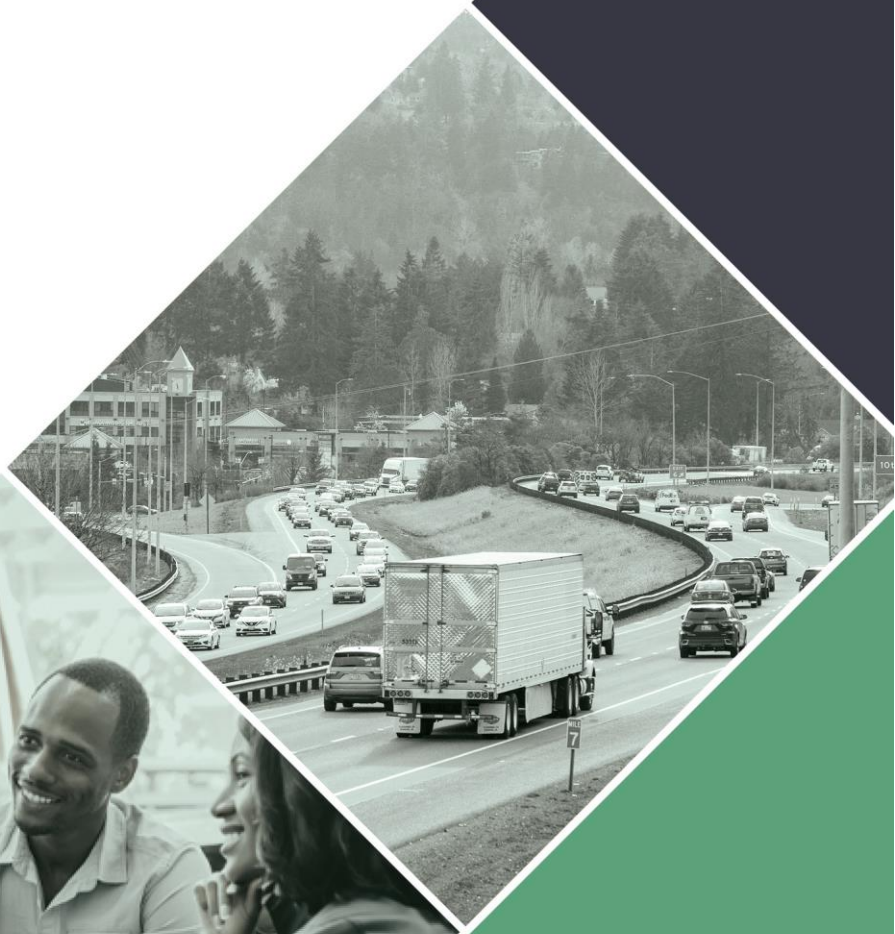
Regional Mobility Pricing Project

I-5 and I-205 Corridor User Analysis

September 2022



Urban Mobility STRATEGY

Oregon Department of Transportation

I-5 and I-205 Corridor User Analysis

September 2022

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Oregon Department of Transportation

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Acronyms and Abbreviations

Acronym/Abbreviation	Definition
EB	eastbound
GPS	Global Positioning System
I-5	Interstate 5
I-205	Interstate 205
NB	northbound
ODOT	Oregon Department of Transportation
OR	Oregon Route
Project	Regional Mobility Pricing Project
R^2	R-squared value
RMPP	Regional Mobility Pricing Project
RTDM	Regional Travel Demand Model
RTP	Regional Transportation Plan
SB	southbound
SR	State Route
TAZ	transportation analysis zones
US	U.S. Route
VMT	vehicle miles traveled
WB	westbound

1 Introduction

1.1 Project Background

In 2016, the Governor's Transportation Vision Panel found that the negative effect of congestion in the Portland metropolitan area was consistently identified as one of the key themes across Oregon. In response to stakeholders across the state, House Bill 2017 Section 120 directed the Oregon Transportation Commission to develop a congestion relief fund and to seek approval from the Federal Highway Administration to implement congestion pricing on Interstate 5 (I-5) and I-205 to reduce traffic congestion in the Portland metropolitan area. The Regional Mobility Pricing Project (RMPP) would apply variable-rate tolls to all lanes of I-5 and I-205 in the Portland metropolitan area within Oregon; to manage congestion and raise revenue for priority transportation projects.

Terminology Explained: Congestion Pricing

The term "congestion pricing" describes a type of tolling that will bring more reliable trips and address congestion by charging higher prices during peak traffic periods. The higher peak prices encourage some drivers to use other travel options such as carpools or transit, to change their travel time to other, less congested times of the day, or not to make the trip at all. Removing a small percentage of the vehicles from a busy road reduces traffic congestion and allows for more efficient flow of vehicles.

The outdated transportation system in the Portland metropolitan area requires the State to take action and make multimodal improvements. The Oregon Department of Transportation (ODOT) is investing in transit, bicycle and pedestrian facilities and changing how we manage roads for safety and traffic flow. Tolling is another necessary tool to fix the transportation system. Tolls are tools to bring more reliable travel and address congestion in the Portland region, reduce greenhouse gas emissions, and fund bottleneck-relief projects. Oregonians across the state need to get to and through the Portland metropolitan area—and right now our regional transportation system isn't keeping up. Hours of delay and congestion come at a high cost to individuals, businesses, and communities. In 2020, traffic counts declined with the COVID-19 pandemic but are back to about 90% of pre-pandemic levels and expected to return to 2019 levels as the economy improves.

Across the United States, there are nearly 40 programs using tolls to manage demand and traffic congestion. Variable-rate tolls manage motor vehicle flows and improve roadway efficiency by charging a higher price during peak traffic periods, usually during morning and afternoon commutes.

1.2 Purpose

This report supports the early planning phase of the Regional Mobility Pricing Project (RMPP or Project) for ODOT. It presents a summary of travel patterns for those who use I-5 and I-205 in the Portland metropolitan area within Oregon. This report identifies and analyzes recent travel patterns on I-5 and I-205, as well as the use of alternate routes during peak periods of traffic congestion. Recognizing how people use I-5 and I-205 will help ODOT develop and evaluate possible congestion pricing scenarios, including where toll points should be located and what kinds of pricing should be applied.

I-5 and I-205 trip patterns examined include trips within the Portland metropolitan area, trips entering from or exiting to a location outside the area, and trips passing through the area. Data for these trip patterns largely comes from aggregated cell-phone data, collected and refined from the StreetLight Data, Inc.

mobility platform for 2019 and the Metro Regional Travel Demand Model (RTDM) base year of 2015. The report presents the following data findings:

- **Travel Characteristics** of trips on I-5 and I-205 in Oregon, including trip distances and the share of trips that are local or external (trips that begin and end outside the geographic evaluation area).
- **Origin/Destination** analysis, including the distribution of where trips are coming from or going to on specified stretches of I-5 and I-205 in Oregon.
- **Travel shed** analysis, or an analysis of how trips route through the roadway network respective to specific points on I-5 and I-205 in Oregon.
- **Rerouting/Diversion** analysis, which analyzes a given travel pattern and how driver routing choices can change between peak hours and off-peak hours.

1.3 Corridor User Analysis Extents and Geographic Evaluation Area

The analyses presented in this report cover the I-5 and I-205 corridors through the Portland region within Oregon. The points that define the *corridor user analysis extents* are: on I-5 from the Columbia Boulevard interchange in north Portland down to and including the Boone Bridge in Wilsonville, and on I-205 from the Glenn Jackson Bridge located across the Columbia River to the southern terminus of I-205 near Tualatin. Trips on I-5 or I-205 that travel exclusively outside of the analysis extents (e.g., trips that begin and end in Washington) are not included in the analysis.

For purposes of origin/destination pairs and travel sheds, the *geographic evaluation area* includes the four-county region of Multnomah, Clackamas, and Washington Counties in Oregon and Clark County in Washington.

Terminology Explained: I-5 and I-205 Corridors

In this report, the term “I-5 and I-205 corridors” generally refers to not only the interstate highways but also adjacent state highways and other roadways that can be used as alternative routes. Most potential users of I-5 and I-205 have multiple routing options and can choose to travel on parallel roadways for all or part of their trips. Particularly when there is severe congestion present, some drivers may choose to use routes that avoid the interstate highways. In exploring the travel patterns of I-5 and I-205 users, this report uses the term “I-5 and I-205 corridors” to be inclusive of nearby roadways and specifies “I-5 and I-205 facilities” when discussing users on the interstates exclusively.

2 Key Findings

This report examines travel characteristics for trips on I-5 and I-205 within the corridor user analysis extents. This section presents the key findings from the analysis.

2.1 General Travel Characteristics

- Although internal trips account for about 80% of all trips, they are only responsible for two-thirds of the total vehicle miles traveled (VMT) within the corridor user analysis extents. Trips with at least one end outside of the four-county geographic evaluation area on average travel longer distances within the corridor user analysis extents on I-5 and I-205 compared to internal trips and therefore have a larger relative impact on VMT and congestion.
- On I-5 and I-205 highway segments within the corridor user analysis extents, trips with only one end in the geographic evaluation area typically travel at least double the average distance within the corridor user analysis extents compared with an internal trip, while external through trips travel about four times the average distance of an internal trip.

2.2 Origin/Destination Analysis

- Highway locations closer to downtown Portland have a higher share of local trips within the geographic evaluation area, whereas locations toward suburban areas have a higher share of external trips.
- I-5 has a higher share of external trips than I-205.
- StreetLight and Metro RTDM data show similar results for trip origins and destinations.

2.3 Distances Traveled

- Trips originating within the four-county geographic evaluation area travel about 5 miles on average on I-5 and I-205 within the corridor user analysis extents, which is 7 fewer miles than trips originating outside the geographic evaluation area.
- About half of the trips coming from outside the four-county geographic evaluation area travel on I-5 or I-205 for at least 10 miles within the corridor user analysis extents.
- More than 10% of all external trips travel 8 to 9 miles within the corridor user analysis extents, accounting for a relatively large portion of external trips. Many of these trips travel between Oregon Route (OR) 217 in Washington County and areas south of the region on I-5.
- Multnomah County most heavily skews toward shorter trips (i.e., under 3 miles) on I-5 and I-205 within the corridor user analysis extents. Clackamas and Washington Counties have a more even distribution of trip distances, including the medium- to long-range trips (i.e., over 3 miles within the corridor user analysis extents).

2.4 Travel Shed for Selected Locations

- A substantial share of trips on I-5 connect to other major regional highways, such as I-84, or travel through the region, whereas trips on I-205 connect with the nearby roadway network more often.

2.5 Existing Routing and Diversion Analysis

Traveler routing choices can vary by time of day and direction, often aligned with recurring congestion patterns.

- I-5 or I-205:
  - For trips that travel the full distance between the southern junction of I-5 and I-205 near Tualatin and the northern junction in Clark County, I-5 carries the majority of trips in both directions in peak and off-peak hours alike. This is likely due to a shorter distance on I-5 at about 30 miles compared to the distance on I-205 at 36 miles and congested conditions occurring on both highways.
  - For trips between the southern junction of I-5 and I-205 and the east Vancouver area around I-205, I-205 carries the majority of trips in both directions in peak and off-peak hours.
  - While there is some limited indication of shifts from I-5 to I-205 during peak hours in the above travel patterns, I-205's attractiveness as an alternative route is likely limited by recurring peak-period congestion.
  - I-5 and I-205 routes between downtown Portland and east Vancouver are roughly equally popular during off-peak hours but I-5 is a favored by most travelers who "reverse commute" from Portland to east Vancouver. This routing choice indicates that I-5 has the potential to attract more of the trips between Portland and Vancouver away from I-205 if less traffic congestion is present on I-5.
- I-5 alternatives around downtown/north Portland:
  - I-405 may be attractive as an alternative to I-5 during some periods, but recurring congestion on I-405 during the peak hours may be significant enough to prevent I-405 from being a consistently attractive alternative route during these peak hours.
  - N Interstate Avenue and N Greely Avenue are used as alternative routes to I-5 during peak commuter periods on I-5 southbound during the AM peak and northbound during the PM peak.
- Routing between downtown Portland and northeast Portland near Portland International Airport:
  - I-84 is preferred going to and from downtown Portland throughout the day. I-5 is not heavily used for these trips during peak and off-peak periods.
  - I-205 is preferred to and from Portland International Airport during off peak times but Sandy Boulevard and NE 82nd Avenue are preferred during peak times.
  - The shifts in route choice are aligned with prevailing commuter travel patterns on I-205 southbound from Clark County during the AM peak and northbound during the PM peak.
- Routing between Wilsonville and Tigard:
  - Alternative routes are more attractive during peak times in both directions, indicating that congestion on I-5 may encourage users to reroute to parallel roadways on both sides of I-5 between Wilsonville and Tigard.

3 Methodology

3.1 Overview of Data Sources

The corridor user analysis uses data provided by StreetLight and the Metro RTDM. StreetLight provides a sample of collected personal cellular device location data, while the Metro RTDM estimates travel demand in the region based on demographics, land use, transportation network characteristics, and reported behavior from household travel surveys and other travel data. Both sources provide valuable information but have biases and limitations. This report uses both StreetLight and the RTDM as independent sources of data and compares the origin and destination analysis results from the two datasets for validation. The variety of tools provide a more complete picture of travel patterns on I-5 and I-205 than using a single data source.

3.2 StreetLight Background Information

StreetLight is a web-based, on-demand mobility data analytics platform. This service uses anonymized, personal cellular-device location data (location-based services data) and navigation Global Positioning System (GPS) data. StreetLight processes the raw location-based services data into probable trips and adjusts the trip data based on sampled devices in comparison to the population at the census block level. In comparison to traditional data collection techniques, the StreetLight tool provides access to a larger scale of transportation data to support better understanding of transportation patterns and behavior in the geographic evaluation area. For more details on StreetLight's methodology and data sources, refer to Appendix A, which includes *StreetLight Insight Metrics: Our Methodology and Data Sources* (updated July 2019) and *StreetLight Volume and Methodology & Validation White Paper* (updated August 2019).

3.3 Analysis Parameters and Sample Size

This analysis uses location-based services data from 2019. The Project Team used the StreetLight location-based services dataset for 2019 weekday travel (Monday to Thursday, January through December) to conduct the origin/destination analysis (Section 4.2) as well as the existing routing and diversion analysis (Section 5). Depending on the geographies selected for a particular analysis, the sample size ranged from roughly 6,000 devices (for a specific origin-destination pattern) to 650,000 or more devices (for regionwide origin/destination analysis of trips).

The Project team also used daily average weekday travel data from Metro's RTDM from the 2015 baseline model to validate the StreetLight data (Section 4.3) and to analyze Distances Traveled on I-5 and I-205 (Section 4.4) and I-5 and I-205 Travel Sheds (Section 4.5).

3.4 Data Limitations

The methods by which StreetLight gathers, transforms, analyzes, and models data are fundamentally insufficient to portray reality with 100% certainty. Any presentation of data, metrics, or statistics should be viewed with a discerning eye. While StreetLight bases its data on actual, historical information collected from travelers, it provides only a sample of the total trips being made, and it requires algorithms to normalize and expand location-based data. As such, the tool's accuracy can be questioned and uncertainty in any findings should be recognized.

Additionally, because StreetLight's data depends on smart device tracking, some inherent biases in the sample base could occur because a higher proportion of members of certain demographic groups may

not use smart devices; therefore, these groups could be underrepresented in StreetLight data. The Project Team does not know the identity of individual drivers or smart devices because the data is anonymized.

Despite the limitations noted above, Streetlight provides useful indicators for understanding travel patterns and user characteristics on I-5 and I-205 within the corridor user analysis extents. Research to date shows that the accuracy of StreetLight information for analyses of trip origins and destinations and other travel patterns is higher for analyses with larger sample sizes, such as those presented in this report.[1] Furthermore, the information presented in this report was cross-checked against the Metro RTDM and was found to be consistent.

3.5 Background Information on Metro Regional Travel Demand Model

The Metro RTDM is used primarily to forecast regional multi-modal travel demand. For this analysis, the Project team used the base model year (2015) to supplement the analysis of travel patterns and validate the information from StreetLight. The model version was developed for the 2018 Regional Transportation Plan (RTP) and is called “Kate”.

The Metro RTDM divides the region into 2,162 transportation analysis zones (TAZs): 2,147 zones within the region and 15 external stations. Based on characteristics of each TAZ and the modeled roadway network, the model estimates person trips for all modes and vehicle demand by hour for all 24 hours of an average weekday. The origins, destinations, and travel paths of the resulting vehicle trips were used to analyze trips that use I-5 and I-205 within the corridor user analysis extents.

[1] Hong Yang, Mecit Cetin, and Qingyu Ma. 2020. *Guidelines for Using StreetLight Data for Planning Tasks.* Virginia Transportation Research Council. March 2020.

4 I-5 and I-205 User Travel Patterns

4.1 General Travel Characteristics

The Project Team performed a high-level overview of travel on I-5 and I-205 facilities using data from the Metro RTDM to better understand user travel patterns within and through the geographic evaluation area (Multnomah, Clackamas, Washington, and Clark counties). All trips that travel on I-5 or I-205 within or through the corridor user analysis extents were analyzed, as described in Section 1.3. These trips were classified into three groups:

- **Internal**, meaning the trip was entirely within the four-county geographic evaluation area
- **Leaving/Entering**, meaning the trip started in and then left the geographic evaluation area, or vice versa
- **External**, or a "pass-through" trip, meaning the trip both began and ended outside the geographic evaluation area.

Table 4-1 shows the share of local and external trips using I-5 and/or I-205 within the corridor user analysis extents, out of the nearly 1.2 million daily trips using these highways.[2] The table also shows the share of VMT, indicating how much each category of trips contributes to traffic volumes on I-5 and I-205 within the corridor user analysis extents.

Table 4-1. I-5 and I-205 Daily Internal vs. External Trips/VMT

Trip Type (on I-5 or I-205)	Share of Total Trips	Share of Total VMT on I-5/I-205 *	Average Trip Distance (miles) on I-5/I-205*
Internal (trip origin and destination both within the four-county area)	87%	73%	4.6
Leaving/Entering (either origin or destination within the four-county area)	11%	21%	10.4
External (trip origin and destination both outside the four-county area)[3]	2%	6%	18.2

Source: 2015 Metro Regional Travel Demand Model
* The VMT and trip distance shown is limited to travel on I-5 and I-205 within the corridor user analysis extents.
I- = Interstate; VMT = vehicle miles traveled

From this analysis, most I-5 and I-205 trips are internal to the geographic evaluation area. Only 13% of I-5 and I-205 trips have origins, destinations, or both outside of the geographic evaluation area. However, leaving/entering and external trips use a disproportionally higher share of the I-5 and I-205 facilities on a per-trip basis. This is because these trips travel larger distances on I-5 or I-205 within the corridor user analysis extents; approximately two to four times the average distance of an (internal) trip traveling within the geographic evaluation area.

[2] The 2015 Metro RTDM estimates over 1.1 million trips use I-5 and/or I-205 within the corridor user analysis extents on an average weekday.

[3] Includes northbound/southbound through trips on I-5 and I-205 between Washington and Oregon as well as trips within Oregon that begin and end outside of the four-county geographic evaluation area (e.g., Salem to Hood River).

When considering contributions to traffic volumes by accounting for longer distances traveled on I-5 and I-205, the share of VMT from trips entering from external areas and/or leaving to external areas rises to 27%. External trips passing through the geographic evaluation area make up a relatively small share (2%) of total trips, they have larger relative impact on traffic volumes (6% of VMT on I-5 and I-205). These comparisons of distance traveled only includes distance on I-5 or I-205 within the corridor user analysis extents, not portions of travel on I-5 or I-205 in Washington or on I-5 south of Wilsonville in Oregon.

4.2 Origin/Destination Analysis

This section summarizes the regional distribution of trip origins or destinations at various locations on I-5 and I-205. In total, nine locations—six along I-5 and three along I-205[4]—were analyzed to provide an understanding of trip patterns at multiple locations along both facilities. The selected locations are shown in Figure 4-1 and listed in Figure 4-2 through Figure 4-10 show trip origins; trip destinations are included in Appendix B. Because the figures show daily travel patterns, the distributions of trips are very similar for origins and destinations.

Table 4-2. This section is organized into nine subsections, one for each location, with corresponding illustrations and descriptions of trips patterns.

Figure 4-2 through Figure 4-10 show trip origins; trip destinations are included in Appendix B. Because the figures show daily travel patterns, the distributions of trips are very similar for origins and destinations.

Table 4-2. Origin/Destination Analysis Locations (listed by highway, north to south)

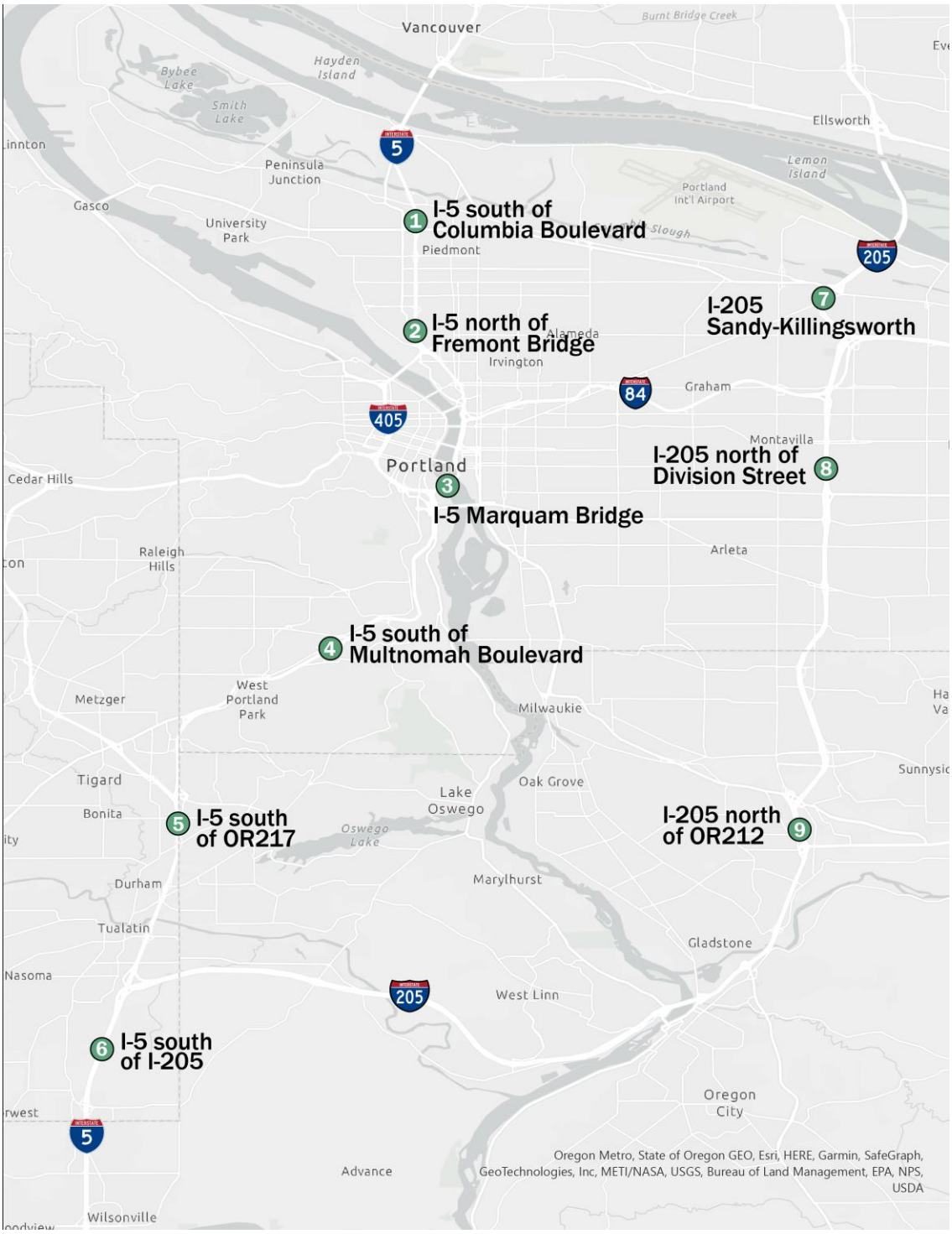
#	Highway	Location (per figure)	Location Reference	
			South of	North of
1	I-5	South of Columbia Blvd	N Columbia Blvd	N Lombard St (US 30)
2		North of Fremont Bridge	N Going St	Fremont Bridge (I-405)
3		Marquam Bridge	SE Yamhill St	I-405
4		South of Multnomah Blvd	SW Multnomah Blvd	SW Taylors Ferry Rd
5		South of OR 217	OR 217	SW Carman Dr
6		South of I-205	I-205	SW Elligsen Rd
7	I-205	I-205 Sandy-Killingsworth	NE Killingsworth St (US 30)	NE Sandy Blvd
8		North of Division St	SE Stark St	SE Division St
9		North of OR 212	Sunrise Hwy (OR 224)	OR 212

I- = Interstate; OR = Oregon Route; US = U.S. Route

While each analysis location showed unique trip patterns, some general trends were also identified for both highways. Highway locations closer to downtown Portland tended to have more localized trips (i.e., a higher share of trip origins or destinations closer to the location analyzed), while locations toward suburban areas tended to have higher trip shares outside the geographic evaluation area Regardless of location on either facility, I-5 tended to have higher shares of external trips than I-205. Most trips crossing the I-5 and I-205 bridges between Oregon and Washington tended to begin/end in Clark County rather than coming from/going to places farther into Washington.

[4] Origin/destination analysis for I-205 at the Abernethy Bridge (Willamette River crossing near Oregon City) was previously performed as part of the I-205 Corridor User Analysis. https://www.oregon.gov/odot/tolling/Documents/I205%20Corridor%20User%20Analysis%20Final.pdf

Figure 4-1. Origin/Destination Analysis Locations (mapped)

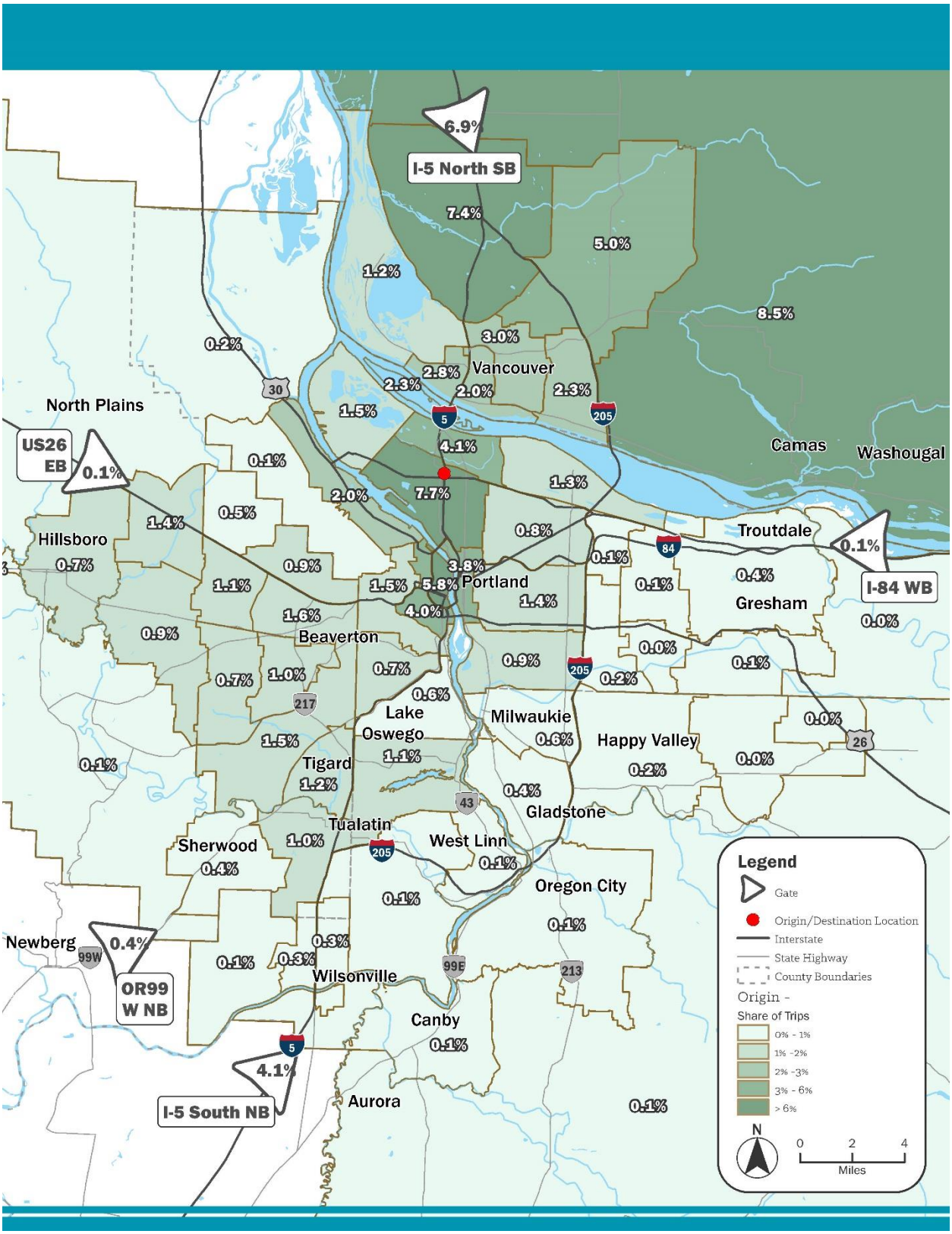


Source: Esri base map

4.2.1 Location #1: I-5 South of Columbia Boulevard

As the northernmost I-5 analysis point, Location #1 tends to serve more commuter traffic between Clark County and downtown Portland. Around 10% of the trips here are interregional, with 6% to 7% coming from or going to Washington north of Clark County and 4% traveling to/from I-5 to the south of the geographic evaluation area. This location carries a relatively high share of traffic to/from Hayden Island as well as the industrial areas around NE Columbia Boulevard.

Figure 4-2. Origins for I-5 Trips South of Columbia Boulevard (Location #1)

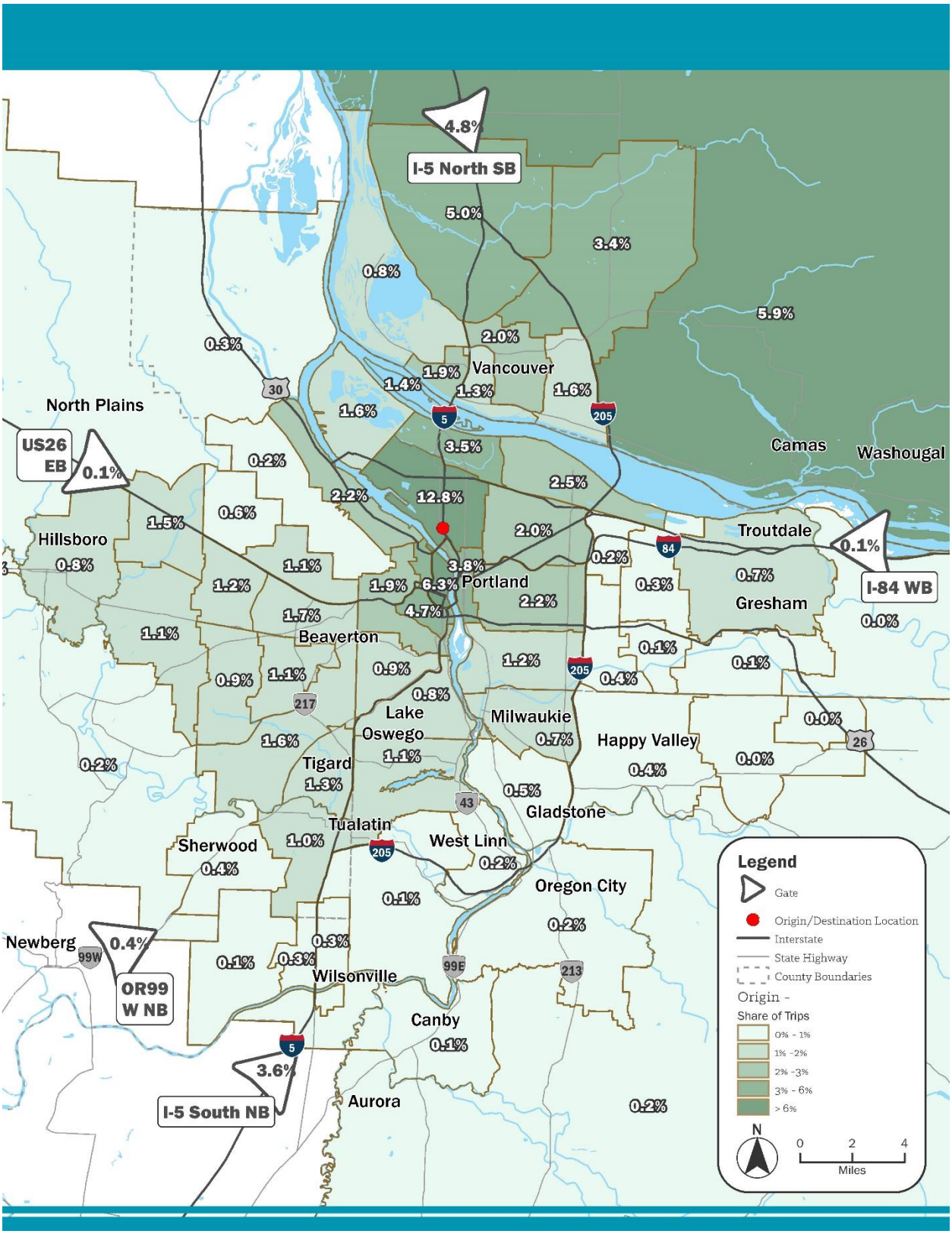


Source: StreetLight Insight Platform

4.2.2 Location #2: I-5 North of Fremont Bridge

Trips on I-5 closer to downtown Portland show some similar patterns in terms of serving commuter traffic to/from Clark County, Washington, as well as serving local trips in north Portland near I-5. A lower share of trips here are entering/exiting the geographic evaluation area, comprising around 8% of total trips.

Figure 4-3. Origins for I-5 Trips North of Fremont Bridge (Location #2)



Source: StreetLight Insight Platform

4.2.3 Location #3: I-5 at Marquam Bridge

The Marquam Bridge, in addition to carrying I-5 traffic, also serves as a primary east-west route connecting U.S. Route (US) 26 and I-84. The bridge serves a substantial number of trips spread over a larger part of the region than the I-5 locations noted to the north—in particular, northeast Portland, southwest Portland, and the Tigard-Tualatin area. Portland International Airport carries the highest share of origin/destination trips of any analysis zone in the region, with nearly 7% of Marquam Bridge traffic going to/from the airport. For external trips, the Marquam Bridge marks the first analysis point where I-5 to the south of the geographic evaluation area generates more trips than to the north.

