-2%
	PDX	-1%	0%	0%	0%	-1%	-1%	-2%	-2%	-1%	0%
	Gateway	-1%	0%	0%	0%	-2%	-1%	-2%	-2%	-2%	0%
	Gresham	-1%	0%	0%	0%	-1%	-1%	-1%	-2%	-1%	0%
	Oregon City	-1%	-1%	-1%	-1%	-1%	-1%	-1%	-1%	-1%	-1%
	Clackamas TC	-1%	0%	0%	0%	-2%	1%	-1%	-1%	-2%	0%
	Tualatin	0%	-1%	-2%	-1%	-2%	-2%	0%	-1%	0%	-1%
	Beaverton	-1%	-1%	-2%	-2%	-2%	-1%	-1%	0%	0%	-2%
	Hillsboro	-1%	-1%	-1%	-1%	-1%	-2%	0%	0%	0%	-1%
	Vancouver CBD	-1%	0%	0%	0%	-1%	-1%	-2%	-2%	-2%	0%

PARK A - Transit

From	To → TAZ	Portland CBD	PDX	Gateway	Gresham	Oregon City	Clackamas TC	Tualatin	Beaverton	Hillsboro	Vancouver CBD
From	Portland CBD	--	0%	0%	0%	-1%	0%	0%	0%	0%	-2%
	PDX	0%	--	0%	0%	0%	0%	0%	0%	0%	-1%
	Gateway	0%	0%	--	0%	0%	0%	0%	0%	0%	-1%
	Gresham	0%	0%	0%	--	0%	0%	0%	0%	0%	-1%
	Oregon City	0%	0%	0%	0%	--	0%	0%	0%	0%	0%
	Clackamas TC	0%	0%	0%	0%	-1%	--	0%	0%	0%	-1%
	Tualatin	0%	0%	0%	0%	0%	0%	--	0%	0%	-1%
	Beaverton	0%	0%	0%	0%	-1%	0%	0%	--	0%	-1%
	Hillsboro	0%	0%	0%	0%	-1%	0%	0%	0%	--	-1%
	Vancouver CBD	-1%	0%	0%	0%	0%	0%	0%	0%	0%	--

% change from Baseline in peak period travel times between select zone pairs

Green = improved travel times in Alternative. Red = worse travel times in Alternative.

PARK B - Auto

From	To: Portland CBD	PDX	Gateway	Gresham	Oregon City	Clackamas TC	Tualatin	Beaverton	Hillsboro	Vancouver CBD
Portland CBD	0%	-3%	-6%	-4%	-6%	-5%	-5%	-7%	-4%	-2%
PDX	-1%	0%	-1%	-1%	-2%	-1%	-3%	-4%	-3%	0%
Gateway	-2%	0%	0%	-1%	-3%	-2%	-4%	-5%	-4%	0%
Gresham	-1%	0%	0%	0%	-2%	-1%	-2%	-3%	-3%	0%
Oregon City	-2%	-1%	-2%	-1%	-4%	-2%	-2%	-1%	-1%	-1%
Clackamas TC	-2%	-1%	-2%	-1%	-4%	0%	-3%	-3%	-4%	-1%
Tualatin	-1%	-3%	-4%	-2%	-3%	-3%	0%	-1%	-1%	-2%
Beaverton	-1%	-2%	-4%	-3%	-2%	-2%	-2%	0%	-1%	-3%
Hillsboro	-1%	-2%	-3%	-3%	-1%	-3%	-1%	0%	0%	-2%
Vancouver CBD	-2%	0%	0%	-1%	-2%	-1%	-4%	-4%	-4%	0%

PARK B - Transit

From	To: Portland CBD	PDX	Gateway	Gresham	Oregon City	Clackamas TC	Tualatin	Beaverton	Hillsboro	Vancouver CBD
Portland CBD	--	0%	0%	0%	-2%	0%	0%	0%	0%	-3%
PDX	0%	--	0%	0%	-1%	0%	0%	0%	0%	-1%
Gateway	0%	0%	--	0%	-1%	0%	0%	0%	0%	-2%
Gresham	0%	0%	0%	--	-1%	0%	0%	0%	0%	-1%
Oregon City	1%	0%	-1%	0%	--	-1%	-1%	0%	0%	-1%
Clackamas TC	0%	0%	0%	0%	-2%	--	0%	0%	0%	-2%
Tualatin	0%	0%	0%	0%	-1%	0%	--	0%	0%	-1%
Beaverton	0%	0%	0%	0%	-2%	0%	0%	--	0%	-2%
Hillsboro	0%	0%	0%	0%	-2%	0%	0%	0%	--	-1%
Vancouver CBD	-2%	0%	-1%	0%	5%	-1%	-1%	-1%	-1%	--

% change from Baseline in peak period travel times between select zone pairs

Green = improved travel times in Alternative. Red = worse travel times in Alternative.

PARK B-R - Auto

		To									
	TAZ	Portland CBD	PDX	Gateway	Gresham	Oregon City	Clackamas TC	Tualatin	Beaverton	Hillsboro	Vancouver CBD
From	Portland CBD	0%	-3%	-5%	-4%	-5%	-5%	-5%	-6%	-4%	-3%
	PDX	-1%	0%	-1%	-1%	-2%	-1%	-3%	-3%	-3%	0%
	Gateway	-2%	0%	0%	-1%	-3%	-2%	-4%	-4%	-3%	0%
	Gresham	-1%	0%	0%	0%	-2%	-1%	-2%	-3%	-3%	0%
	Oregon City	-2%	-1%	-2%	-1%	-2%	-2%	-1%	-1%	-1%	-1%
	Clackamas TC	-2%	-1%	-2%	-1%	-3%	0%	-2%	-2%	-3%	-1%
	Tualatin	0%	-2%	-3%	-2%	-2%	-2%	0%	-1%	-1%	-2%
	Beaverton	0%	-2%	-3%	-3%	-1%	-2%	-1%	0%	-1%	-2%
	Hillsboro	0%	-1%	-2%	-2%	-1%	-3%	-1%	0%	0%	-2%
	Vancouver CBD	-2%	0%	0%	-1%	-2%	-1%	-3%	-4%	-3%	0%

PARK B-R - Transit

		To									
	TAZ	Portland CBD	PDX	Gateway	Gresham	Oregon City	Clackamas TC	Tualatin	Beaverton	Hillsboro	Vancouver CBD
From	Portland CBD	--	0%	0%	0%	-2%	0%	0%	0%	0%	-4%
	PDX	0%	--	0%	0%	-1%	0%	0%	0%	0%	-2%
	Gateway	0%	0%	--	0%	-1%	0%	0%	0%	0%	-3%
	Gresham	0%	0%	0%	--	-1%	0%	0%	0%	0%	-2%
	Oregon City	1%	0%	-1%	0%	--	-1%	-1%	0%	0%	-1%
	Clackamas TC	0%	0%	0%	0%	-2%	--	0%	0%	0%	-2%
	Tualatin	0%	0%	0%	0%	-1%	0%	--	0%	0%	-2%
	Beaverton	0%	0%	0%	0%	-2%	0%	0%	--	0%	-2%
	Hillsboro	0%	0%	0%	0%	-2%	0%	0%	0%	--	-2%
	Vancouver CBD	-2%	0%	-1%	0%	5%	-1%	-1%	-1%	-1%	--

% change from Baseline in peak period travel times between select zone pairs

Green = improved travel times in Alternative. Red = worse travel times in Alternative.

RD A - Auto

From \ To (TAZ)	Portland CBD	PDX	Gateway	Gresham	Oregon City	Clackamas TC	Tualatin	Beaverton	Hillsboro	Vancouver CBD
Portland CBD	0%	-4%	-13%	-9%	1%	1%	-10%	-4%	-4%	-7%
PDX	-2%	0%	0%	-9%	-12%	-11%	-8%	-4%	-4%	3%
Gateway	-10%	1%	0%	4%	-13%	-12%	-12%	-9%	-8%	1%
Gresham	-2%	2%	6%	2%	0%	-5%	-4%	-5%	-5%	-6%
Oregon City	2%	-12%	-13%	-8%	1%	-8%	-10%	-14%	-2%	-10%
Clackamas TC	3%	-10%	-12%	-4%	-9%	0%	-12%	2%	-2%	-8%
Tualatin	-9%	-8%	-13%	-12%	-15%	-14%	0%	-12%	1%	-9%
Beaverton	-3%	-6%	-11%	-8%	-14%	2%	-12%	0%	2%	-7%
Hillsboro	-6%	-7%	-10%	-9%	2%	-4%	1%	1%	0%	-8%
Vancouver CBD	-5%	1%	0%	5%	-10%	-8%	-10%	-8%	-7%	0%

RD A - Transit

From \ To (TAZ)	Portland CBD	PDX	Gateway	Gresham	Oregon City	Clackamas TC	Tualatin	Beaverton	Hillsboro	Vancouver CBD
Portland CBD	--	0%	0%	0%	0%	0%	0%	0%	0%	-7%
PDX	0%	--	0%	0%	-2%	0%	0%	0%	0%	-3%
Gateway	0%	0%	--	0%	-2%	0%	0%	0%	0%	-4%
Gresham	0%	0%	0%	--	-1%	0%	0%	0%	0%	-3%
Oregon City	-1%	0%	0%	0%	--	-1%	0%	-1%	-1%	-3%
Clackamas TC	0%	0%	0%	0%	-3%	--	0%	0%	0%	-3%
Tualatin	0%	0%	0%	0%	0%	0%	--	0%	0%	-3%
Beaverton	0%	0%	0%	0%	0%	0%	0%	--	0%	-4%
Hillsboro	0%	0%	0%	0%	0%	0%	0%	0%	--	-2%
Vancouver CBD	-7%	-1%	-1%	-1%	-3%	-2%	-3%	-4%	-3%	--

% change from Baseline in peak period travel times between select zone pairs

Green = improved travel times in Alternative. Red = worse travel times in Alternative.

RD B - Auto

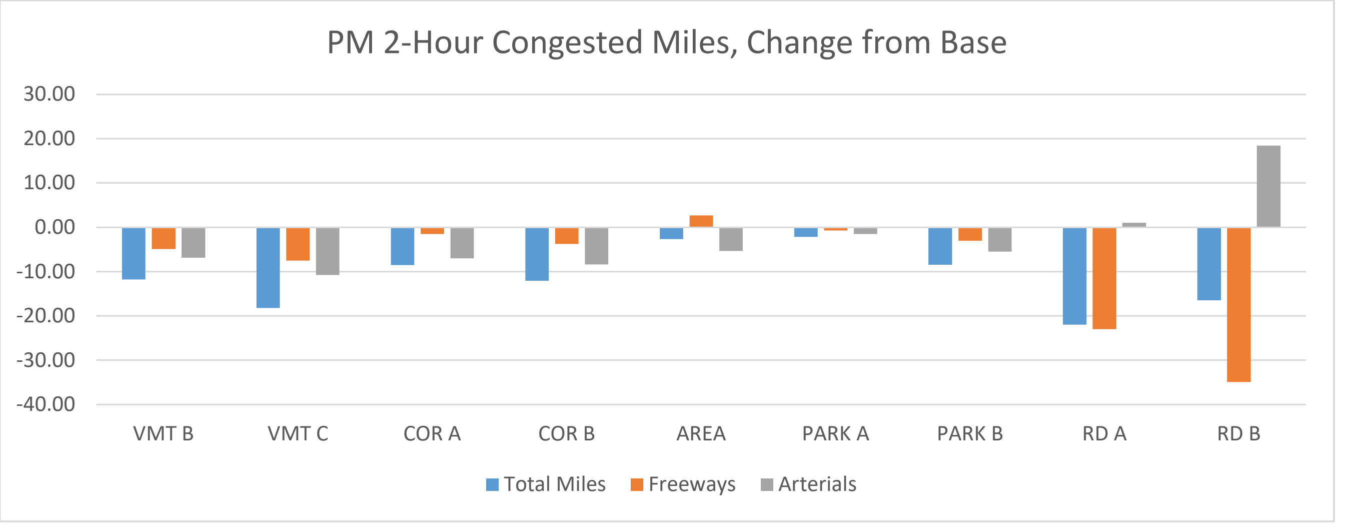
From	TAZ	To: Portland CBD	PDX	Gateway	Gresham	Oregon City	Clackamas TC	Tualatin	Beaverton	Hillsboro	Vancouver CBD
From	Portland CBD	0%	-7%	-24%	4%	3%	5%	-16%	-5%	-8%	-13%
	PDX	-2%	0%	4%	9%	-19%	-16%	-13%	-4%	-7%	5%
	Gateway	-15%	4%	0%	12%	-21%	-18%	-21%	-15%	-14%	3%
	Gresham	11%	3%	10%	2%	2%	5%	-6%	-7%	-9%	-6%
	Oregon City	6%	-17%	-19%	5%	3%	-11%	6%	-19%	10%	-15%
	Clackamas TC	8%	11%	-17%	6%	-15%	-1%	-18%	7%	-2%	-13%
	Tualatin	-14%	-13%	-22%	-6%	-22%	-23%	0%	-19%	4%	-16%
	Beaverton	-3%	-9%	-18%	-3%	-22%	6%	-19%	0%	4%	-13%
	Hillsboro	-7%	-10%	-16%	-6%	7%	-1%	4%	4%	0%	-13%
	Vancouver CBD	-7%	2%	2%	8%	-15%	-11%	-17%	-12%	-12%	0%

RD B - Transit

From	TAZ	To: Portland CBD	PDX	Gateway	Gresham	Oregon City	Clackamas TC	Tualatin	Beaverton	Hillsboro	Vancouver CBD
From	Portland CBD	--	0%	0%	0%	2%	0%	0%	0%	0%	-12%
	PDX	0%	--	0%	0%	-2%	0%	0%	0%	0%	-5%
	Gateway	0%	0%	--	0%	-2%	0%	0%	0%	0%	-6%
	Gresham	0%	0%	0%	--	-2%	0%	0%	0%	0%	-4%
	Oregon City	-1%	0%	0%	0%	--	0%	2%	-1%	-1%	-5%
	Clackamas TC	0%	0%	0%	0%	-4%	--	0%	0%	0%	-4%
	Tualatin	0%	0%	0%	0%	2%	0%	--	0%	0%	-5%
	Beaverton	0%	0%	0%	0%	2%	0%	0%	--	0%	-6%
	Hillsboro	0%	0%	0%	0%	1%	0%	0%	0%	--	-4%
	Vancouver CBD	-13%	-3%	-4%	-3%	-5%	-4%	-6%	-7%	-5%	--

Appendix D.1 Model Data Summary - Congestion outputs

	Base		VMT B		VMT C		COR A		COR B		PARK A		PARK B		RD A		RD B	
PM 2-HR Congested links (0.9<=vc<1)	miles	share	miles	share	miles	share	miles	share	miles	share	miles	share	miles	share	miles	share	miles	share
Total	88.3	2.3%	76.6	2.0%	70.1	1.9%	79.9	2.1%	76.3	2.0%	86.2	2.3%	79.9	2.1%	66.4	1.8%	71.9	1.9%
change from Base			-11.8	-13.3%	-18.2	-20.6%	-8.5	-9.6%	-12.1	-13.7%	-2.2	-2.5%	-8.5	-9.6%	-22.0	-24.9%	-16.5	-18.7%
Freeway	40.9	17.4%	36.0	15.3%	33.4	14.2%	39.4	16.7%	37.1	15.8%	40.2	17.1%	37.9	16.1%	17.9	7.6%	5.9	2.5%
change from Base			-4.9	-11.9%	-7.5	-18.4%	-1.5	-3.7%	-3.7	-9.1%	-0.7	-1.7%	-3.0	-7.3%	-23.0	-56.3%	-35.0	-85.5%
Arterial	47.5	1.3%	40.6	1.1%	36.7	1.0%	40.5	1.1%	39.1	1.1%	46.0	1.3%	42.0	1.2%	48.5	1.4%	65.9	1.9%
change from Base			-6.9	-14.5%	-10.7	-22.6%	-7.0	-14.7%	-8.3	-17.6%	-1.5	-3.1%	-5.5	-11.5%	1.0	2.1%	18.5	38.9%
PM 2-HR Severely Congested (vc>1)	miles	share	miles	share	miles	share	miles	share	miles	share	miles	share	miles	share	miles	share	miles	share
Total	52.3	1.4%	40.8	1.1%	31.5	0.8%	48.5	1.3%	49.1	1.3%	47.2	1.3%	42.8	1.1%	44.5	1.2%	46.4	1.2%
change from Base			-11.5	-22.0%	-20.8	-39.8%	-3.8	-7.3%	-3.2	-6.1%	-5.1	-9.8%	-9.5	-18.1%	-7.8	-14.9%	-5.9	-11.3%
Freeway	18.4	7.8%	13.6	5.8%	11.6	4.9%	16.9	7.2%	18.4	7.8%	15.4	6.6%	14.4	6.1%	7.5	3.2%	3.6	1.5%
change from Base			-4.8	-25.8%	-6.9	-37.2%	-1.5	-8.2%	0.0	0.0%	-3.0	-16.2%	-4.0	-21.8%	-10.9	-59.2%	-14.8	-80.5%
Arterial	33.9	1.0%	27.1	0.8%	19.9	0.6%	31.6	0.9%	30.7	0.9%	31.8	0.9%	28.4	0.8%	37.0	1.0%	42.8	1.2%
change from Base			-6.8	-20.0%	-14.0	-41.3%	-2.3	-6.7%	-3.2	-9.4%	-2.1	-6.3%	-5.5	-16.1%	3.1	9.1%	8.9	26.3%
PM 2-HR Pass Veh Hours of Delay	miles	share	miles	share	miles	share	miles	share	miles	share	miles	share	miles	share	miles	share	miles	share
Total	9207	6.8%	7281	5.7%	5762	4.8%	9860	7.5%	9676	7.4%	8581	6.4%	7748	6.0%	6000	4.6%	5631	4.4%
change from Base			-1926	-20.9%	-3445	-37.4%	653	7.1%	468	5.1%	-626	-6.8%	-1459	-15.9%	-3207	-34.8%	-3576	-38.8%
Freeway	5675	4.2%	4420	3.5%	3410	2.8%	6233	4.7%	6059	4.6%	5292	4.0%	4758	3.7%	2270	1.8%	1078	0.8%
change from Base			-1255	-22.1%	-2265	-39.9%	558	9.8%	384	6.8%	-382	-6.7%	-917	-16.2%	-3405	-60.0%	-4597	-81.0%
Arterial	3533	2.6%	2862	2.2%	2352	2.0%	3627	2.8%	3617	2.8%	3289	2.5%	2990	2.3%	3731	2.9%	4553	3.5%
change from Base			-671	-19.0%	-1180	-33.4%	95	2.7%	84	2.4%	-244	-6.9%	-543	-15.4%	198	5.6%	1021	28.9%
PM 2-HR Average Pass Veh Speed	26.1		26.7		27.2		26.2		26.1		26.3		26.7		26.6		26.2	
PM 2-HR Truck Hrs of Delay on Frt Net	287		241		203		313		324		279		264		164		123	
change from Base			-46	-16.2%	-84	-29.4%	25	8.8%	36	12.6%	-9	-3.0%	-23	-8.1%	-124	-43.0%	-164	-57.2%
AWD Total Transit Trips	462496		470237		486312		488174		494745		470973		509588		466494		472576	
change from Base			7741	1.7%	23816	5.1%	25679	5.6%	32249	7.0%	8478	1.8%	47093	10.2%	3999	0.9%	10080	2.2%
Transit Percent of Person Trips	6.3%		6.4%		6.6%		6.7%		6.7%		6.4%		7.0%		6.4%		6.4%	