Figure 4-4. Origins for I-5 Trips across Marquam Bridge (Location #3)

Source: StreetLight Insight Platform

4.2.4 Location #4: I-5 South of Multnomah Boulevard

With the portion of I-5 between downtown Portland and the Beaverton Tigard Highway (OR 217), trip origins and destinations are largely either local trips – especially those traveling between the Tigard/Tualatin areas and downtown Portland – or trips using I-5 to enter/leave the geographic evaluation area. The northwest and southeast parts of the region comprise very little of I-5 traffic at this location. Almost 11% of trips enter/leave the geographic evaluation area to the south of Clackamas County, showing a higher trend in longer-distance trips starting/ending around downtown or northeast Portland.

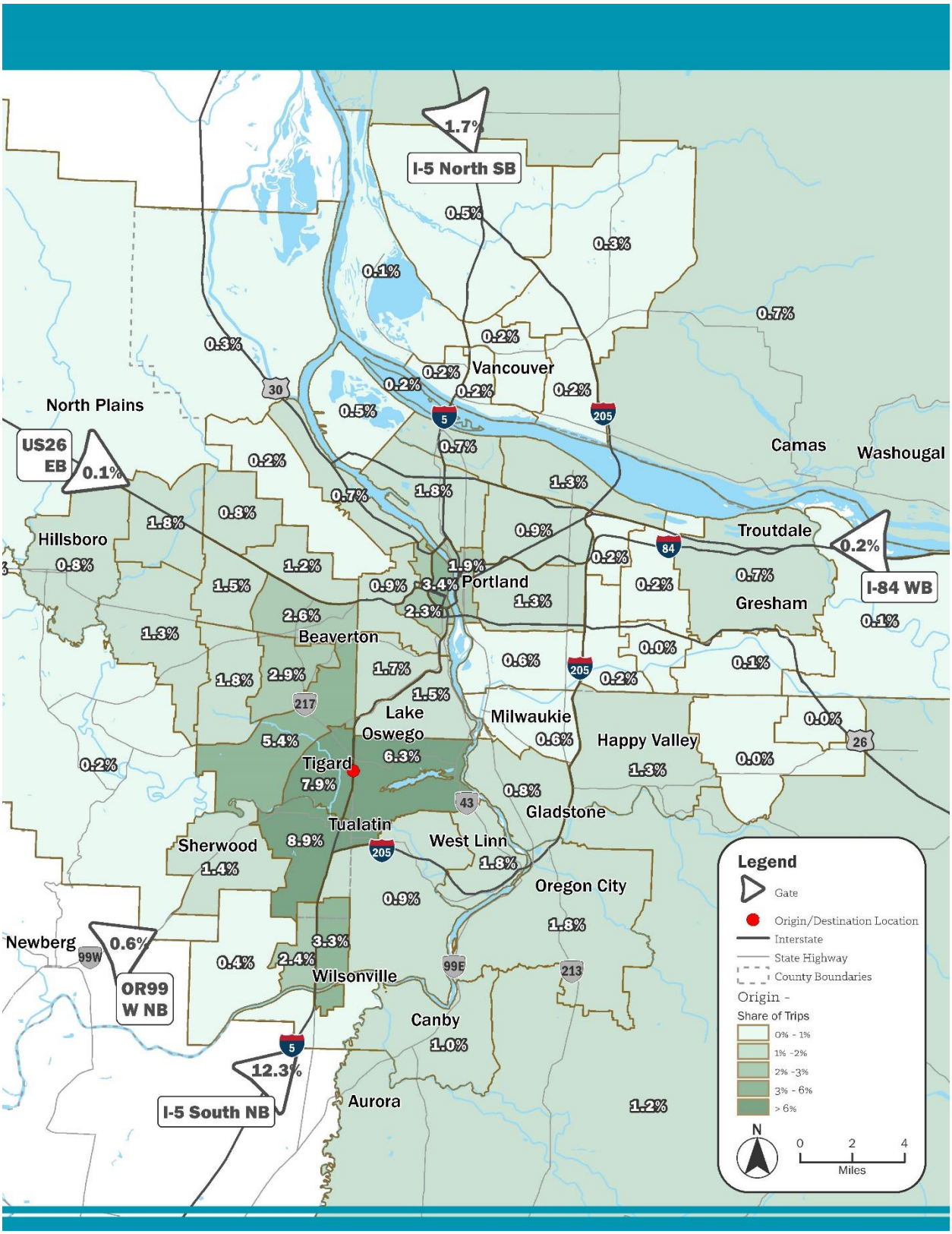
Figure 4-5. Origins for I-5 Trips South of Multnomah Boulevard (Location #4)

Source: StreetLight Insight Platform

4.2.5 Location #5: I-5 South of OR 217

Due to its location just south of the Beaverton Tigard Highway (OR 217) junction of I-5, Location #5 serves areas in Washington County and Clackamas County toward Oregon City at a far higher rate than to the north of this junction. This portion of I-5 contains a mix of local traffic in cities such as Tigard, Lake Oswego, and Tualatin, as well as east-west trips across the geographic evaluation area and trips between central Portland and I-5 to the south of the region. Because this part of I-5 lies in a suburban area, around 13% of trips enter or leave the geographic evaluation area to the north or south; this is higher than the external trip rates shown in more urban areas of I-5.

Figure 4-6. Origins for I-5 Trips South of OR 217 (Location #5)



Source: StreetLight Insight Platform

4.2.6 Location #6: I-5 South of I-205

Near the southern end of the corridor user analysis extents, trips on I-5 to the south of I-205 strongly trend toward external trips, with nearly 27% entering or leaving the geographic evaluation area to the south. While local trips in Wilsonville make up a relatively high share of traffic at this location, on the whole, trips are more evenly spread around the region, indicating this point as a main gateway into the Portland metropolitan area. The relatively high share of airport trips here also indicates the significance of I-5 in accessing the airport from rural areas to the south/southwest of the region.

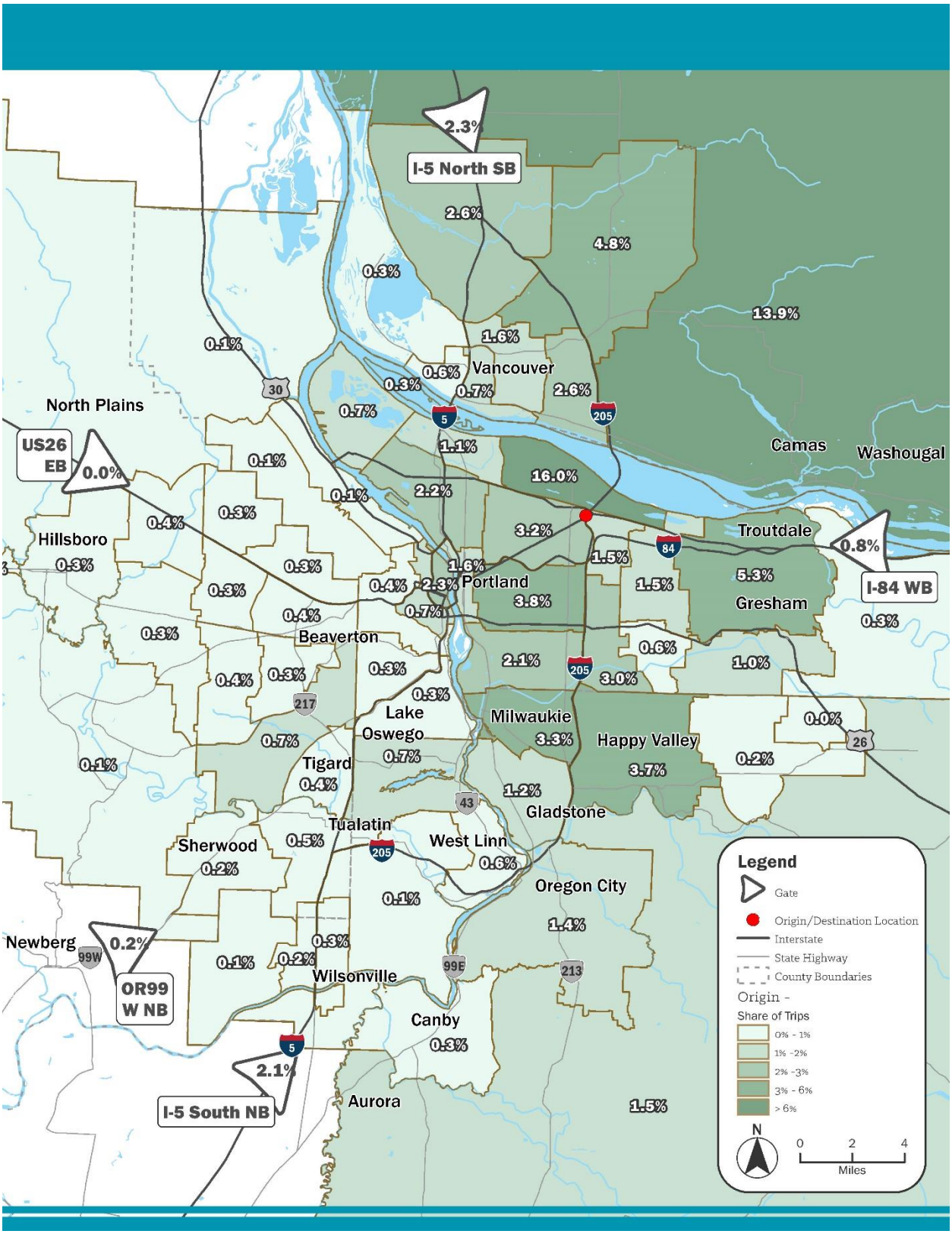
Figure 4-7. Origins for I-5 Trips South of I-205 (Location #6)

Source: StreetLight Insight Platform

4.2.7 Location #7: I-205 at Sandy-Killingsworth Area

Toward the north end of the corridor user analysis extents on I-205, trip origins and destinations are heavily concentrated around Portland International Airport, suburban Vancouver, and suburban/rural Clark County. This part of I-205 also serves trips to/from the Gresham and Troutdale areas, as well as southeast Portland. Unlike I-5 toward the north of the corridor user analysis extents, I-205 carries a much lower share of external trips: around 5% of trips here are entering/exiting the geographic evaluation area. Likewise, Washington County represents a relatively small share of trips.

Figure 4-8. Origins for I-205 Trips South of Killingsworth Street (Location #7)

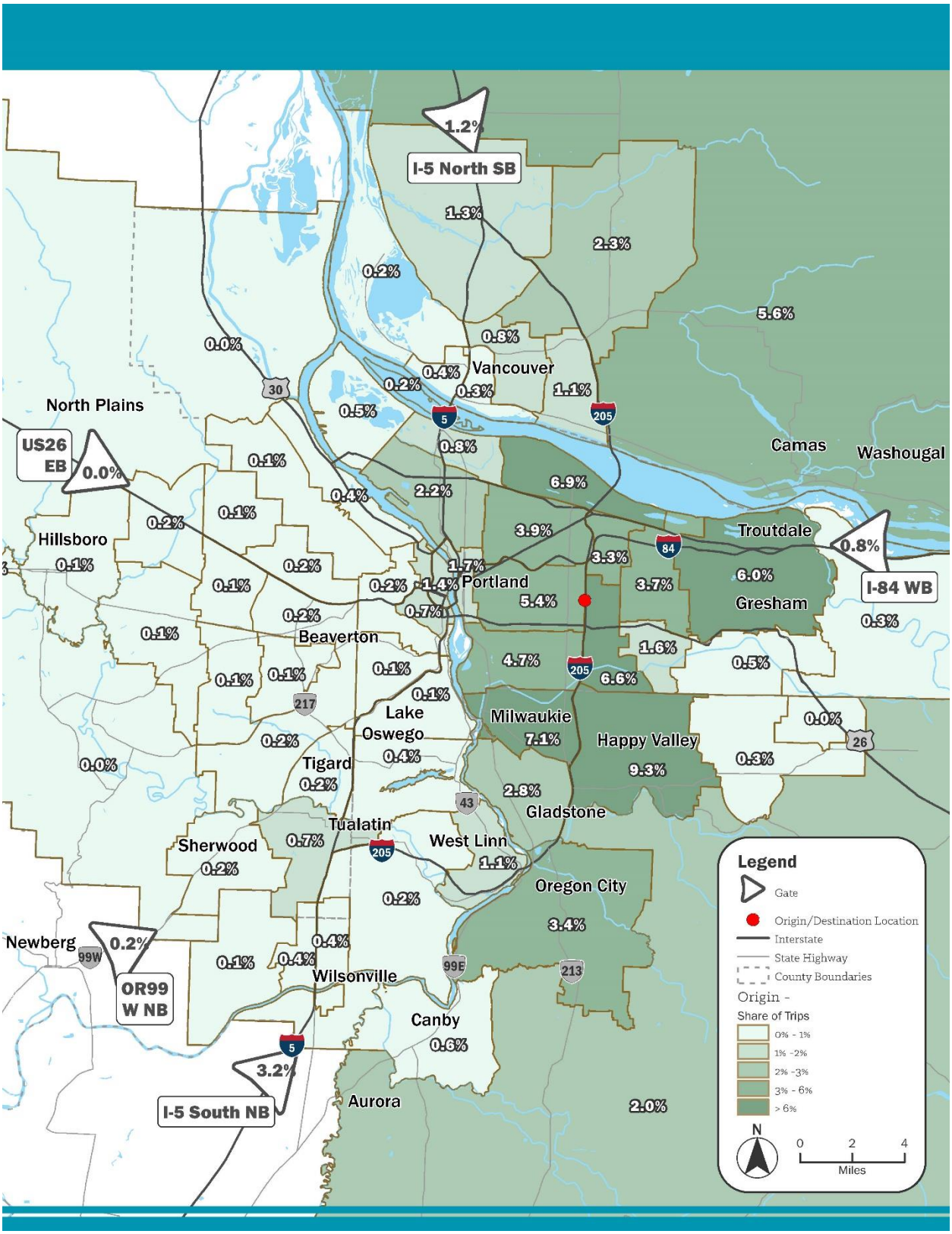


Source: StreetLight Insight Platform

4.2.8 Location #8: I-205 North of Division Street

Farther south along I-205, while Portland International Airport and Clark County comprise a high share of trips, this portion of the highway is more heavily used by local trips in east and southeast Portland. Trips from Oregon City and rural Clackamas County also comprise a higher portion of trips at this location. Like the rest of I-205 in the corridor user analysis extents, trip origins/destinations are much less prevalent going to/from Washington County or outside the geographic evaluation area indicating that I-205 in general largely serves traffic within the geographic evaluation area when compared to I-5.

Figure 4-9. Origins for I-205 Trips North of Division Street (Location #8)

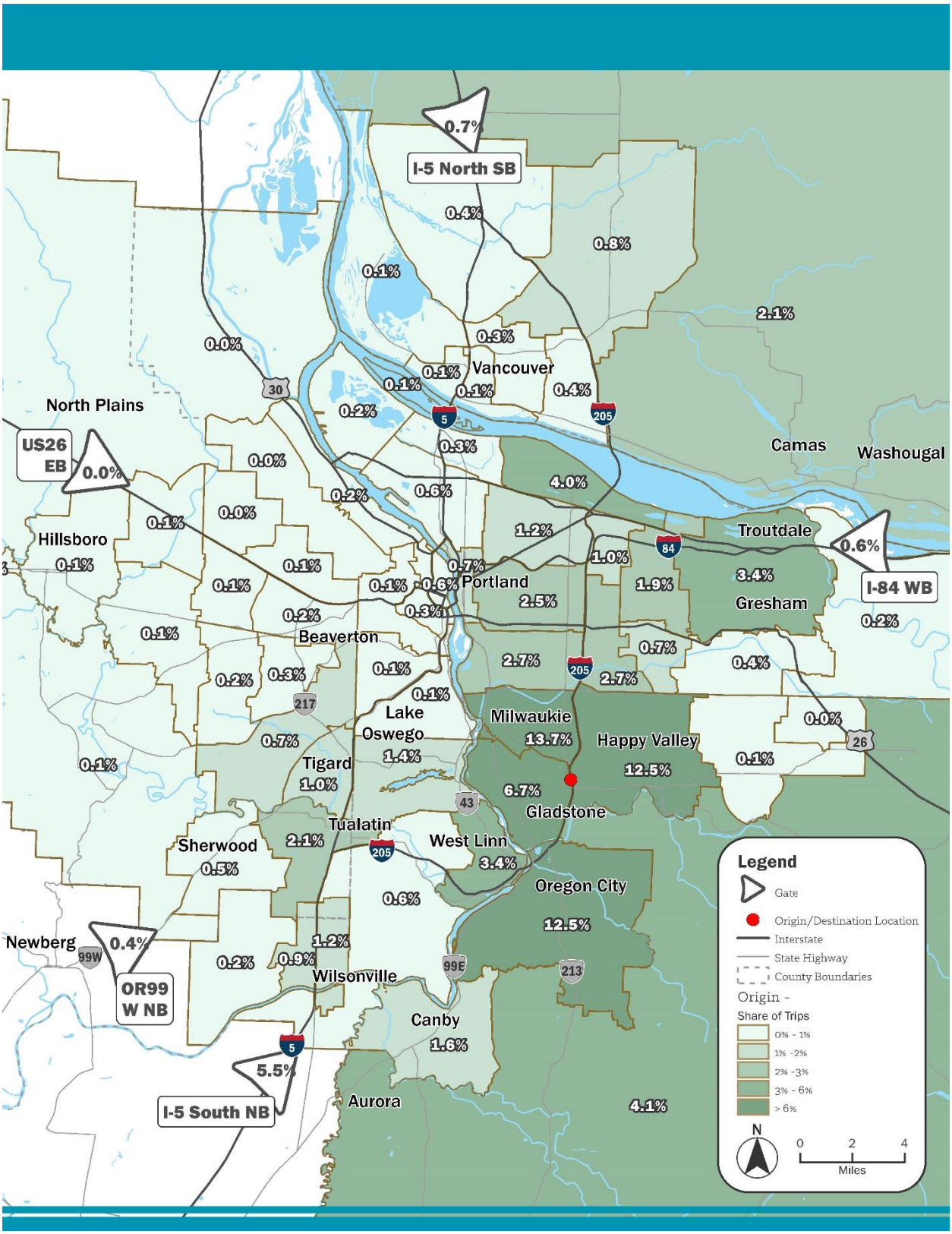


Source: StreetLight Insight Platform

4.2.9 Location #9: I-205 North of OR 212

On I-205 to the south of Portland proper, this location serves more traffic between east/southeast Portland that is leaving or entering the geographic evaluation area to the south; external trips to/from the south make up around 5% of all traffic here. While Portland International Airport trips and trips to/from the Gresham and Troutdale areas still contribute a relatively high share of total traffic, the largest concentration of traffic is more local, coming from and going to areas such as Damascus, Clackamas, and Oregon City. I-205 in this area also appears to be a main link connecting rural Clackamas County with the Portland metropolitan area, with 4% of total traffic at this location coming from or going to the southeast.

Figure 4-10. Origins for I-205 Trips North of OR 212 (Location #9)



Source: StreetLight Insight Platform

4.3 Comparing Origin/Destination Analysis Results from StreetLight with Regional Travel Demand Model

As described in Section 3, Methodology, both StreetLight and the Metro RTDM provide estimates for the number of trips and the characteristics of trips in the region but develop these estimates using different methods and data sources. This section provides a comparison of the StreetLight and Metro RTDM data to ensure the findings are similar and validate the results of the corridor user analysis. Appendix C includes figures showing the trip origin and destination information obtained from the RTDM.

For each of the nine locations included in the origin/destination analysis above, the origins and destinations given in each source were compared by calculating the R-squared value between the two data sets, as shown in Table 4-3. This value provides a statistical measure representing the percent of variation between both sources. An R-squared value of 0 would indicate that the two sources are not correlated at all, while an R-squared value of 1 would indicate perfect correlation. The R-squared values were calculated across 71 geographic areas (aggregations of RTDM transportation analysis zones) in the four-county geographic evaluation area.

Table 4-3. Comparison of Origin/Destination Analysis between StreetLight Insight Platform and Regional Travel Demand Model

#	Location	Trip Distribution: R^2 Correlation between StreetLight and RTDM	
		By Origins	By Destinations
1	I-5 south of Columbia Boulevard	0.95	0.91
2	I-5 north of I-405	0.96	0.97
3	I-5 Marquam Bridge	0.80	0.80
4	I-5 south of Multnomah Boulevard	0.94	0.95
5	I-5 south of OR 217	0.94	0.95
6	I-5 south of I-205	0.95	0.96
7	I-205 south of Killingsworth Street	0.89	0.91
8	I-205 north of Division Street	0.93	0.94
9	I-205 north of OR 212	0.94	0.94

Source: 2015 Metro Regional Travel Demand Model, *StreetLight Insight Platform*
I- = Interstate; OR = Oregon Route; R^2 = R-squared value; RTDM = Regional Travel Demand Model

Overall, analysis results for trip origins and destinations are very similar between the Metro RTDM and StreetLight for all nine locations.[5] The statistical comparison of fit between the two tools shows R-squared values close to or over 0.95 at most locations. They match most closely at locations on I-5 north of I-405 and on I-5 south of I-205, where the R-squared values are between 0.95 and 0.97. The data sources are least correlated for trips across the I-5 Marquam Bridge, where the R-squared value is 0.80.

4.4 Distances Traveled on I-5 and I-205

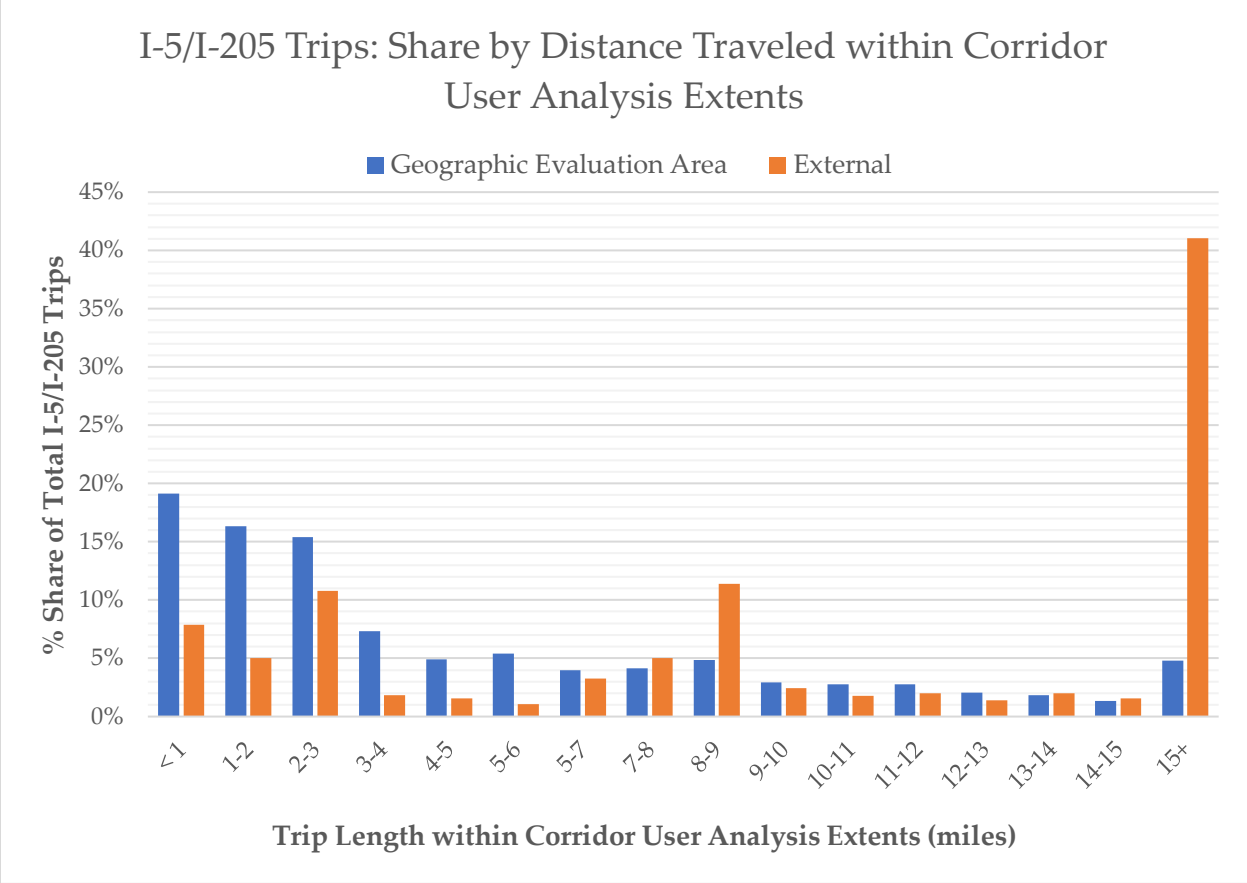
Another important consideration for understanding user travel patterns is the distance traveled on I-5 and I-205 facilities. Trip length data for this section came from the Metro RTDM and was measured according to the length of trip using the I-5 and I-205 facilities within the corridor user analysis extents only. The

[5] A similar comparison between Streetlight and the Metro RTDM was performed for the origin/destination analysis for I-205 at the Abernethy Bridge as part of the I-205 Corridor User Analysis. These results also showed a high degree of consistency between the two data sources. https://www.oregon.gov/odot/tolling/Documents/I205%20Corridor%20User%20Analysis%20Final.pdf

corridor user analysis extents include (1) I-5 between the Columbia Boulevard interchange in north Portland and Boone Bridge near Wilsonville and (2) I-205 between just south of the Glenn Jackson Bridge and the southern terminus of I-205 near Tualatin. For example, if a trip totaled 5 miles but traveled on I-5 within the corridor user analysis extents for only 2 miles, the trip is considered a 2-mile trip within the corridor user analysis extents.

Trips that travel on I-5 and I-205 within the corridor user analysis extents were classified according to their starting location. Figure 4-11 shows the share of distances traveled within the corridor user analysis extents for trips starting inside of the geographic evaluation area and outside of it. Table 4-4 breaks down the data further by trip origin county. Graphs showing the percentage shares of all I-5 and I-205 trips originating in each county by distance within the corridor user analysis extents can also be found in Appendix D.

Figure 4-11. Trips on I-5/I-205 within Corridor User Analysis Extents by Distance Traveled



Source: 2015 Metro Regional Travel Demand Model
*Distance traveled on I-5/I-205 within the corridor user analysis extents

Table 4-4. Trips on I-5/I-205 within Corridor User Analysis Extents by County

Start Location of I-5/I-205Trip*	Share of Total I-5/I-205 Trip Origins (daily)	Average Distance Traveled within Corridor User Analysis Extents (miles)	% of Shorter I-5/I-205 Trips (3 miles or less)	% of Longer I-5/I-205 Trips (10 miles or more)
Multnomah County	42%	4.1	60%	10%
Clackamas County	26%	5.9	39%	22%
Washington County	16%	5.4	48%	18%
Clark County, Washington	8%	5.3	50%	19%
Total from Four-County Region	**93%**	**4.9**	**51%**	**16%**
Outside of Region	**7%**	**12.3**	**24%**	**50%**

Source: 2015 Metro Regional Travel Demand Model

I- = Interstate; OR = Oregon Route; RMPP = Regional Mobility Pricing Project

*Analysis limited to trips using I-5 or I-205 within the corridor user analysis extents.

The trip distance data shows a stark difference between trips originating within the geographic evaluation area and trips originating outside the area. Within the geographic evaluation area, trips on I-5 and I-205 are more heavily skewed toward shorter distances, with about half of trips traveling less than 3 miles on I-5 or I-205. In contrast, about half of the trips coming from outside the geographic evaluation area are on I-5 or I-205 for at least 10 miles. A relatively large portion of external trips traveled 8 to 9 miles within the corridor user analysis extents; many of these trips start south of the region and travel on I-5 toward OR 217 in Washington County.

Between the four counties in the geographic evaluation area, Multnomah County is the most heavily skewed toward shorter trips that travel less than 3 miles on I-5 or I-205 within the corridor user analysis extents. Trips originating in Clackamas and Washington Counties have a more even distribution in the medium- to long-range (i.e., over 10 miles), indicating drivers in these counties use I-5 and/or I-205 to reach a variety of destinations within the region. With Clark County located entirely to the north of the corridor user analysis extents, trips from here were much more heavily skewed toward the 2- to 4- mile range and showed very low trip shares in the intermediate 5- to 10-mile range. This indicates that many drivers from Clark County are either using I-5 and I-205 to enter Portland or are passing through the entire region.

4.5 I-5 and I-205 Travel Shed for Selected Locations

This analysis examines the routes that are commonly used to travel to and from nine locations on I-5 and I-205. Each location corresponds to those previously identified for the origin/destination analysis. Both directions of travel are studied separately, resulting in a total of 18 travel shed summaries. For each location and direction of travel, data from the RTDM was used to determine the paths of trips passing by that point and identify commonly used routes.

In this section of the report, travel sheds for southbound I-5 at Marquam Bridge and northbound I-205 between OR 212 and OR 224 are given as examples of the analysis on each corridor. Appendix E includes figures showing the travel shed for each location listed.

At a high level, these travel shed maps demonstrate notable differences in the kinds of trips being made on I-5 or I-205 based on which routes are used most commonly to access these facilities. While shorter

trips near the highway are notable contributors, I-5 is heavily used as a regional connector, with notable shares of trips either traveling through the region on I-5 or using the facility to reach other major regional roadways and highways. The I-205 travel shed maps, in contrast, show heavier use of the local road network near each analysis location. Along I-205 near Portland International Airport, much of the regional traffic appeared to focus on using I-205 to reach the airport area or to access I-84 toward either downtown Portland or outside the region to the east.

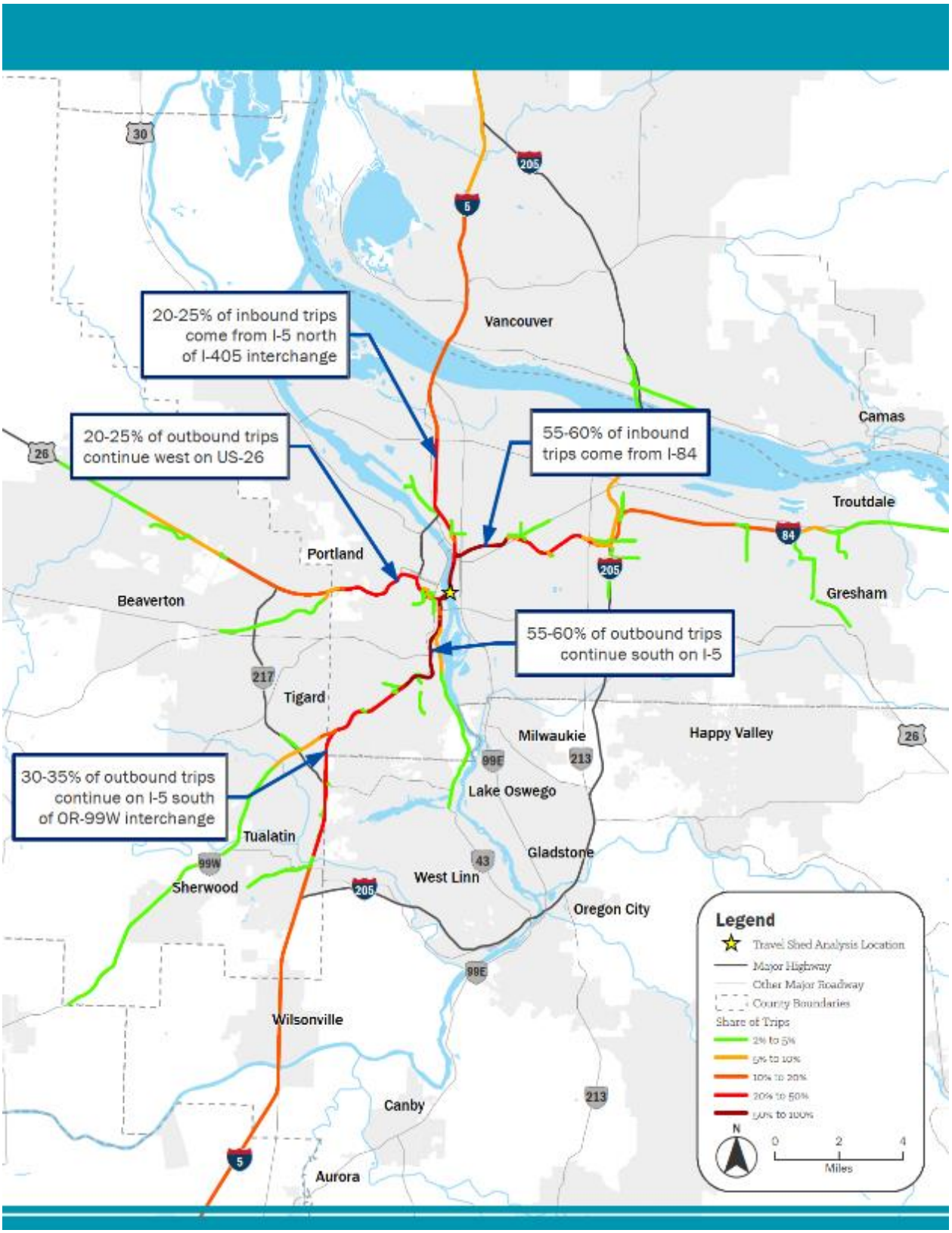
4.5.1 I-5 Travel Shed Analysis Example: Southbound at Marquam Bridge

Figure 4-12 shows the commonly used routes to travel to and from southbound I-5 at the Marquam Bridge over the Willamette River. Darker colors indicate that a large share of the trips that travel southbound across the Marquam Bridge use those routes while lighter colors indicate a smaller share of trips using those routes. Roadway segments farther from the Marquam Bridge tend to be lighter, representing the wide dispersion of the origins and destinations of trips that cross the Marquam Bridge.

As noted in the figure, over half of the trips that travel south on I-5 at the Marquam Bridge come from I-84. Around a quarter of the inbound trips originate north of the I-5 and I-405 interchange, and the remaining share of inbound trips (15% to 20%) enter I-5 near the Rose Quarter, between the I-405 interchange and the I-84 interchange.

After crossing the Marquam Bridge, 55% to 60% of trips continue south on I-5. Around half of these trips (30% to 35% of all southbound trips on Marquam Bridge) continue on I-5 south of the OR 99W interchange. Around a third of all southbound trips on the Marquam Bridge connect to I-405, with most of these trips routing to westbound US 26 through the Vista Ridge Tunnel. Over 15% of inbound trips come from north of the Columbia River, and approximately 15% of outbound trips continue south of Wilsonville, demonstrating the use of I-5 as a connection to and from the region.

Figure 4-12. Travel Shed for Southbound Trips on I-5 at Marquam Bridge

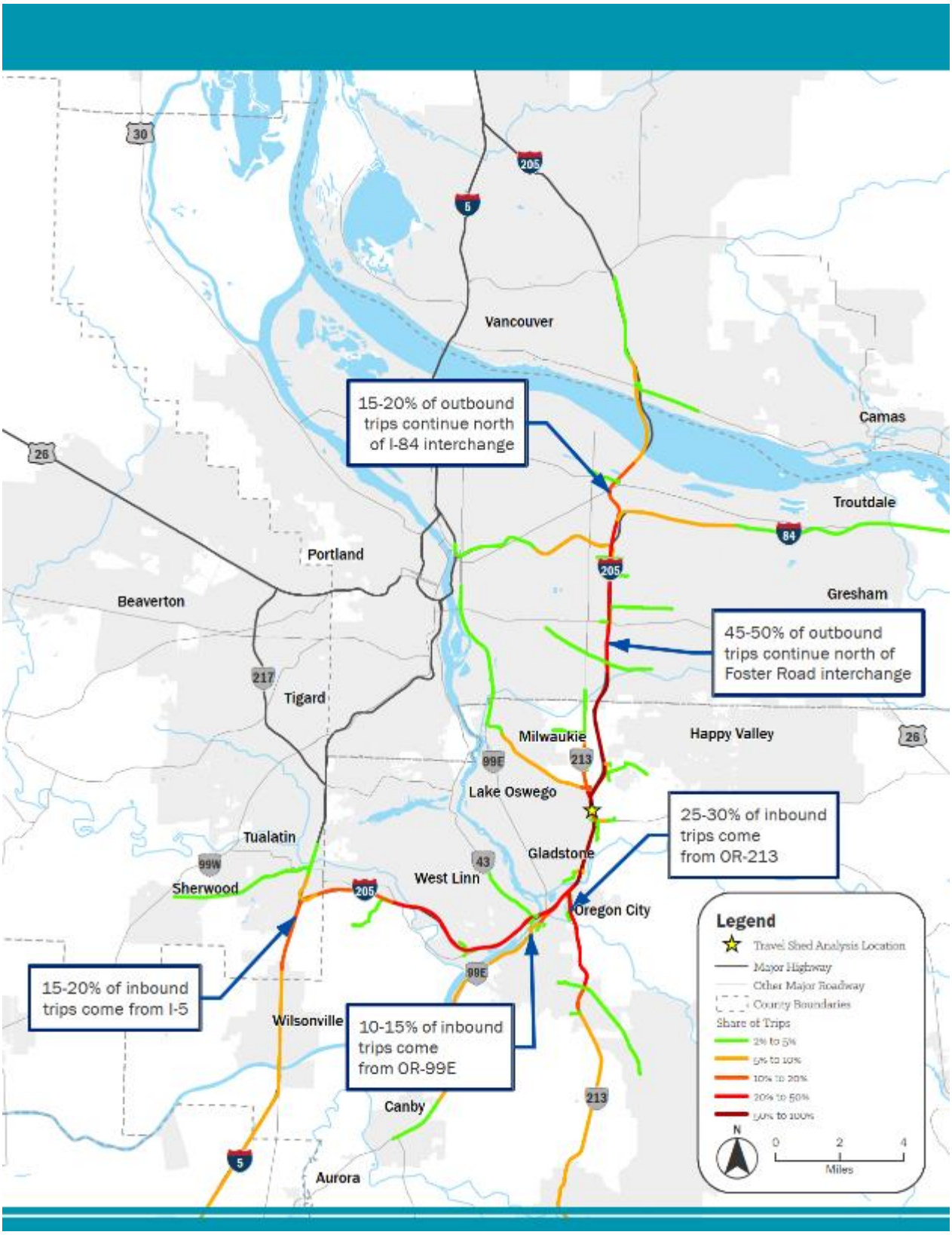


Source: 2015 Metro Regional Travel Demand Model

4.5.2 I-205 Travel Shed Analysis Example: Northbound between OR 212 and OR 224

Figure 4-13 shows a map of the travel shed for northbound trips on I-205 between OR 212 and OR 224. This map uses the same colors as Figure 4-12 to indicate which roadways are commonly used to travel to and from this point on I-205. The “tails” of the travel shed shown in Figure 4-13 are spread among many highways, arterials and their numerous connecting roadways to the north and south of this point on I-205. Around 15% to 20% of inbound trips come from I-5 and almost a third of inbound trips come from OR 213. Around 10% to 15% of inbound trips travel on OR 99E through Oregon City. About a third of trips exit on SE 82nd Avenue (OR 213), and around 10% of all trips in this travel shed then continue to OR 224. Nearly half of the trips northbound between OR 212 and OR 224 exit I-205 at or before the Foster Road interchange. Only around 15% to 20% of trips continue on I-205 beyond the I-84 interchange.

Figure 4-13. Travel Shed for Northbound Trips on I-205 between OR -212 and OR -224



Source: 2015 Metro Regional Travel Demand Model

5 Existing Routing and Diversion Analysis

This section provides examples of how user routing choices on I-5 and I-205 change between peak and off-peak periods. These choices are associated with changing levels of congestion on the interstate highways. The routing choices are illustrated in Table 5-1 for seven travel pattern examples, with a description of each example, including the key corridor alternatives available for routing choice.

For each travel pattern, the share of routing alternatives used during the AM and PM peak commuter periods (7 to 9 a.m.; 4 to 6 p.m.) is compared with the share of routing alternatives used during off-peak periods. By highlighting changes in routing that occur between congested and uncongested periods, this analysis indicates how congestion can affect routing choice. In other words, the figures below show how travelers who may prefer to travel on I-5 or I-205 choose to reroute or divert to other roadways when congestion is present on the interstate highways.

Table 5-1. Corridor Routing Alternatives Analyzed

Example #	Corridor Alternatives	Route Analyzed (both directions)
1.1	I-5 vs. I-205	Between I-5/I-205 northern junction (near Vancouver) and I-5/I-205 southern junction (near Tualatin)
1.2		Between east Vancouver area (near I-205) and downtown Portland
1.3		Between east Vancouver area (near I-205) and I-5/I-205 southern junction (near Tualatin)
2.1	I-5 vs. I-405 and North Portland Arterials (N Greeley Ave and N Interstate Ave)	Between north Portland and I-5 at SW Terwilliger Blvd
2.2		Between Vancouver (near I-5) and downtown Portland
3	I-5 and NE Lombard St vs. I-84 and I-205	Between Portland International Airport area and downtown Portland
4	I-5 vs. Wilsonville area arterials (e.g., Boones Ferry Rd)	Between Tigard and Wilsonville

The following analysis examines weekday trips (Monday to Thursday) using 2019 annual data extracted on StreetLight's Insight Platform. Analysis results indicate that routing patterns tend to change from peak to off-peak periods, usually shifting onto local streets when the highway segment is congested in the same travel direction. Trip patterns between some origin/destination pairs show a less clear pattern, likely due to heavy congestion on all route alternatives, which is more common when both alternatives are highways and/or heavily traveled arterials.

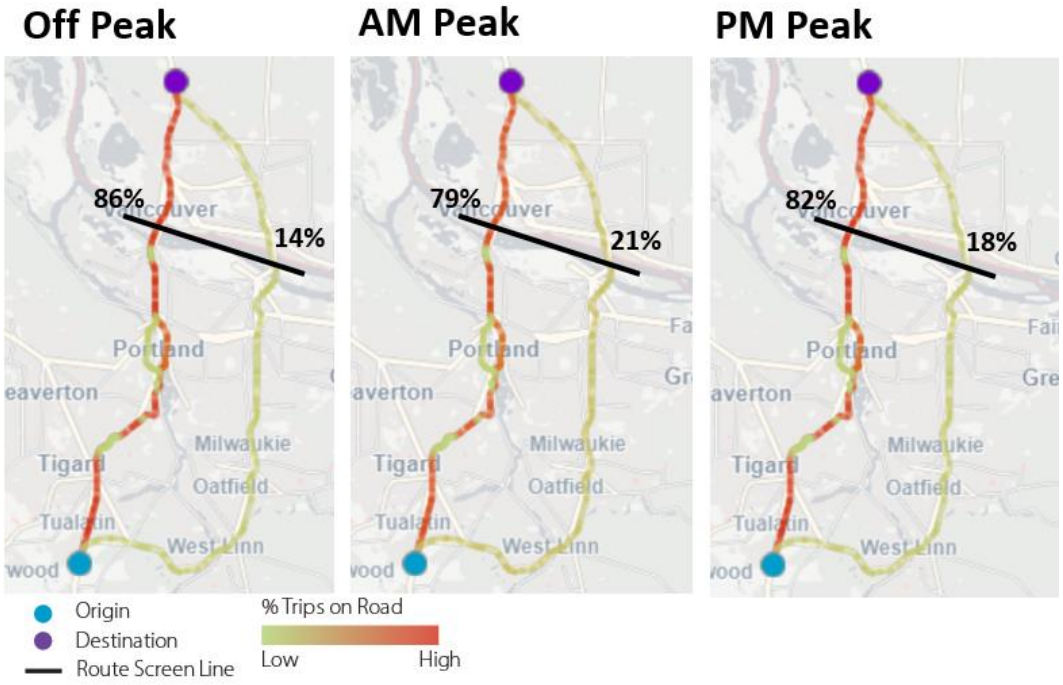
5.1 Example Set 1: I-5 vs I-205

The first set of examples considers travel patterns where drivers can reasonably choose between using either I-5 or I-205 to reach their destinations. The following three subsections consider different start/end points for trips that can choose between using I-5 or I-205 for part or all of their trips.

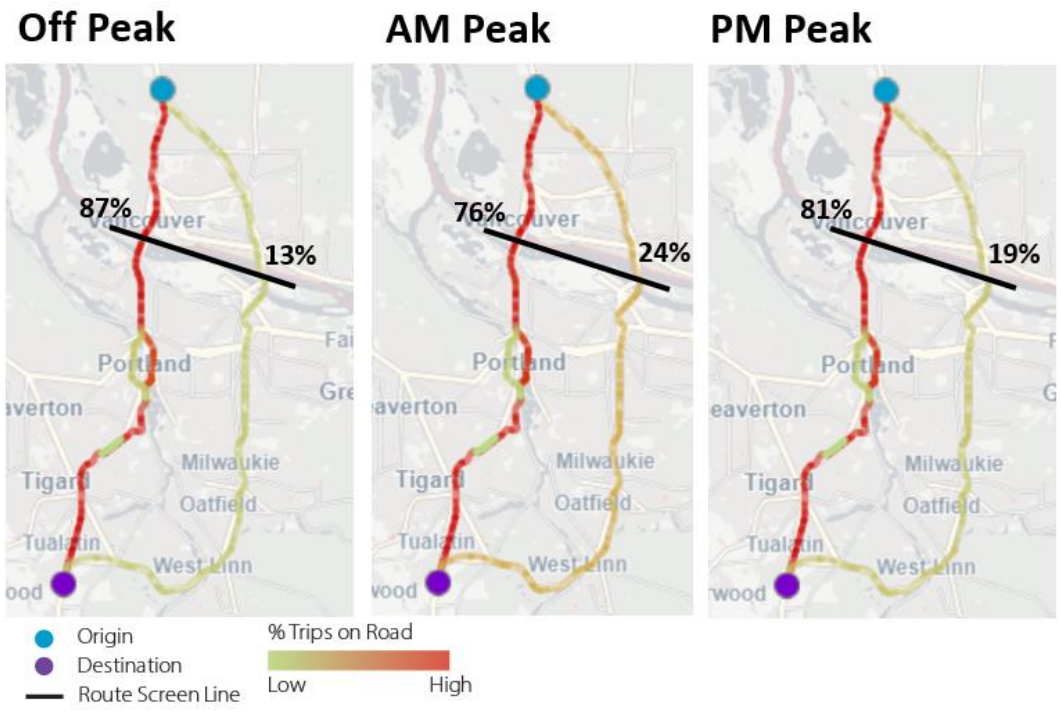
5.1.1 Example 1.1: Between I-5/I-205 North Junction and I-5/I-205 South Junction

The first example (shown in Figure 5-1) considers the entirety of I-205, between the southern terminus of I-205 near Tualatin and the northern terminus of I-205 in Clark County. During off-peak hours, I-5 carries 85% to 90% of these regional trips in both directions because it is the more direct and shorter distance of the two routes. During peak periods, the relative share of I-205 usage increases slightly, though I-5 continues to carry 75% to 85% of trips. Because both facilities experience high levels of congestion during peak periods, the attractiveness of I-205 as an alternative appears somewhat limited during these hours.

Figure 5-1. Share of Trips on Routing Alternatives between I-5/I-205 Junction North and I-5/I-205 Junction South



Northbound: I-5 south of I-205 to I-5 north of Vancouver



Southbound: I-5 north of Vancouver to I-5 south of I-205
Off-Peak: 10 a.m. – 3 p.m.; AM Peak: 7 – 9 a.m.; PM Peak: 4 – 6 p.m.
(Approximate Device Count: 48,000; Approximate Trip Count: 97,000)
Source: StreetLight Insight Platform

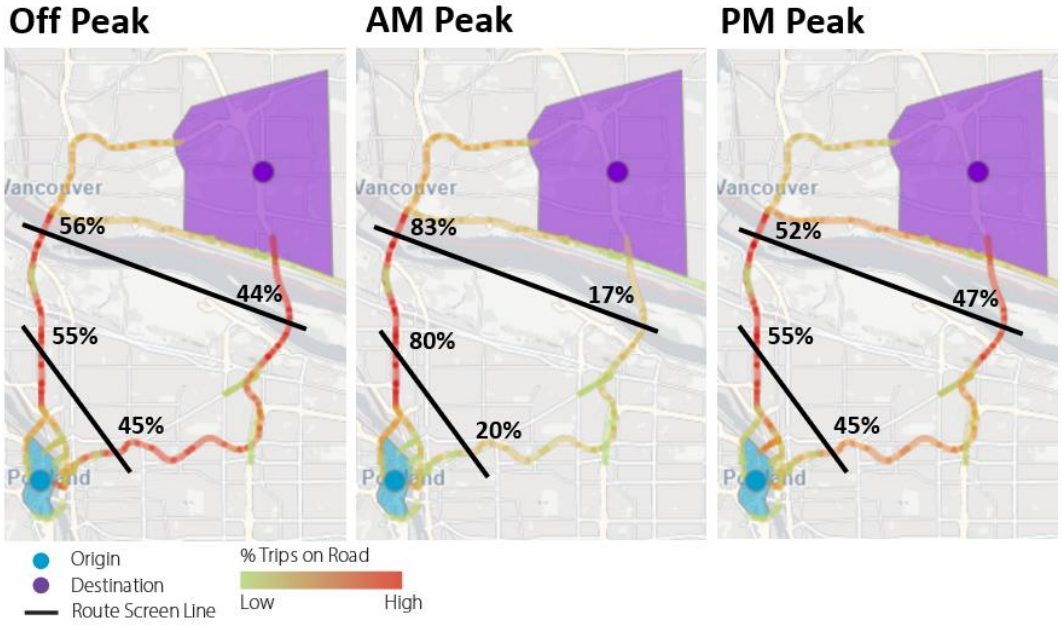
5.1.2 Example 1.2: Between Downtown Portland and East Vancouver Area near I-205

The second example for the I-5 versus I-205 route choices looks at travel between downtown Portland and eastern Vancouver, Washington, as shown in Figure 5-2**.** The I-205 route connects via I-84 in Oregon while the I-5 routes use State Route (SR) 14 or SR 500 in Washington.

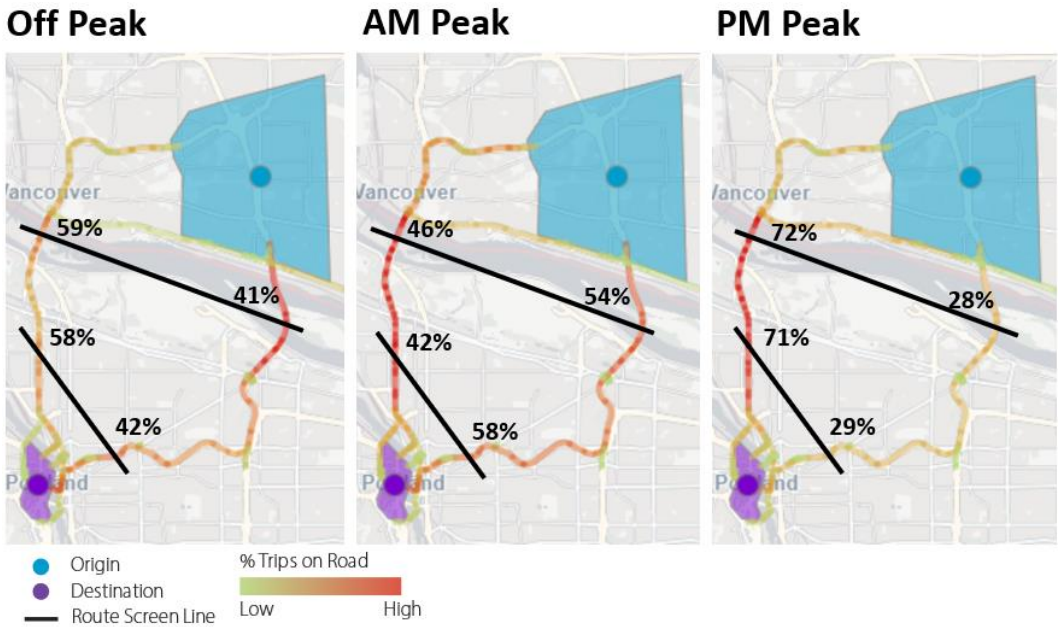
The off-peak period shows a relatively close split between users choosing to travel along I-5 (55% to 60%) and along I-205 (40% to 45%). However, during both peak periods, I-5 can become a favored route choice, depending on time of day and direction. For this travel pattern, I-5 becomes most attractive in the opposite direction of the primary commute pattern for Clark County. Many Clark County commuters travel southbound towards downtown Portland during the AM peak period and return northbound towards Vancouver during the PM peak period.

The changes in route choice for trips between downtown Portland and east Vancouver indicate that these travelers, who can readily choose between either I-5 or I-205 routes, are attracted to I-5 in the opposite or "reverse" direction of the peak commuter trend. For example, morning travel northbound from Portland to Vancouver favors I-5 (80% to 85% of trips) in the opposite direction of the heavier demand pattern of southbound commuter travel from Clark County. The reverse is true in the PM peak period, when southbound travel from Vancouver to Portland is more likely to use I-5 (70% to 75% of trips) in the opposite direction of the heavier demand pattern of northbound commuter travel to Clark County. These changes in routing choice indicate that I-5 attracts more of the trips between Vancouver and Portland when less traffic congestion may be present on I-5. This may be explained by more directional congestion on the I-5 route, in line with peak major commuter patterns and more balanced congestion patterns on the I-205/I-84 route.

Figure 5-2. Share of Trips on Routing Alternatives between Downtown Portland and East Vancouver Area near I-205



Northbound: Downtown Portland to east Vancouver area near I-205



Southbound: East Vancouver area near I-205 to downtown Portland
Off-Peak: 10 a.m. – 3 p.m.; AM Peak: 7 – 9 a.m.; PM Peak: 4 – 6 p.m.
(Approximate Device Count: 14,000; Approximate Trip Count: 29,000)
Source: StreetLight Insight Platform

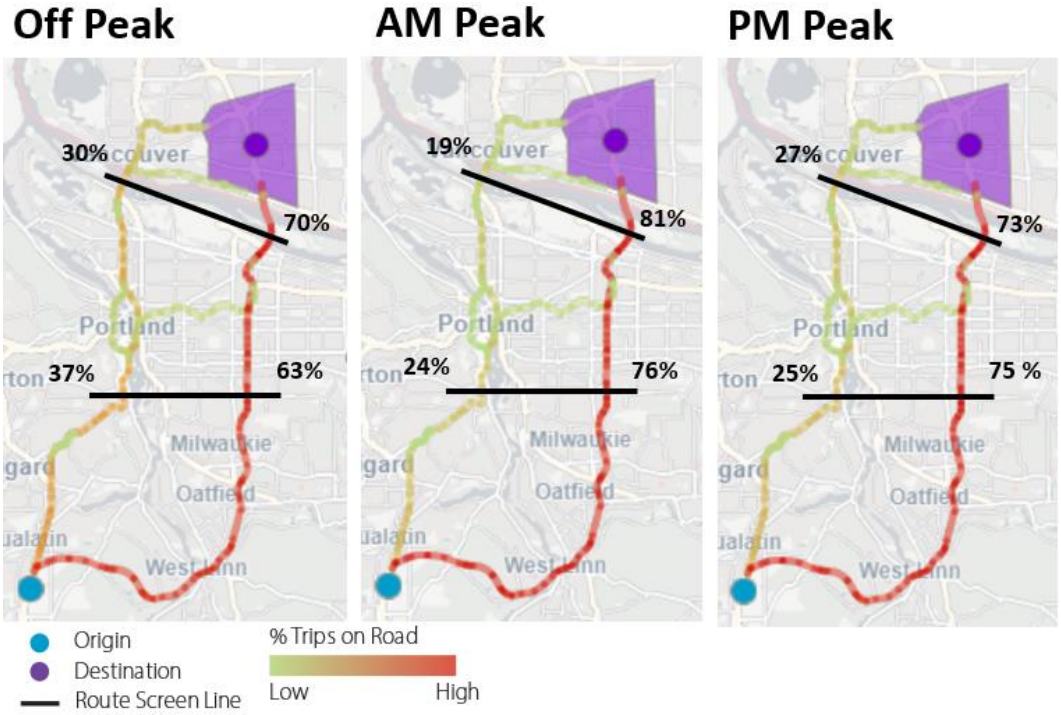
5.1.3 Example 1.3: Between I-5/I-205 Junction South and East Vancouver Area near I-205

This example for the I-5 versus I-205 routing choice looks at travel between the I-5/I-205 junction near Tualatin and the east Vancouver area near I-205, as shown in Figure 5-3. Users may choose to drive directly on I-205 or use I-5 with east/west connections via SR 500, SR 14, or I-84.

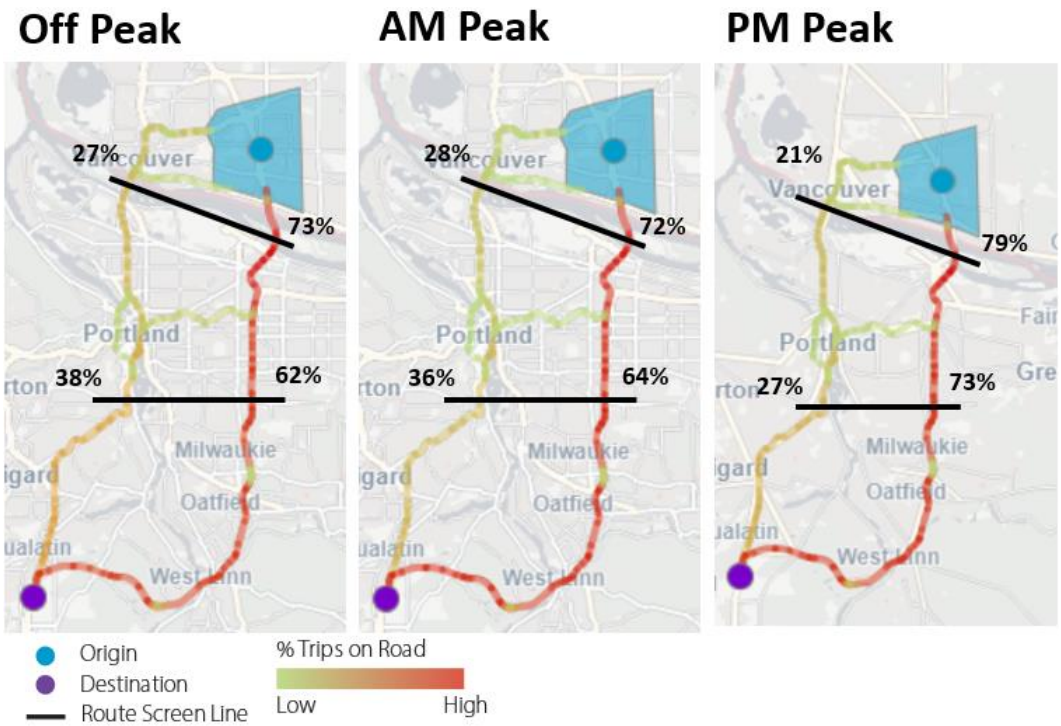
I-205 is the primary route during the off-peak period in both directions, used by about 60% to 65% of these trips. An additional 10% connect via I-5 and I-84, resulting in approximately 70% to 75% of these trips using the I-205 Glenn Jackson Bridge to cross between Oregon and Washington. During peak periods, the I-205 route generally becomes more attractive for this travel pattern. While there is some variation depending on direction, time of day, and location analyzed, the peak period route choices generally show 5% to 10% higher usage on the I-205 routes compared to the off-peak period.

This result is similar to the patterns observed previously for travel between I-5/I-205 junction in the north and south (Section 5.1.1). Here too, I-205 becomes slightly more attractive during peak periods, but the scale of shifts are likely limited due to congestion on I-205 as well as I-5.

Figure 5-3. Share of Trips on Routing Alternatives betweenI-5/I-205 Junction South and East Vancouver Area near I-205



Northbound: I-5/I-205 junction south to east Vancouver Area near I-205



Southbound: East Vancouver Area near I-205 to I-5/I-205 Junction South
Off-Peak: 10 a.m. – 3 p.m.; AM Peak: 7 – 9 a.m.; PM Peak: 4 – 6 p.m.
(Approximate Device Count: 14,000; Approximate Trip Count: 29,000)
Source: StreetLight Insight Platform

5.2 Example Set 2: I-5 Alternatives Around Downtown/North Portland

The examples in this section focus on routing choices near downtown and north Portland, where I-5 alternatives include I-405 around downtown and arterial streets running parallel to I-5 through north Portland.

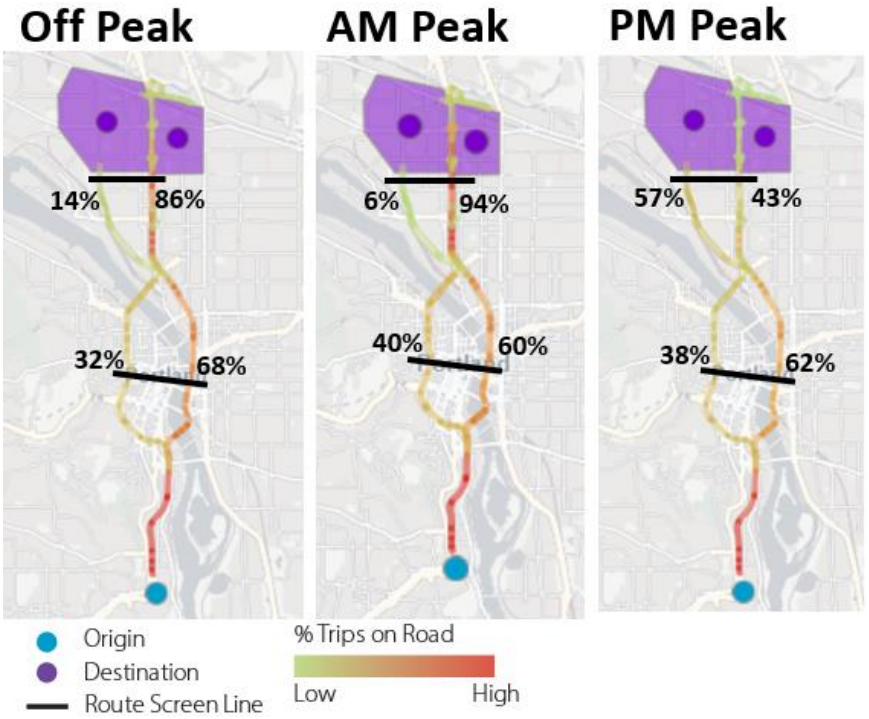
5.2.1 Example 2.1: Between I-5 at SW Terwilliger Boulevard and North Portland

The two route choices between I-5 near SW Terwilliger Boulevard and parts of north Portland on either side of I-5 are shown in Figure 5-4. Users with this travel pattern choose between routing on I-5 or I-405 around downtown Portland, as well as between using I-5 or N Greeley Avenue in north Portland.

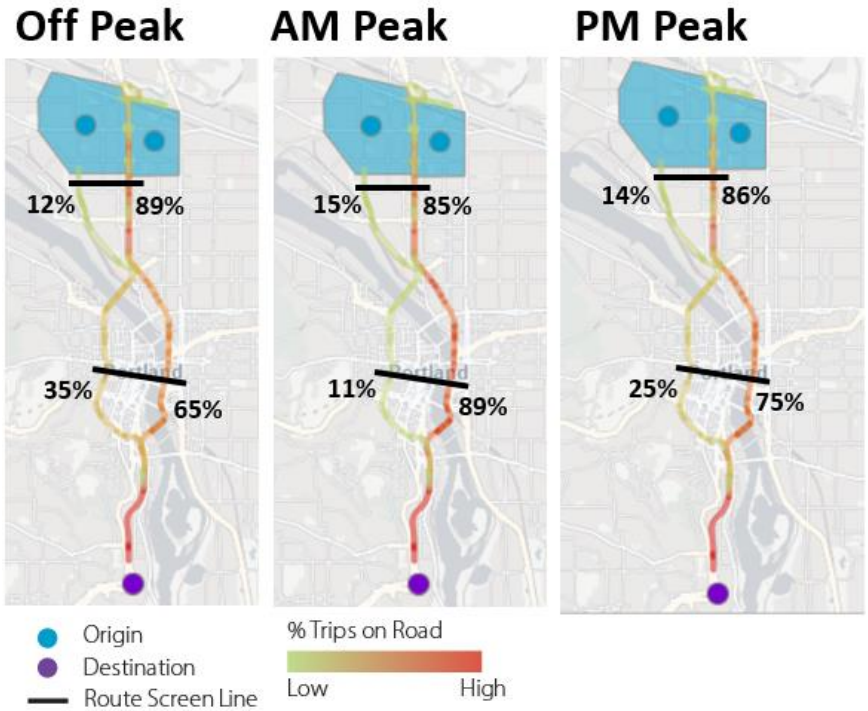
Although I-5 is used for most of these trips (approximately 65% to 70%) around downtown Portland, about a third of users travel on I-405 instead during off-peak times. During peak hours, I-405 shows some increase in route choice in the northbound direction, approaching a near-even split with I-5. However, the share of southbound trips on I-405 decreases during peak periods. The lack of a consistent pattern indicates that I-405 may be attractive as an alternative to I-5 during some periods, but recurring congestion on I-405 during the peak hours may be significant enough to prevent I-405 from being a consistently attractive alternative route.

For routing choices in north Portland, I-5 is generally the preferred route in both directions during off-peak as well as peak periods. The one exception is observed northbound during the PM peak period, when most users choose to use N Greeley Avenue to reach north Portland. This notable shift of routing to an arterial street likely reflects high levels of congestion on northbound I-5 from downtown Portland in the PM peak period.

Figure 5-4. Share of Trips on Routing Alternatives between I-5 at SW Terwilliger Boulevard and North Portland



Northbound: I-5 at SW Terwilliger Boulevard to north Portland



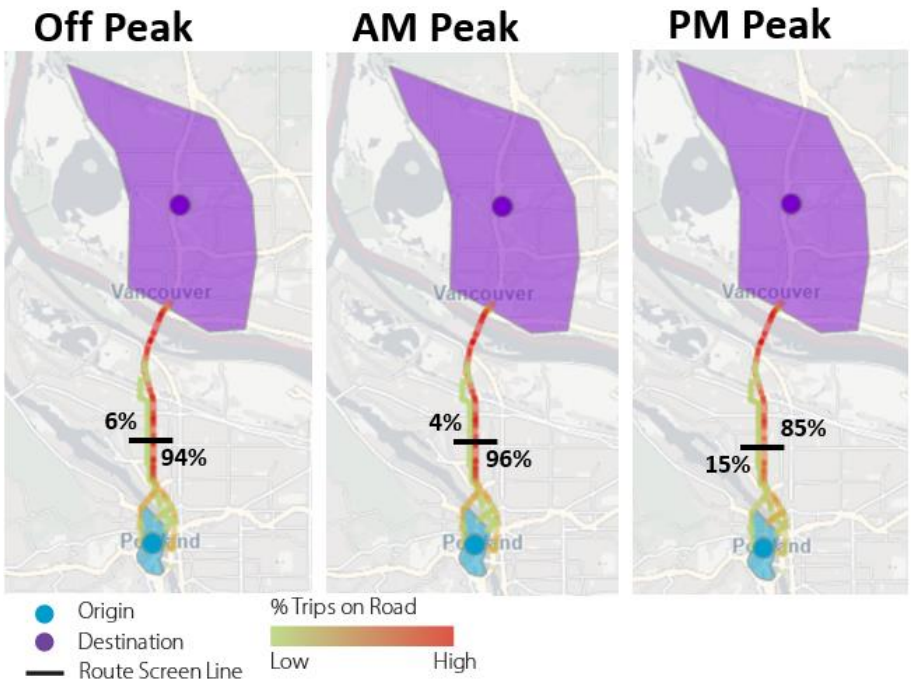
Southbound: North Portland to I-5 at SW Terwilliger Boulevard
Off-Peak: 10 a.m. – 3 p.m. AM Peak: 7 – 9 a.m.; PM Peak: 4 – 6 p.m.
(Approximate Device Count: 9,000; Approximate Trip Count: 26,000)
Source: StreetLight Insight Platform

5.2.2 Example 2.2: Between Downtown Portland and Vancouver Area near I-5

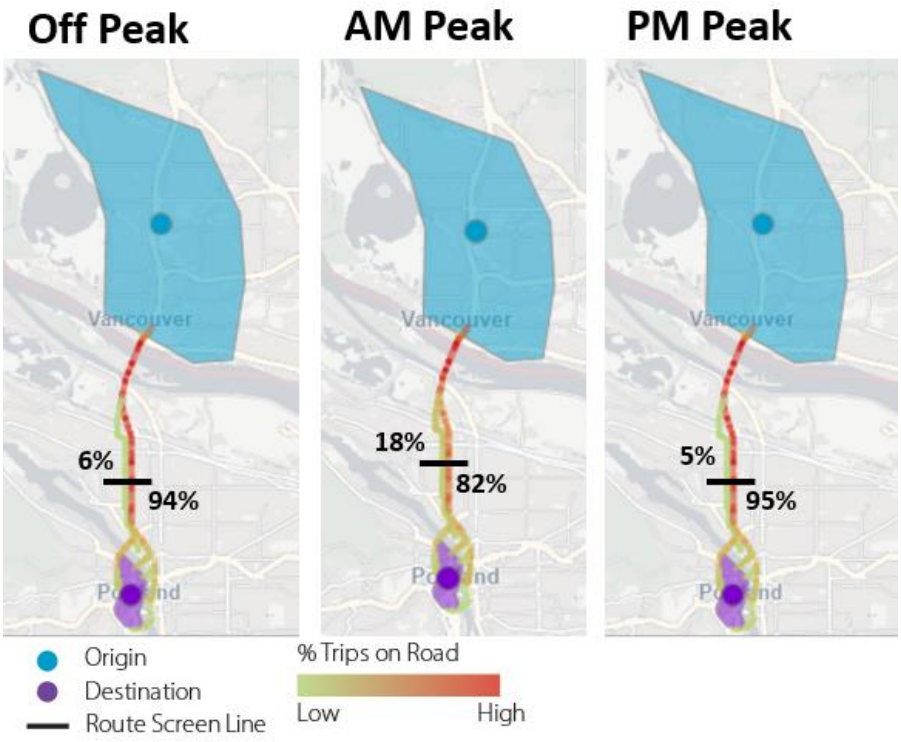
The next example examines travel between downtown Portland and Vancouver in the areas on either side of I-5, as shown in Figure 5-5. These trips have route choices using I-5 directly or using N Interstate Avenue through north Portland and getting back on I-5 farther to the north toward Vancouver.