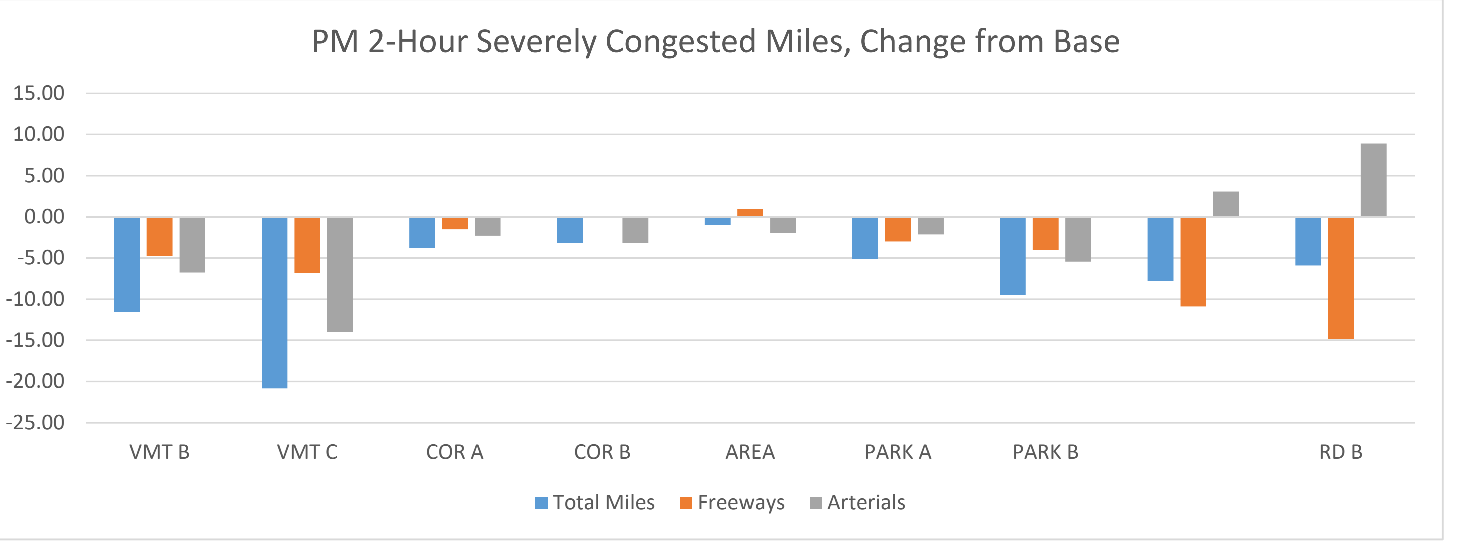


Figure 1.4-5 Total Daily Transit Trips, Change from Base

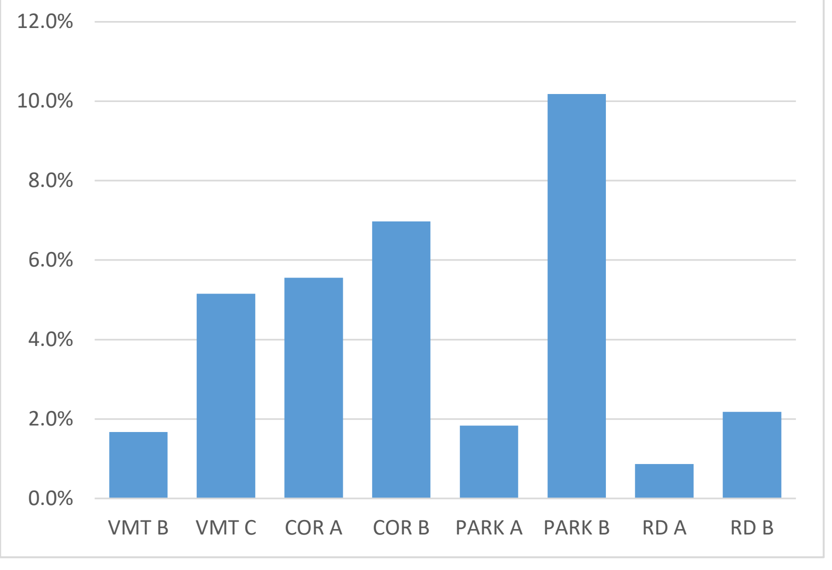
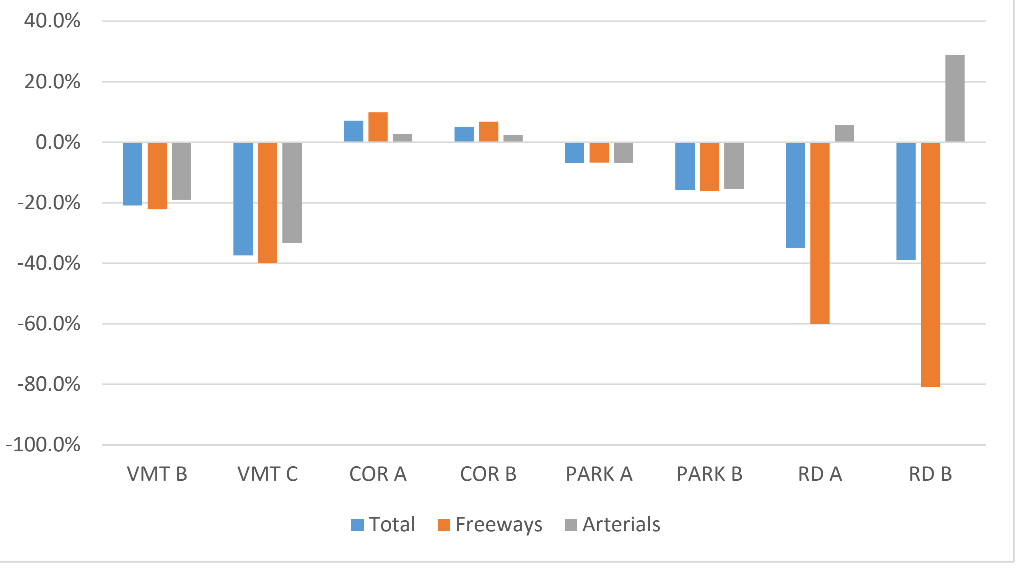


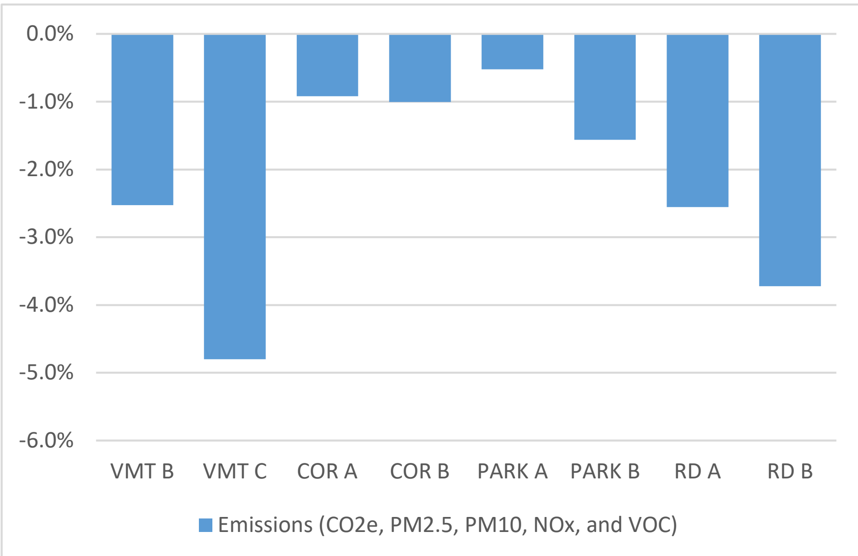
Figure 1.4-6 Change in Vehicle Hours of Delay - Region



Data from MCE outputs

	VMT B	VMT C	COR A	COR B	PARK A	PARK B	RD A	RD B
% change	-2.5%	-4.8%	-0.9%	-1.0%	-0.5%	-1.6%	-2.6%	-3.7%

Figure 1.4-11. Change in Emissions - Region



BY AUTO

Average number of jobs accessible w/in a typical commute time[1] for different communities, PM 2-HR	Base	VMT B	VMT C	COR A	COR B	PARK A	PARK B	RD A	RD B
All Zones	431,056	450,316	466,243	423,924	421,609	435,753	444,035	455,838	447,686
Equity Zones	473,250	489,267	502,353	471,586	469,267	477,160	483,845	492,285	481,407
Non-Equity Zones	405,047	426,307	443,984	394,546	392,233	410,231	419,496	433,372	426,900

Average percentage of all jobs accessible w/in a typical commute time[1] for different communities, PM 2-HR	Base	VMT B	VMT C	COR A	COR B	PARK A	PARK B	RD A	RD B
All Zones	40.2%	42.0%	43.5%	39.6%	39.4%	40.7%	42.6%	42.6%	41.8%
Equity Zones	44.2%	45.7%	46.9%	44.0%	43.8%	44.6%	46.0%	46.0%	44.9%
Non-Equity Zones	37.8%	39.8%	41.5%	36.8%	36.6%	38.3%	40.5%	40.5%	39.9%

Change from Base: Jobs Accessible W/in in a Typical Commute Time[1] for Diff Communities, PM 2-HR	VMT B	VMT C	COR A	COR B	PARK A	PARK B	RD A	RD B
All Jobs								
Region	19,260	35,187	(7,132)	(9,446)	4,698	12,979	24,782	16,630
Equity Focus Areas	16,016	29,103	(1,664)	(3,983)	3,909	10,594	19,035	8,157
Non-Equity Focus Areas	21,260	38,937	(10,501)	(12,814)	5,184	14,449	28,325	21,853

Change from Base: Jobs Accessible W/in in a Typical Commute Time[1] for Diff Communities, PM 2-HR	VMT B	VMT C	COR A	COR B	PARK A	PARK B	RD A	RD B
All Jobs								
Region	4.47%	8.16%	-1.65%	-2.19%	1.09%	3.01%	5.75%	3.86%
Equity Focus Areas	3.38%	6.15%	-0.35%	-0.84%	0.83%	2.24%	4.02%	1.72%
Non-Equity Focus Areas	5.25%	9.61%	-2.59%	-3.16%	1.28%	3.57%	6.99%	5.40%

Percent change of jobs accessible compared to All Zones	Base	VMT B	VMT C	COR A	COR B	PARK A	PARK B	RD A	RD B
Equity Zones	9.8%	8.6%	7.7%	11.2%	11.3%	9.5%	9.0%	8.0%	7.5%
Non-Equity Zones	-6.0%	-5.3%	-4.8%	-6.9%	-7.0%	-5.9%	-5.5%	-4.9%	-4.6%

Average number of middle-wage jobs accessible w/in a typical commute time[1] for different communities, PM 2-HR	Base	VMT B	VMT C	COR A	COR B	PARK A	PARK B	RD A	RD B
All Zones	118,411	123,695	128,076	116,444	115,807	119,696	121,969	125,205	122,962
Equity Zones	130,072	134,462	138,056	129,630	128,985	131,145	132,984	135,289	132,312
Non-Equity Zones	111,223	117,058	121,925	108,316	107,685	112,639	115,179	118,990	117,199

Average percentage of middle-wage jobs accessible w/in a typical commute time[1] for different communities, PM 2-HR	Base	VMT B	VMT C	COR A	COR B	PARK A	PARK B	RD A	RD B
All Zones	11.1%	45.6%	47.2%	10.9%	43%	44.1%	46.2%	46.2%	45.3%
Equity Zones	12.1%	49.6%	50.9%	12.1%	48%	48.4%	49.9%	49.9%	48.8%
Non-Equity Zones	10.4%	43.2%	45.0%	10.1%	40%	41.5%	43.9%	43.9%	43.2%

Percent change of mid-wage jobs accessible compared to All Zones	Base	VMT B	VMT C	COR A	COR B	PARK A	PARK B	RD A	RD B
Equity Zones	9.8%	8.7%	7.8%	11.3%	11.4%	9.6%	9.0%	8.1%	7.6%
Non-Equity Zones	-6.1%	-5.4%	-4.8%	-7.0%	-7.0%	-5.9%	-5.6%	-5.0%	-4.7%

Average Number of Community Places[2] Accessible W/In a Typical Commute Time[1] for Diff Communities, PM 2-HR	Base	VMT B	VMT C	COR A	COR B	PARK A	PARK B	RD A	RD B
All Zones	1,537	1,702	1,768	1,636	1,627	1,649	1,688	1,700	1,667
Equity Zones	1,499	1,651	1,707	1,621	1,605	1,606	1,638	1,661	1,628
Non-Equity Zones	1,560	1,733	1,806	1,645	1,641	1,675	1,719	1,724	1,690

Percent change of community places accessible compared to All Zones	Base	VMT B	VMT C	COR A	COR B	PARK A	PARK B	RD A	RD B
Equity Zones	-2.5%	-3.0%	-3.4%	-0.9%	-1.4%	-2.6%	-2.9%	-2.3%	-2.3%
Non-Equity Zones	1.5%	1.8%	2.1%	0.6%	0.8%	1.6%	1.8%	1.4%	1.4%

Change from Base: Community Places Accessible W/in in a Typical Commute Time[1] for Diff Communities, PM 2-HR	VMT B	VMT C	COR A	COR B	PARK A	PARK B	RD A	RD B
All Zones	165	231	99	91	112	151	163	130
Equity Focus Areas	153	209	122	106	108	140	162	130
Non-Equity Focus Areas	172	245	85	81	114	158	164	130

Change from Base: Community Places Accessible W/in in a Typical Commute Time[1] for Diff Communities, PM 2-HR	VMT B	VMT C	COR A	COR B	PARK A	PARK B	RD A	RD B
Region	10.72%	15.05%	6.45%	5.89%	7.27%	9.85%	10.61%	8.44%
Equity Focus Areas	10.18%	13.94%	8.14%	7.10%	7.18%	9.34%	10.82%	8.66%
Non-Equity Focus Areas	11.03%	15.71%	5.44%	5.17%	7.32%	10.15%	10.49%	8.31%

[1]Typical Commute Times

Mode	Travel Time Community Places	Travel Time Job Access
Auto	20 minutes	30 minutes
Transit	30 minutes	45 minutes

[2] **Community places** include hospitals and other medical services, civic places such as post offices, churches, social services, libraries, schools and colleges, financial institutions, grocerty stores, and essential retail services such as hardware stores, pharmacies, and laundry services

Figure 1.4-12. Change in Jobs Accessible by Auto

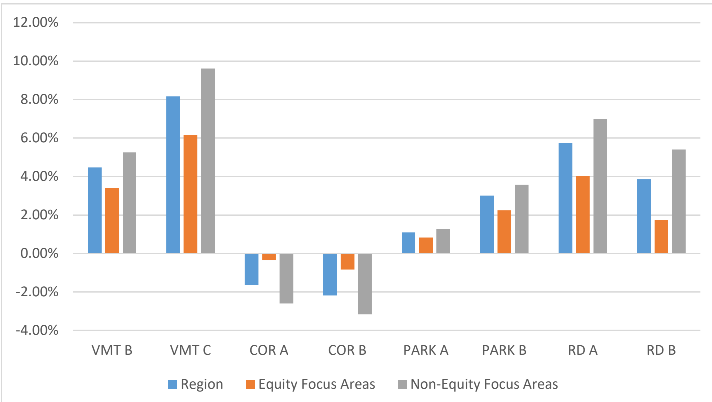
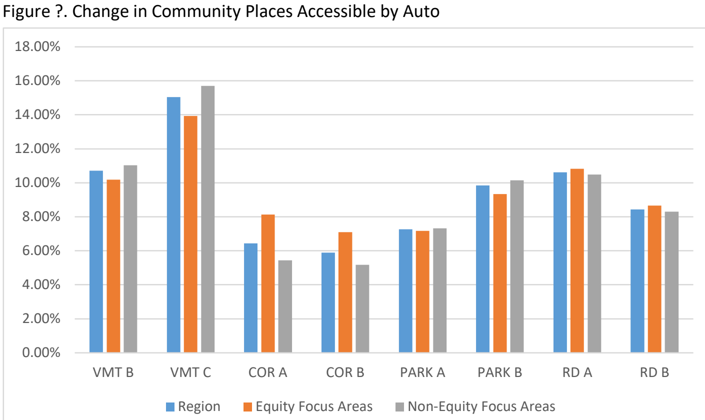


Figure ?. Change in Community Places Accessible by Auto



BY TRANSIT

Average number of jobs accessible w/in a typical commute time[1] for different communities, PM 2-HR	Base	VMT B	VMT C	COR A	COR B	PARK A	PARK B	RD A	RD B
All zones	107,864	109,097	110,058	108,817	108,789	108,242	108,831	107,625	106,394
Equity Zones	135,194	136,216	137,049	135,823	135,750	135,488	135,902	134,804	133,288
Non-Equity Zones	91,019	92,381	93,422	92,171	92,171	91,447	92,145	90,872	89,816

Average percentage of all jobs accessible w/in a typical commute time[1] for different communities, PM 2-HR	Base	VMT B	VMT C	COR A	COR B	PARK A	PARK B	RD A	RD B
All zones	10.1%	10.2%	10.3%	10.2%	10.2%	10.1%	10.0%	10.0%	9.9%
Equity Zones	12.6%	12.7%	12.8%	12.7%	12.7%	12.7%	12.6%	12.6%	12.4%
Non-Equity Zones	43.1%	39.8%	41.5%	36.8%	36.6%	38.3%	40.5%	40.5%	39.9%

Change from Base: Jobs Accessible W/in in a Typical Commute Time[1] for Diff Communities, PM 2-HR								
All Jobs	**VMT B**	**VMT C**	**COR A**	**COR B**	**PARK A**	**PARK B**	**RD A**	**RD B**
Region	1,233	2,194	953	925	377	967	(239)	(1,471)
Equity Focus Areas	1,022	1,855	629	557	295	708	(390)	(1,906)
Non-Equity Focus Areas	1,363	2,403	1,153	1,152	428	1,126	(147)	(1,203)

Change from Base: Jobs Accessible W/in in a Typical Commute Time[1] for Diff Communities, PM 2-HR								
All Jobs	**VMT B**	**VMT C**	**COR A**	**COR B**	**PARK A**	**PARK B**	**RD A**	**RD B**
Region	1.14%	2.03%	0.88%	0.86%	0.35%	0.90%	-0.22%	-1.36%
Equity Focus Areas	0.76%	1.37%	0.47%	0.41%	0.22%	0.52%	-0.29%	-1.41%
Non-Equity Focus Areas	1.50%	2.64%	1.27%	1.27%	0.47%	1.24%	-0.16%	-1.32%

Percent change of jobs accessible compared to All Zones	Base	VMT B	VMT C	COR A	COR B	PARK A	PARK B	RD A	RD B
Equity Zones	25.3%	24.9%	24.5%	24.8%	24.8%	25.2%	24.9%	25.3%	25.3%
Non-Equity Zones	-15.6%	-15.3%	-15.1%	-15.3%	-15.3%	-15.5%	-15.3%	-15.6%	-15.6%

Average number of middle-wage jobs accessible w/in a typical commute time[1] for different communities, PM 2-HR	Base	VMT B	VMT C	COR A	COR B	PARK A	PARK B	RD A	RD B
All zones	29,564	29,899	30,163	29,820	29,814	29,666	29,827	29,497	29,160
Equity Zones	37,111	37,393	37,621	37,281	37,260	37,191	37,307	37,001	36,589
Non-Equity Zones	24,912	25,280	25,566	25,221	25,223	25,028	25,217	24,872	24,581

Average percentage of middle-wage jobs accessible w/in a typical commute time[1] for different communities, PM 2-HR	Base	VMT B	VMT C	COR A	COR B	PARK A	PARK B	RD A	RD B
All zones	2.8%	11.0%	11.1%	2.8%	11.0%	10.9%	10.9%	10.9%	10.8%
Equity Zones	3.5%	13.8%	13.9%	3.5%	13.7%	13.7%	13.6%	13.6%	13.5%
Non-Equity Zones	2.3%	9.3%	9.4%	2.4%	9.3%	9.2%	9.2%	9.2%	9.1%

Percent change of mid-wage jobs accessible compared to All Zones	Base	VMT B	VMT C	COR A	COR B	PARK A	PARK B	RD A	RD B
Equity Zones	25.5%	25.1%	24.7%	25.0%	25.0%	25.4%	25.1%	25.4%	25.5%
Non-Equity Zones	-15.7%	-15.4%	-15.2%	-15.4%	-15.4%	-15.6%	-15.5%	-15.7%	-15.7%

Average Number of Community Places[2] Accessible W/In a Typical Commute Time[1] for Diff Communities, PM 2-HR	Base	VMT B	VMT C	COR A	COR B	PARK A	PARK B	RD A	RD B
All zones	425	459	464	462	460	455	459	451	445
Equity Zones	468	502	507	501	501	498	501	494	488
Non-Equity Zones	399	433	438	437	435	429	433	425	418

Percent change of community places accessible compared to All Zones	Base	VMT B	VMT C	COR A	COR B	PARK A	PARK B	RD A	RD B
Equity Zones	10.1%	9.4%	9.2%	8.6%	8.9%	9.5%	9.2%	9.5%	9.6%
Non-Equity Zones	-6.2%	-5.8%	-5.6%	-5.3%	-5.5%	-5.8%	-5.7%	-5.9%	-5.9%

Change from Base: Community Places Accessible W/in in a Typical Commute Time[1] for Diff Communities, PM 2-HR	VMT B	VMT C	COR A	COR B	PARK A	PARK B	RD A	RD B
All Zones	34	39	36	35	30	34	26	20
Equity Focus Areas	34	39	33	33	30	33	26	20
Non-Equity Focus Areas	34	39	38	37	30	34	26	20

Change from Base: Community Accessible W/in in a Typical Commute Time[1] for Diff Communities, PM 2-HR	VMT B	VMT C	COR A	COR B	PARK A	PARK B	RD A	RD B
Region	8.05%	9.23%	8.56%	8.30%	7.11%	7.99%	6.19%	4.59%
Equity Focus Areas	7.34%	8.31%	7.10%	7.11%	6.50%	7.13%	5.63%	4.18%
Non-Equity Focus Areas	8.56%	9.89%	9.61%	9.17%	7.55%	8.61%	6.59%	4.89%