While N Interstate Avenue is shown to carry less than 10% of this travel pattern's traffic volume during off-peak times in both directions, it carries approximately 15% to 20% in the peak commuter directions during the AM and PM peak periods. This directional increase in routing choice away from I-5 to an arterial street aligns with peak commuter travel patterns for Clark County commuters and the heavily congested periods on I-5 (southbound in the AM peak period and northbound in the PM peak period).

Figure 5-5. Share of Trips on Routing Alternatives between Downtown Portland and Vancouver Area near I-5



Northbound: Downtown Portland to Vancouver Area near I-5 corridor



Southbound: Vancouver area near I-5 to downtown Portland
Off-Peak: 10 a.m. – 3 p.m.; AM Peak: 7 – 9 a.m.; PM Peak: 4 – 6 p.m.
(Approximate Device Count: 14,000; Approximate Trip Count: 50,000)
Source: StreetLight Insight Platform

5.3 Example Set 3: Downtown Portland and Northeast Portland (near Portland International Airport)

Shown in Figure 5-6, this example focuses on the route choices between downtown Portland and the area around Portland International Airport. In this figure, the route choices are compared at three distinct locations:

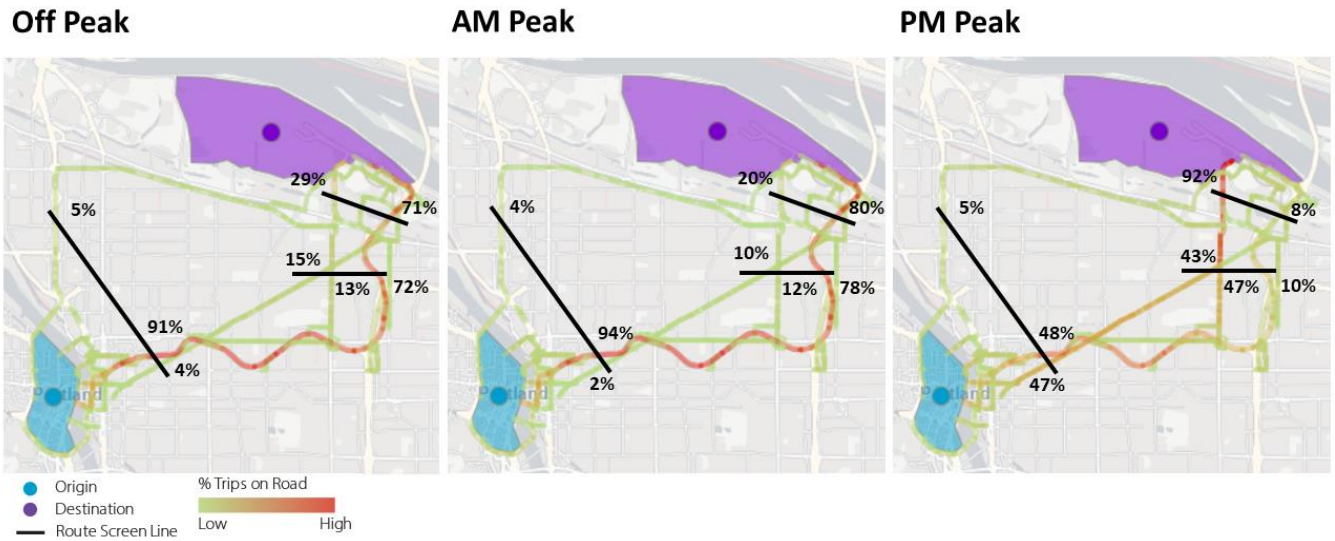
- I-5 vs. I-84 vs. Sandy Boulevard, near downtown Portland
- I-205 vs. Sandy Boulevard vs. NE 82nd Avenue, in northeast Portland
- I-205 vs. NE 82nd Avenue, near Portland International Airport

I-84 is clearly the preferred route going to and from downtown Portland during most times of day. During off-peak hours, over 90% of trips use I-84. However, during the PM peak period, nearly half of the northbound trips leaving downtown choose to travel via Sandy Boulevard. This shift in route choice is not as strong for southbound trips but nonetheless the share of trips on I-84 decreases to below 75% in the AM peak. For the most part, I-5 is not a heavily used route for this travel patterns during either peak or off-peak periods.

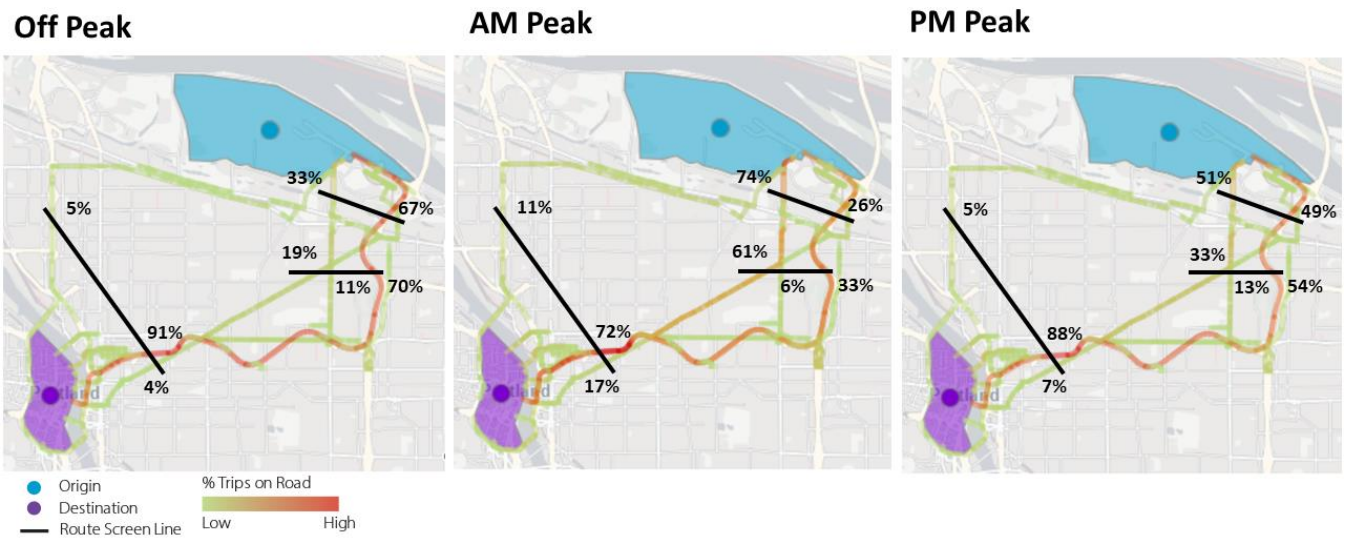
Closer to Portland International Airport, I-205 as the preferred off-peak route because it is the shortest route on a higher-speed facility. However, during peak times, a notable share of drivers use arterial streets such as Sandy Boulevard and NE 82nd Avenue. During the AM peak period, going from the airport toward downtown, the I-205 share on this route drops from approximately 65% to 75% down to 25% to 35%. For trips leaving downtown during the PM peak period, this share of trips on I-205 drops from over 70% to approximately 10%.

As was seen in other route analyses in this report, these shifts in route choice align with prevailing commuter travel patterns southbound from Clark County during the AM peak period and northbound during the PM peak period. As previously shown in other examples on I-5, alternative routes are more heavily used when commuter travel patterns are likely contributing to congestion on I-205. Increases in alternative route use can be seen on NE 82nd Avenue and NE Sandy Boulevard for travel between downtown Portland and Portland International Airport during peak travel times.

Figure 5-6. Share of Trips on Routing Alternatives between Downtown Portland and Portland International Airport



Eastbound/Northbound: Downtown Portland to Portland International Airport



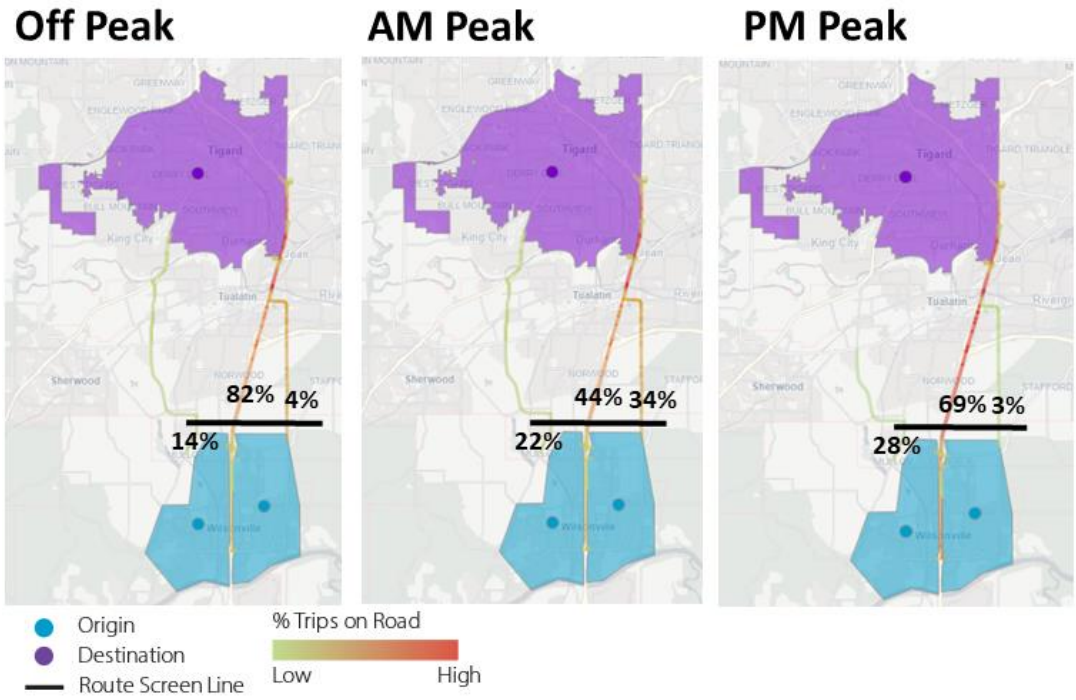
Westbound/Southbound: Portland International Airport to downtown Portland
Off-Peak: 10 a.m. – 3 p.m.; AM Peak: 7 – 9 a.m.; PM Peak: 4 – 6 p.m.
(Approximate Device Count: 35,000; Approximate Trip Count: 67,000)
Source: StreetLight Insight Platform

5.4 Example Set 4: Routing between Wilsonville and Tigard

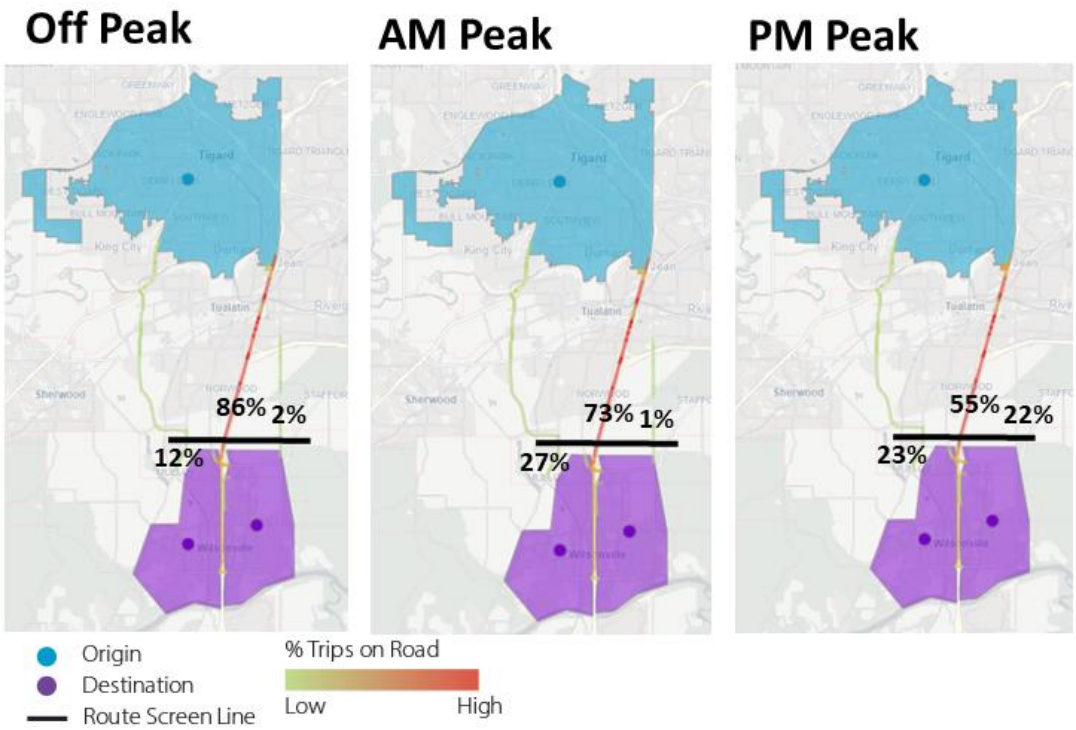
This example examines travel between areas near Wilsonville and Tigard, as shown in Figure 5-7. It illustrates route choices that are alternatives to I-5, including routes using SW 65th Avenue east of I-5 and routes using SW 124th Avenue or SW Boones Ferry Road west of I-5.

During off-peak times, I-5 is used by over 80% of trips in both directions between Wilsonville and Tigard. This high share of I-5 trips decreases in both directions during both the AM and PM peak periods. During the AM peak period, this shift is more notable in the northbound peak direction where the I-5 share of trips drops to approximately half of the share observed during off-peak periods. Likewise, in the PM peak period—with southbound as the peak direction—the I-5 share of trips decreases by over 30% compared to the off-peak periods. This indicates that the higher levels of congestion on I-5 during peak hours may be enough to make these alternative routes more attractive in both directions.

Figure 5-7. Share of Trips on Routing Alternatives between Wilsonville and Tigard



Northbound: Wilsonville to Tigard



Southbound: Tigard to Wilsonville
Off-Peak: 10 a.m. – 3 p.m.; AM Peak: 7 – 9 a.m.; PM Peak: 4 – 6 p.m.
(Approximate Device Count: 8,000; Approximate Trip Count: 27,000)
Source: StreetLight Insight Platform

Appendix A StreetLight Methodology References

A.1 Data Source, Methodology and Validation Documentations from StreetLight

StreetLight's data source, data processing methodology and validation can be found in the following white papers:

- *StreetLight Insight Metrics: Our Methodology and Data Sources*, StreetLight Data, Inc., July 2019
- *StreetLight Volume Methodology & Validation White Paper*, StreetLight Data, Inc., August 2019

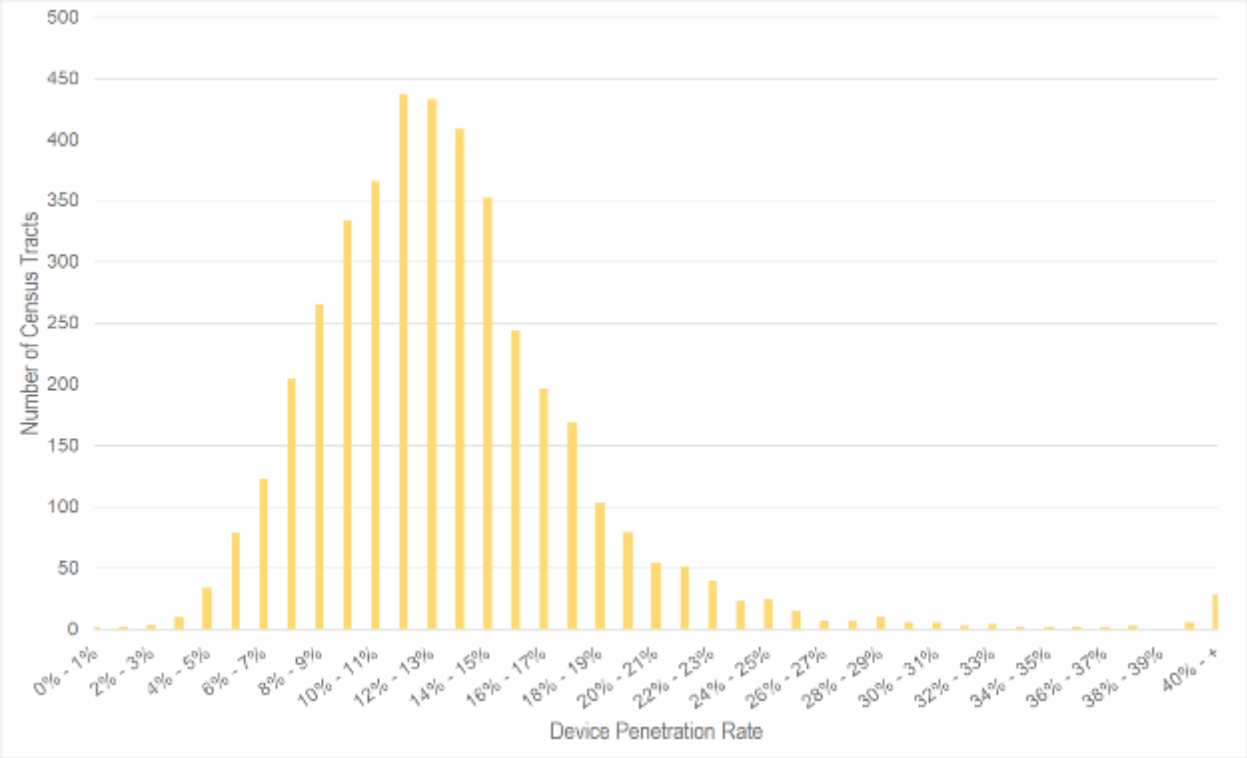
A.2 Device Sample Share

How Big Data Supports Environmental Justice in Transportation, StreetLight Data, Inc. August 2020: https://www.streetlightdata.com/big-data-supports-environmental-justice-in-transportation/

In this article, StreetLight published a case study of device sample share in Florida at the census tract level. Device sample share is defined as number of devices captured over total population. StreetLight calculated the number of devices in one census block based on the device "home location," which is defined as the location of the device during nighttime. The assumption is that if a device stays overnight in one census block, then this census block is most likely its home location. The device sample is then aggregated to the census tract level. As shown in Figure A-1, the study found 90% of census tracts have 6% to 20% device sample share. The average device sample share across all census tracts are about 13%, meaning that the sample reflects devices that belong to about 13% of the population.[6]

[6] "How Big Data Supports Environmental Justice in Transportation," StreetLight Data, Aug. 3, 2020. https://www.streetlightdata.com/big-data-supports-environmental-justice-in-transportation/

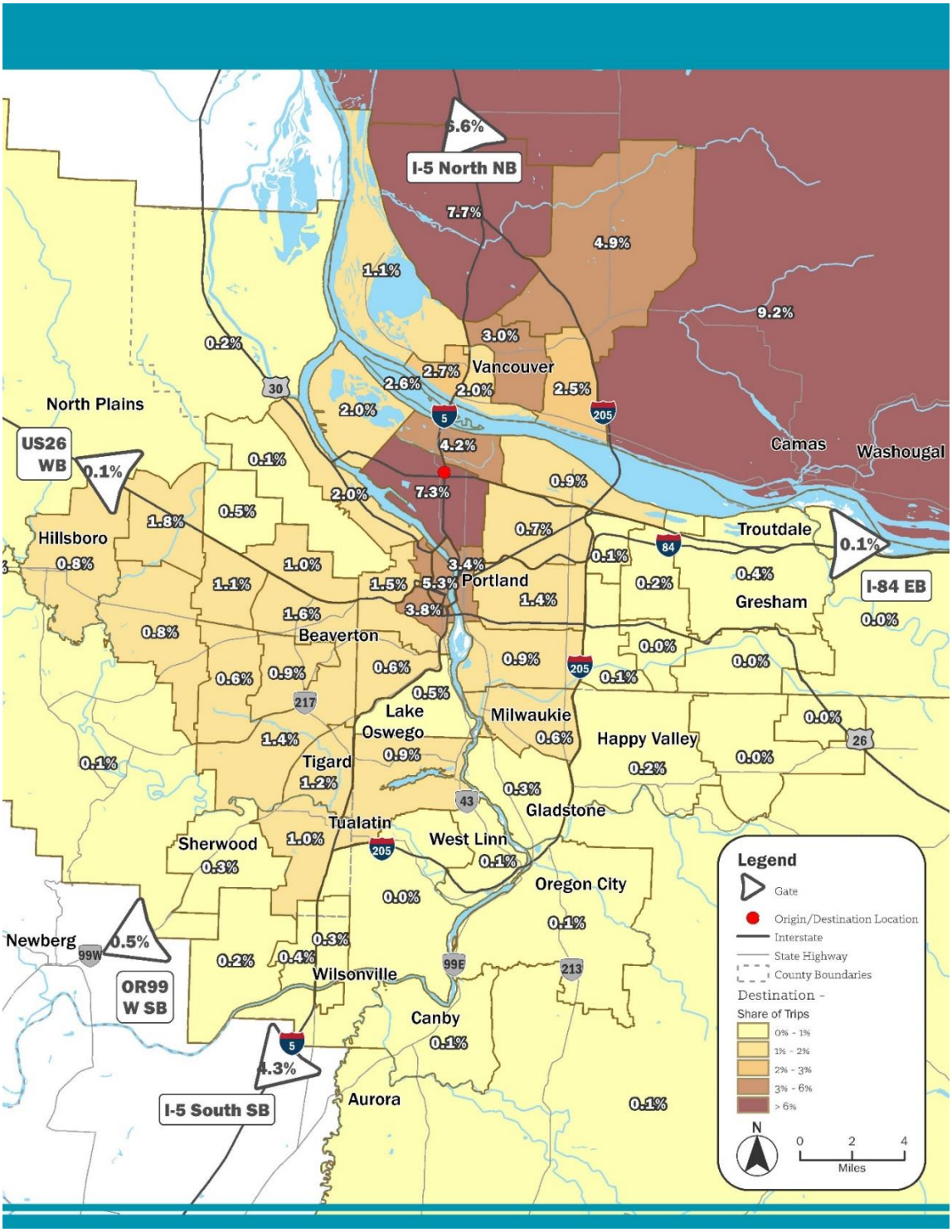
Figure A-1. Device Sample Share in Census Tracts in Florida



Source: How Big Data Supports Environmental Justice in Transportation, StreetLight Data, Inc., August 3, 2020

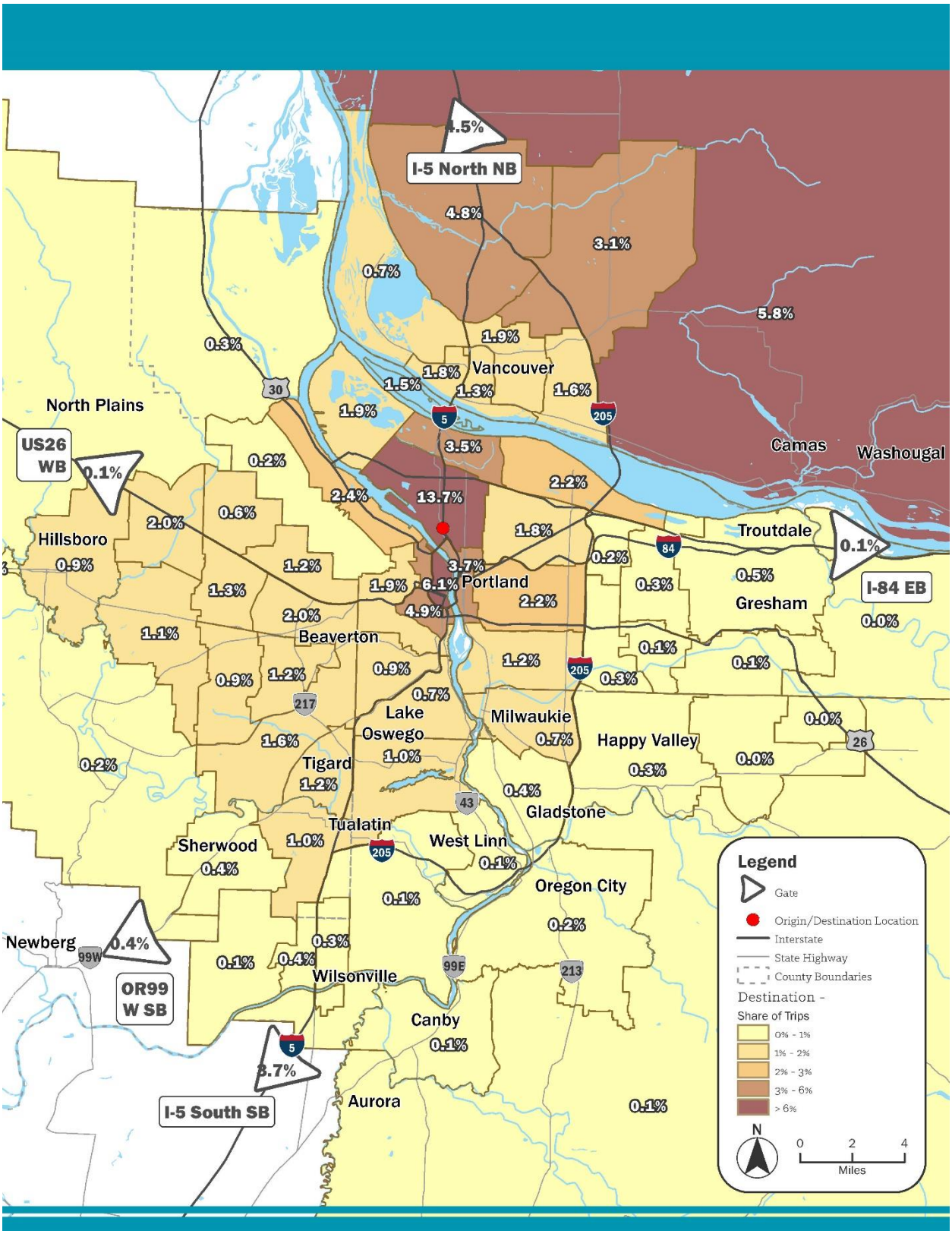
Appendix B Trip Destination Maps - StreetLight

Figure B-1. Destinations for I-5 Trips South of Columbia Boulevard



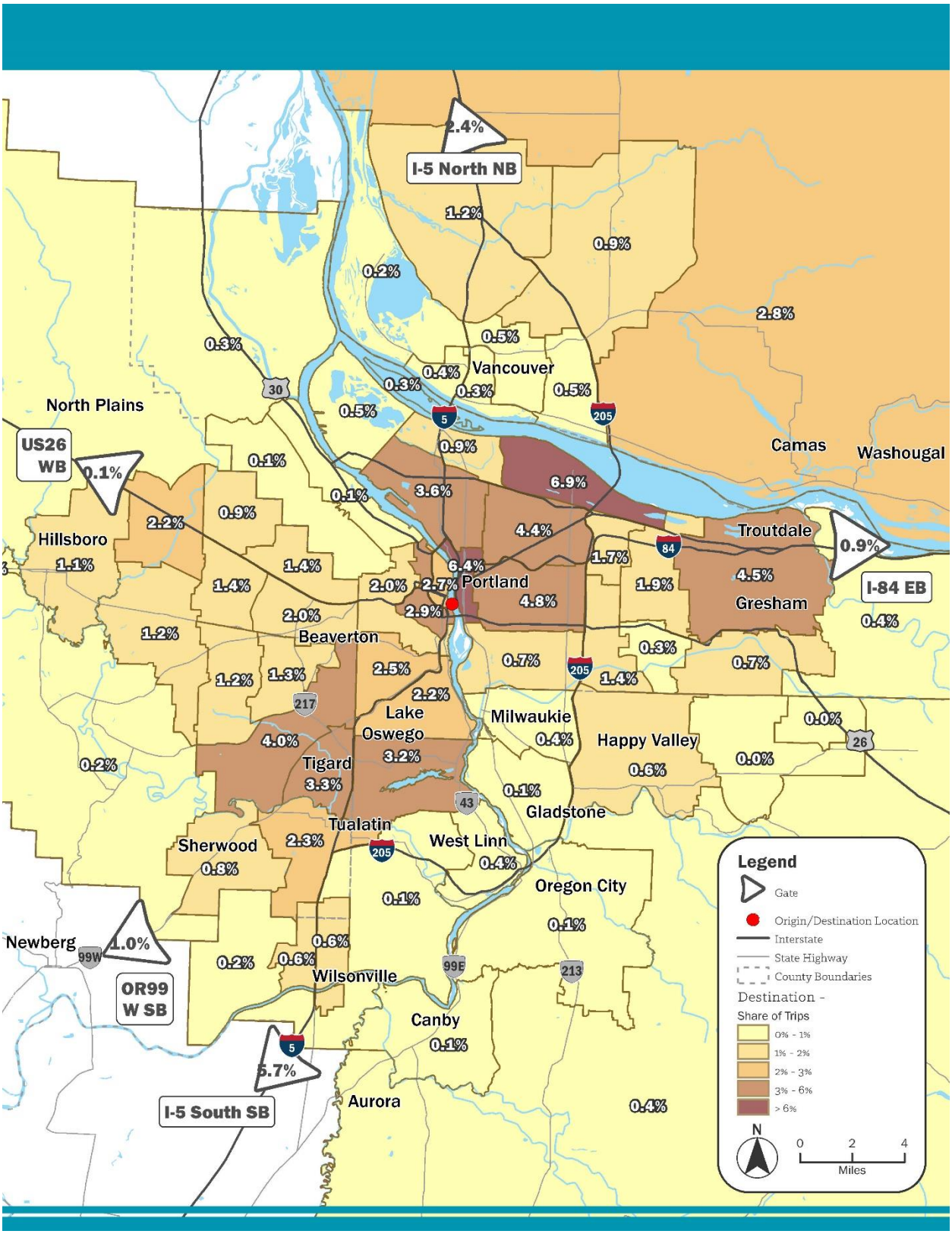
Source: StreetLight Insight Platform

Figure B-2. Destinations for I-5 Trips North of Fremont Bridge



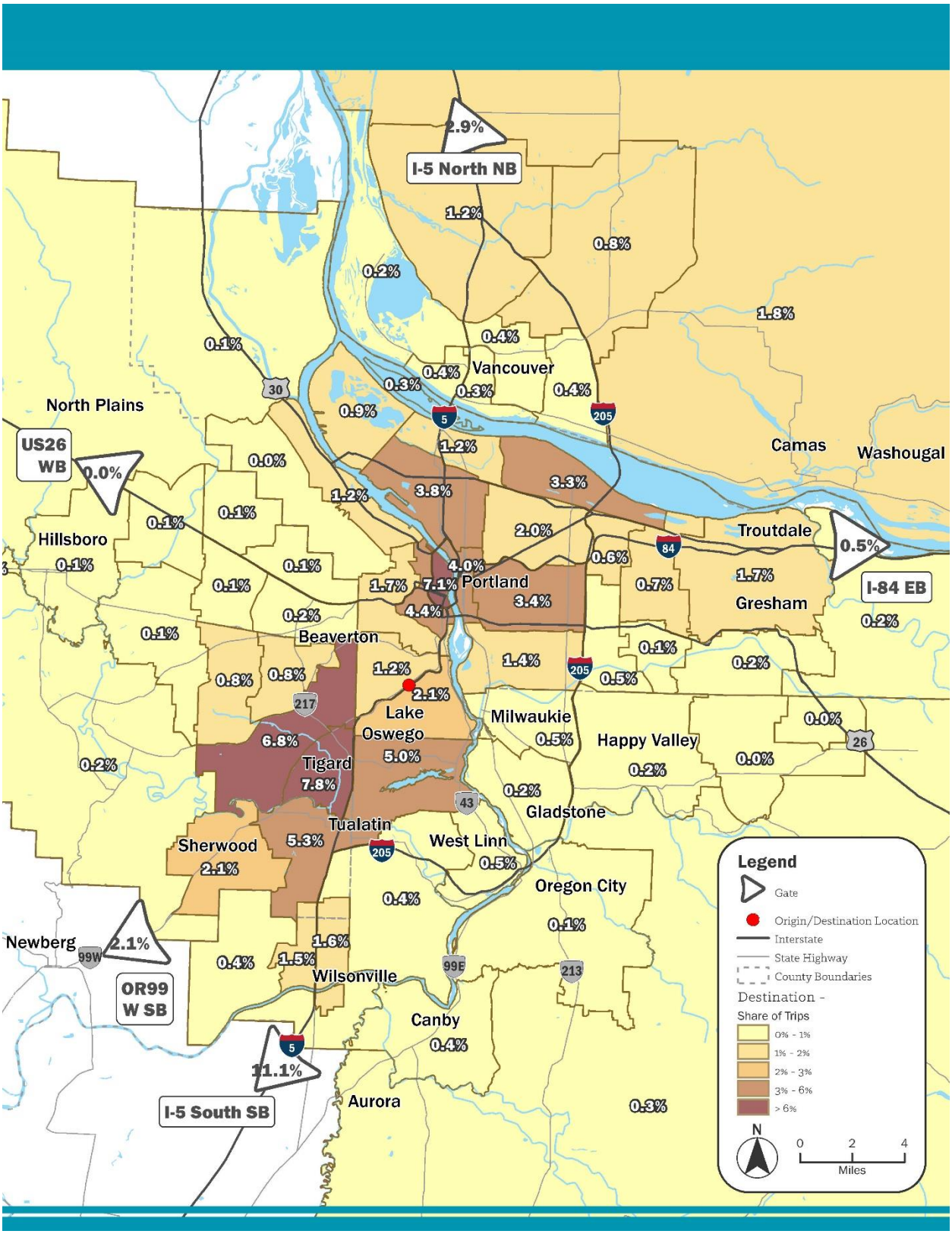
Source: StreetLight Insight Platform

Figure B-3. Destinations for I-5 Trips across Marquam Bridge



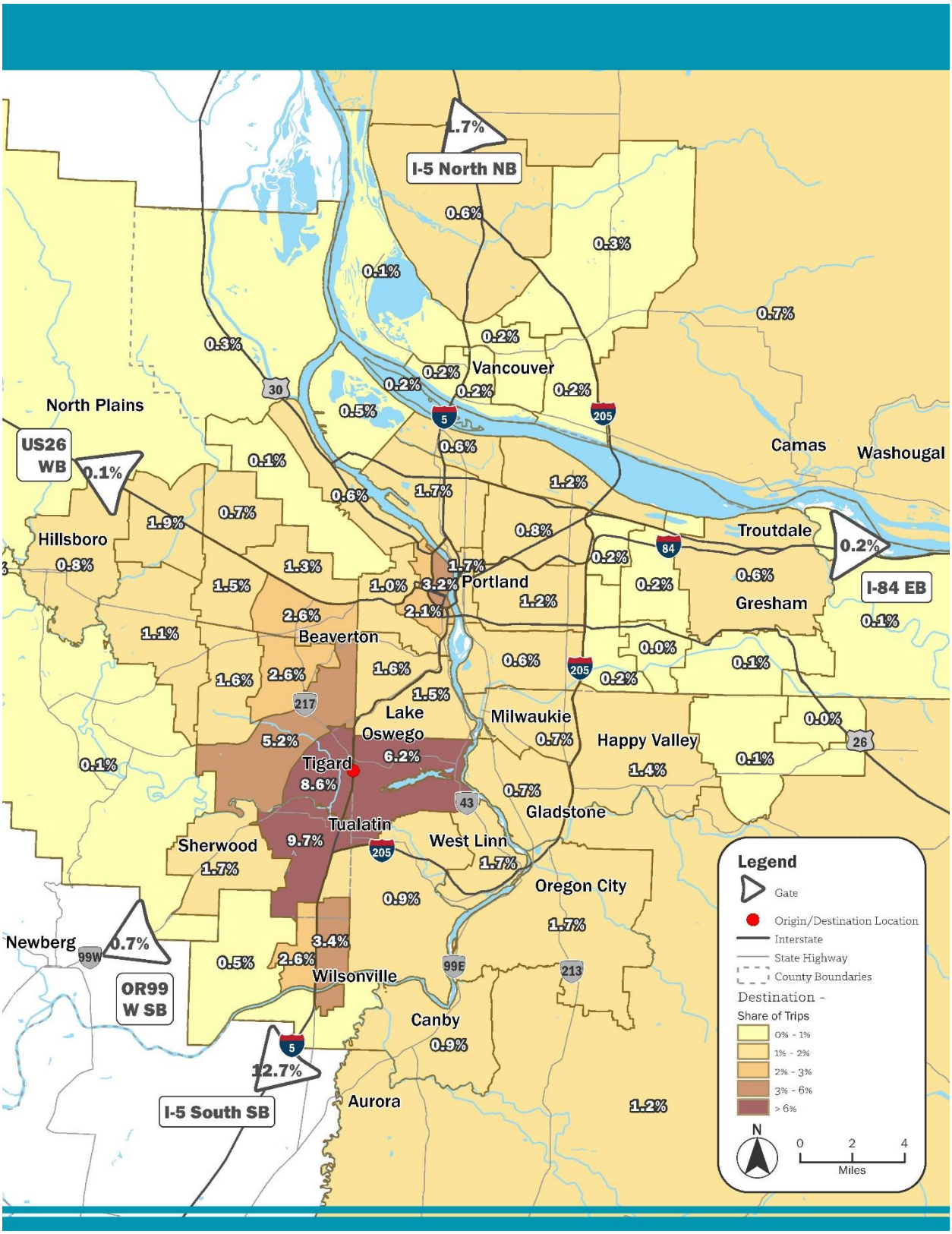
Source: StreetLight Insight Platform

Figure B-4. Destinations for I-5 Trips South of Multnomah Boulevard



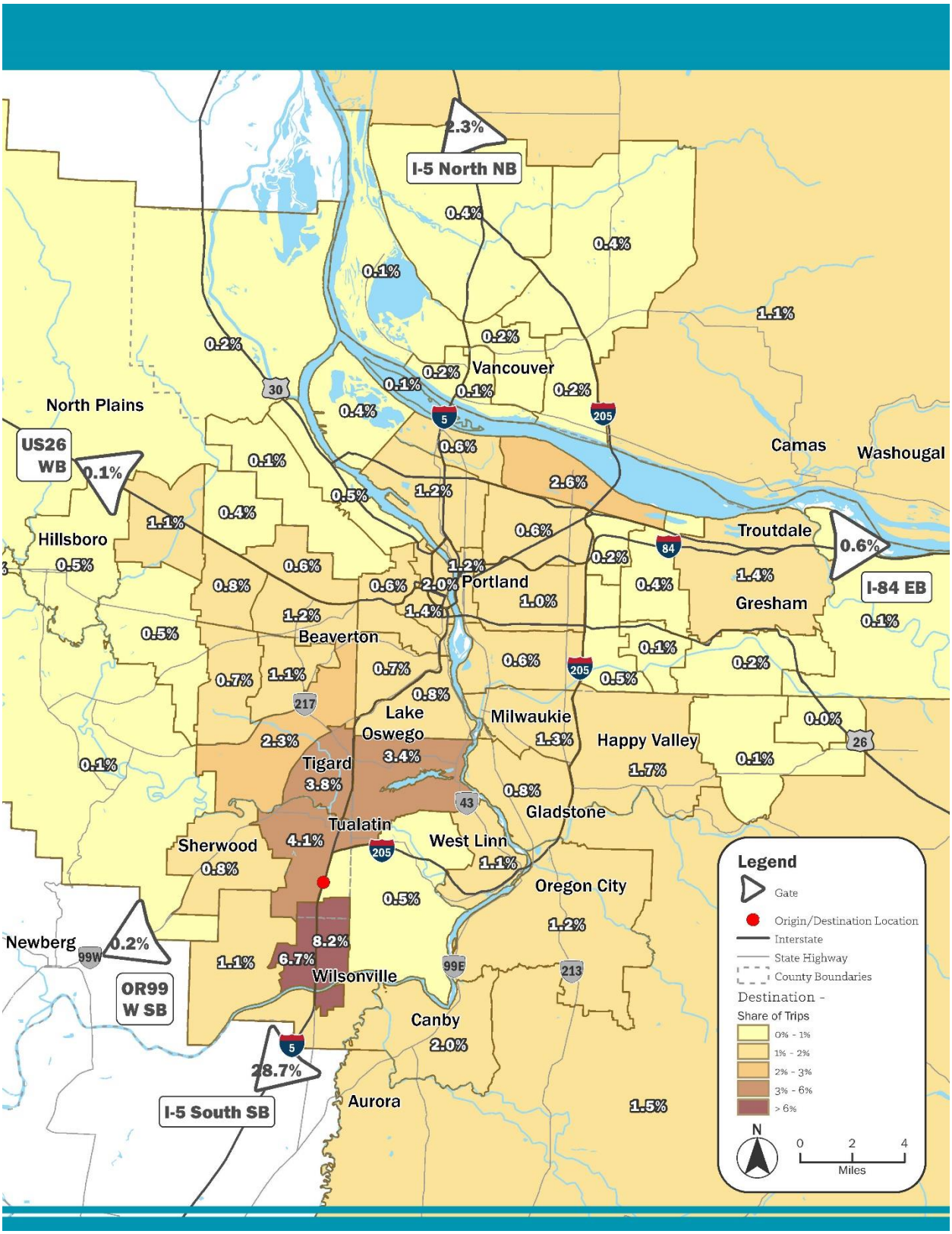
Source: StreetLight Insight Platform

Figure B-5. Destinations for I-5 Trips South of OR 217



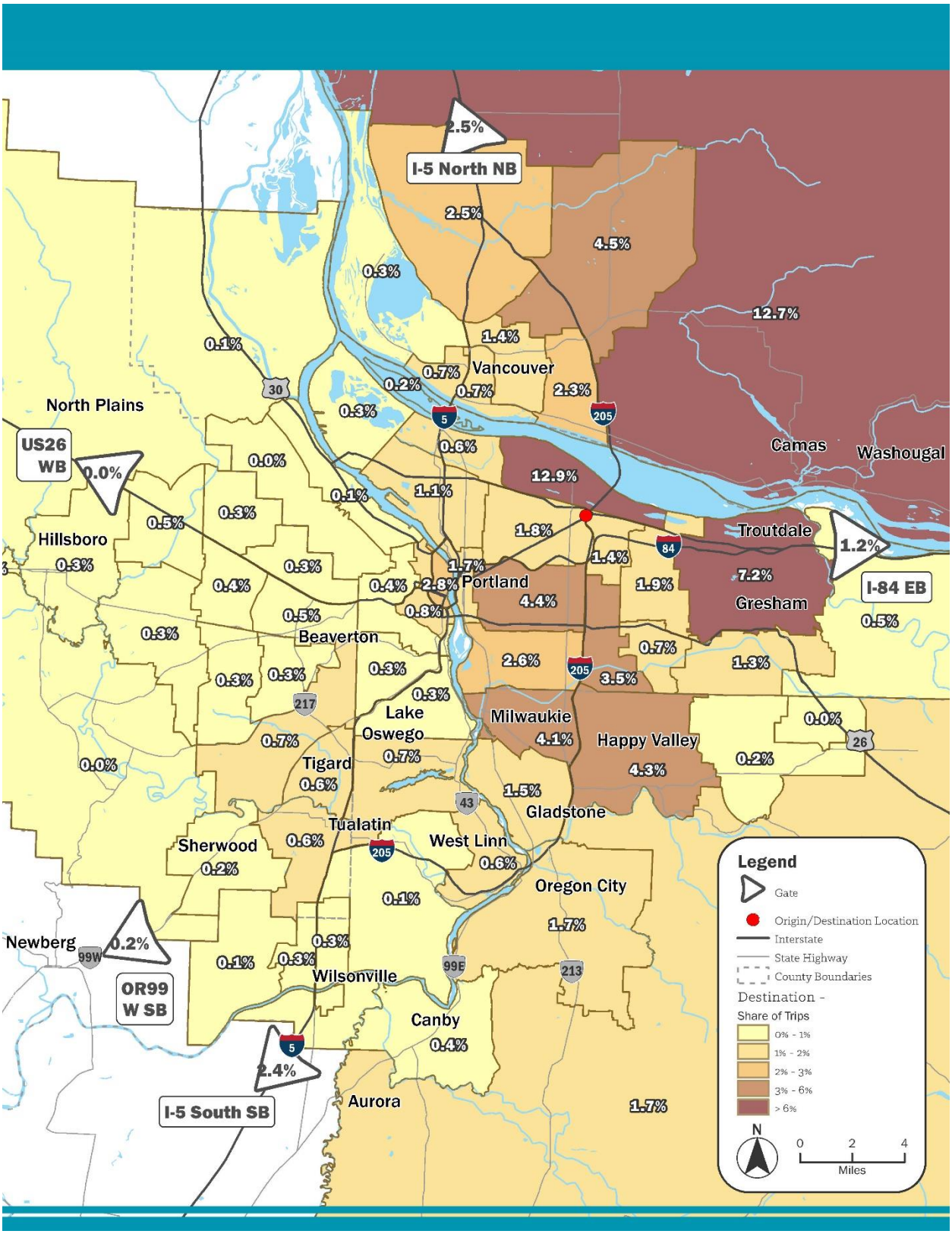
Source: StreetLight Insight Platform

Figure B-6. Destinations for I-5 Trips South of I-205



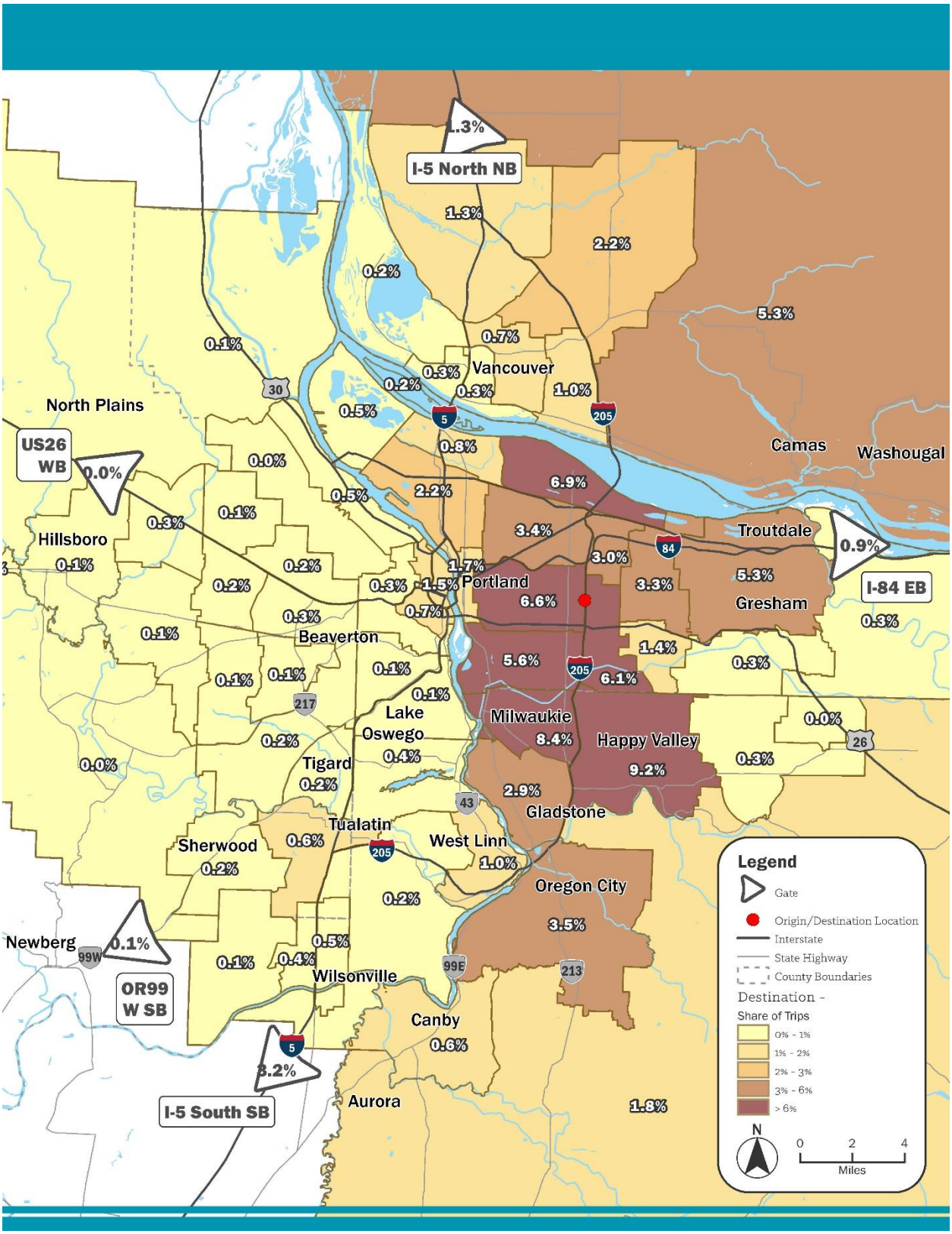
Source: StreetLight Insight Platform

Figure B-7. Destinations for I-205 Trips South of Killingsworth Street



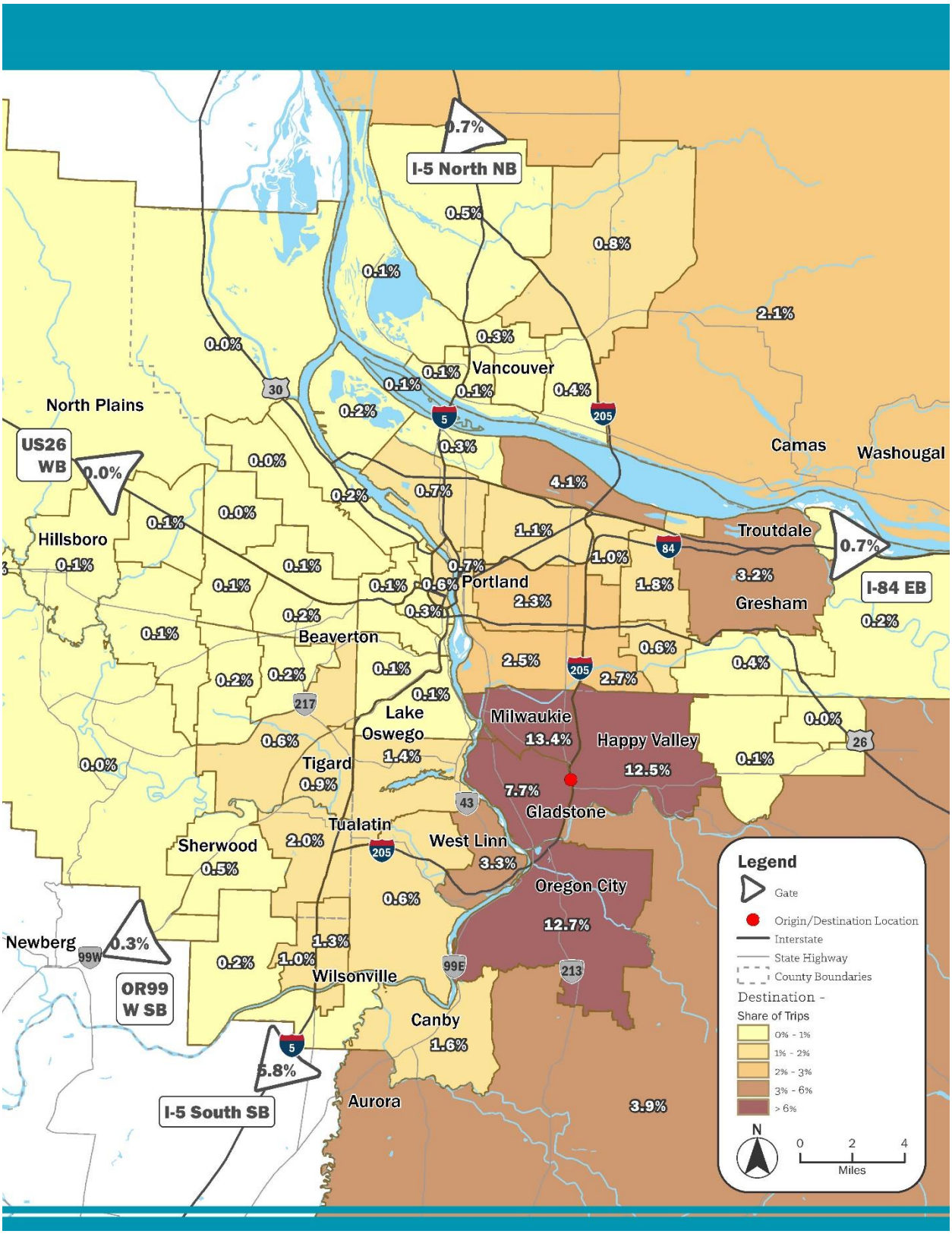
Source: StreetLight Insight Platform

Figure B-8. Destinations for I-205 Trips North of Division Street



Source: StreetLight Insight Platform

Figure B-9. Destinations for I-205 Trips North of OR 212



Source: StreetLight Insight Platform

Appendix C Trip Origin and Destination Maps - Regional Travel Demand Model