[1]Typical Commute Times		
Mode	**Travel Time Community Places**	**Travel Time Job Access**
Auto	20 minutes	30 minutes
Transit	30 minutes	45 minutes

[2] **Community places** include hospitals and other medical services, civic places such as post offices, churches, social services, libraries, schools and colleges, financial institutions, grocerty stores, and essential retail services such as hardware stores, pharmacies, and laundry services

Figure 1.4-14. Change in Jobs Accessible by Transit

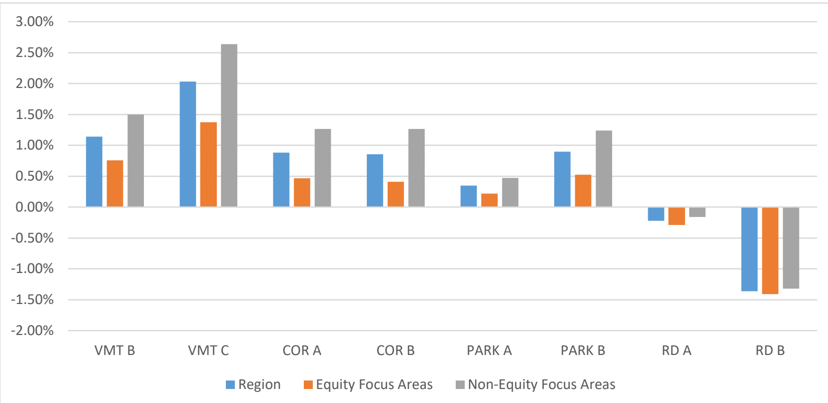
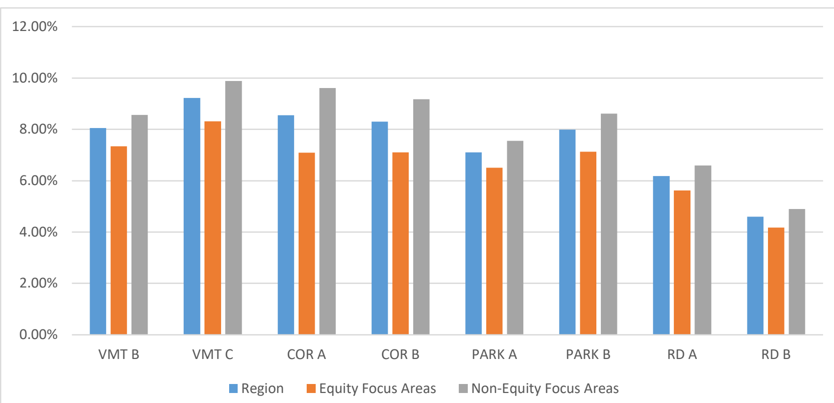


Figure ?. Change in Community Places Accessible by Transit



Appendix D.1 Model Data Summary - Cost outputs

RCPS Scenario	Operating K	Toll K	Parking K	Trfare K	Totcost K
BASE	$8,108	$0	$2,333	$689	$11,130
VMT B	$9,580	$0	$2,308	$700	$12,589
VMT C	$10,786	$0	$2,247	$724	$13,757
COR A	$7,986	$489	$1,997	$727	$11,199
COR B	$7,954	$641	$1,914	$736	$11,245
AREA A	$8,002	$387	$2,083	$714	$11,185
PARK A	$7,940	$0	$2,427	$764	$11,131
PARK B	$8,061	$0	$2,396	$702	$11,159
RD A	$7,869	$971	$2,303	$698	$11,841
RD B	$7,702	$1,128	$2,269	$710	$11,808

Change from Base					
RCPS Scenario	**Operating K**	**Toll K**	**Parking K**	**Trfare K**	**Totcost K**
VMT B	$1,472	$0	-$25	$11	$1,459
VMT C	$2,678	$0	-$86	$35	$2,627
COR A	-$122	$489	-$336	$38	$69
COR B	-$154	$641	-$419	$47	$115
AREA A	-$106	$387	-$251	$25	$55
PARK A	-$46	$0	$63	$13	$29
PARK B	-$168	$0	$94	$75	$1
RD A	-$238	$971	-$30	$9	$712
RD B	-$406	$1,128	-$64	$21	$678

Percent Change from Base					
RCPS Scenario	**Operating K**	**Toll K**	**Parking K**	**Trfare K**	**Totcost K**
VMT B	18.16%	0.00%	-0.31%	0.14%	17.99%
VMT C	27.95%	0.00%	-0.90%	0.37%	27.42%
COR A	-1.13%	4.54%	-3.12%	0.35%	0.64%
COR B	-1.93%	8.03%	-5.25%	0.59%	1.44%
AREA A	-1.33%	4.86%	-3.15%	0.32%	0.70%
PARK A	-0.58%	0.00%	0.78%	0.16%	0.37%
PARK B	-2.12%	0.00%	1.18%	0.95%	0.01%
RD A	-2.96%	12.05%	-0.38%	0.11%	8.83%
RD B	-5.16%	14.33%	-0.82%	0.26%	8.62%

Figure 1.4-15. Total Travel Cost, Change from Base

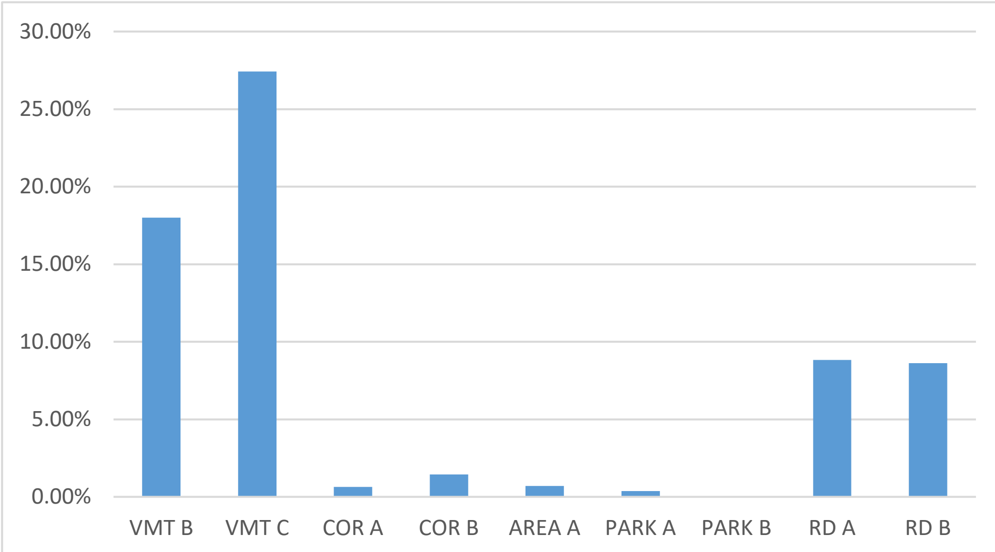
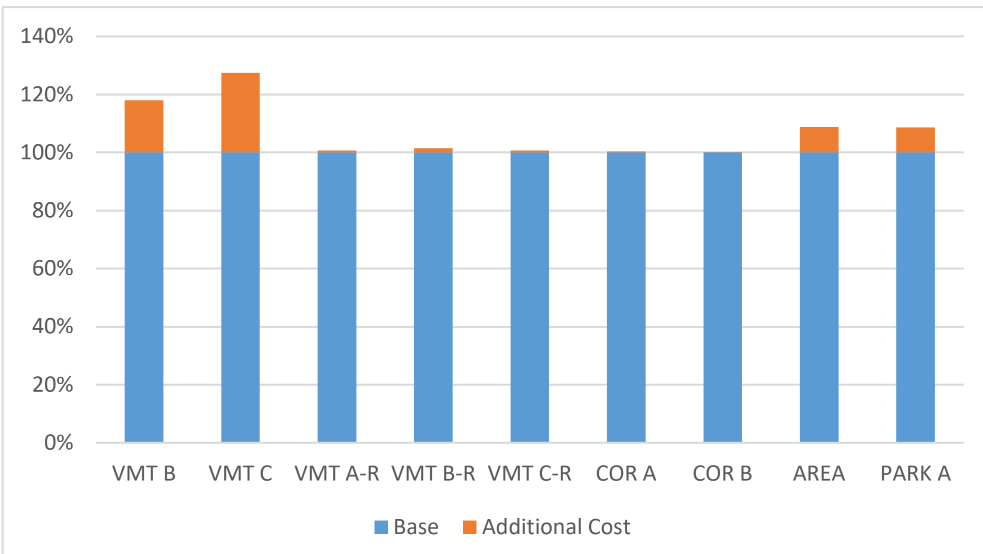


Figure 1.4-16. Total Travel Cost, Increase over Base



APPENDIX D.2: INDIVIDUAL TRIP EXAMPLES

Name	Mode	Trip	VMT B		VMT C		COR A		COR B		PARK A	
			Change in Travel Time	Change in Cost	Change in Travel Time	Change in Cost	Change in Travel Time	Change in Cost	Change in Travel Time	Change in Cost	Change in Travel Time	Change in Cost
Sally	Drive	Oregon City to Swan Island	2.0	$2.50	4.0	$4.50	2.0	$0.00	10.0	$11.50	1.5	$0.00
Ben	Transit	Gresham to Gateway	0.0	$0.00	0.0	$0.00	0.0	$0.00	0.0	$0.00	0.0	$0.00
Jill	Drive	Beaverton to Hillsboro	1.0	$1.50	1.5	$2.50	0.0	$0.00	0.0	$0.00	0.0	$0.50
Jack	Drive	Vancouver to Lloyd Center	0.5	$1.50	1.0	$3.00	0.5	$0.00	0.0	$5.50	0.0	$4.00
Martha	Transit	Inner-East Side Portland to Downtown Portland	0.5	$0.00	0.5	$0.00	0.5	$0.00	0.0	$0.00	0.5	$0.00
Angela	Drive	Northeast Portland to Hillsboro	2.5	$2.50	4.5	$5.00	4.0	$11.50	4.0	$11.50	0.0	$0.00
Roberto	Drive	Woodstock to Downtown Portland	1.0	$1.00	2.0	$1.50	2.5	$5.50	5.0	$5.50	1.0	$4.00
Marcus	Transit	Tigard to PSU	0.5	$0.00	0.5	$0.00	0.0	$0.00	0.0	$0.00	0.0	$0.00
Sarah	Transit	Lake Oswego to St. Vincent's	1.0	$0.00	2.0	$0.00	1.5	$0.00	1.5	$0.00	0.5	$0.00
Mike	Drive	Milwaukie to Wilsonville	1.5	$2.50	3.0	$5.00	0.0	$0.00	0.5	$0.00	0.0	$0.50
Carrie	Drive	Vancouver to Downtown Portland	0.5	$1.50	1.5	$2.50	1.5	$5.50	1.5	$5.50	0.0	$4.00

APPENDIX D.3: EXAMPLE TRIP COSTS

Additional One-Way Costs For Various Driving Trips (over 2027FC base)											
From	To	Dist. (Total)	Dist. (FWY)	VMT B	VMT C	COR A	COR B	PARK A	PARK B	RD A	RD B
Troutdale Airport	Hillsboro Intel Campus	31.4	29	$ 2.15	$ 4.14	$ -	$ -	$ -	$ -	$ 3.83	$ 7.66
Portland Airport	Bridgeport Village	22.3	20	$ 1.53	$ 2.94	$ -	$ -	$ -	$ -	$ 2.64	$ 5.28
Downtown Beaverton	Oregon City	18.6	18	$ 1.27	$ 2.46	$ -	$ -	$ -	$ 4.46	$ 2.38	$ 4.75
Clackamas Town Center	Gateway	7.7	7	$ 0.53	$ 1.02	$ -	$ -	$ 0.40	$ 2.03	$ 0.92	$ 1.85
Gateway	Montgomery Park	9.4	9	$ 0.64	$ 1.24	$ -	$ -	$ -	$ -	$ 1.19	$ 2.38
Adidas Headquarters	Nike Headquarters	12.2	10	$ 0.84	$ 1.61	$ -	$ -	$ -	$ -	$ 1.32	$ 2.64
Downtown Gresham	Lloyd District	14.8	12	$ 1.01	$ 1.95	$ -	$ 5.63	$ 3.97	$16.13	$ 1.58	$ 3.17

*For RD A and RD B, trips are assumed to utilize the throughway.
*For COR A and COR B, trips not ending in downtown Portland are assumed to remain on the throughways.

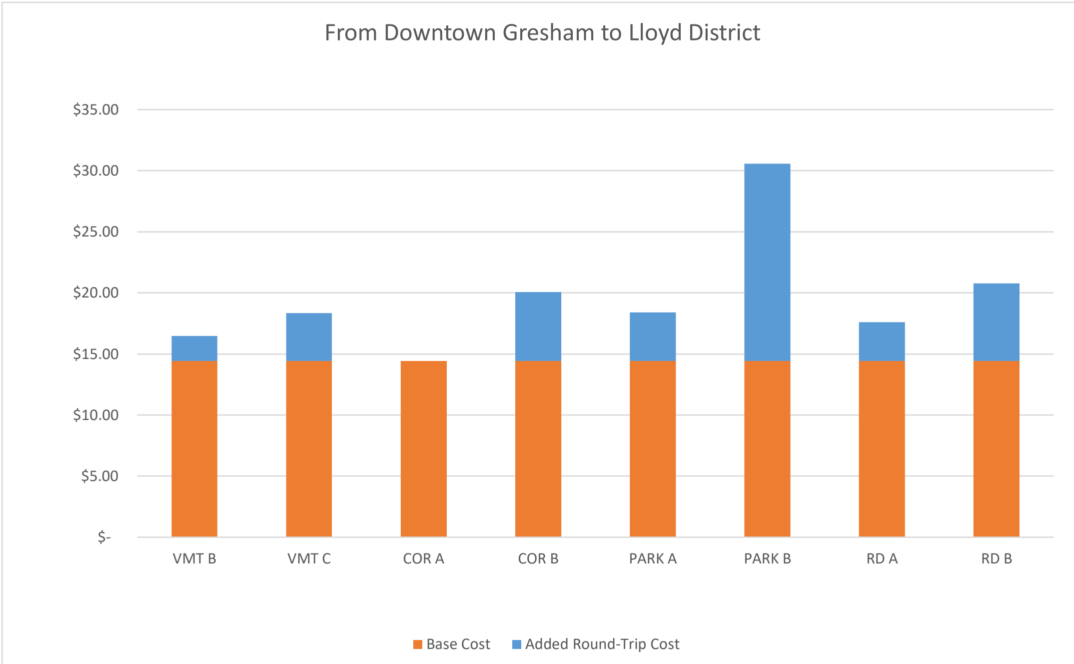
Additional Round-Trip Costs For Various Driving Trips (over 2027FC base)												
From	To	Dist. (Total)	Dist. (FWY)	VMT B	VMT C	COR A	COR B	PARK A	PARK B	RD A	RD B	Base Total
Troutdale Airport	Hillsboro Intel Campus	62.8	58	$ 4.30	$ 8.29	$ -	$ -	$ -	$ -	$ 7.66	$15.31	$ 13.25
Portland Airport	Bridgeport Village	44.6	40	$ 3.06	$ 5.89	$ -	$ -	$ -	$ -	$ 5.28	$10.56	$ 9.41
Downtown Beaverton	Oregon City	37.2	36	$ 2.55	$ 4.91	$ -	$ -	$ -	$ 4.46	$ 4.75	$ 9.50	$ 9.95
Clackamas Town Center	Gateway	15.4	14	$ 1.05	$ 2.03	$ -	$ -	$ 0.40	$ 2.03	$ 1.85	$ 3.70	$ 4.48
Gateway	Montgomery Park	18.8	18	$ 1.29	$ 2.48	$ -	$ -	$ -	$ -	$ 2.38	$ 4.75	$ 3.97
Adidas Headquarters	Nike Headquarters	24.4	20	$ 1.67	$ 3.22	$ -	$ -	$ -	$ -	$ 2.64	$ 5.28	$ 5.15
Downtown Gresham	Lloyd District	29.6	24	$ 2.03	$ 3.91	$ -	$ 5.63	$ 3.97	$16.13	$ 3.17	$ 6.34	$ 14.44

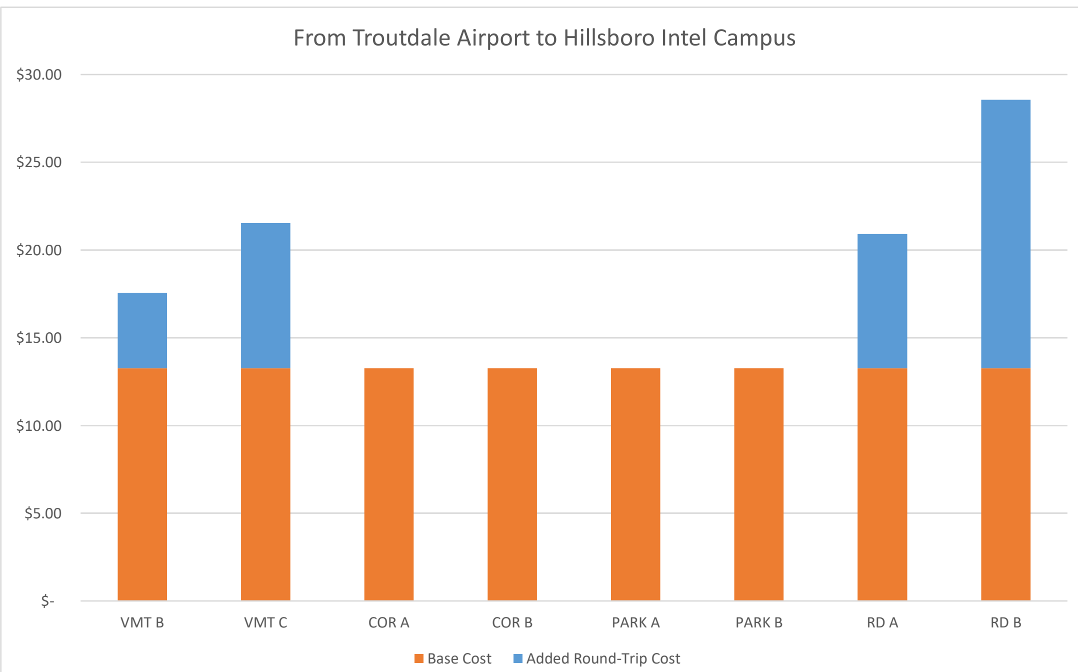
*For RD A and RD B, trips are assumed to utilize the throughway.
*For COR A and COR B, trips not ending in downtown Portland are assumed to remain on the throughways.

Total Round-Trip Costs For Various Driving Trips (over 2027FC base)												
From	To	Dist. (Total)	Dist. (FWY)	VMT B	VMT C	COR A	COR B	PARK A	PARK B	RD A	RD B	Base Total
Troutdale Airport	Hillsboro Intel Campus	31.4	29	$17.55	$21.54	$13.25	$13.25	$13.25	$13.25	$20.91	$28.56	$ 13.25
Portland Airport	Bridgeport Village	22.3	20	$12.47	$15.30	$ 9.41	$ 9.41	$ 9.41	$ 9.41	$14.69	$19.97	$ 9.41
Downtown Beaverton	Oregon City	18.6	18	$12.50	$14.86	$ 9.95	$ 9.95	$ 9.95	$14.41	$14.70	$19.45	$ 9.95
Clackamas Town Center	Gateway	7.7	7	$ 5.53	$ 6.51	$ 4.48	$ 4.48	$ 4.88	$ 6.51	$ 6.33	$ 8.18	$ 4.48
Gateway	Montgomery Park	9.4	9	$ 5.25	$ 6.45	$ 3.97	$ 3.97	$ 3.97	$ 3.97	$ 6.34	$ 8.72	$ 3.97
Adidas Headquarters	Nike Headquarters	12.2	10	$ 6.82	$ 8.37	$ 5.15	$ 5.15	$ 5.15	$ 5.15	$ 7.79	$10.43	$ 5.15
Downtown Gresham	Lloyd District	14.8	12	$16.46	$18.34	$14.44	$20.07	$18.41	$30.57	$17.60	$20.77	$ 14.44

*For RD A and RD B, trips are assumed to utilize the throughway.
*For COR A and COR B, trips not ending in downtown Portland are assumed to remain on the throughways.