Figure C-1. Origins for I-5 Trips South of Columbia Boulevard

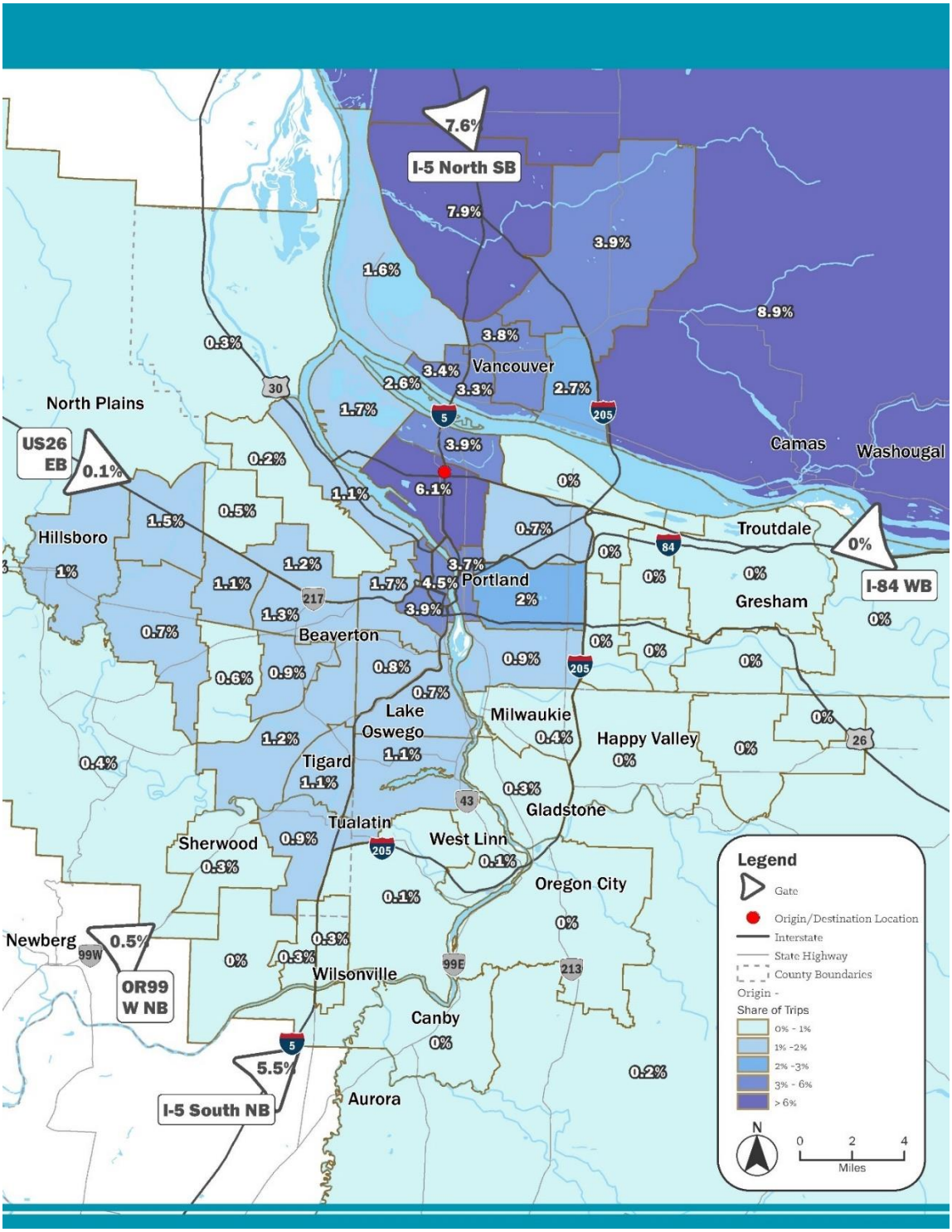


Figure C-2. Destinations for I-5 Trips South of Columbia Boulevard

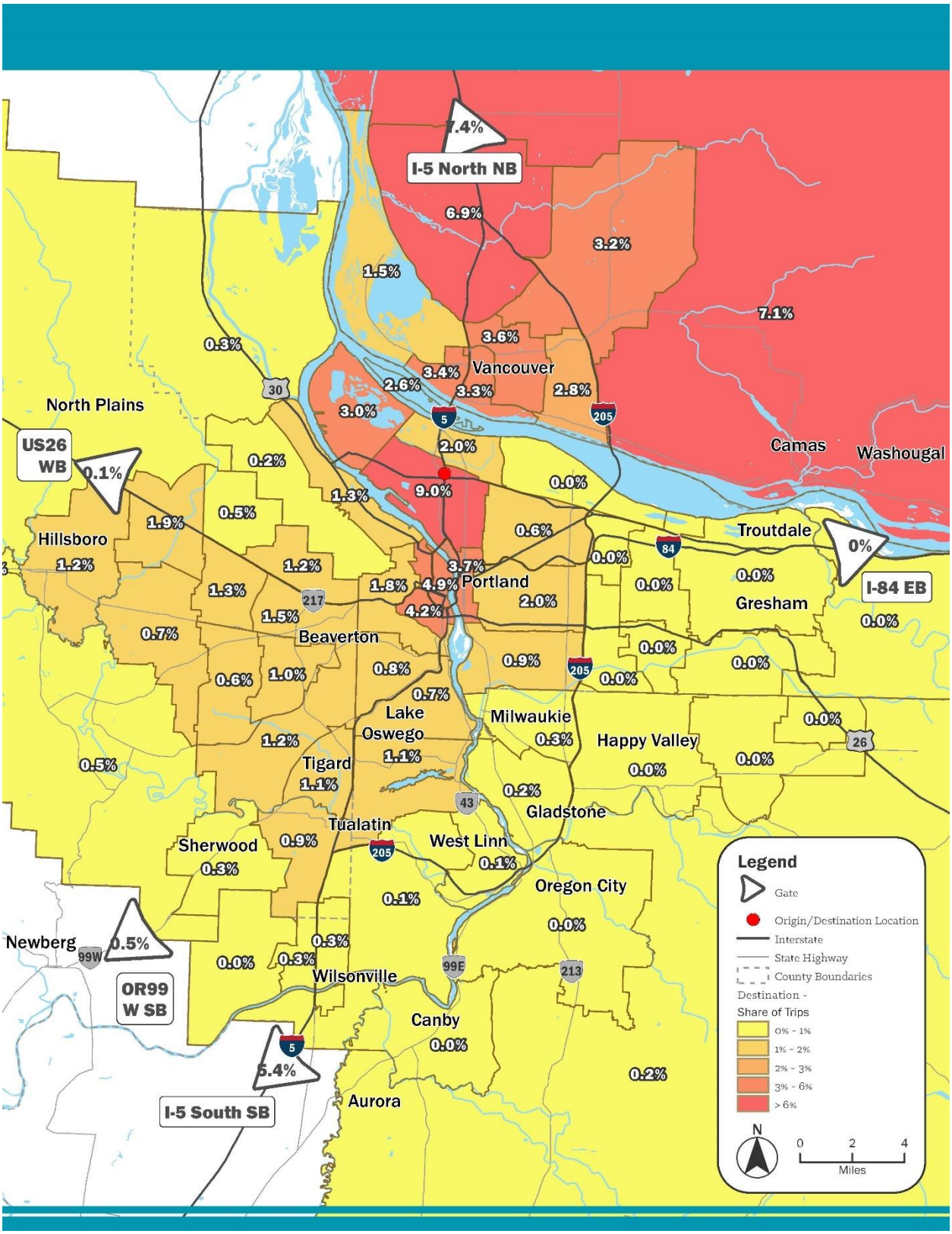


Figure C-3. Origins for I-5 Trips North of Fremont Bridge

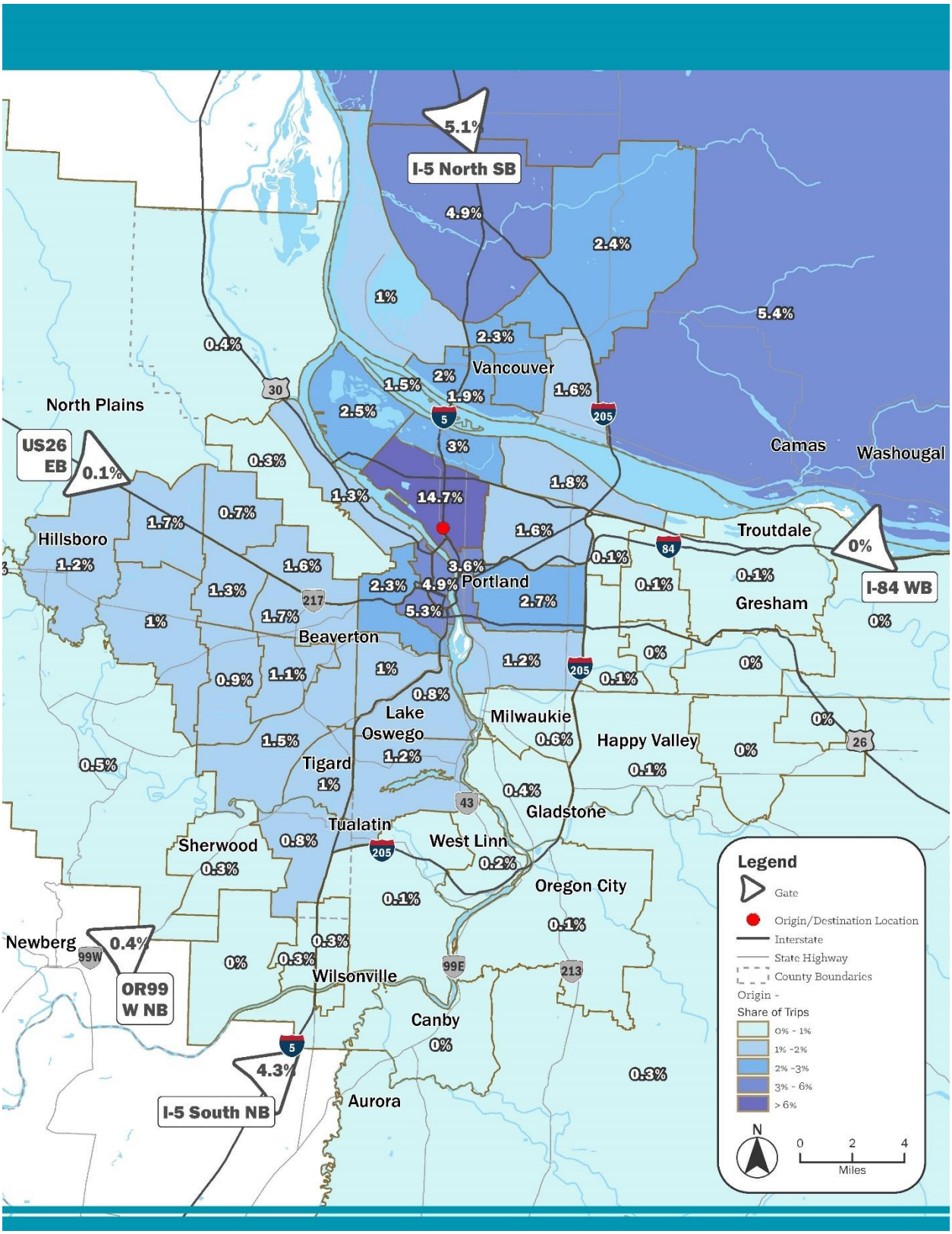


Figure C-4. Destinations for I-5 Trips North of Fremont Bridge

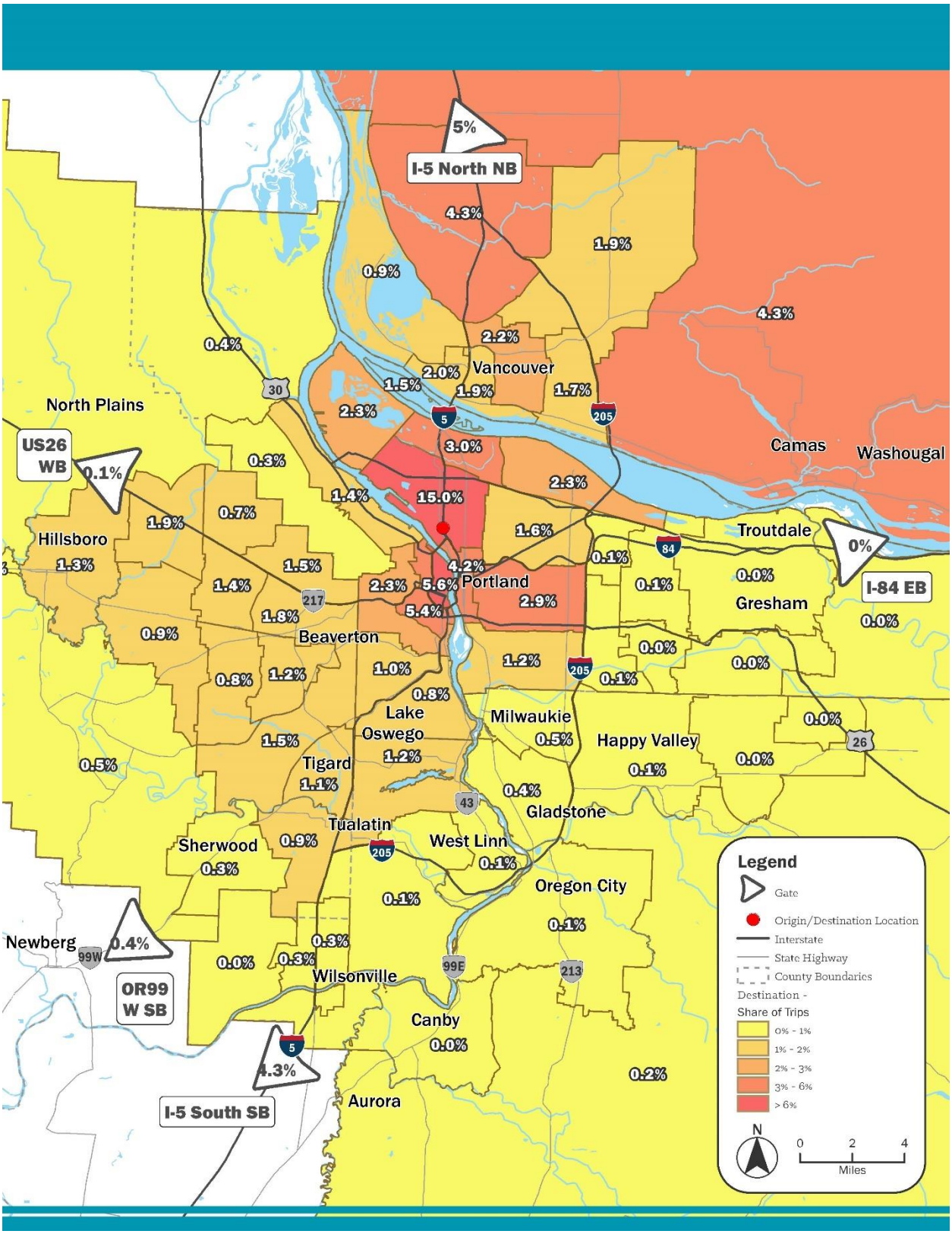


Figure C-5. Origins for I-5 Trips across Marquam Bridge

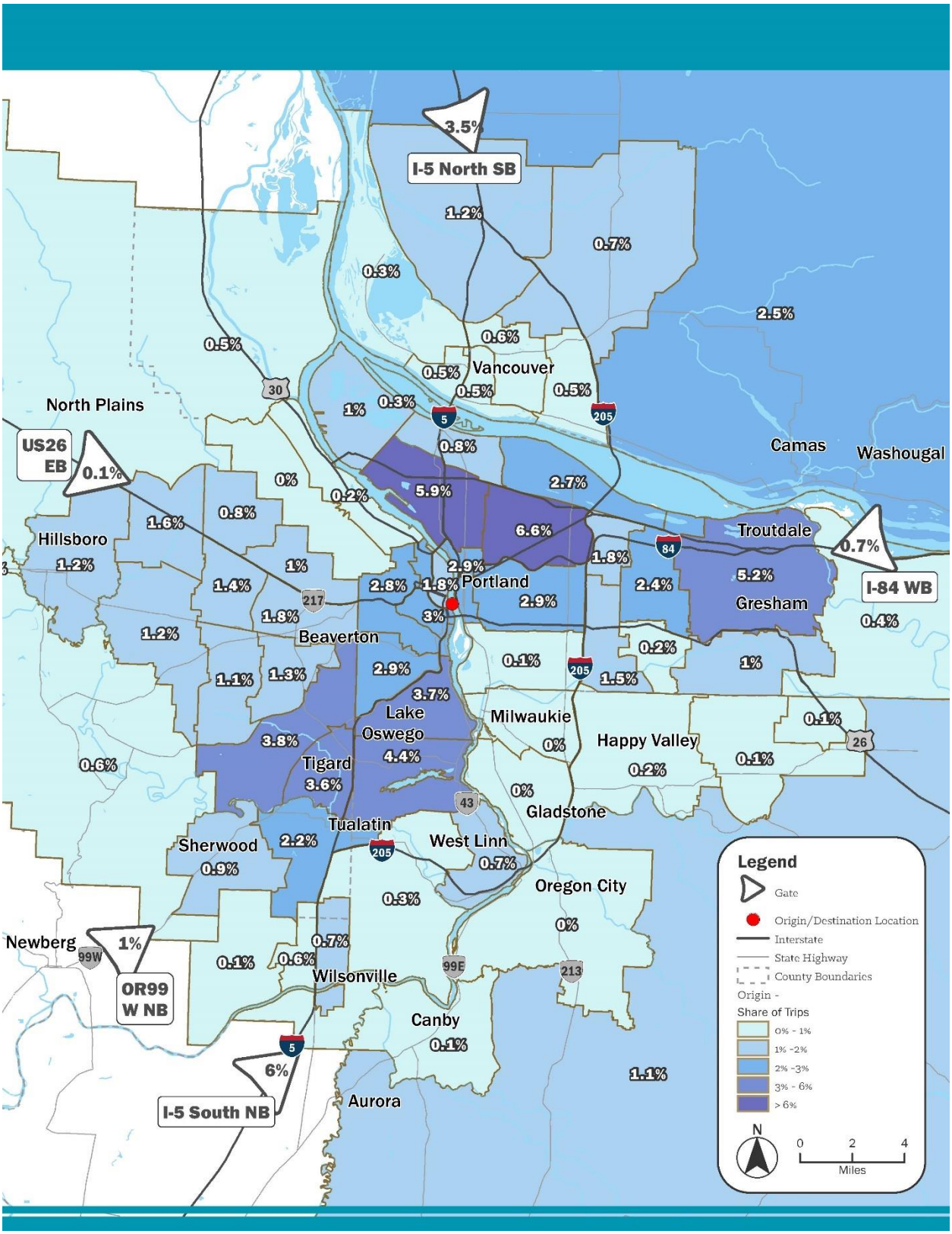


Figure C-6. Destinations for I-5 Trips across Marquam Bridge

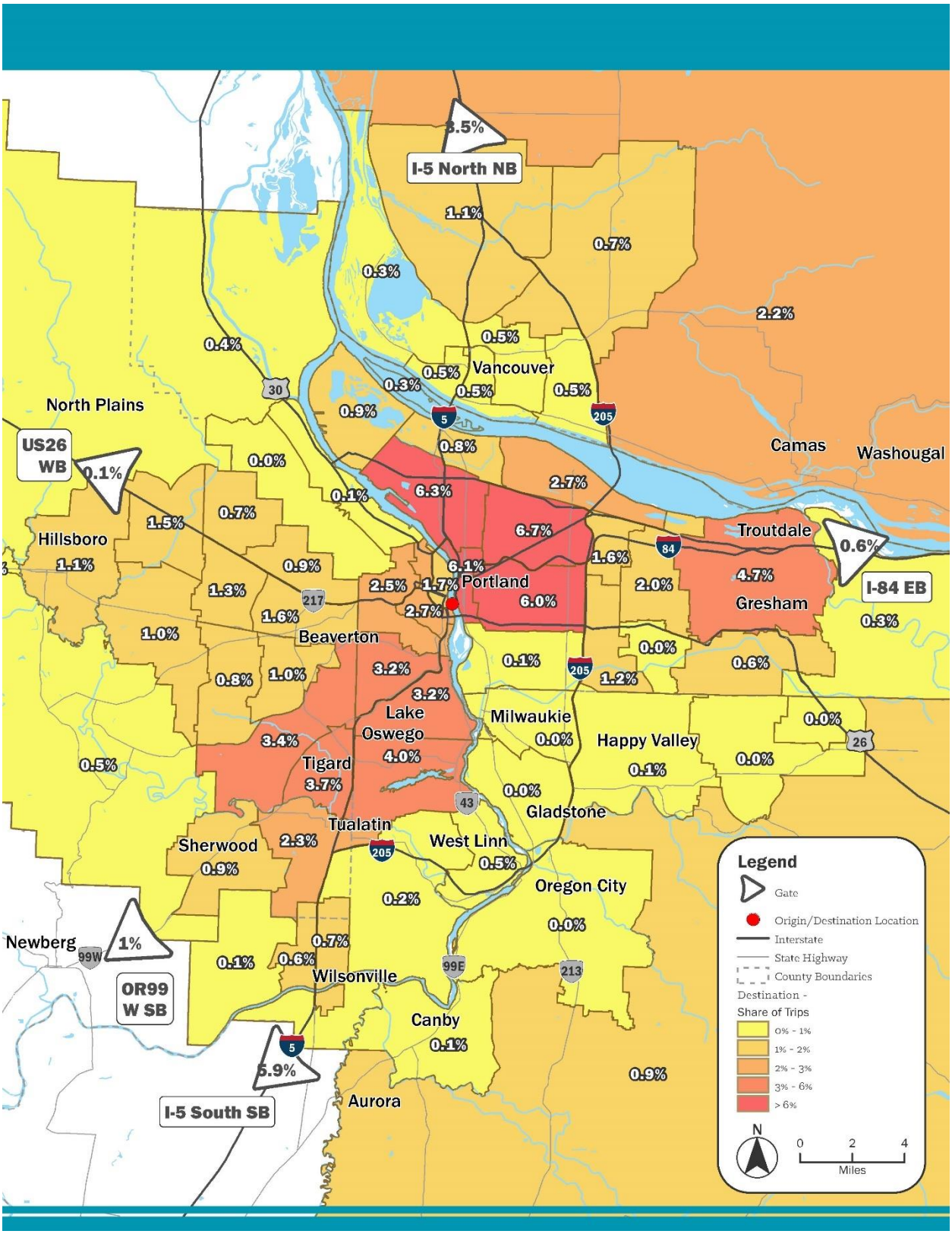


Figure C-7. Origins for I-5 Trips South of Multnomah Boulevard

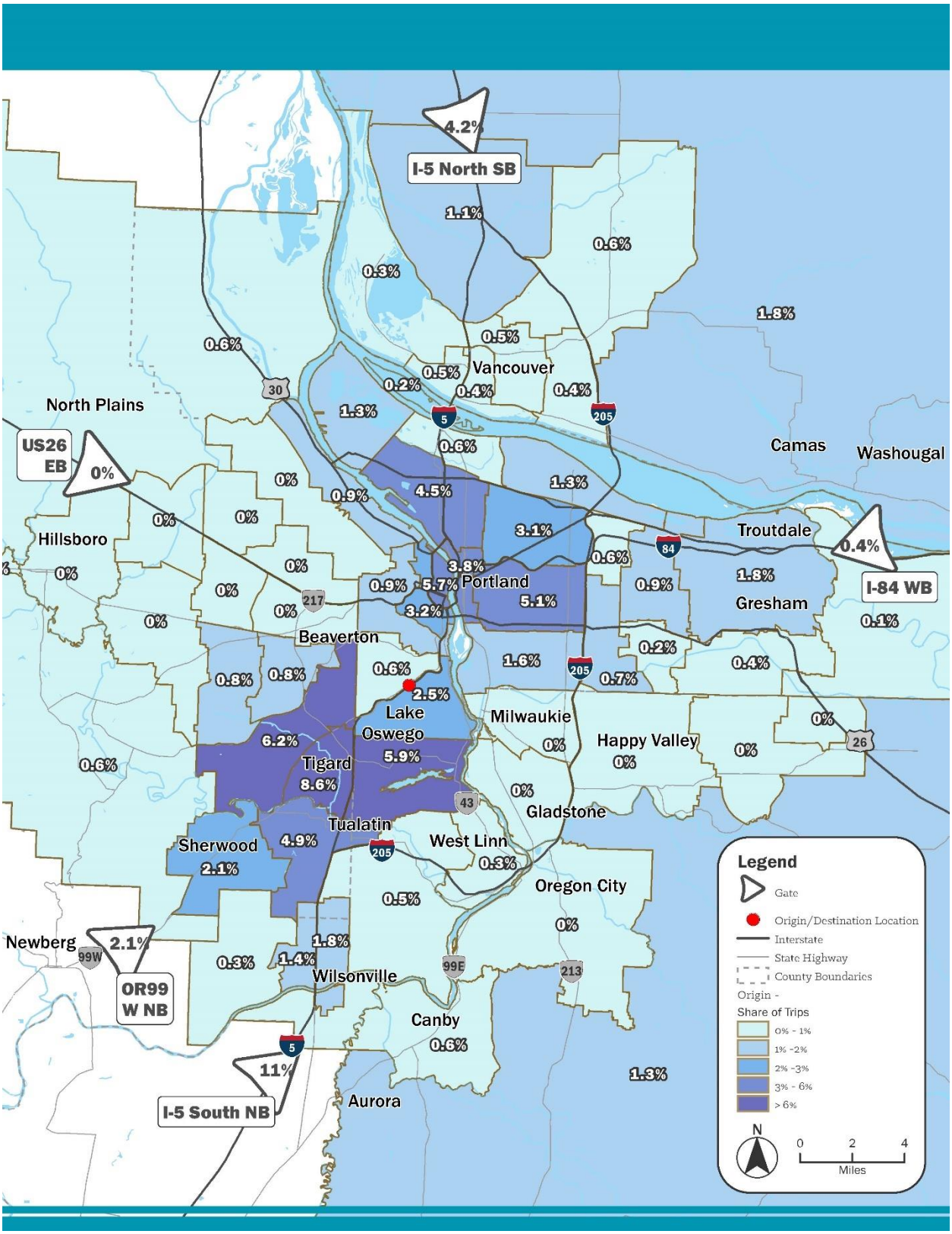


Figure C-8. Destinations for I-5 Trips South of Multnomah Boulevard

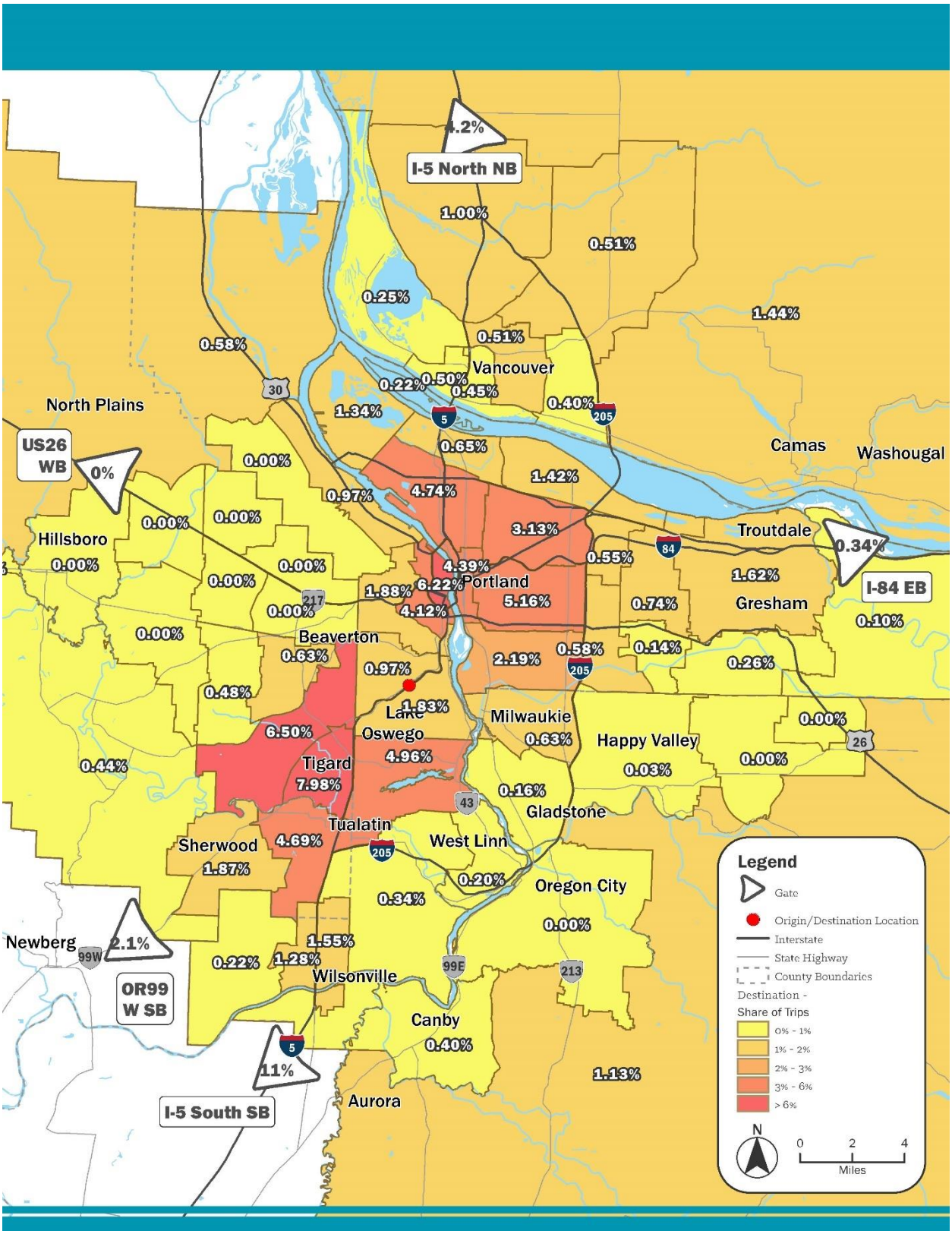


Figure C-9. Origins for I-5 Trips South of OR 217

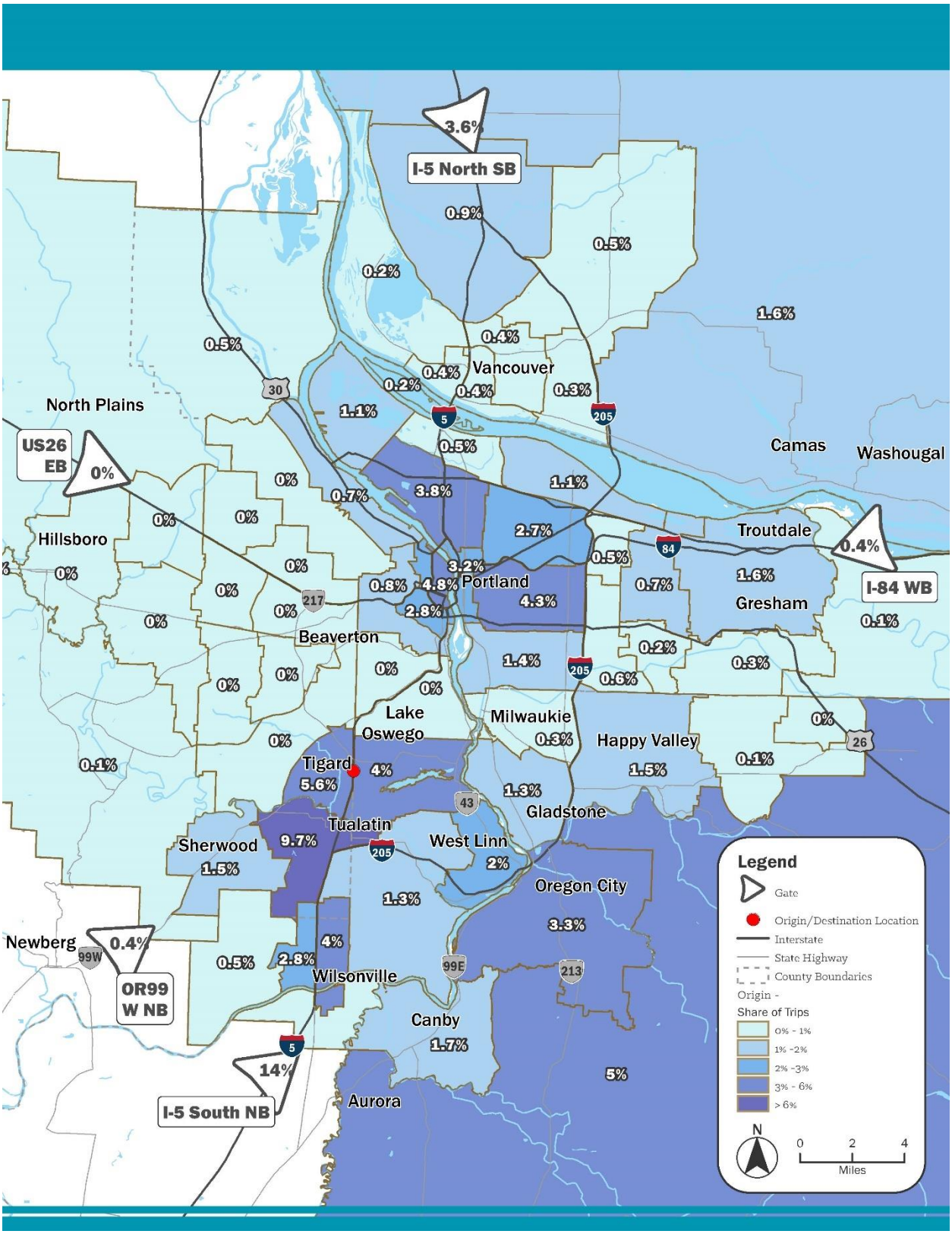


Figure C-10. Destinations for I-5 Trips South of OR 217

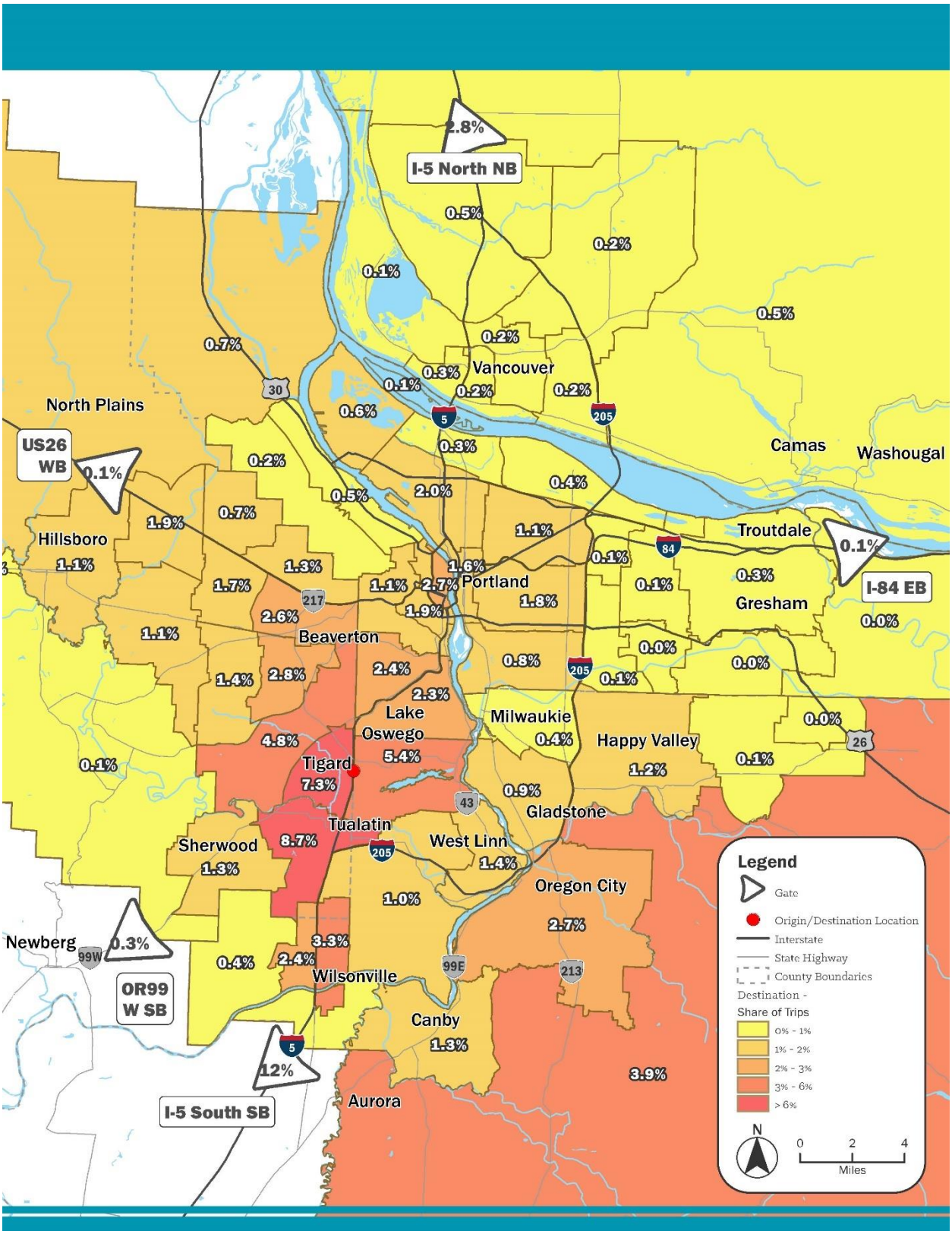


Figure C-11. Origins for I-5 Trips South of I-205

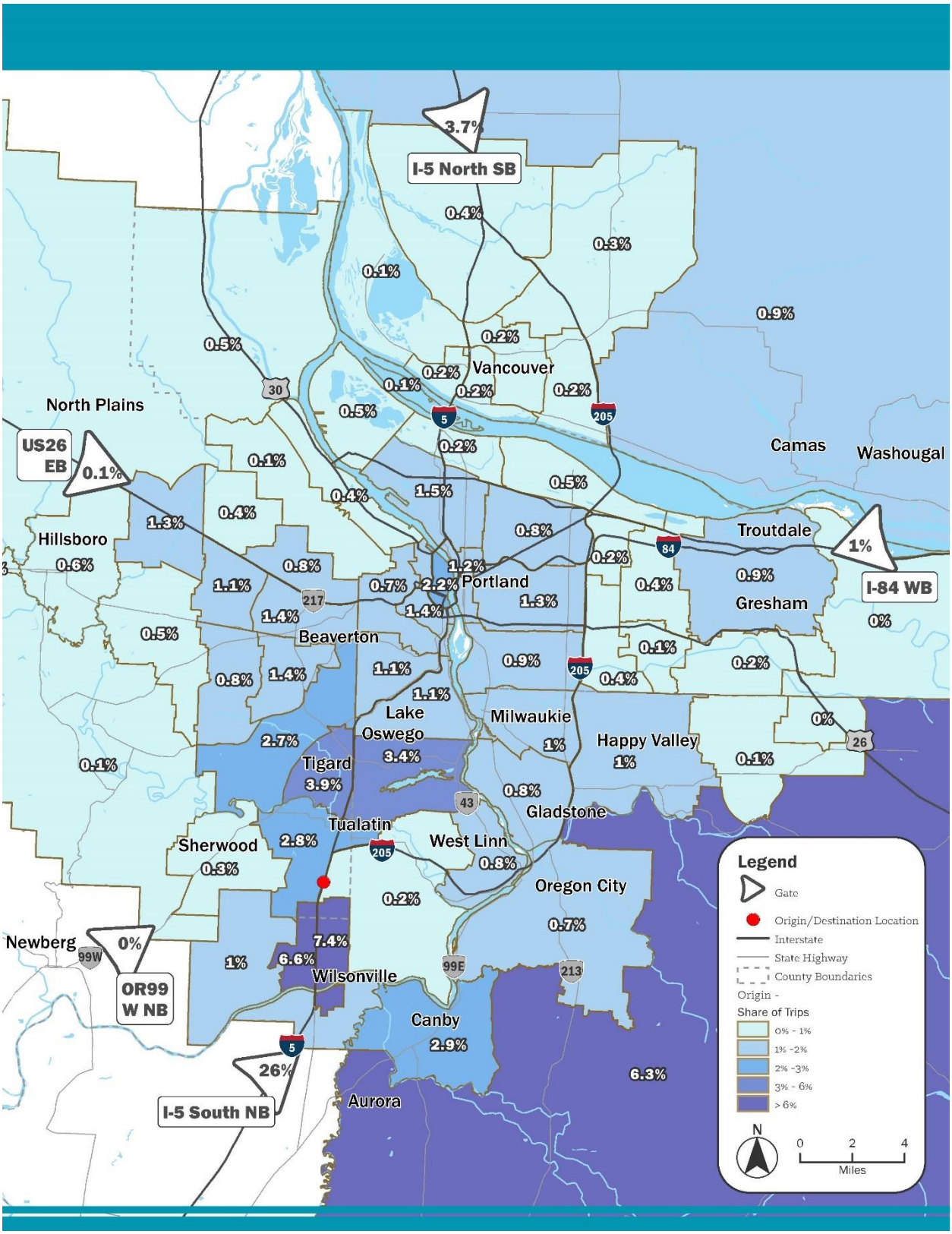


Figure C-12. Destinations for I-5 Trips South of I-205

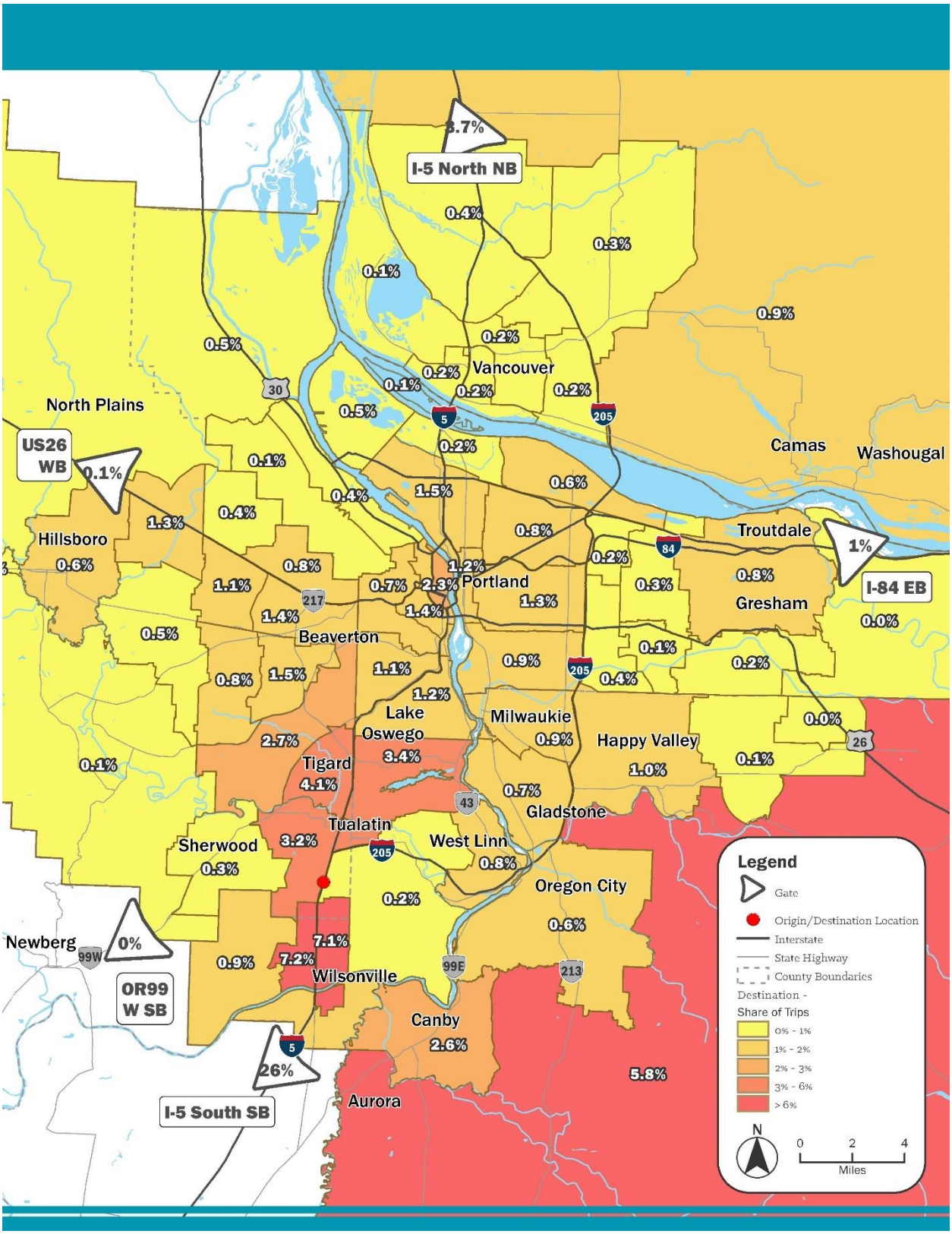


Figure C-13. Origins for I-205 Trips South of Killingsworth Street