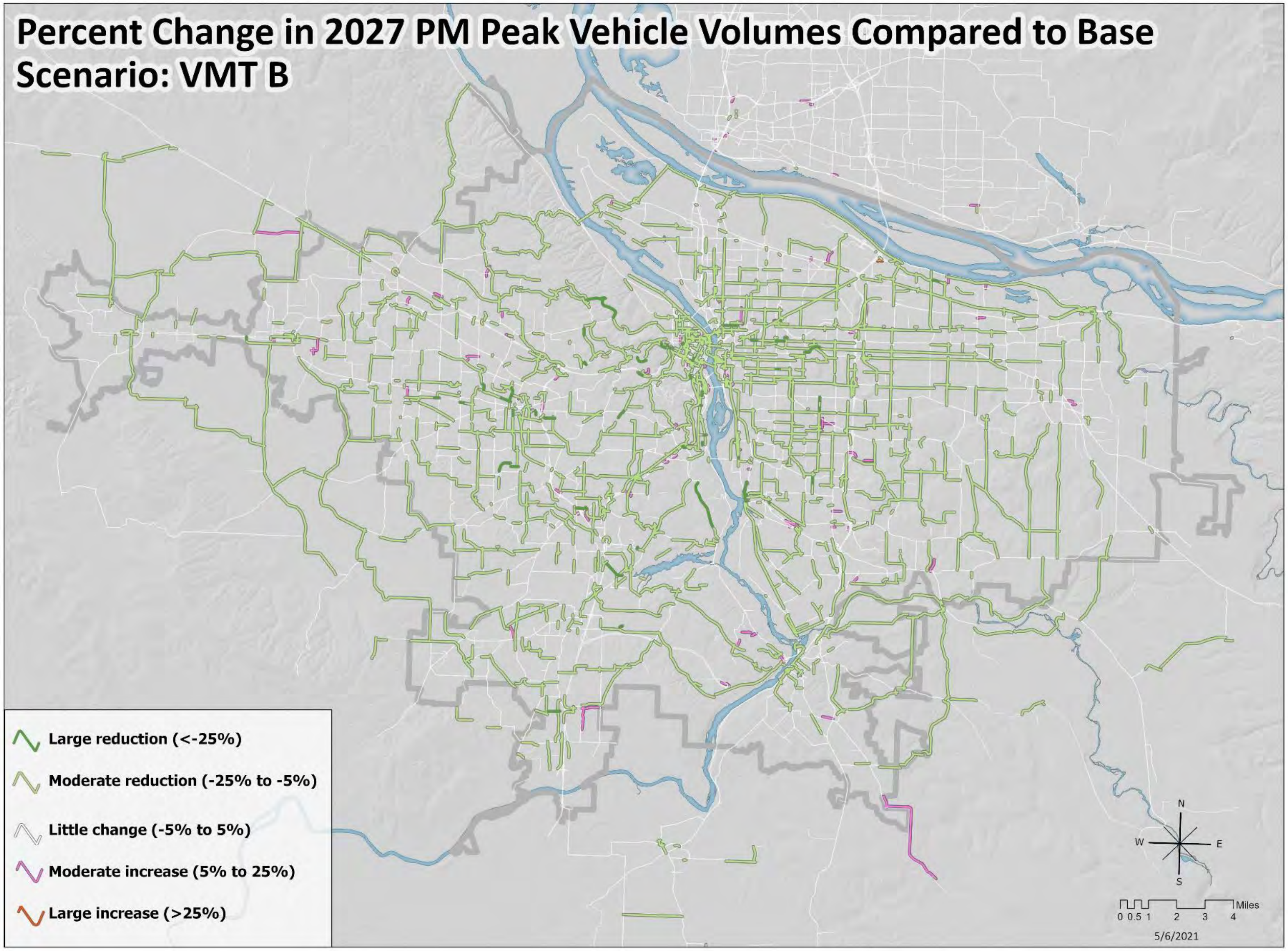
Additional Round-Trip Costs For Various Transit Trips (over 2027FC base)									
From	To	VMT B	VMT C	COR A	COR B	PARK A	PARK B	RD A	RD B
Troutdale Airport	Hillsboro Intel Campus	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Portland Airport	Bridgeport Village	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Downtown Beaverton	Oregon City	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Clackamas Town Center	Gateway	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Gateway	Montgomery Park	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Adidas Headquarters	Nike Headquarters	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Downtown Gresham	Lloyd District	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -


From Downtown Gresham to Lloyd District
$35.00
$30.00
$25.00
$20.00
$15.00
$10.00
$5.00
$-
VMT B
VMT C
COR A
COR B
PARK A
PARK B
RD A
RD B
Base Cost
Added Round-Trip Cost

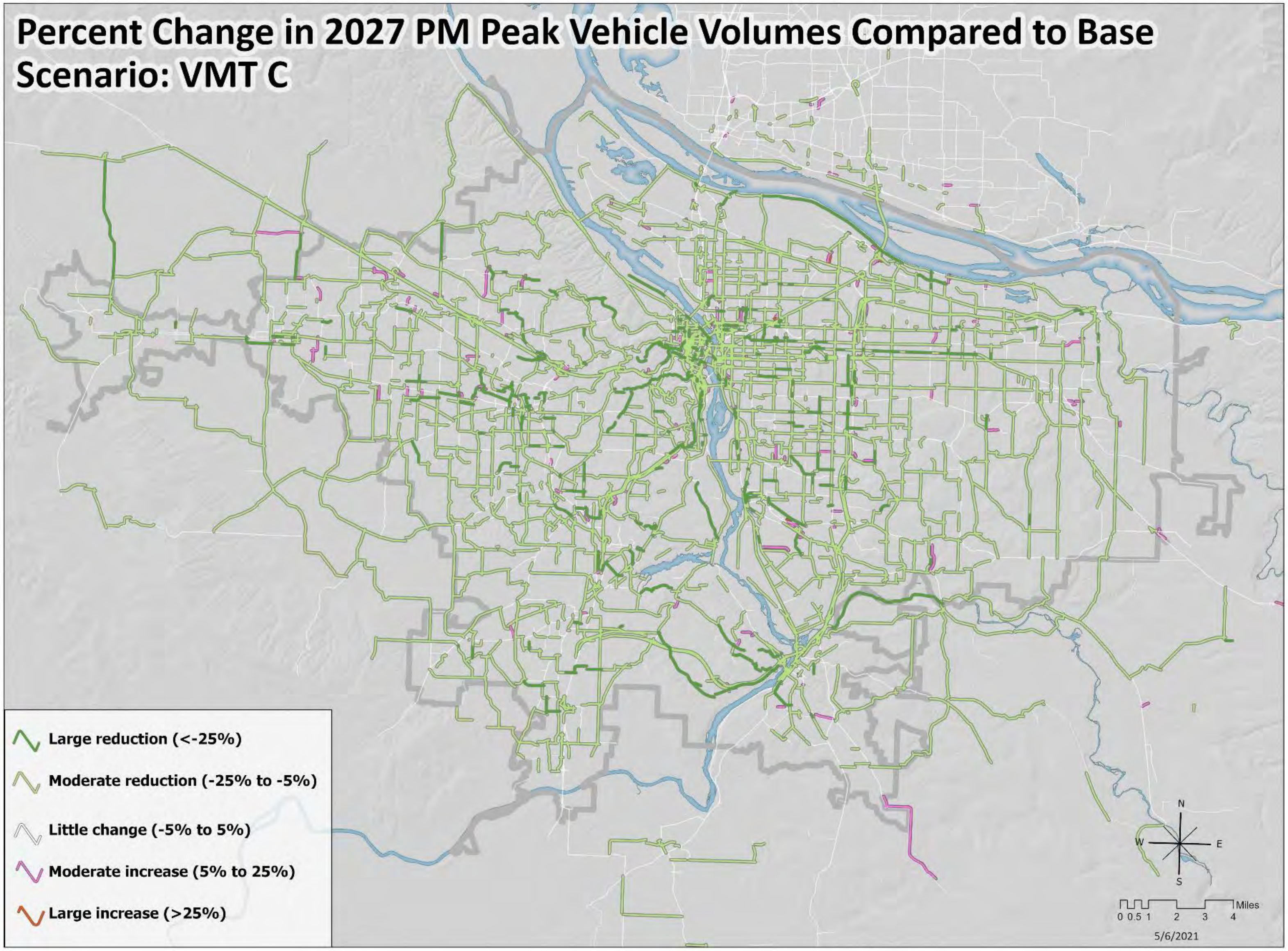

From Troutdale Airport to Hillsboro Intel Campus
$30.00
$25.00
$20.00
$15.00
$10.00
$5.00
$-
VMT B
VMT C
COR A
COR B
PARK A
PARK B
RD A
RD B
Base Cost
Added Round-Trip Cost

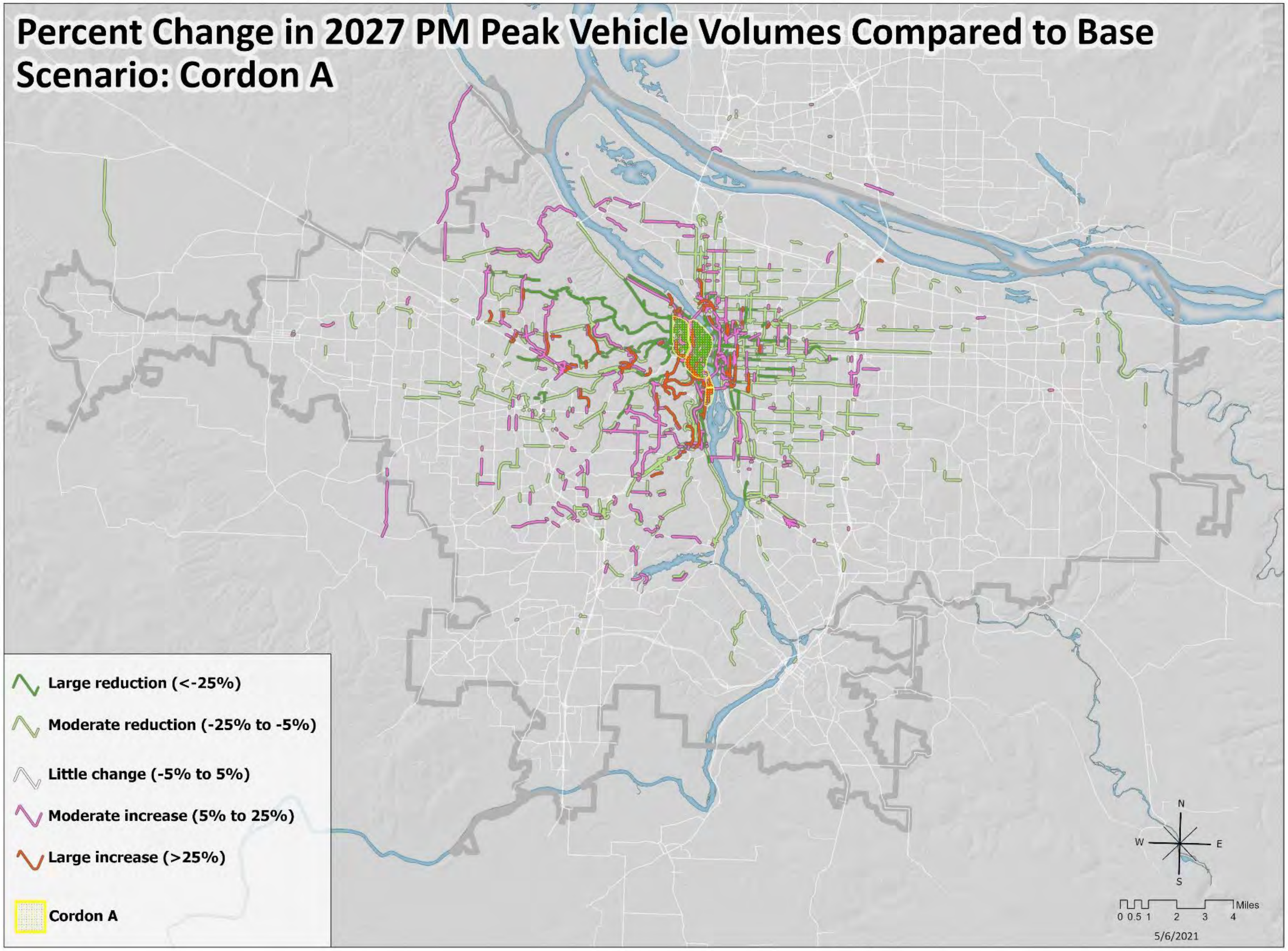
APPENDIX D.4: CHANGE IN VEHICLE VOLUMES MAPS

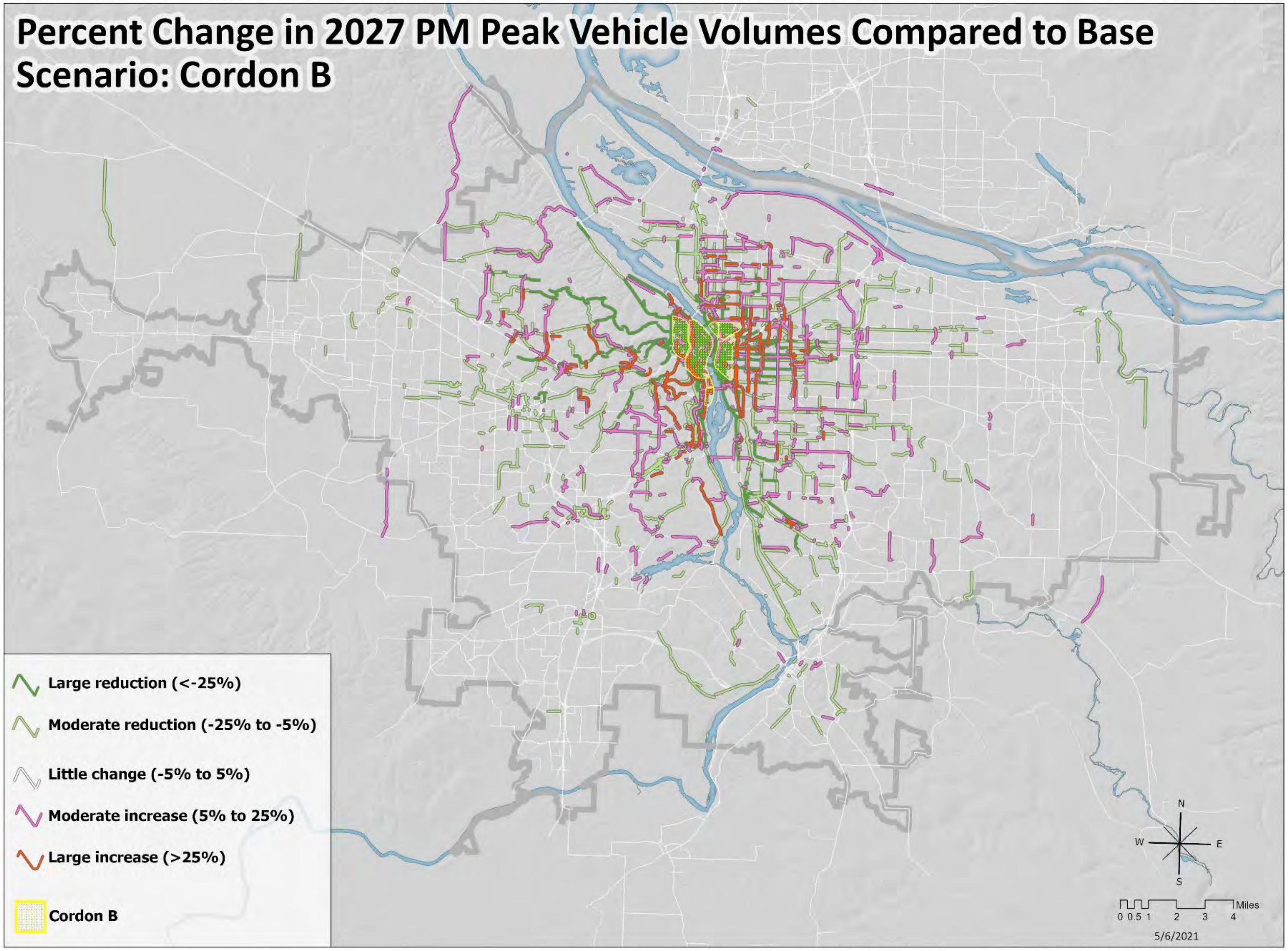
Percent Change in 2027 PM Peak Vehicle Volumes Compared to Base Scenario: VMT B



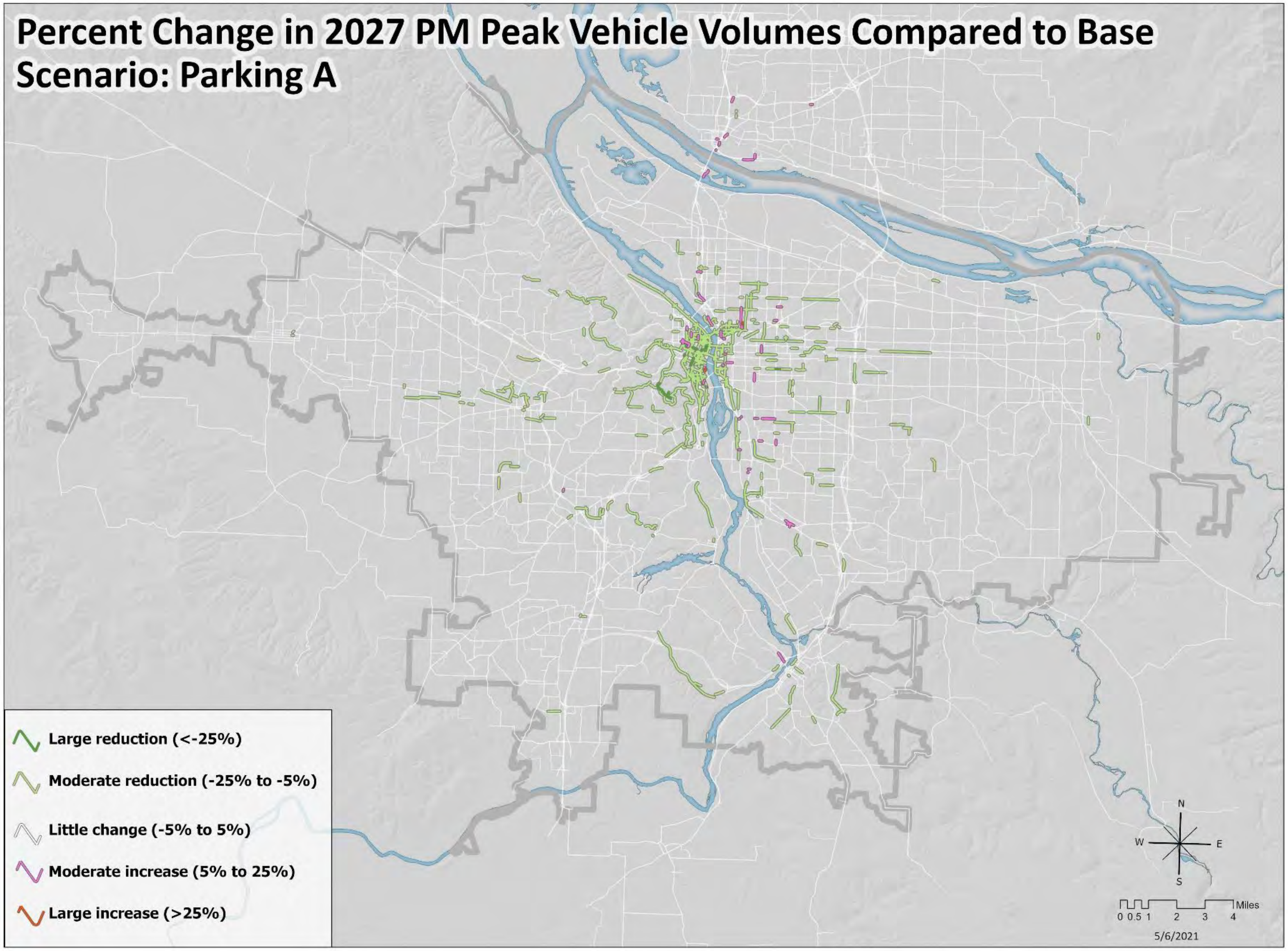
Percent Change in 2027 PM Peak Vehicle Volumes Compared to Base Scenario: VMT C