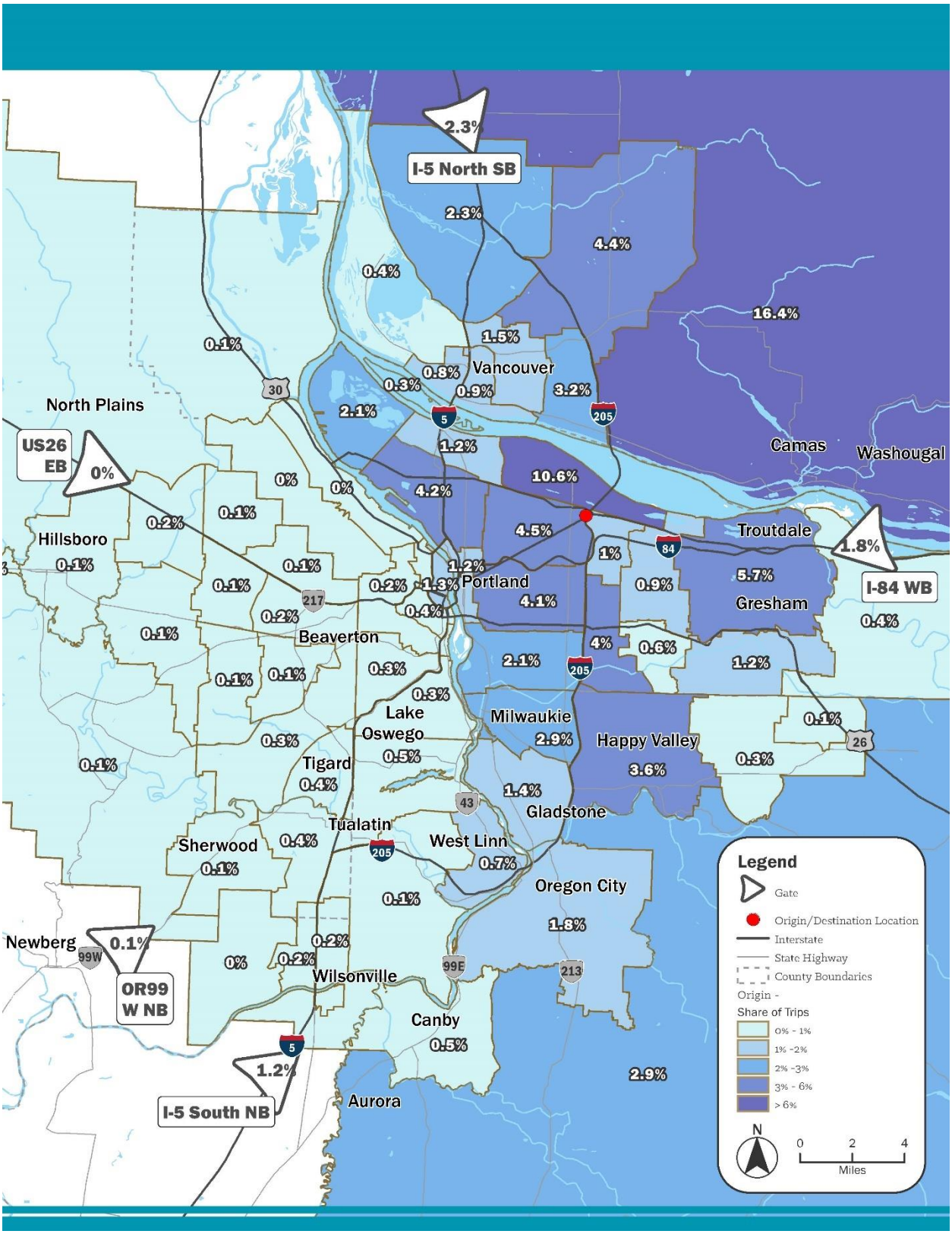


Figure C-14. Destinations for I-205 Trips South of Killingsworth Street

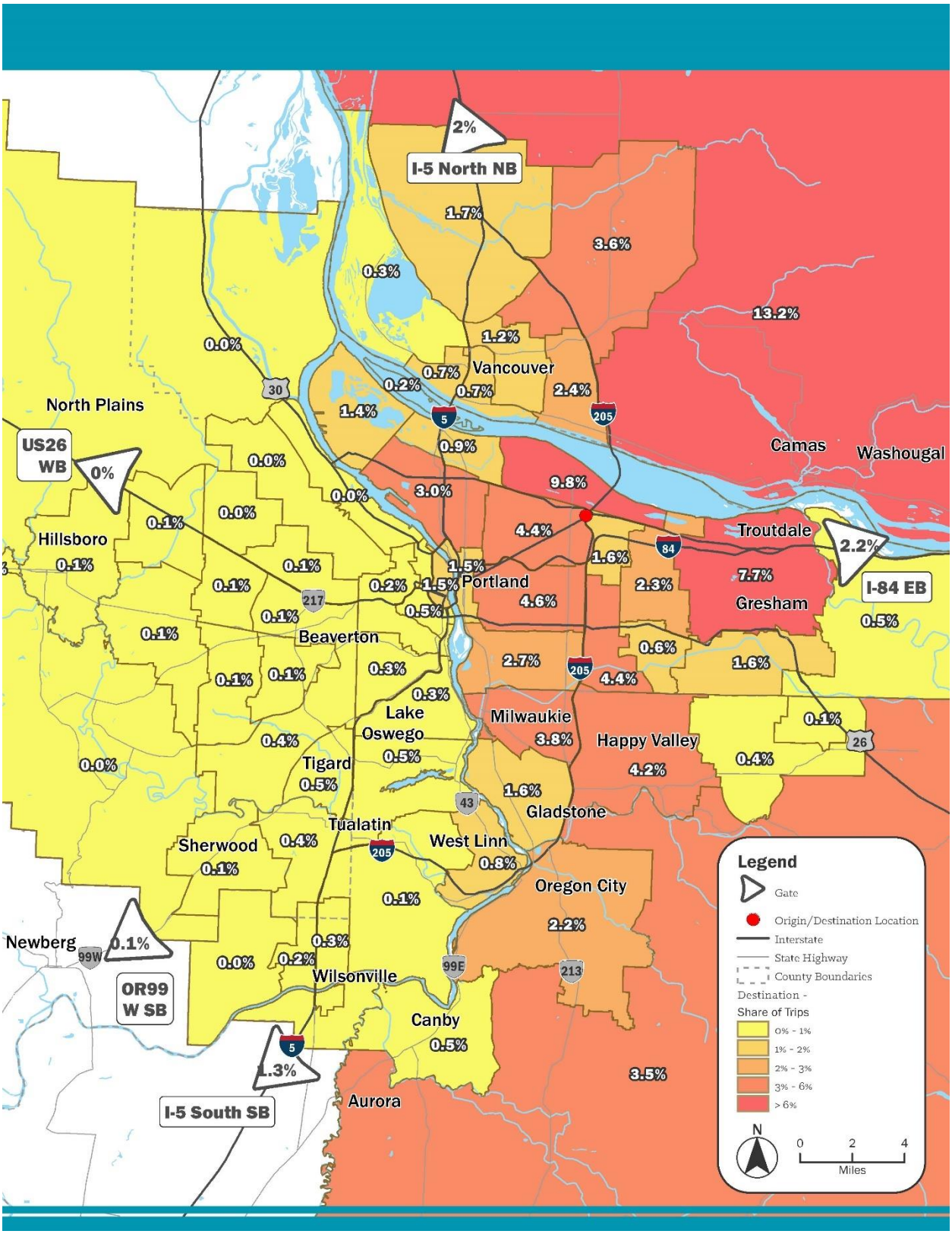


Figure C-15. Origins for I-205 Trips North of Division Street

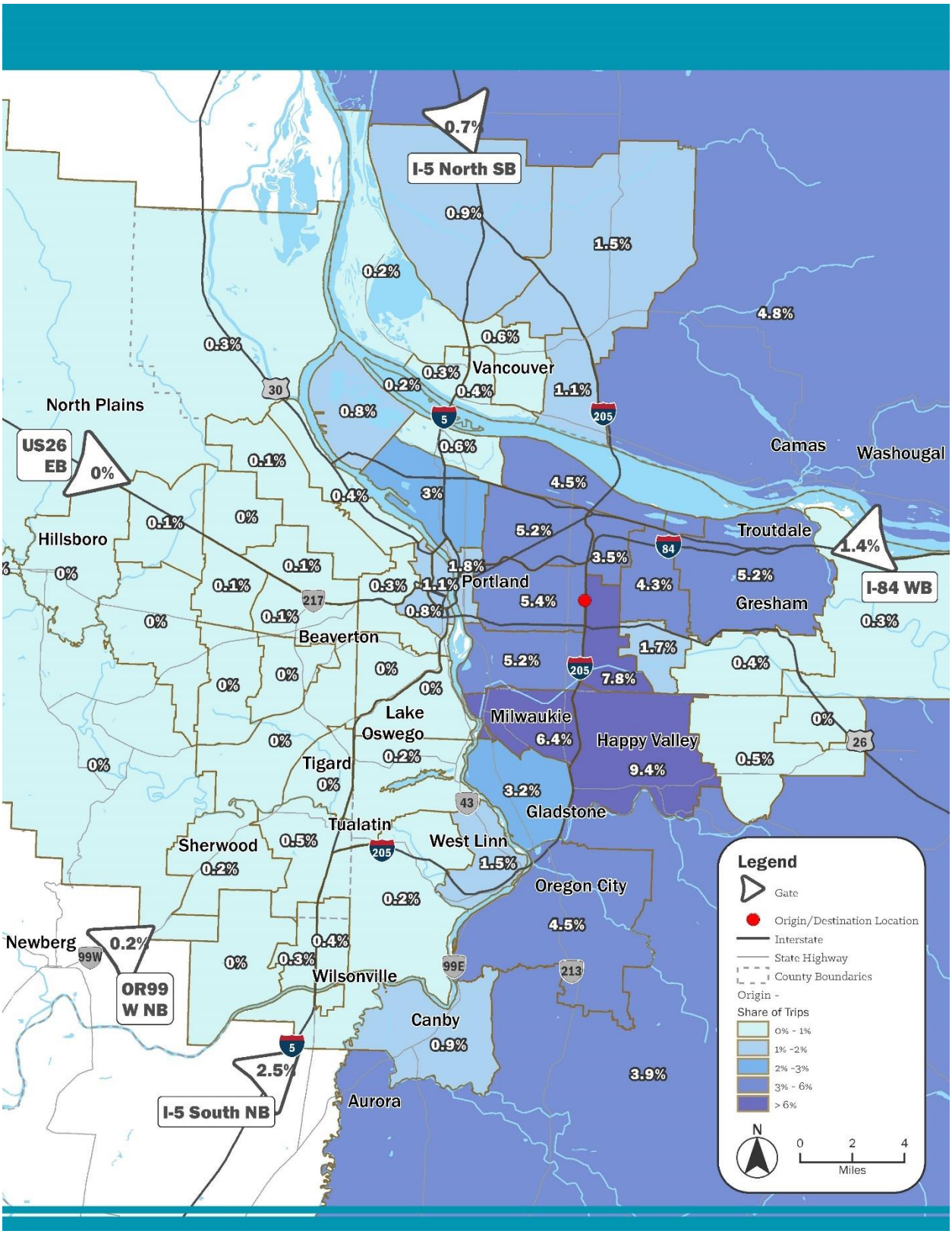


Figure C-16. Destinations for I-205 Trips North of Division Street

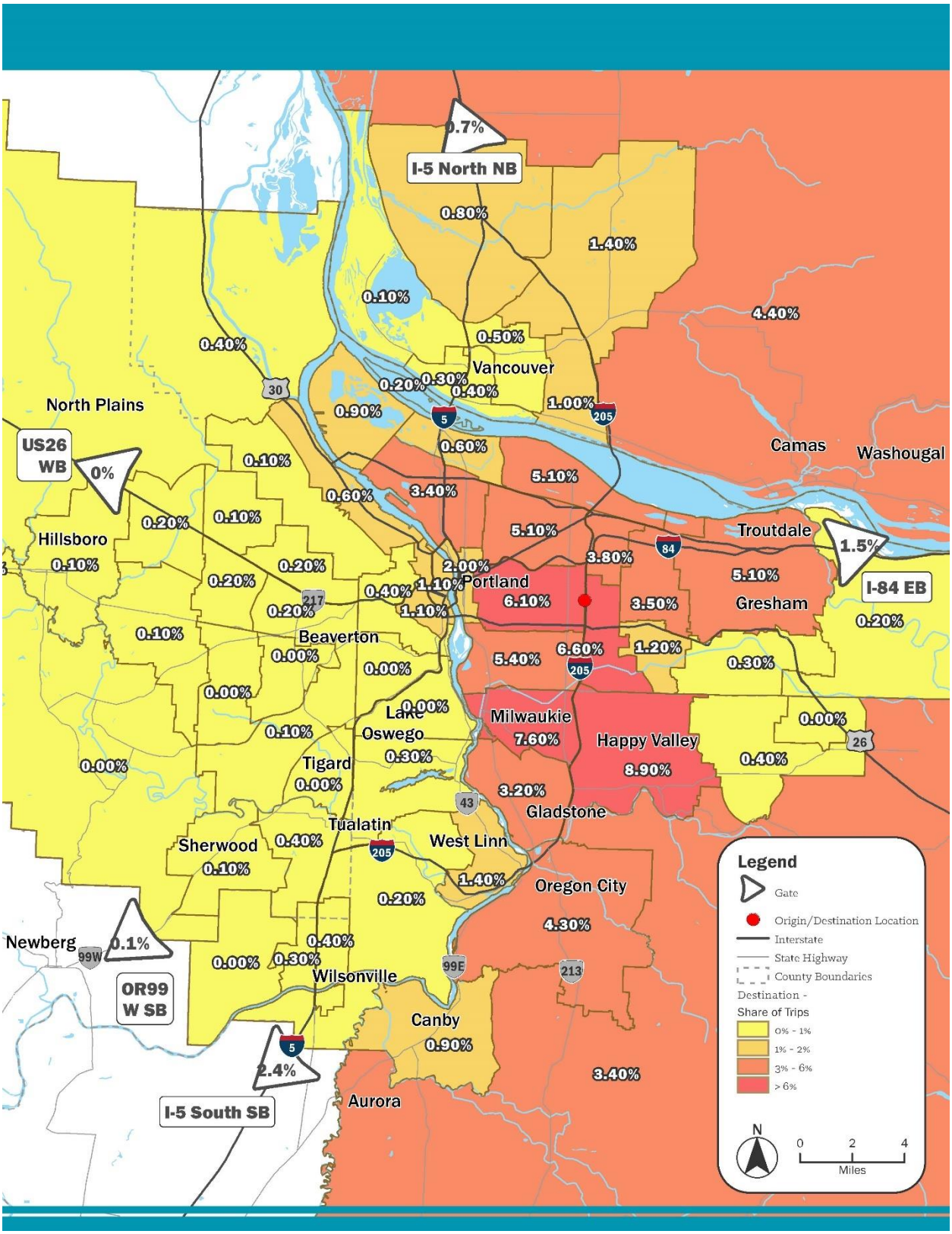


Figure C-17. Origins for I-205 Trips North of OR 212

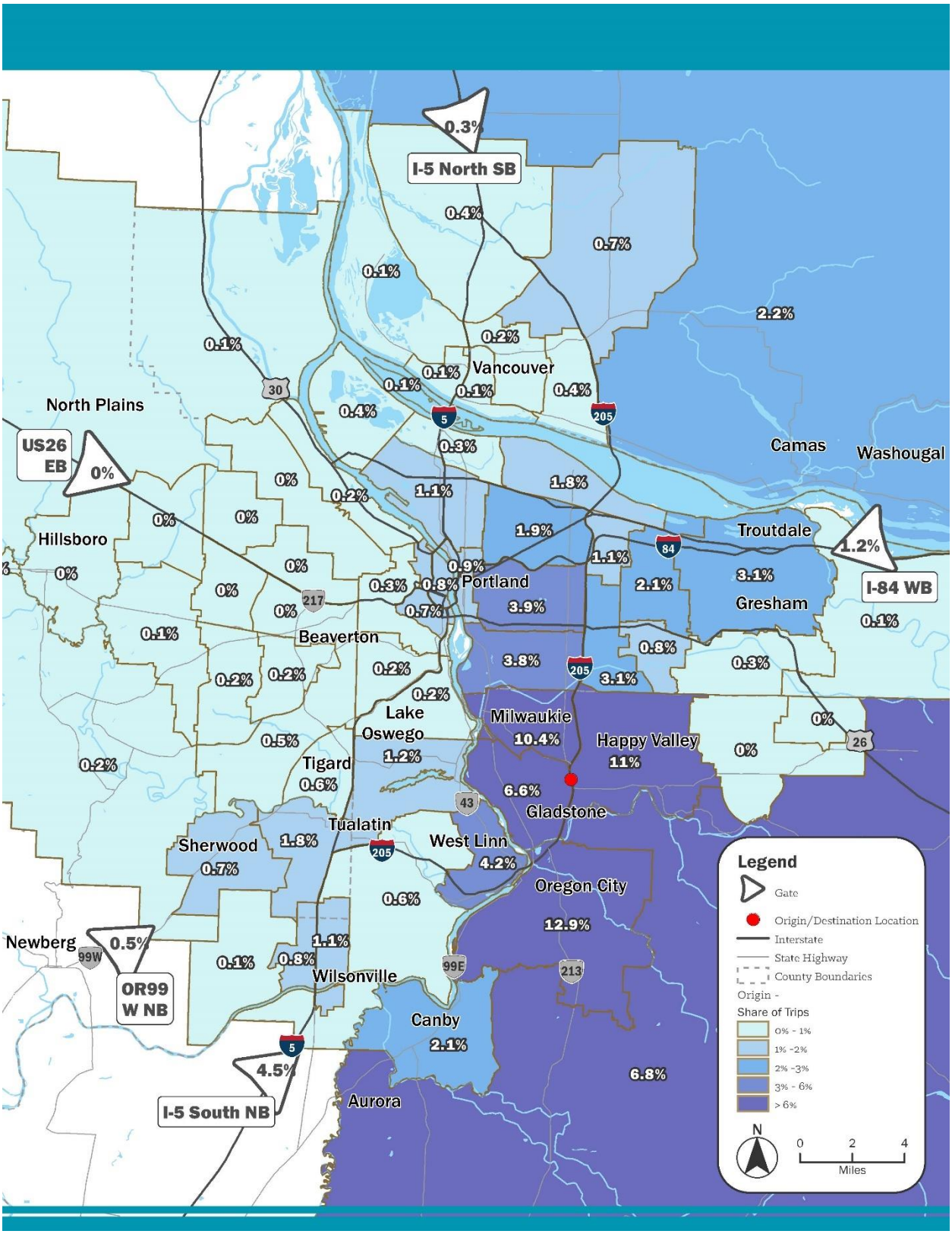
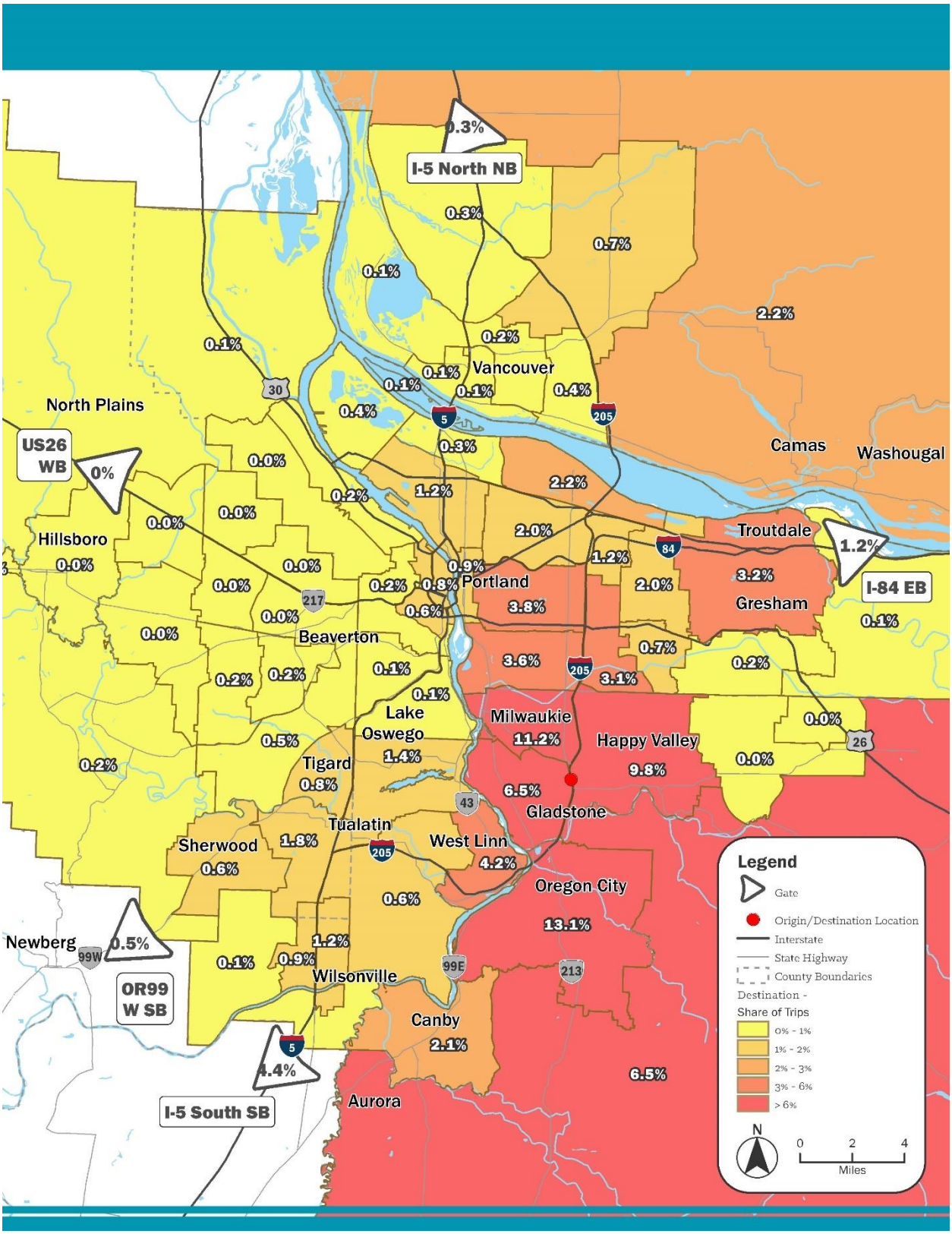


Figure C-18. Destinations for I-205 Trips North of OR 212



Appendix D Distance Traveled on I-5 and I-205 by County

The graphs below show the share of I-5 and I-205 trips beginning in each county by distance traveled on I-5 or I-205 within the corridor user analysis extents.

Figure D-1. I-5/I-205 Trips Beginning in Multnomah County by Distance Traveled within Corridor User Analysis Extents

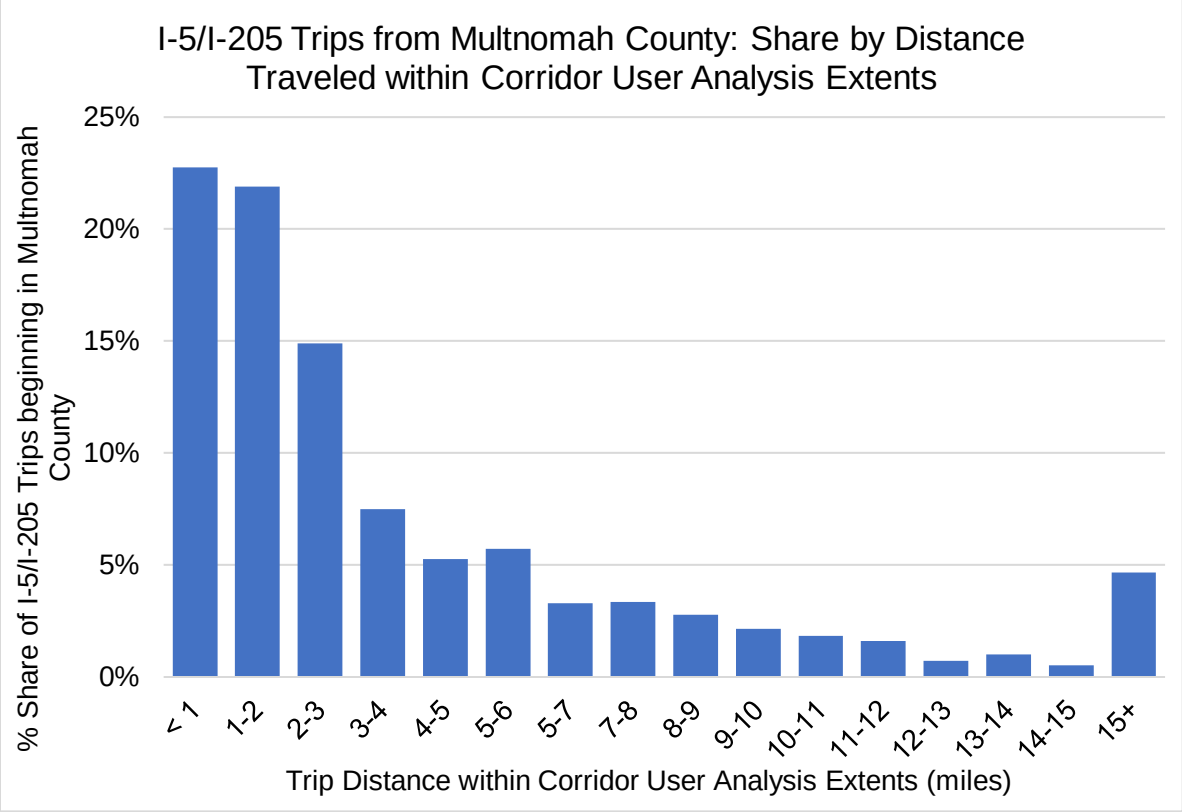


Figure D-2. I-5/I-205 Trips Beginning in Clackamas County by Distance Traveled within Corridor User Analysis Extents

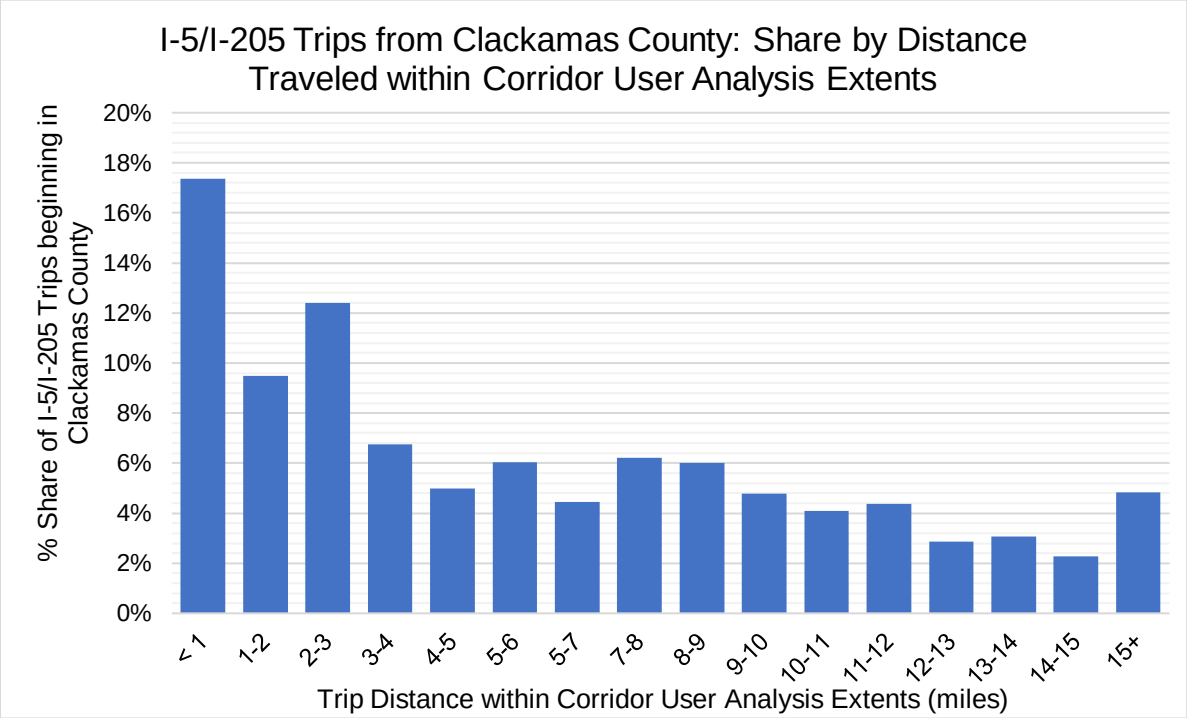


Figure D-3. I-5/I-205 Trips Beginning in Clark County by Distance Traveled within Corridor User Analysis Extents

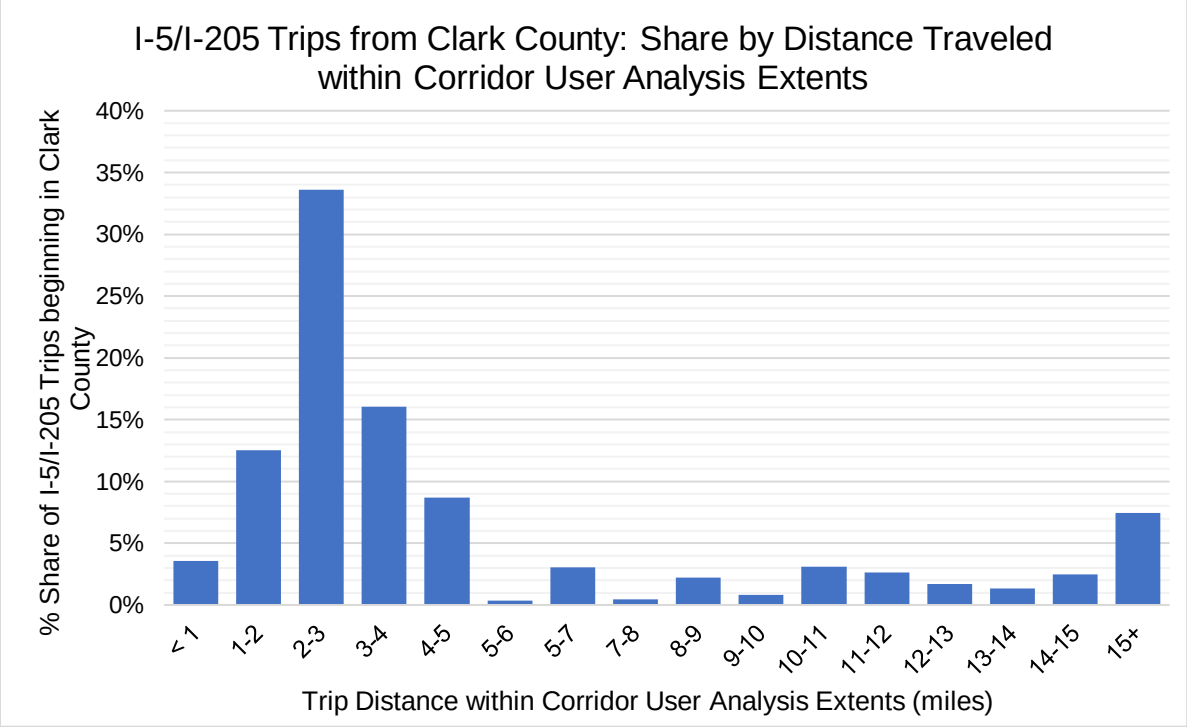
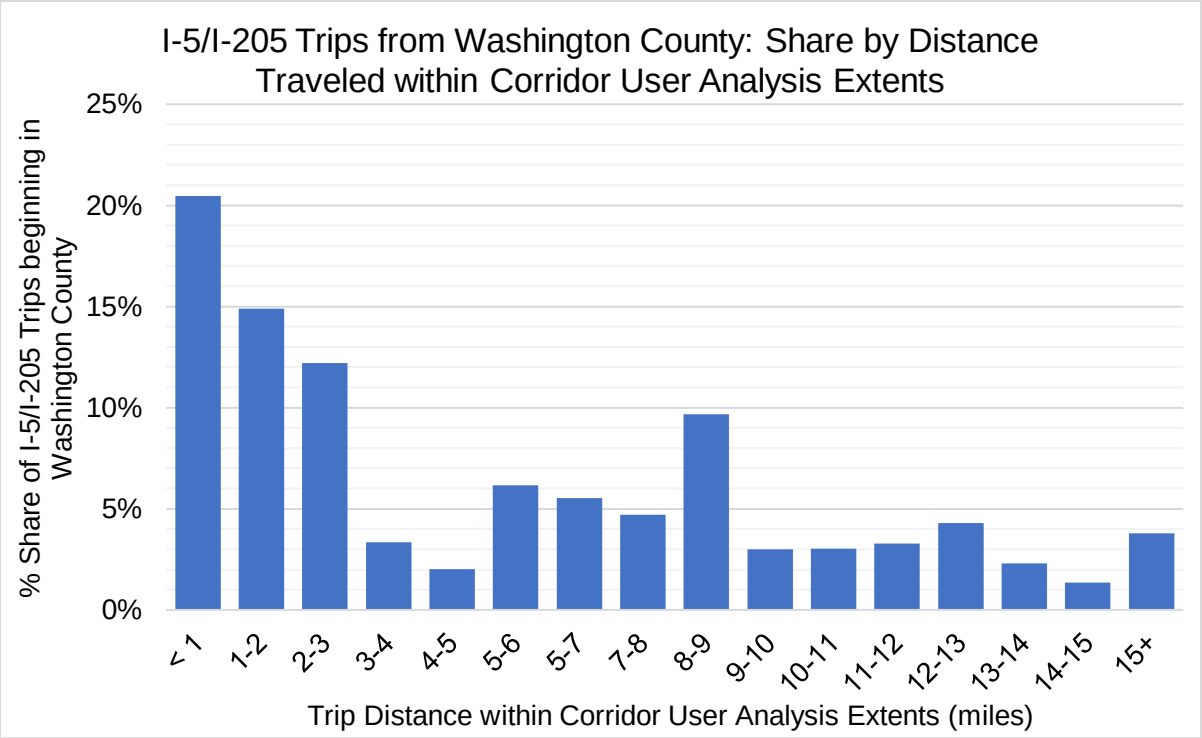