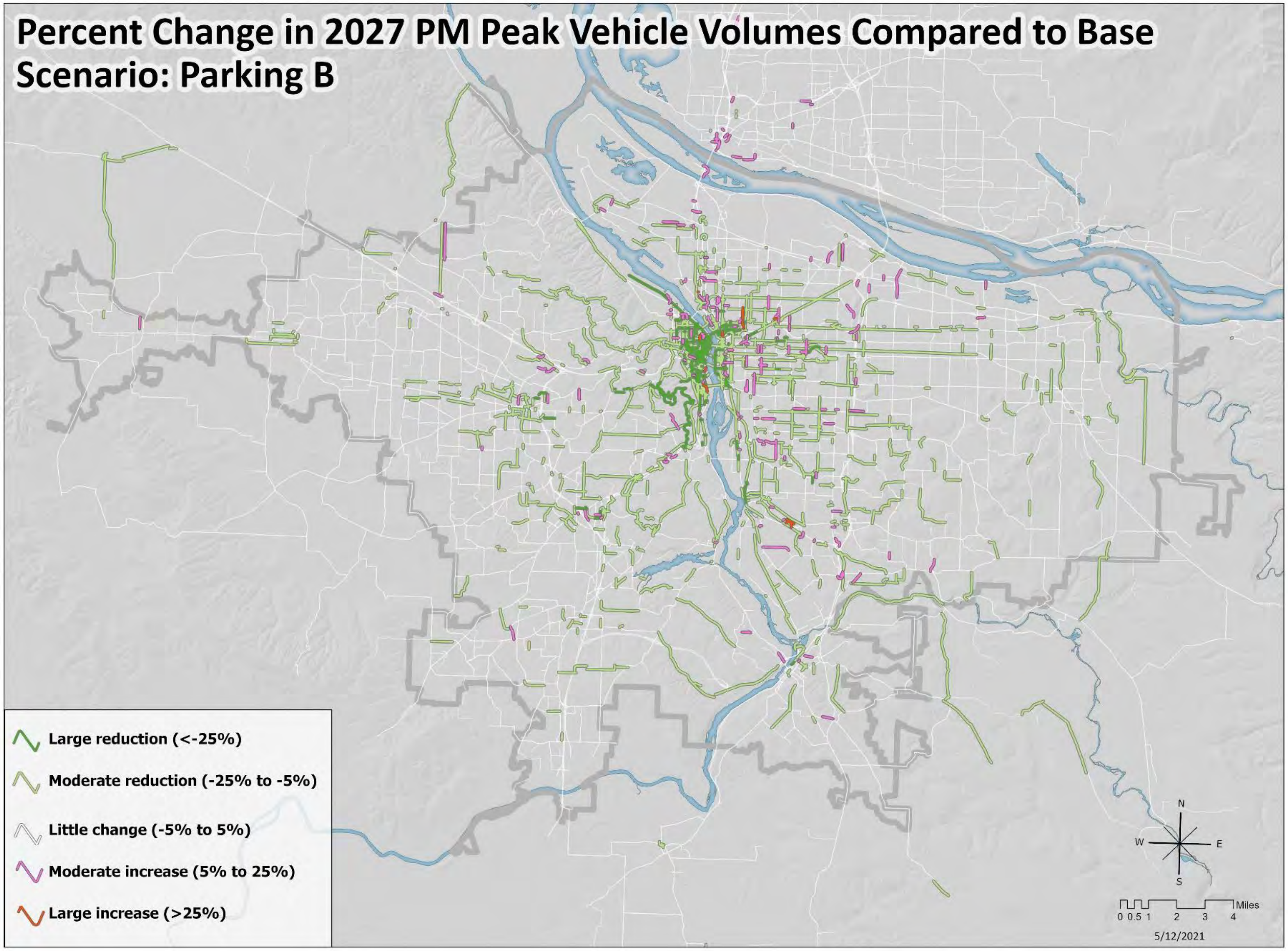



Percent Change in 2027 PM Peak Vehicle Volumes Compared to Base Scenario: Cordon A
Large reduction (<-25%)
Moderate reduction (-25% to -5%)
Little change (-5% to 5%)
Moderate increase (5% to 25%)
Large increase (>25%)
Cordon A
N
W
E
S
0 0.5 1 2 3 4 Miles
5/6/2021


Percent Change in 2027 PM Peak Vehicle Volumes Compared to Base Scenario: Cordon B
Large reduction (<-25%)
Moderate reduction (-25% to -5%)
Little change (-5% to 5%)
Moderate increase (5% to 25%)
Large increase (>25%)
Cordon B
N
W
E
S
0 0.5 1 2 3 4 Miles
5/6/2021

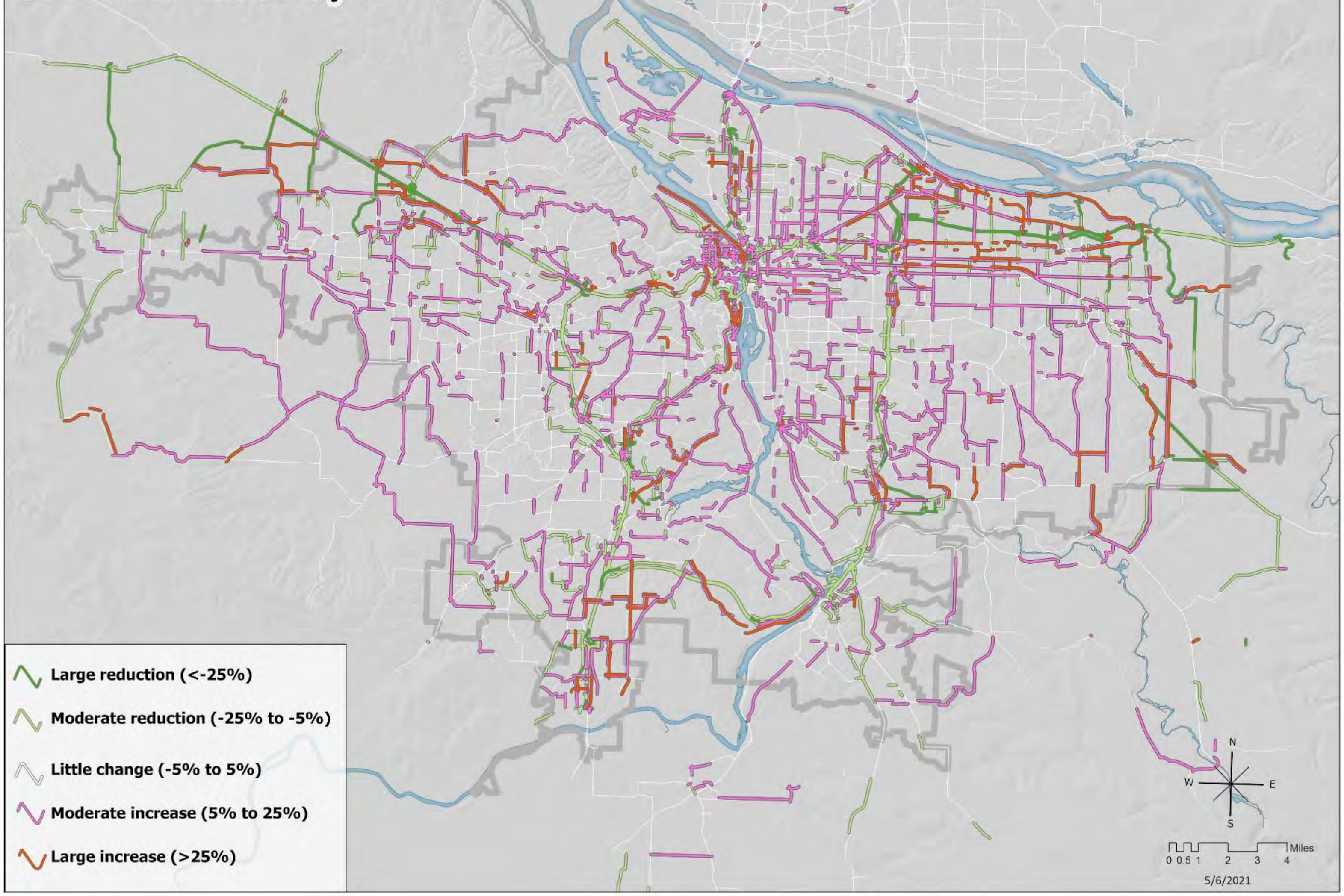
Percent Change in 2027 PM Peak Vehicle Volumes Compared to Base Scenario: Parking A

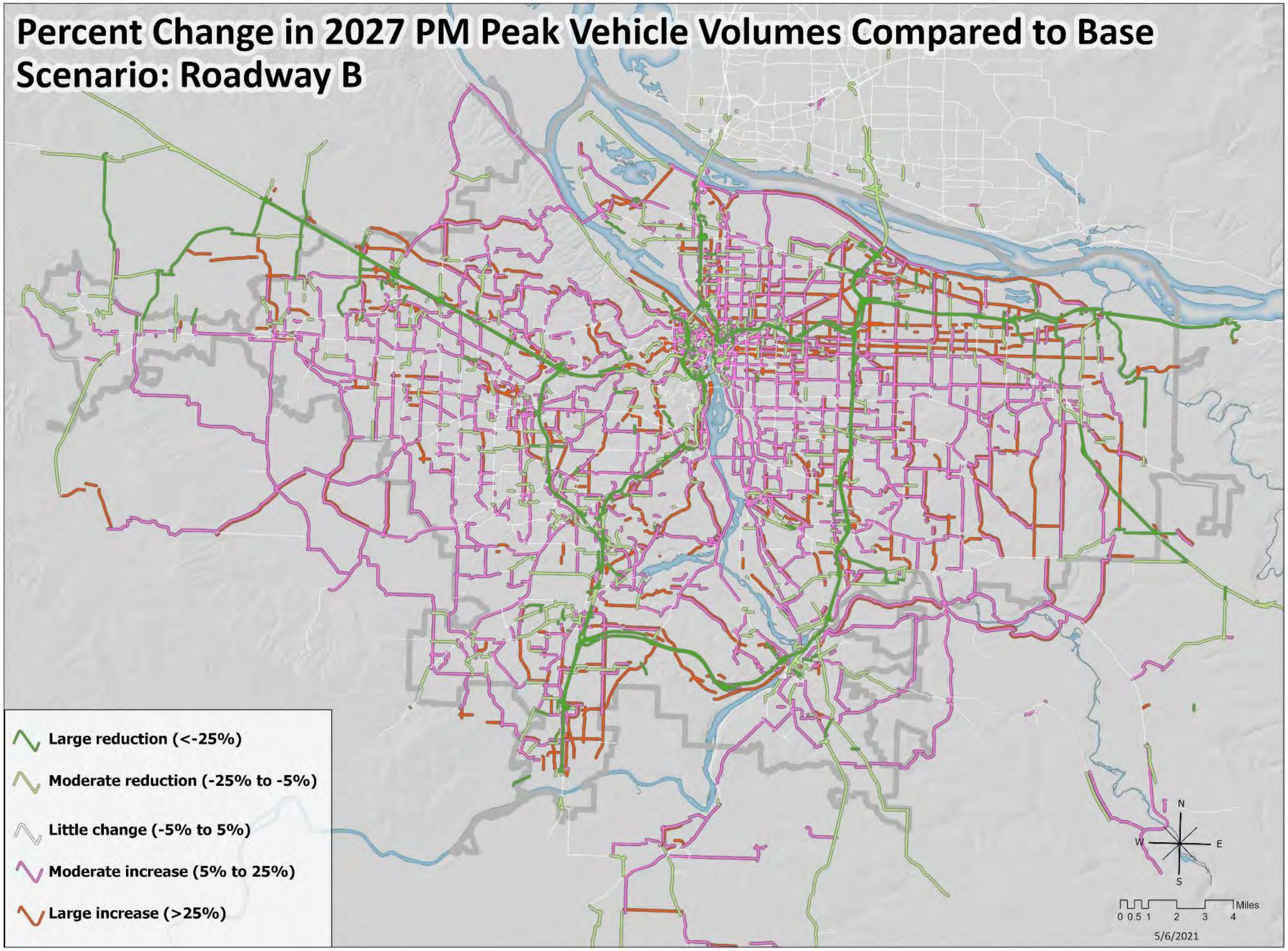




Percent Change in 2027 PM Peak Vehicle Volumes Compared to Base
Scenario: Parking B
Large reduction (<-25%)
Moderate reduction (-25% to -5%)
Little change (-5% to 5%)
Moderate increase (5% to 25%)
Large increase (>25%)
N
W
E
S
Miles
0 0.5 1 2 3 4
5/12/2021

Percent Change in 2027 PM Peak Vehicle Volumes Compared to Base Scenario: Roadway A

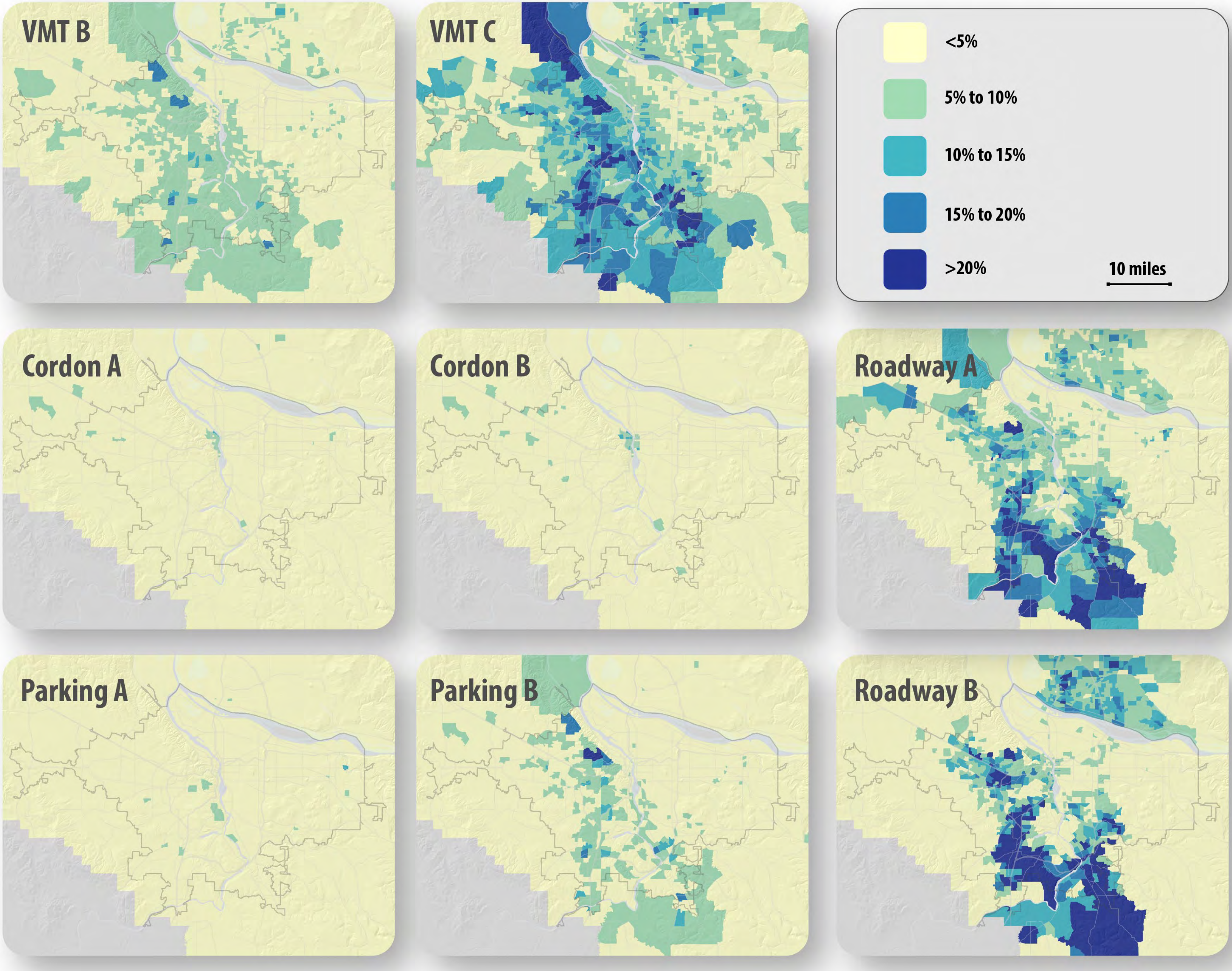




Percent Change in 2027 PM Peak Vehicle Volumes Compared to Base Scenario: Roadway B
Large reduction (<-25%)
Moderate reduction (-25% to -5%)
Little change (-5% to 5%)
Moderate increase (5% to 25%)
Large increase (>25%)
N
E
S
W
0 0.5 1 2 3 4 Miles
5/6/2021

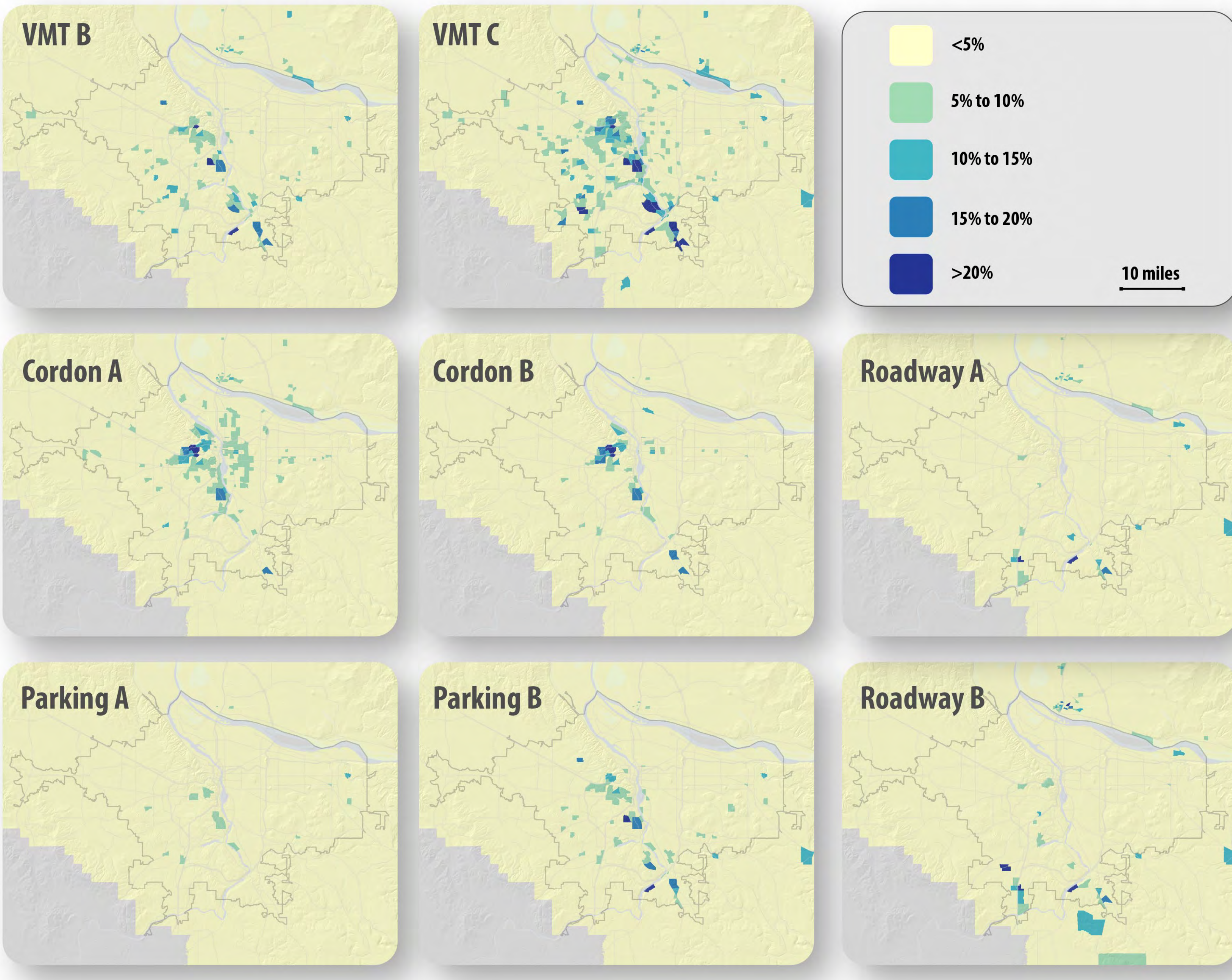
APPENDIX D.5: CHANGE IN ACCESSIBILITY TO JOBS BY AUTO MAPS

Percent Change in Access to Jobs by Auto

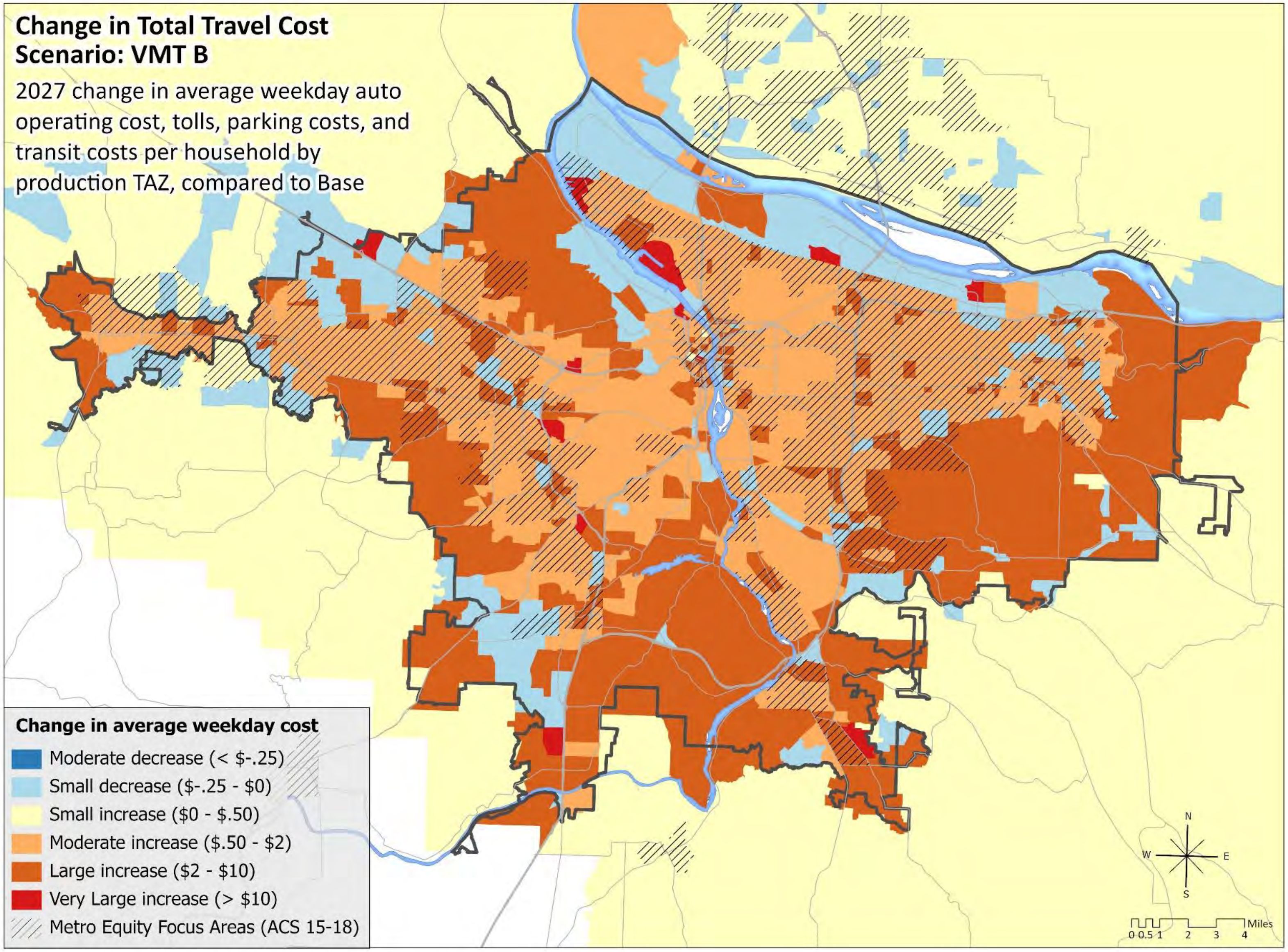


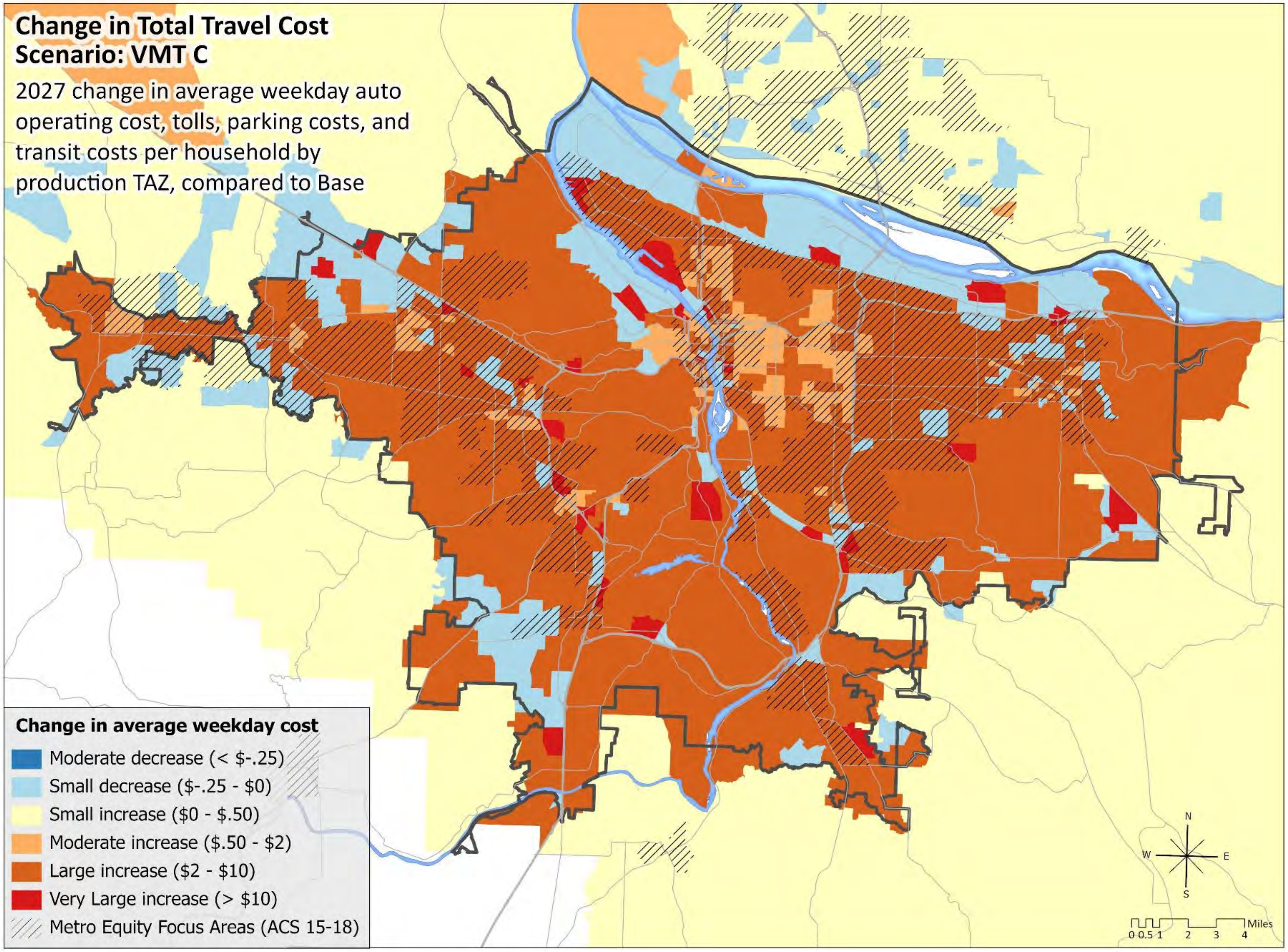
APPENDIX D.6: CHANGE IN ACCESSIBILITY TO JOBS BY TRANSIT MAPS

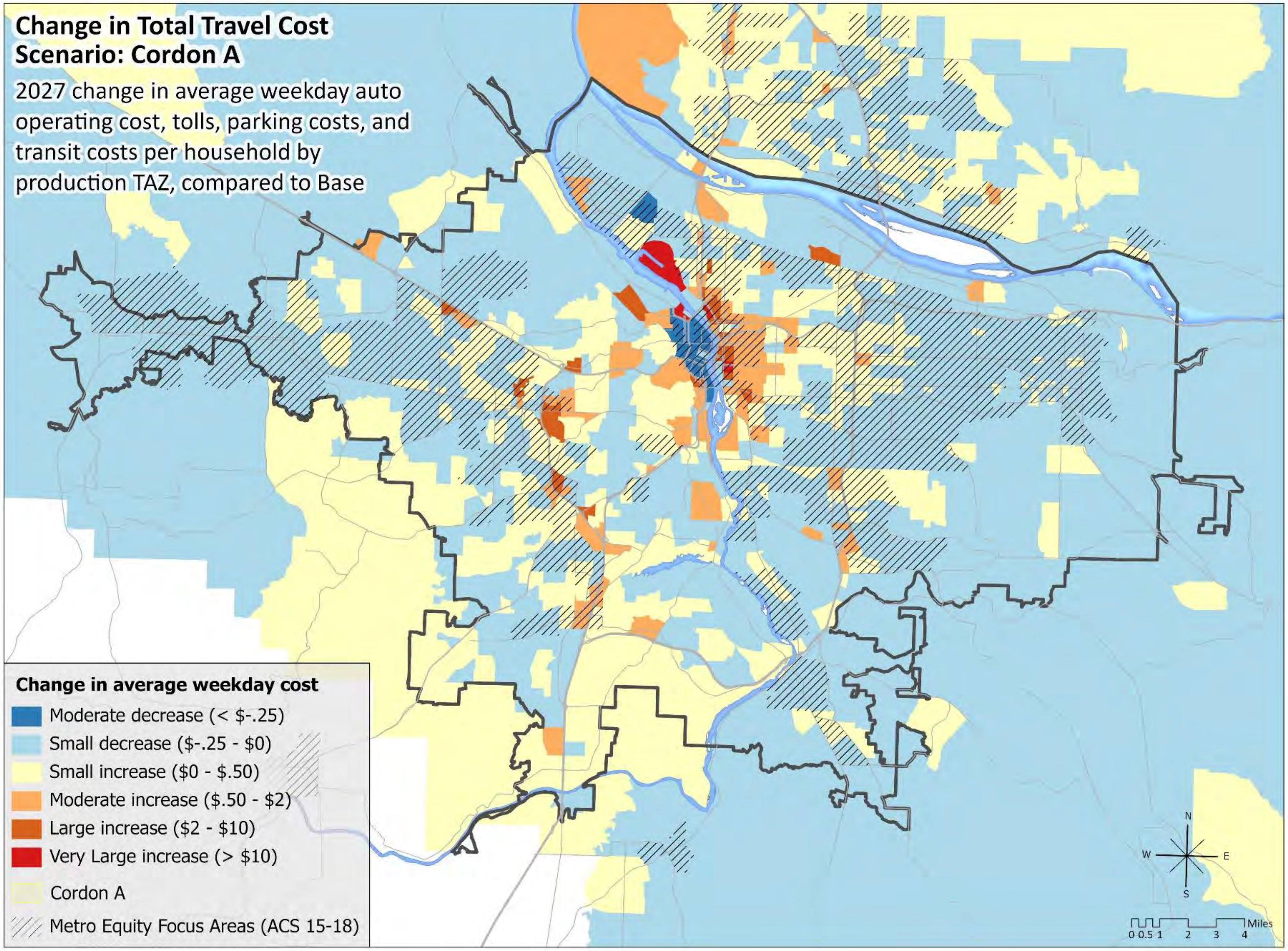
Percent Change in Access to Jobs by Transit

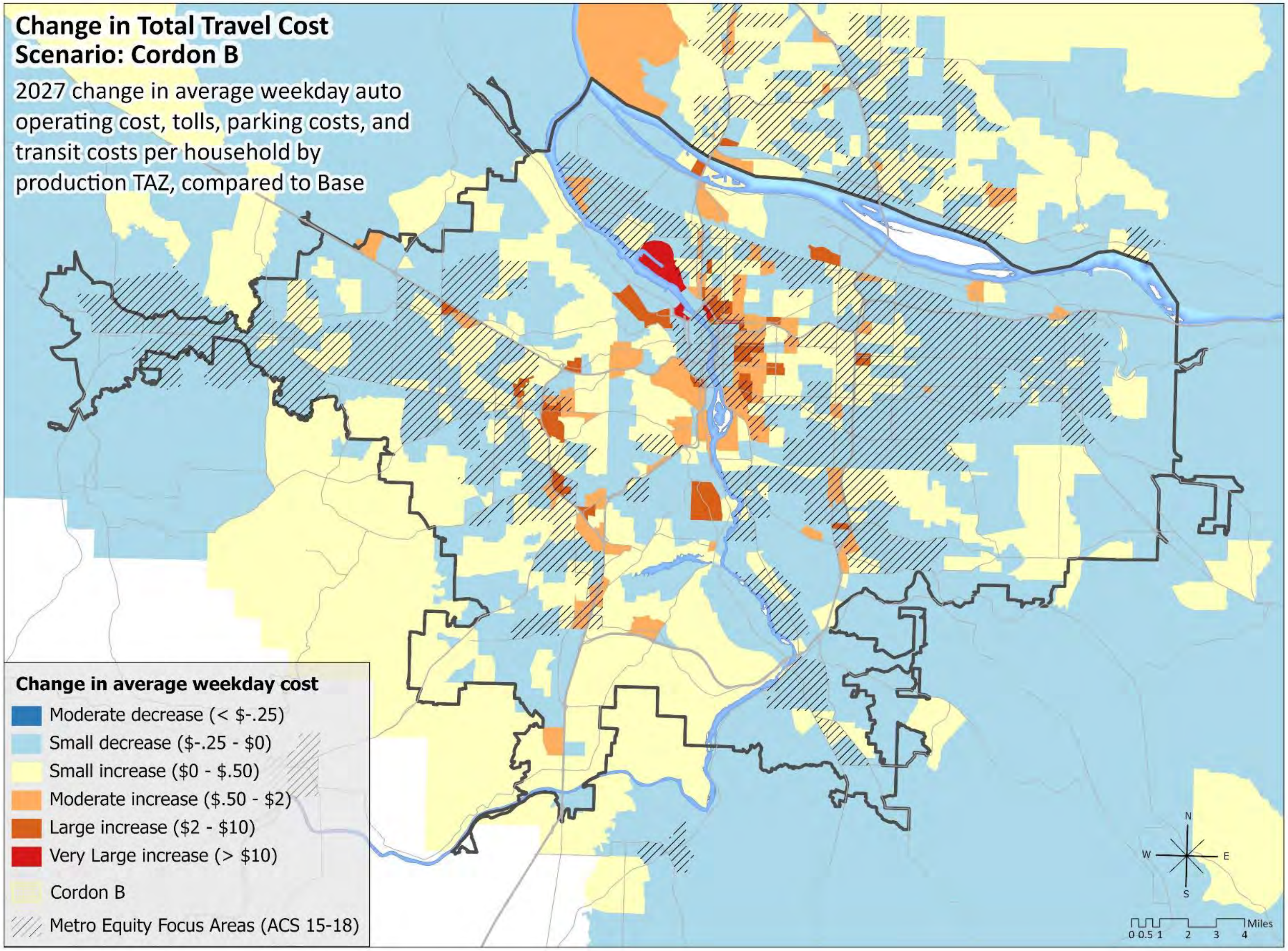


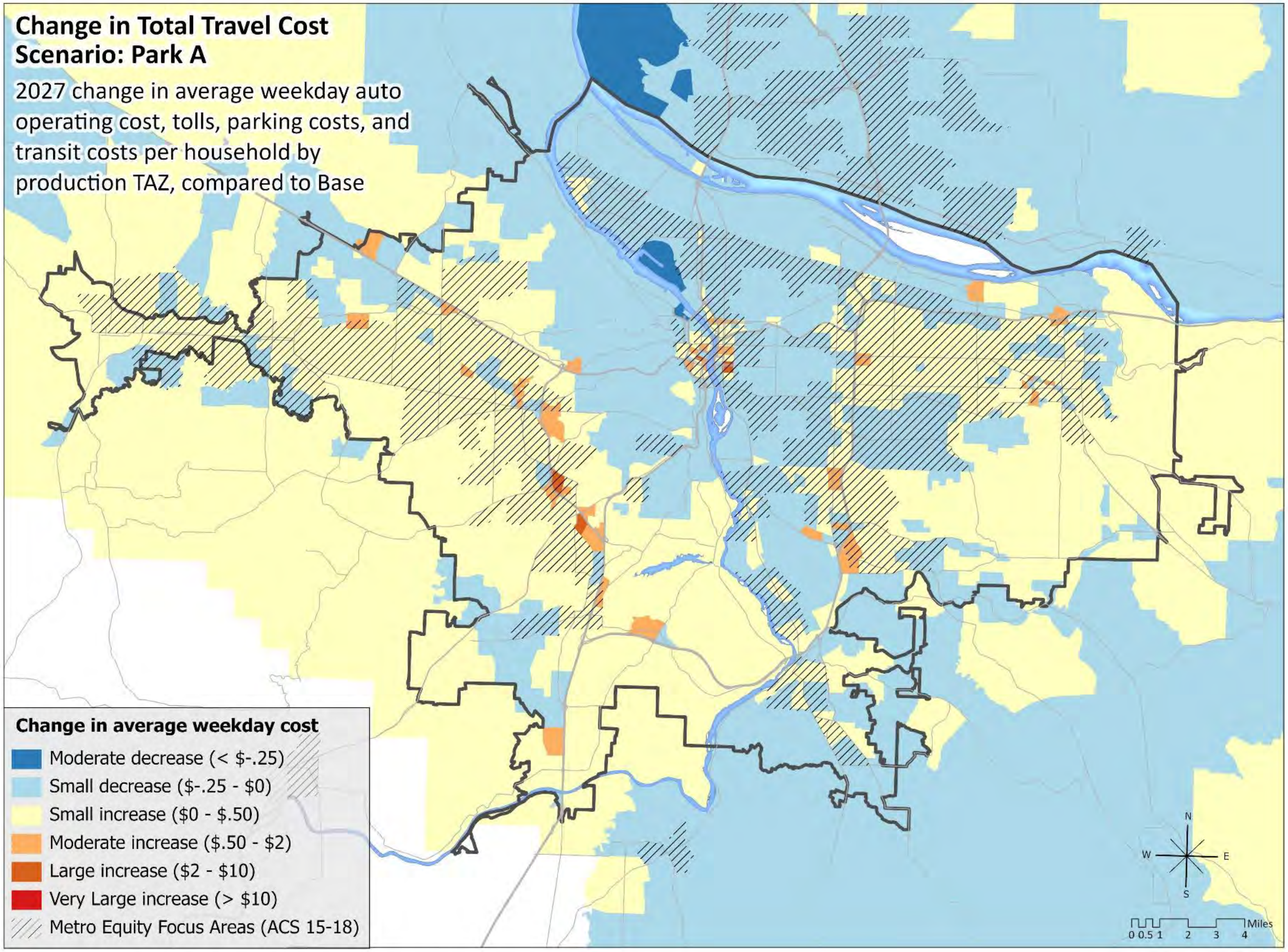
APPENDIX D.7: CHANGE IN TOTAL TRAVEL COST MAPS

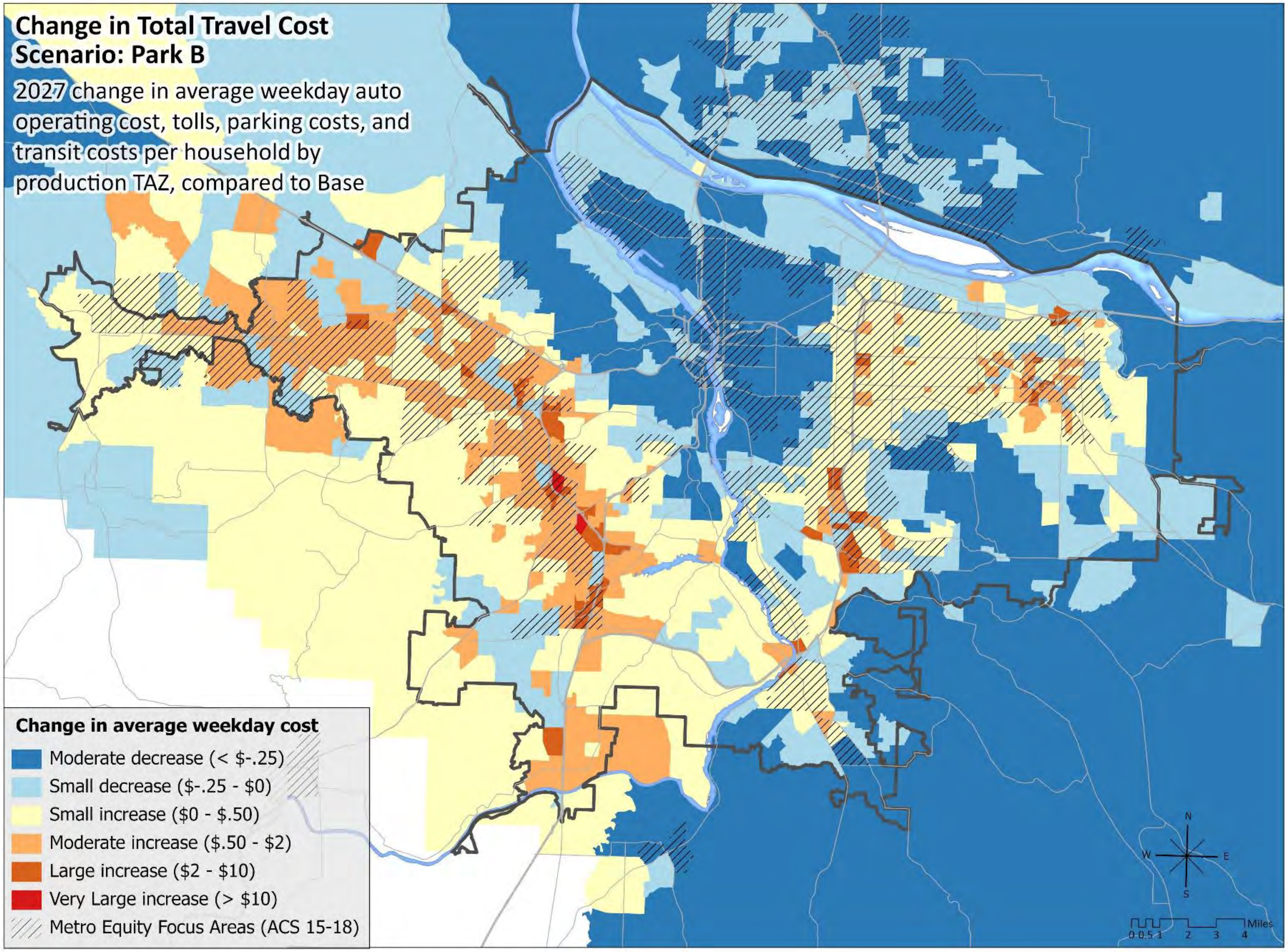

Change in Total Travel Cost
Scenario: VMT B
2027 change in average weekday auto operating cost, tolls, parking costs, and transit costs per household by production TAZ, compared to Base
Change in average weekday cost
Moderate decrease (< $-.25)
Small decrease ($-.25 - $0)
Small increase ($0 - $.50)
Moderate increase ($.50 - $2)
Large increase ($2 - $10)
Very Large increase (> $10)
Metro Equity Focus Areas (ACS 15-18)
N
W
E
S
0 0.5 1 2 3 4
Miles


Change in Total Travel Cost
Scenario: VMT C
2027 change in average weekday auto operating cost, tolls, parking costs, and transit costs per household by production TAZ, compared to Base
Change in average weekday cost
Moderate decrease (< $-.25)
Small decrease ($-.25 - $0)
Small increase ($0 - $.50)
Moderate increase ($.50 - $2)
Large increase ($2 - $10)
Very Large increase (> $10)
Metro Equity Focus Areas (ACS 15-18)
N
W
E
S
0 0.5 1 2 3 4 Miles

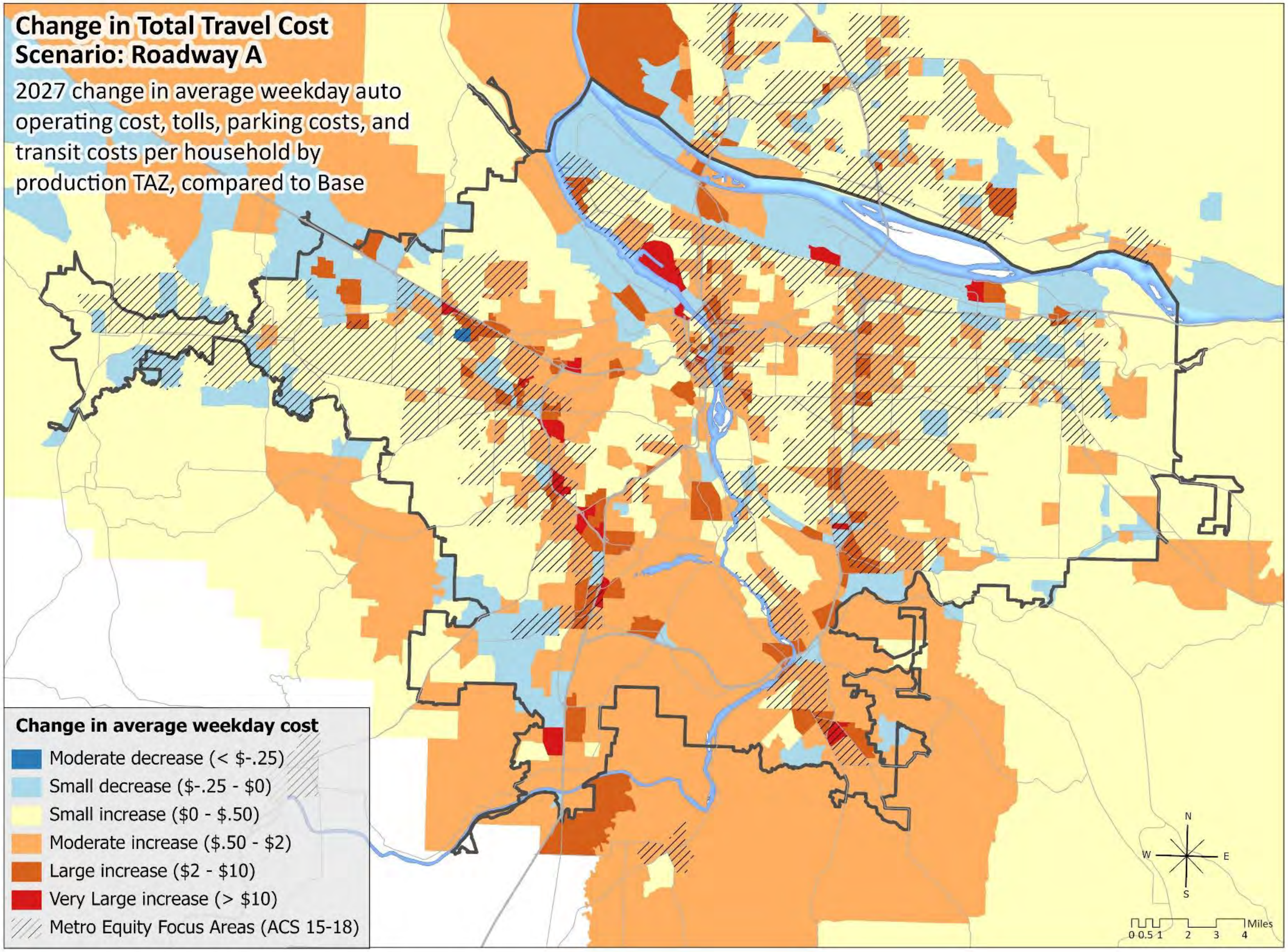

Change in Total Travel Cost
Scenario: Cordon A
2027 change in average weekday auto operating cost, tolls, parking costs, and transit costs per household by production TAZ, compared to Base
Change in average weekday cost
Moderate decrease (< $-.25)
Small decrease ($-.25 - $0)
Small increase ($0 - $.50)
Moderate increase ($.50 - $2)
Large increase ($2 - $10)
Very Large increase (> $10)
Cordon A
Metro Equity Focus Areas (ACS 15-18)
N
W
E
S
0 0.5 1 2 3 4
Miles

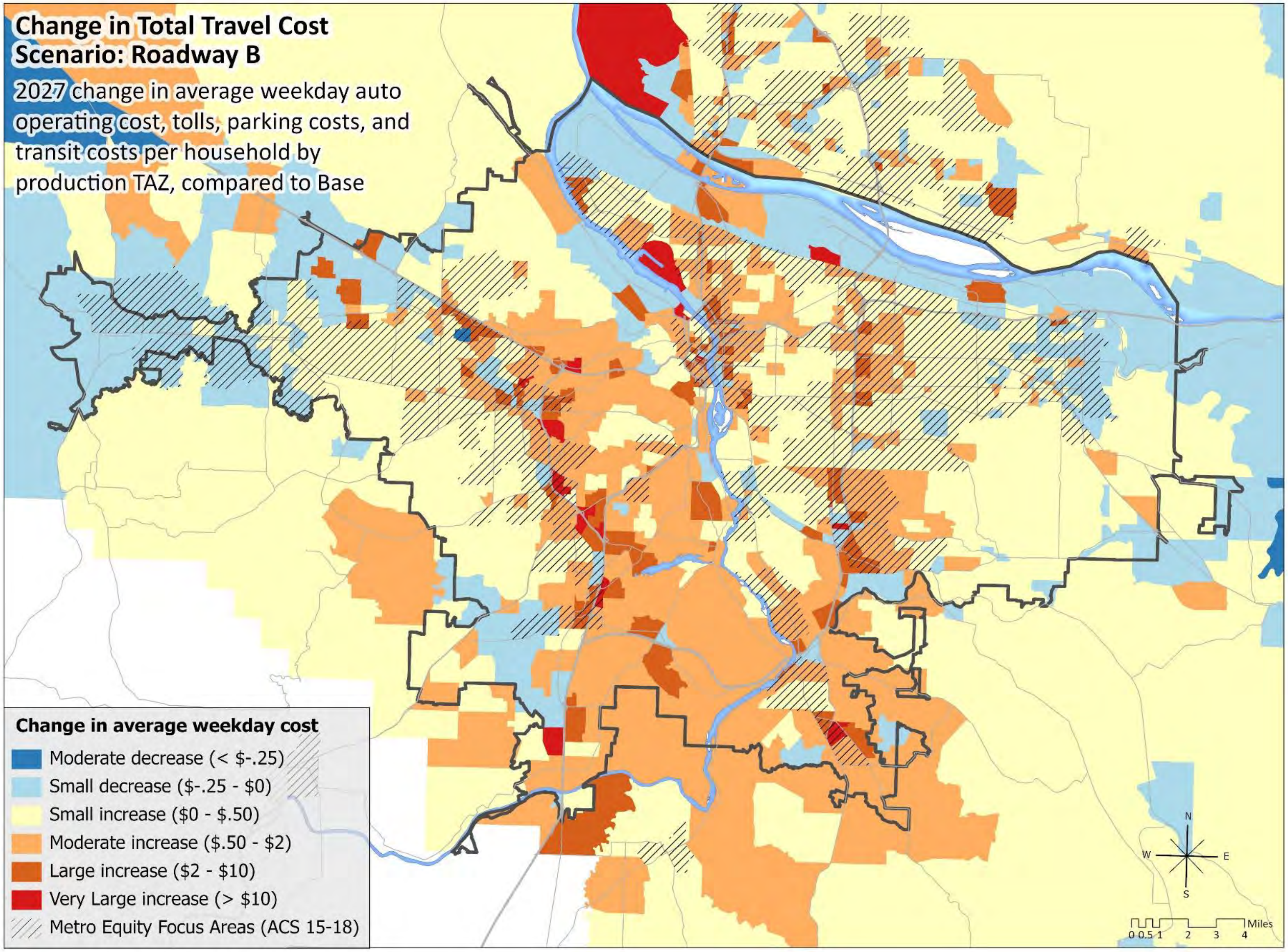

Change in Total Travel Cost
Scenario: Cordon B
2027 change in average weekday auto operating cost, tolls, parking costs, and transit costs per household by production TAZ, compared to Base
Change in average weekday cost
Moderate decrease (< $-.25)
Small decrease ($-.25 - $0)
Small increase ($0 - $.50)
Moderate increase ($.50 - $2)
Large increase ($2 - $10)
Very Large increase (> $10)
Cordon B
Metro Equity Focus Areas (ACS 15-18)
N
W
E
S
0 0.5 1 2 3 4 Miles


Change in Total Travel Cost
Scenario: Park A
2027 change in average weekday auto operating cost, tolls, parking costs, and transit costs per household by production TAZ, compared to Base
Change in average weekday cost
Moderate decrease (< $-.25)
Small decrease ($-.25 - $0)
Small increase ($0 - $.50)
Moderate increase ($.50 - $2)
Large increase ($2 - $10)
Very Large increase (> $10)
Metro Equity Focus Areas (ACS 15-18)
N
W
E
S
0 0.5 1 2 3 4
Miles

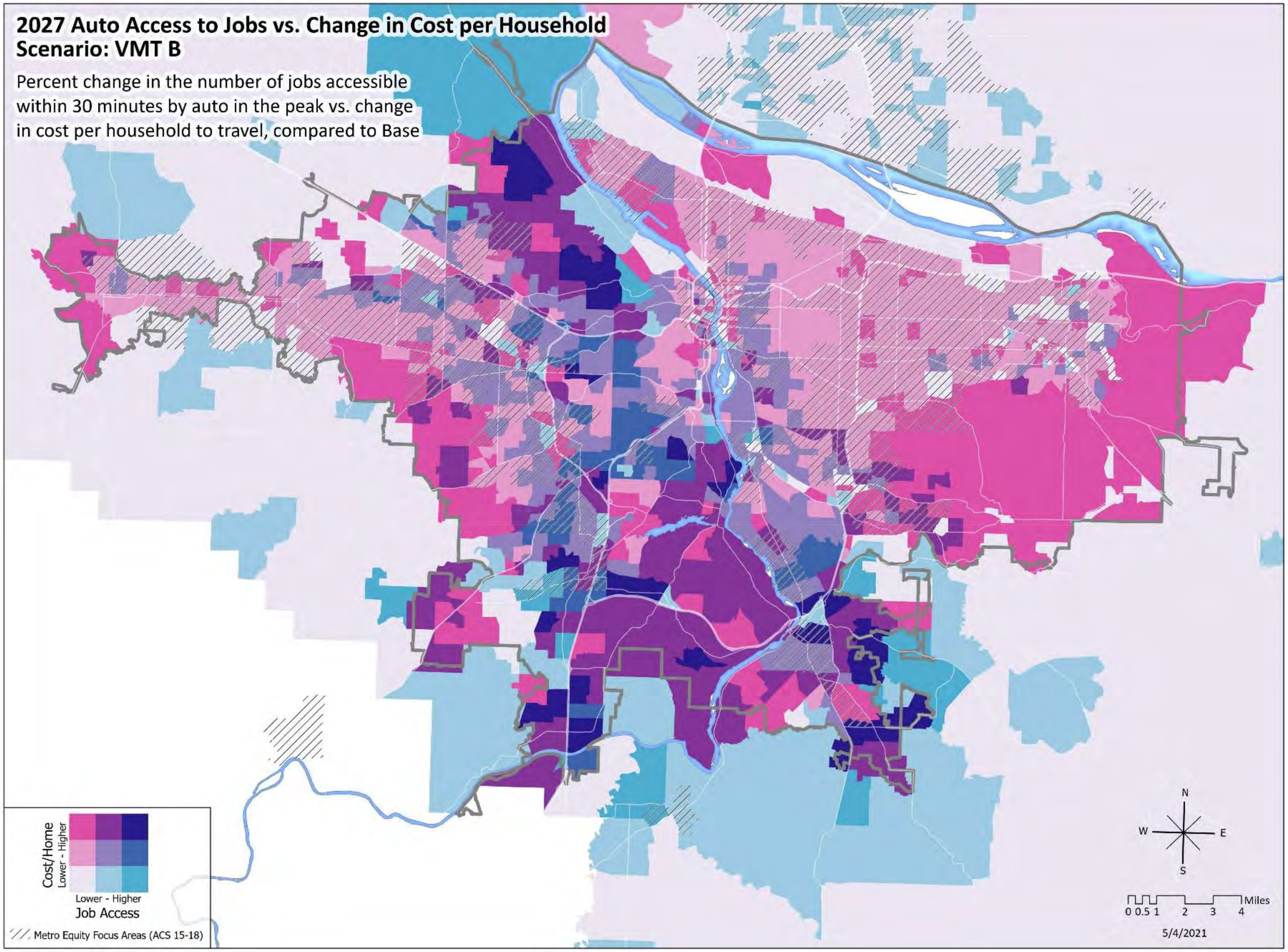


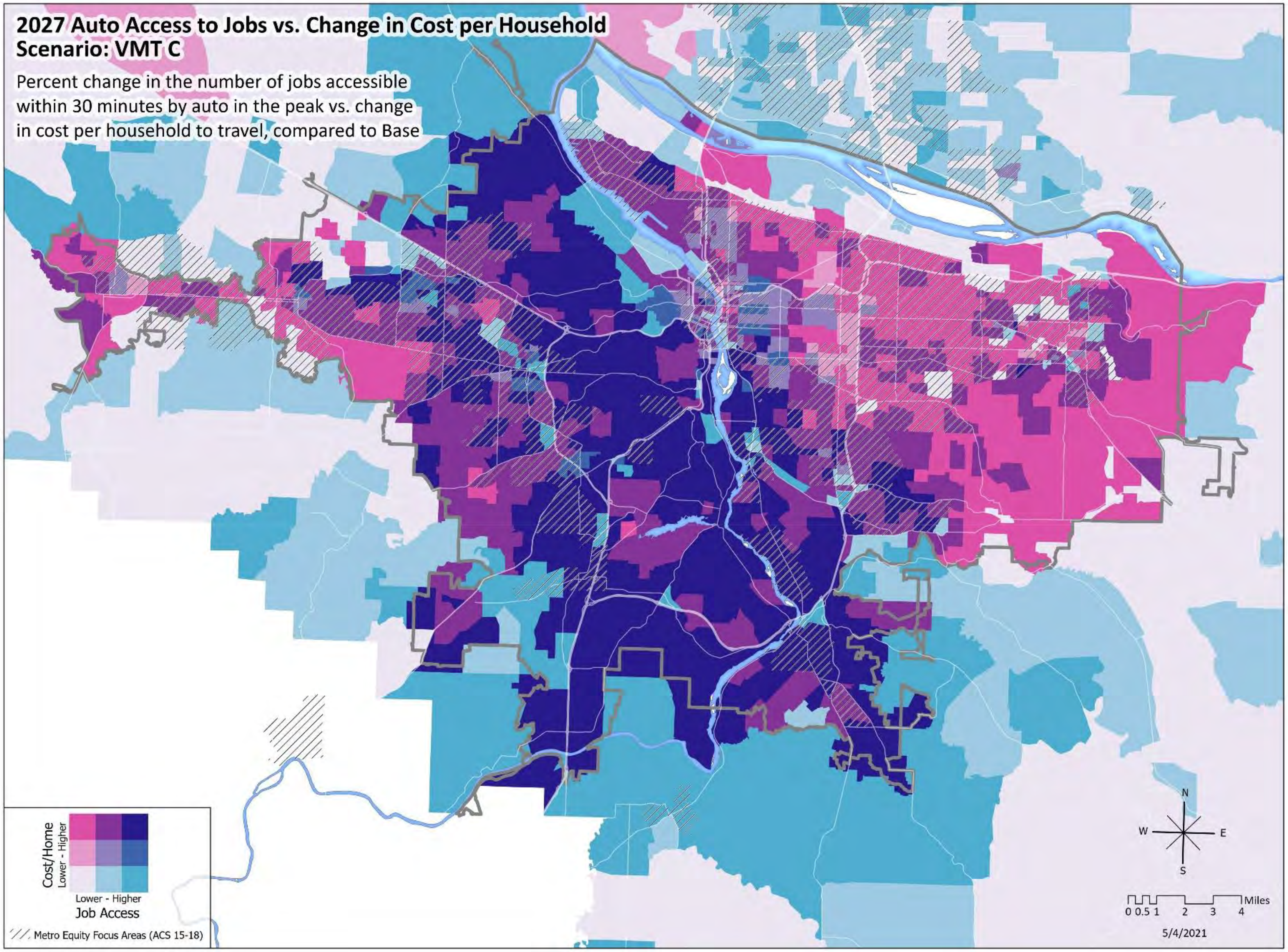
Change in Total Travel Cost
Scenario: Park B
2027 change in average weekday auto operating cost, tolls, parking costs, and transit costs per household by production TAZ, compared to Base
Change in average weekday cost
Moderate decrease (< $-.25)
Small decrease ($-.25 - $0)
Small increase ($0 - $.50)
Moderate increase ($.50 - $2)
Large increase ($2 - $10)
Very Large increase (> $10)
Metro Equity Focus Areas (ACS 15-18)
N
W
E
S
0 0.5 1 2 3 4
Miles

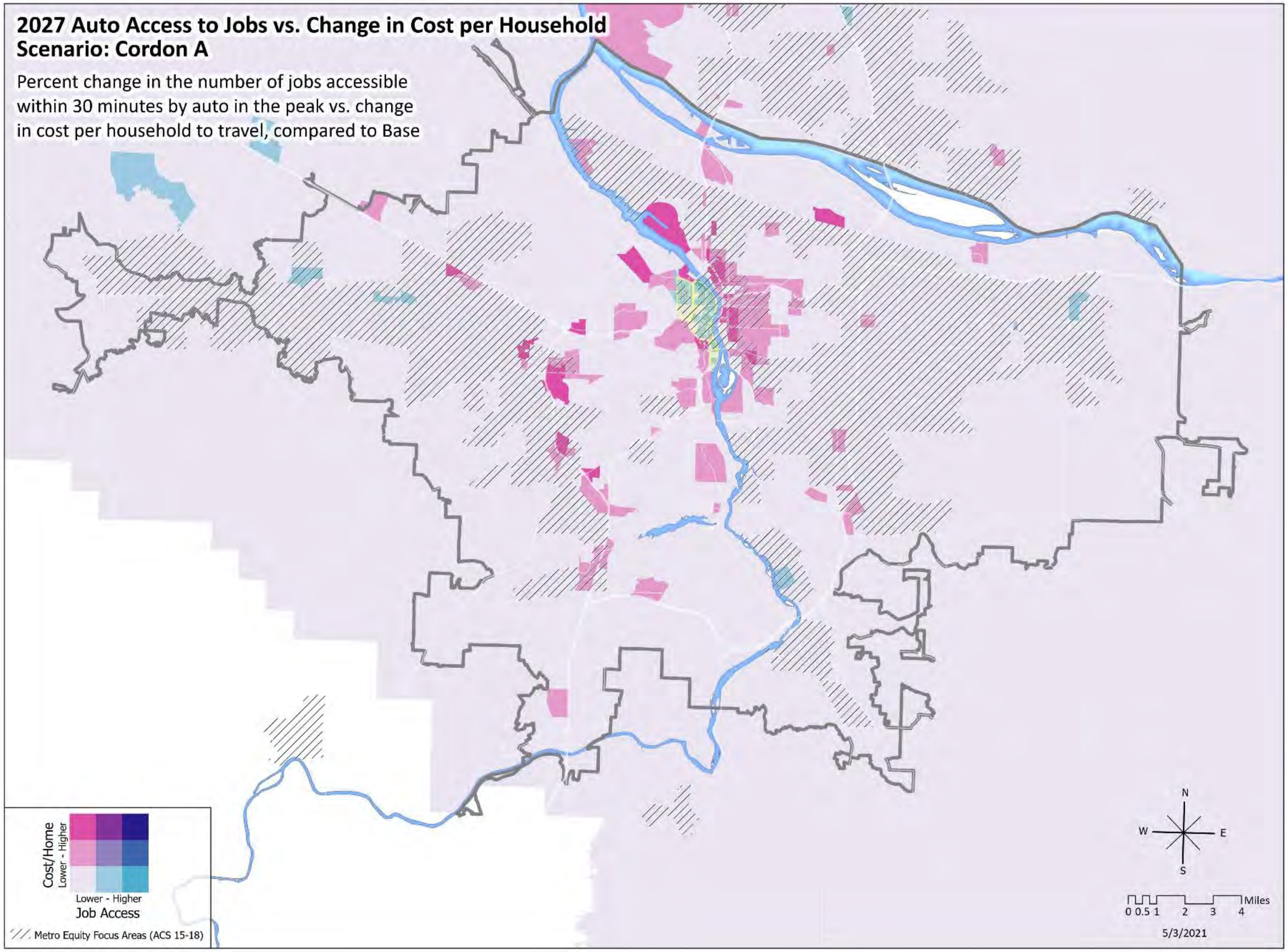

Change in Total Travel Cost
Scenario: Roadway A
2027 change in average weekday auto operating cost, tolls, parking costs, and transit costs per household by production TAZ, compared to Base
Change in average weekday cost
Moderate decrease (< $-.25)
Small decrease ($-.25 - $0)
Small increase ($0 - $.50)
Moderate increase ($.50 - $2)
Large increase ($2 - $10)
Very Large increase (> $10)
Metro Equity Focus Areas (ACS 15-18)
N
W
E
S
0 0.5 1 2 3 4
Miles

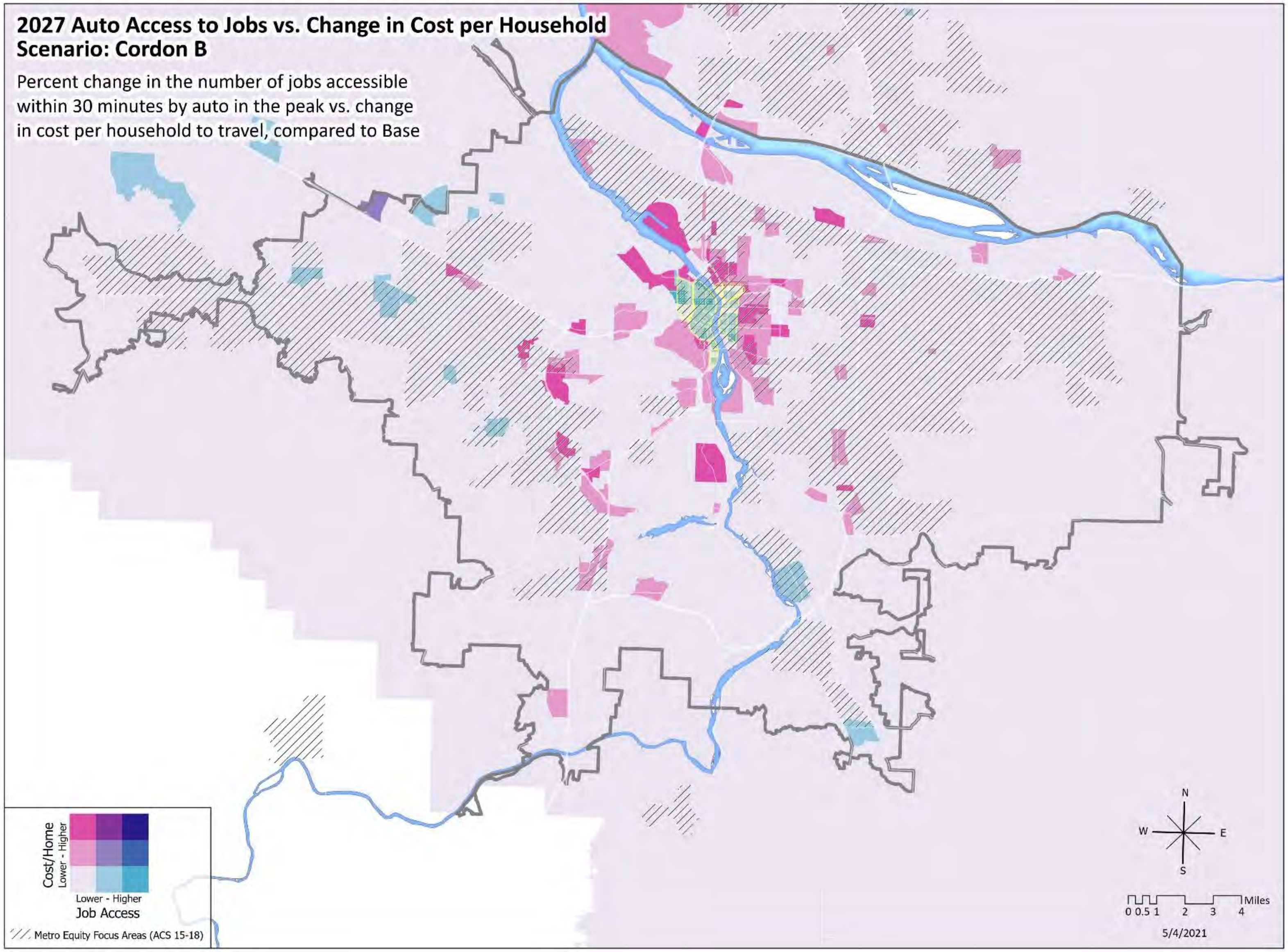

Change in Total Travel Cost
Scenario: Roadway B
2027 change in average weekday auto operating cost, tolls, parking costs, and transit costs per household by production TAZ, compared to Base
Change in average weekday cost
Moderate decrease (< $-.25)
Small decrease ($-.25 - $0)
Small increase ($0 - $.50)
Moderate increase ($.50 - $2)
Large increase ($2 - $10)
Very Large increase (> $10)
Metro Equity Focus Areas (ACS 15-18)
N
W
E
S
0 0.5 1 2 3 4 Miles

APPENDIX D.8: BIVARIATE MAPS: CHANGE IN ACCESSIBILITY TO JOBS BY AUTO AND CHANGE IN TOTAL TRAVEL COST

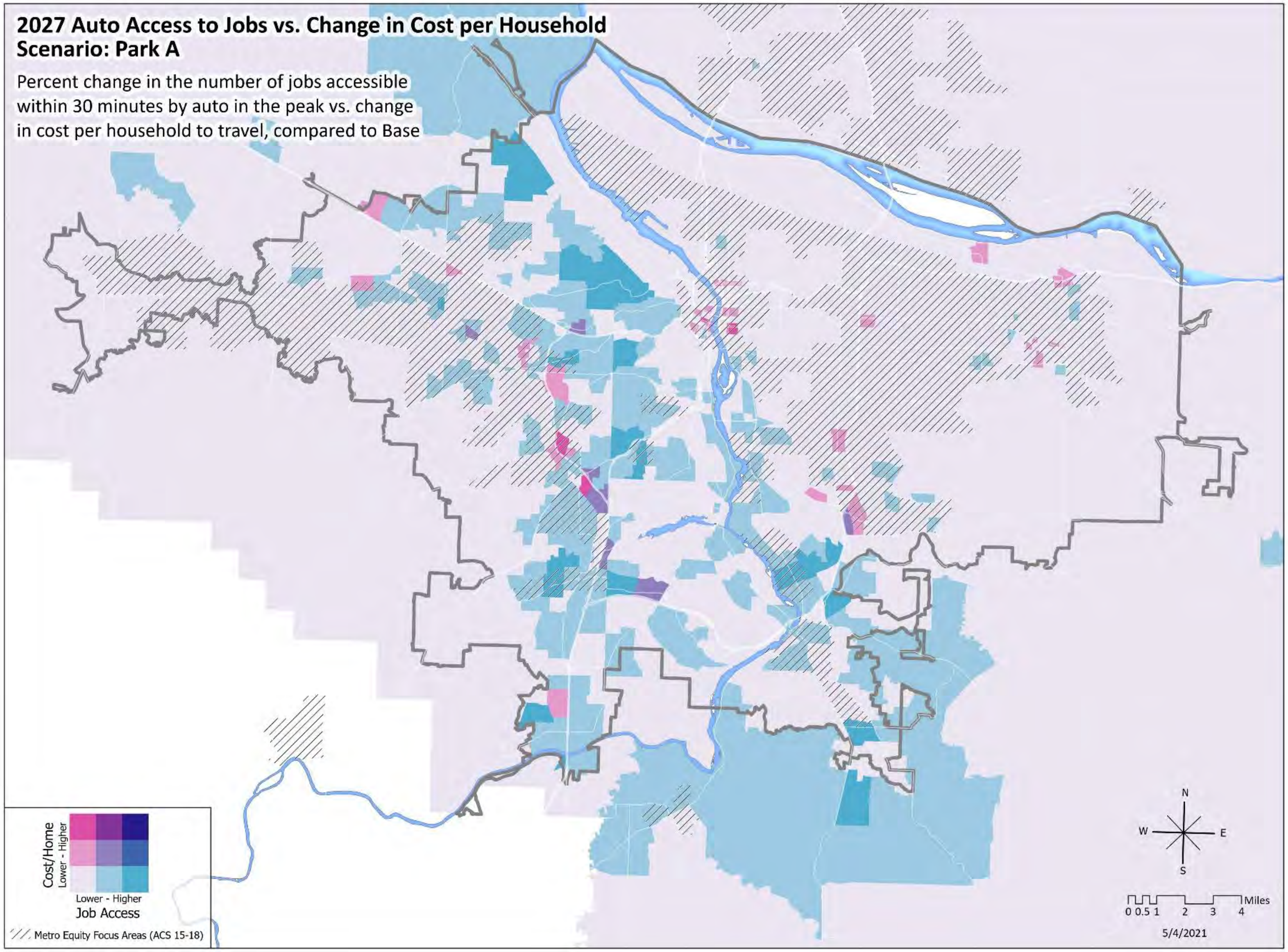

2027 Auto Access to Jobs vs. Change in Cost per Household
Scenario: VMT B
Percent change in the number of jobs accessible within 30 minutes by auto in the peak vs. change in cost per household to travel, compared to Base
Cost/Home
Lower - Higher
Lower - Higher
Job Access
Metro Equity Focus Areas (ACS 15-18)
N
W
E
S
0 0.5 1 2 3 4
Miles
5/4/2021


2027 Auto Access to Jobs vs. Change in Cost per Household
Scenario: VMT C
Percent change in the number of jobs accessible within 30 minutes by auto in the peak vs. change in cost per household to travel, compared to Base
Cost/Home
Lower - Higher
Lower - Higher
Job Access
Metro Equity Focus Areas (ACS 15-18)
N
W
E
S
0 0.5 1 2 3 4
Miles
5/4/2021

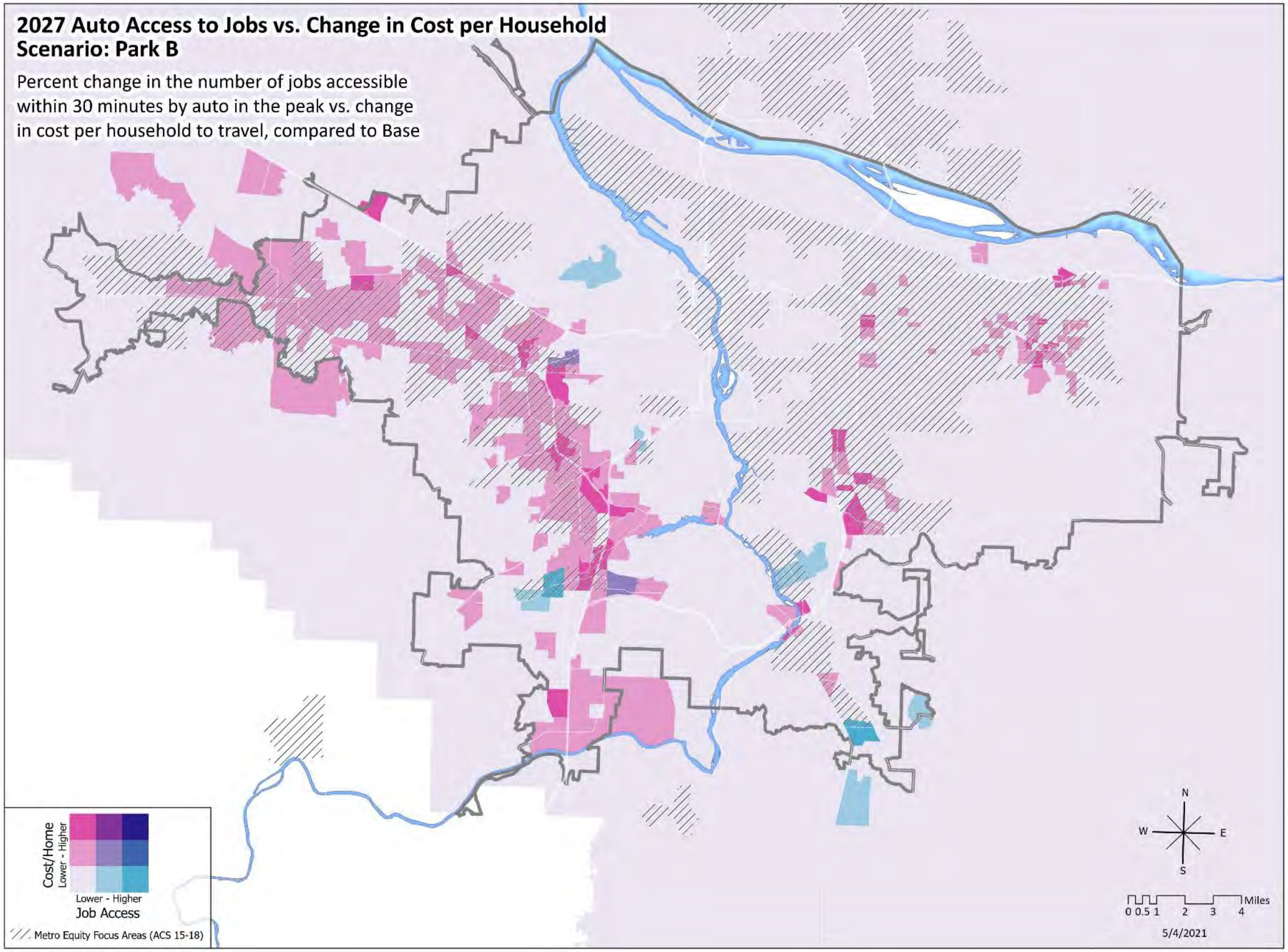

2027 Auto Access to Jobs vs. Change in Cost per Household
Scenario: Cordon A
Percent change in the number of jobs accessible within 30 minutes by auto in the peak vs. change in cost per household to travel, compared to Base
Cost/Home
Lower - Higher
Lower - Higher
Job Access
Metro Equity Focus Areas (ACS 15-18)
N
W
E
S
0 0.5 1 2 3 4 Miles
5/3/2021



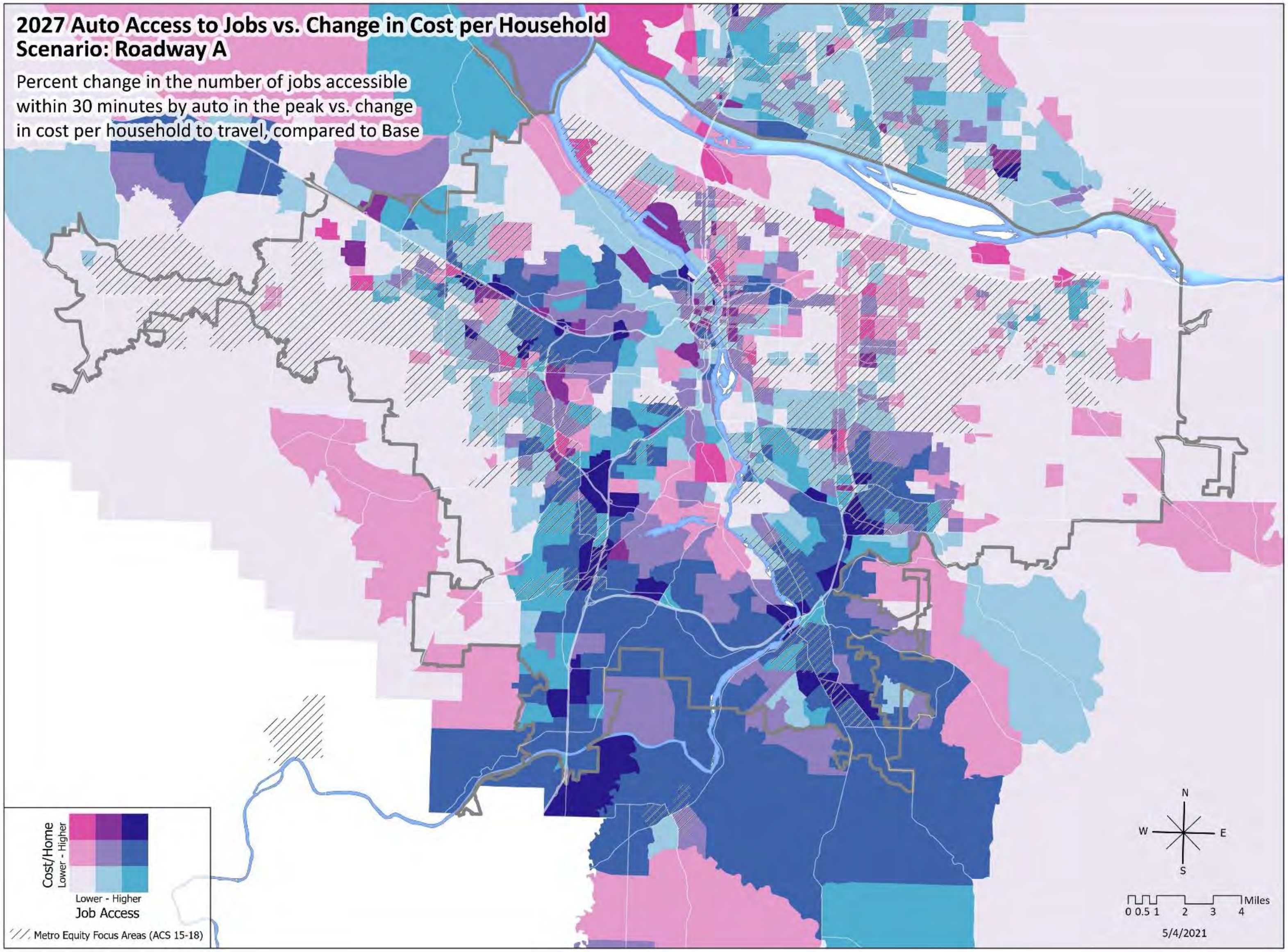
2027 Auto Access to Jobs vs. Change in Cost per Household
Scenario: Cordon B
Percent change in the number of jobs accessible within 30 minutes by auto in the peak vs. change in cost per household to travel, compared to Base
Cost/Home
Lower - Higher
Lower - Higher
Job Access
Metro Equity Focus Areas (ACS 15-18)
N
W
E
S
0 0.5 1 2 3 4
Miles
5/4/2021



2027 Auto Access to Jobs vs. Change in Cost per Household
Scenario: Park A
Percent change in the number of jobs accessible within 30 minutes by auto in the peak vs. change in cost per household to travel, compared to Base
Cost/Home
Lower - Higher
Lower - Higher
Job Access
Metro Equity Focus Areas (ACS 15-18)
N
W
E
S
0 0.5 1 2 3 4
Miles
5/4/2021



2027 Auto Access to Jobs vs. Change in Cost per Household
Scenario: Park B
Percent change in the number of jobs accessible within 30 minutes by auto in the peak vs. change in cost per household to travel, compared to Base
Cost/Home
Lower - Higher
Lower - Higher
Job Access
Metro Equity Focus Areas (ACS 15-18)
N
W
E
S
0 0.5 1 2 3 4
Miles
5/4/2021


2027 Auto Access to Jobs vs. Change in Cost per Household
Scenario: Roadway A
Percent change in the number of jobs accessible within 30 minutes by auto in the peak vs. change in cost per household to travel, compared to Base
Cost/Home
Lower - Higher
Lower - Higher
Job Access
Metro Equity Focus Areas (ACS 15-18)
N
W
E
S
0 0.5 1 2 3 4
Miles
5/4/2021

2027 Auto Access to Jobs vs. Change in Cost per Household
Scenario: Roadway B

Percent change in the number of jobs accessible within 30 minutes by auto in the peak vs. change in cost per household to travel, compared to Base