Figure D-4. Corridor Trips Beginning in Washington County by Distance Traveled



Appendix E I-5 and I-205 Travel Shed Analysis Maps

Figure E-1. I-5 Northbound between N Columbia Boulevard and N Lombard Street

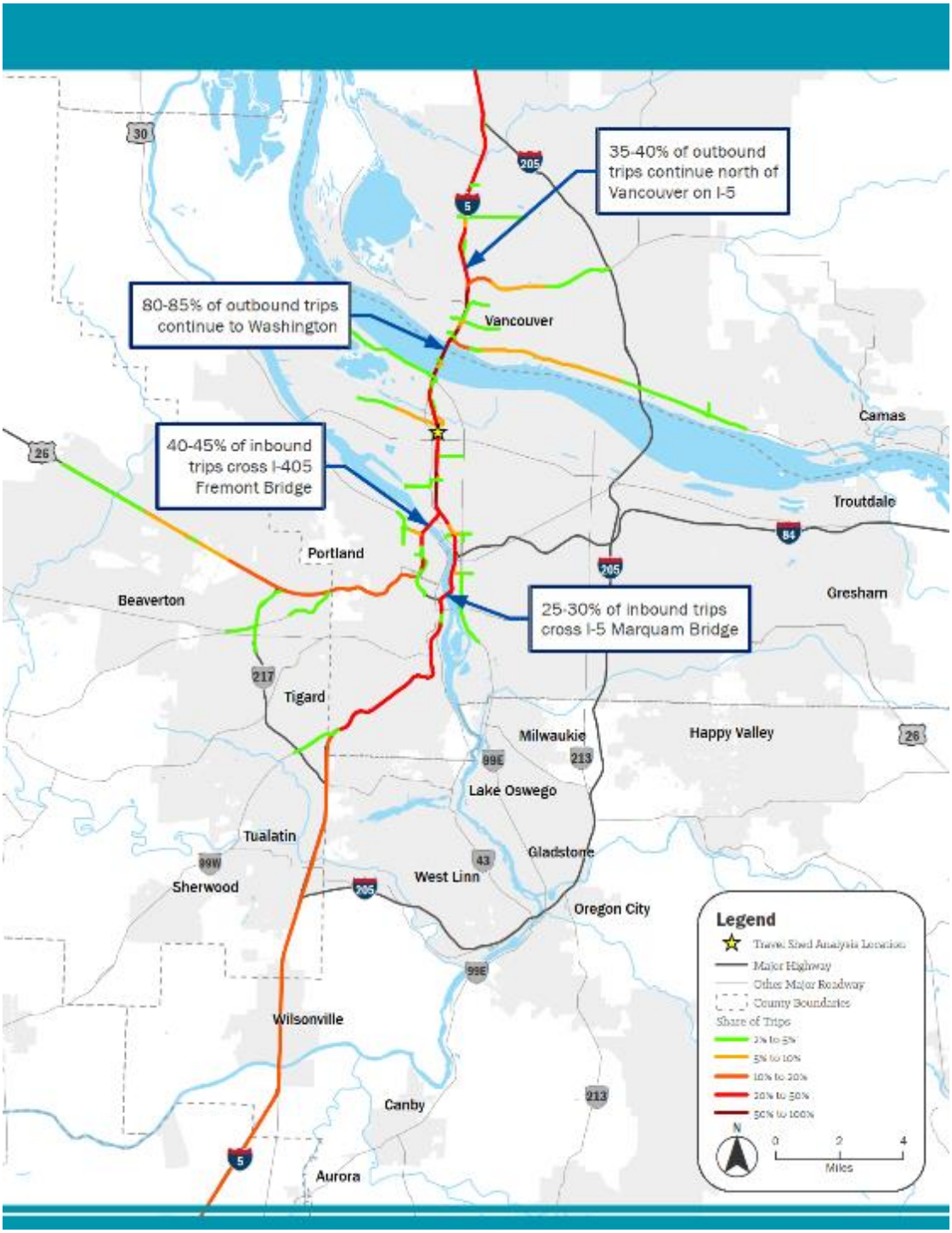


Figure E-2. I-5 Southbound between N Columbia Boulevard and N Lombard Street

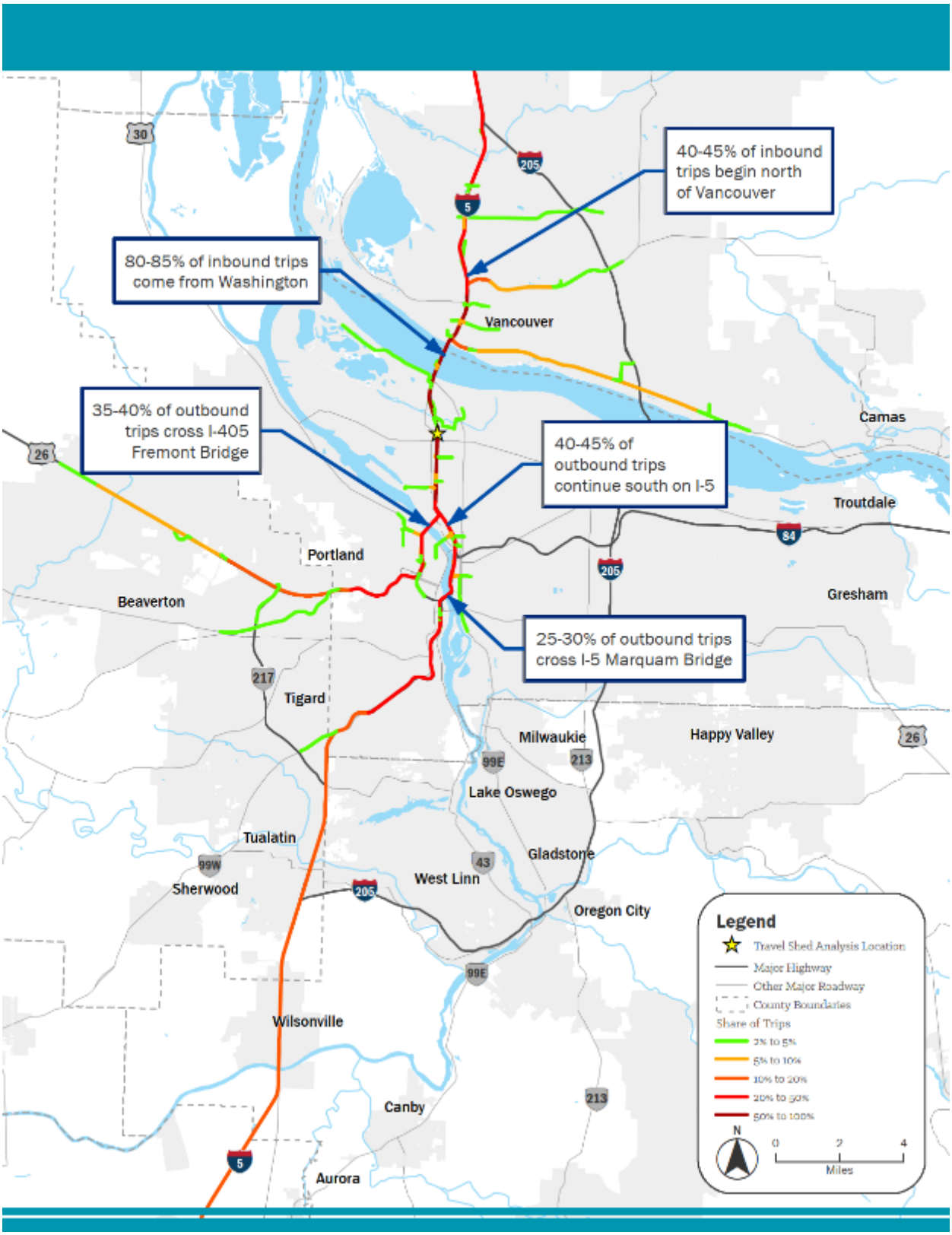


Figure E-3. I-5 Northbound between N Skidmore Street and I-405

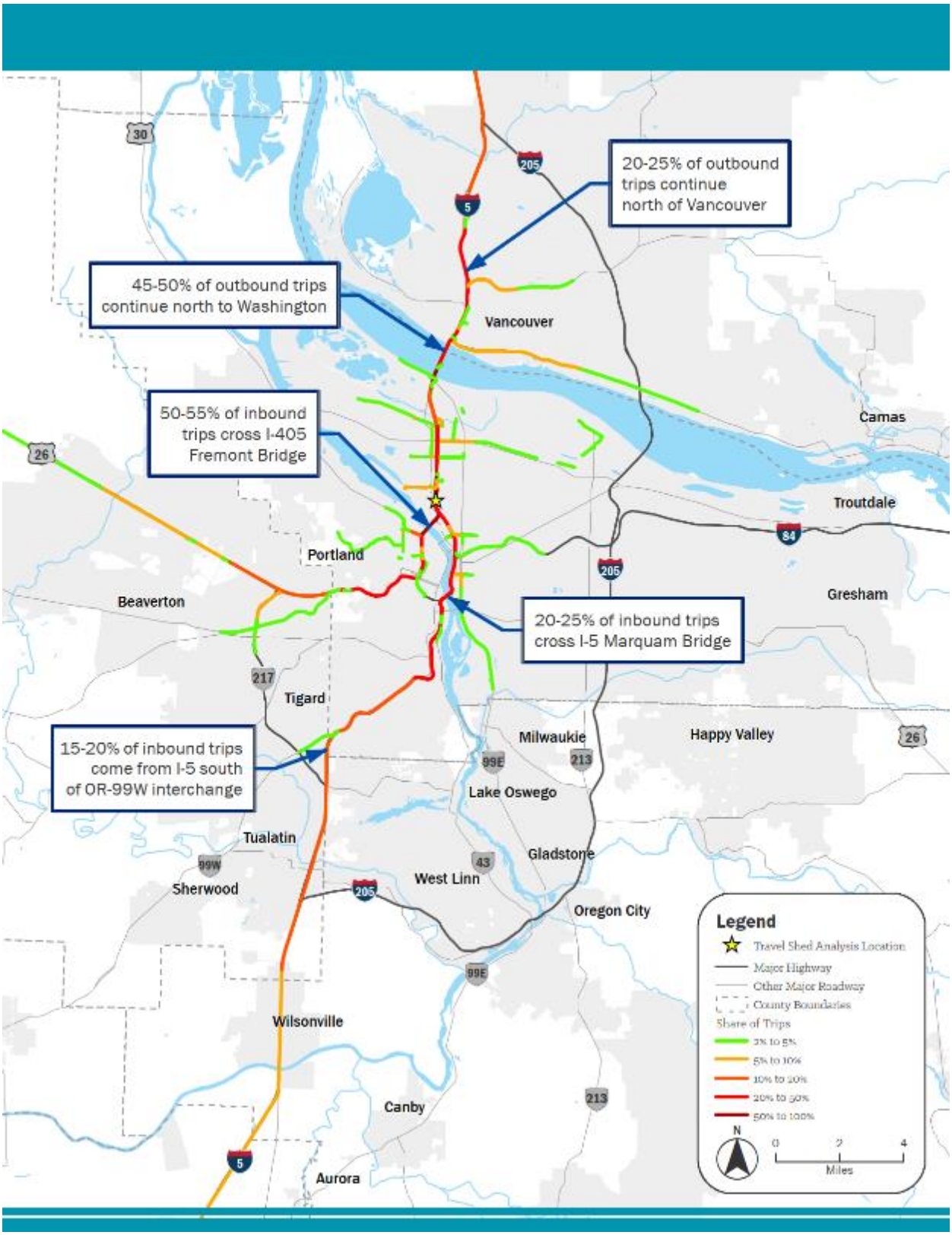


Figure E-4. I-5 Southbound between N Skidmore Street and I-405

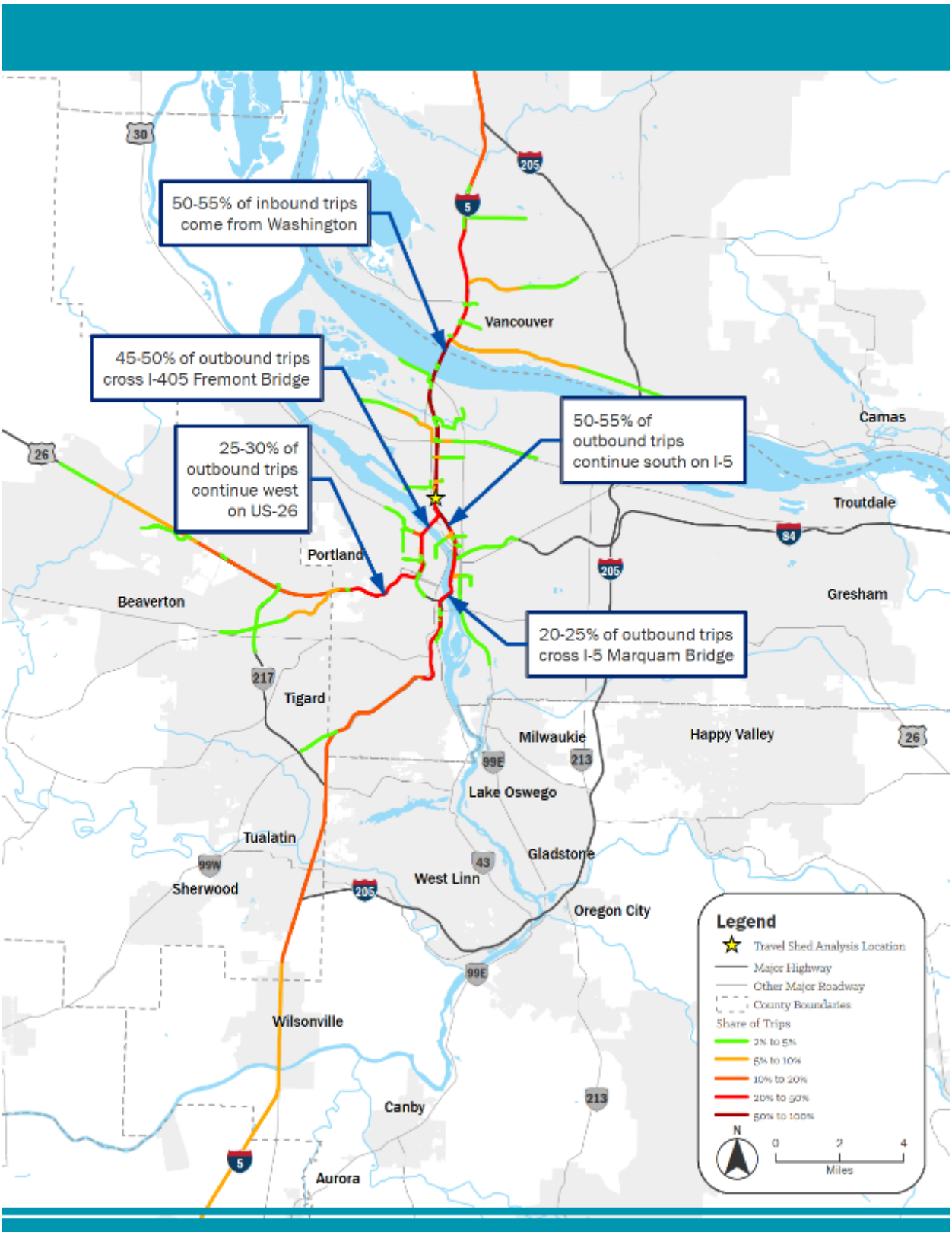


Figure E-5. I-5 Northbound Marquam Bridge

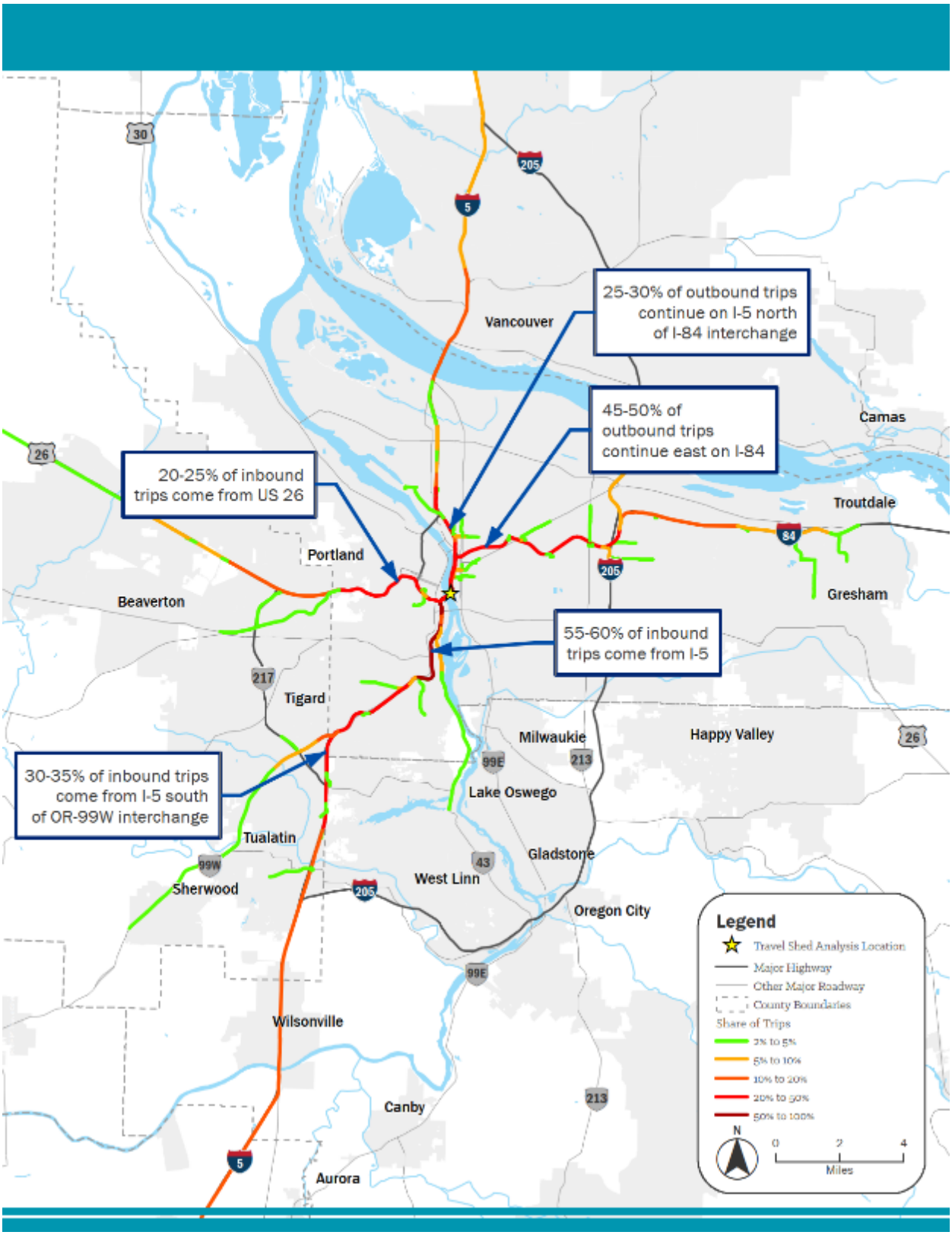


Figure E-6. I-5 Southbound Marquam Bridge

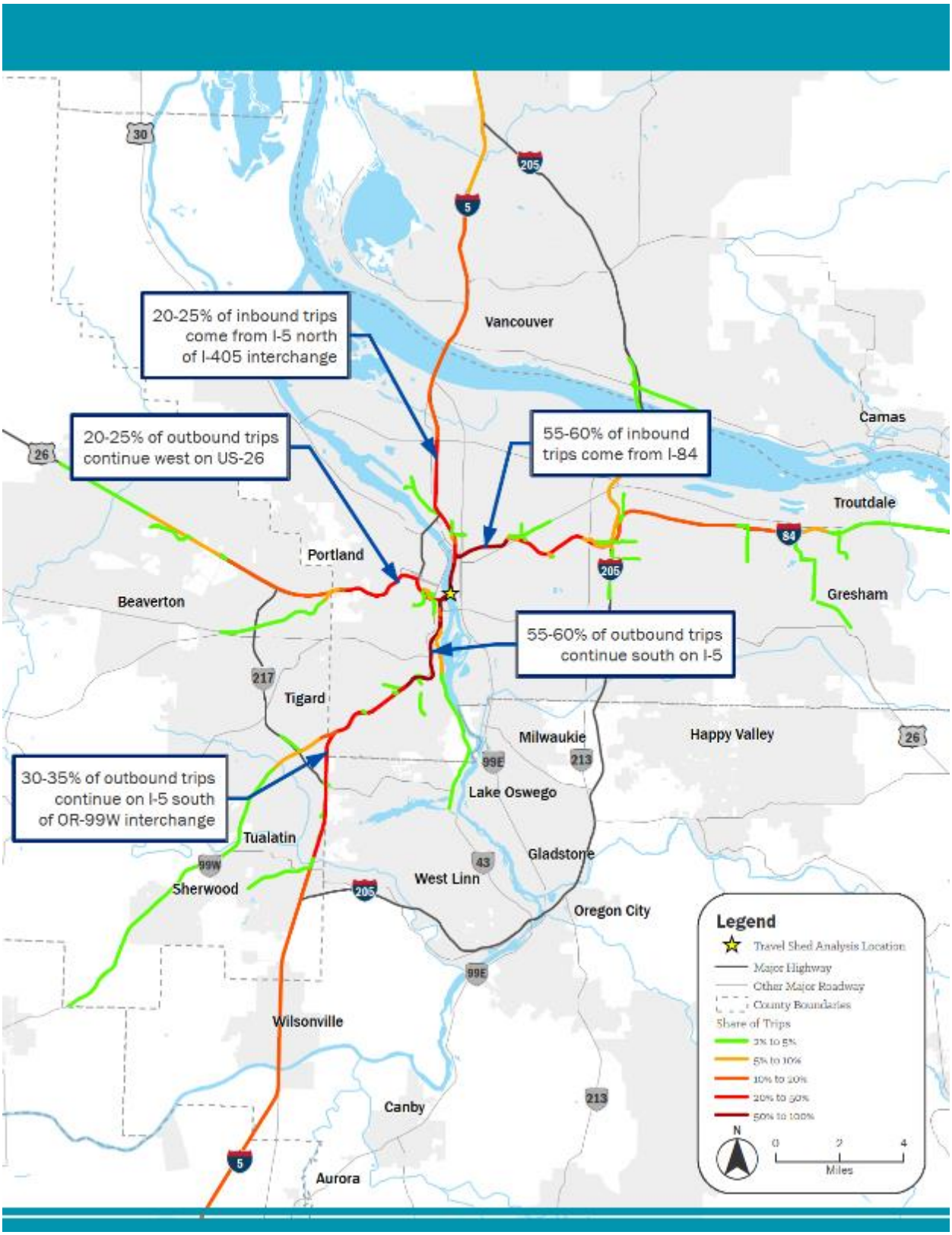


Figure E-7. I-5 Northbound between SW Multnomah Boulevard and SW Taylors Ferry Road

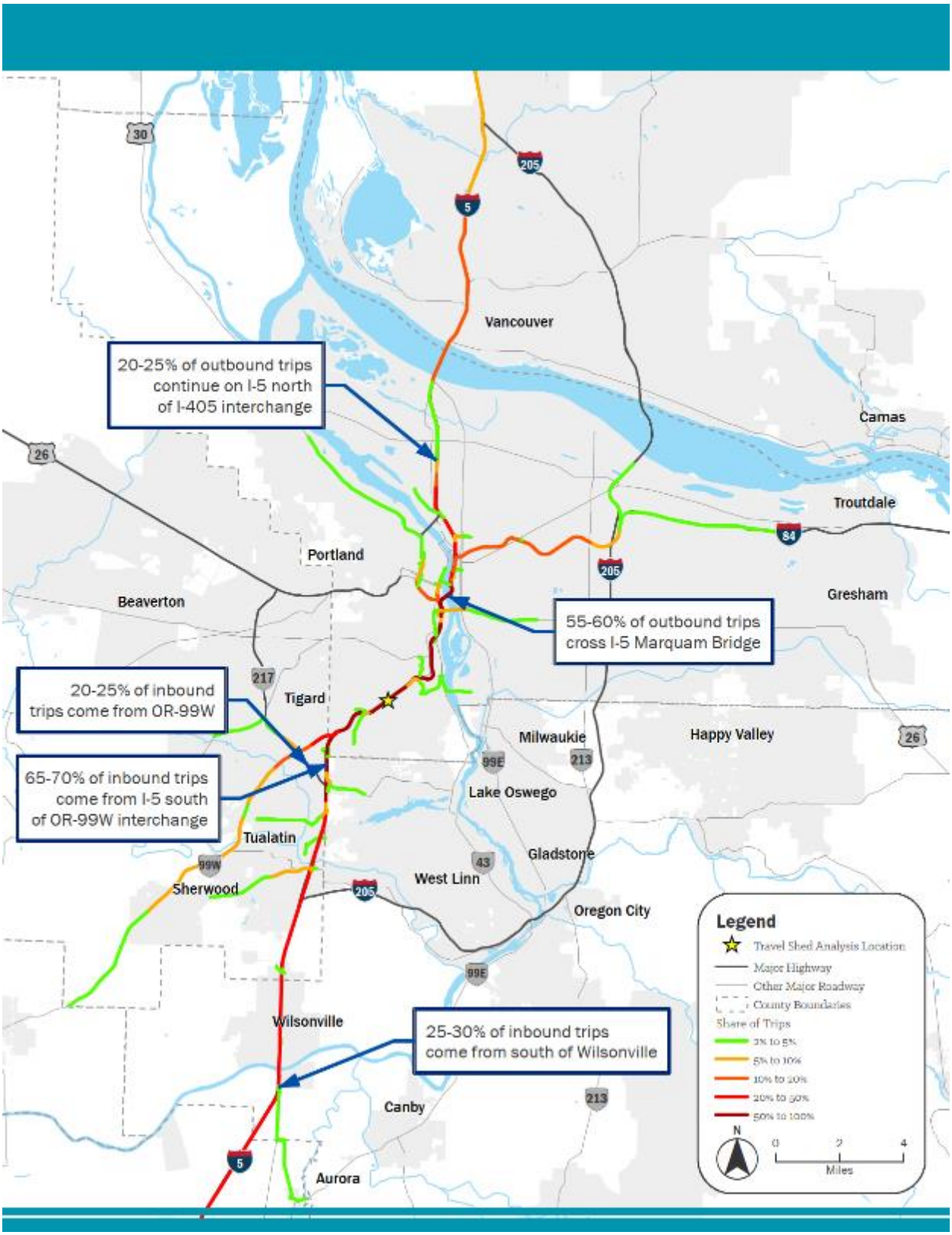


Figure E-8. I-5 Southbound between SW Multnomah Boulevard and SW Taylors Ferry Road

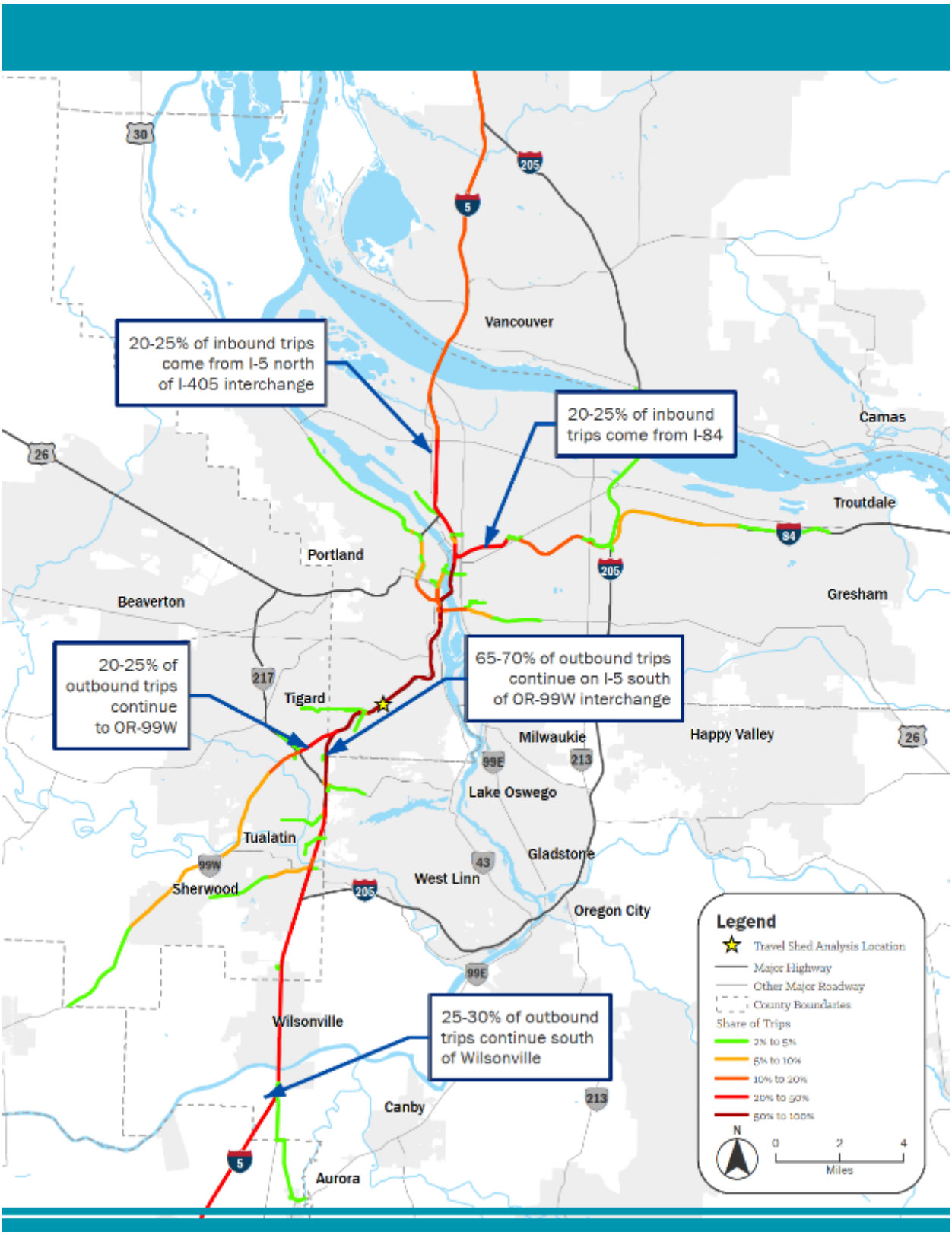


Figure E-9. I-5 Northbound between OR 217 and SW Carman Drive

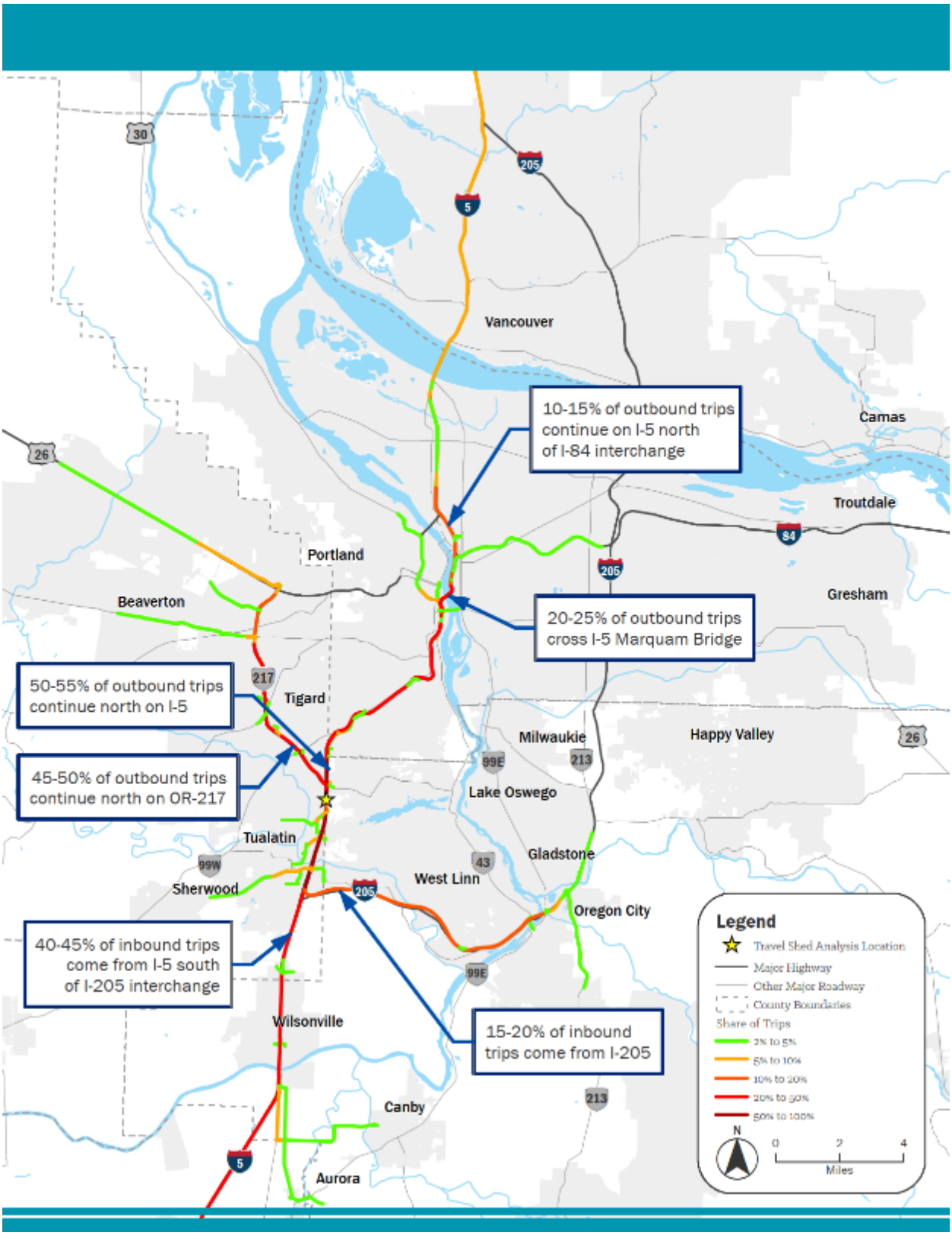


Figure E-10. I-5 Southbound between OR 217 and SW Carman Drive

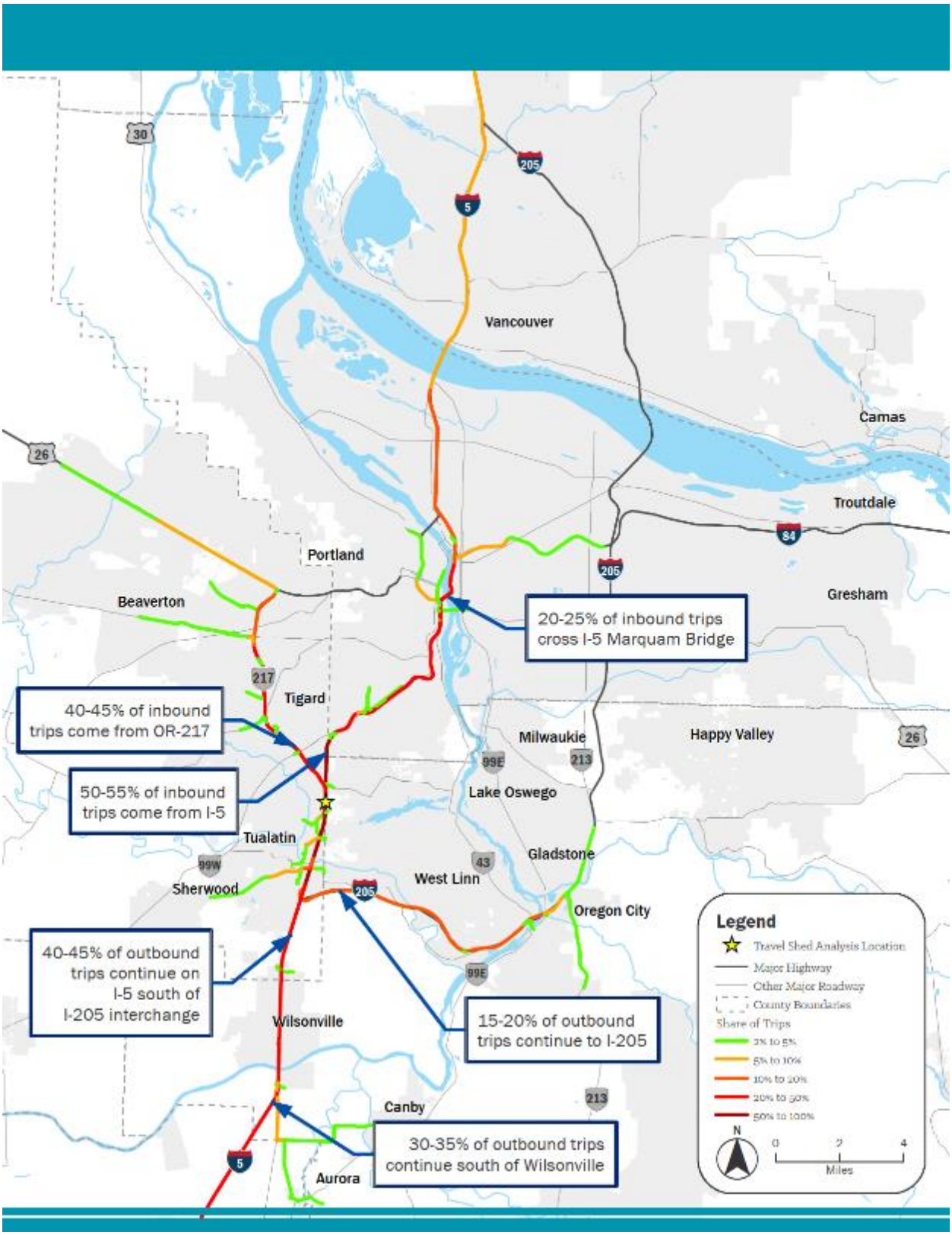


Figure E-11. I-5 Northbound between I-205 and SW Elligsen Road

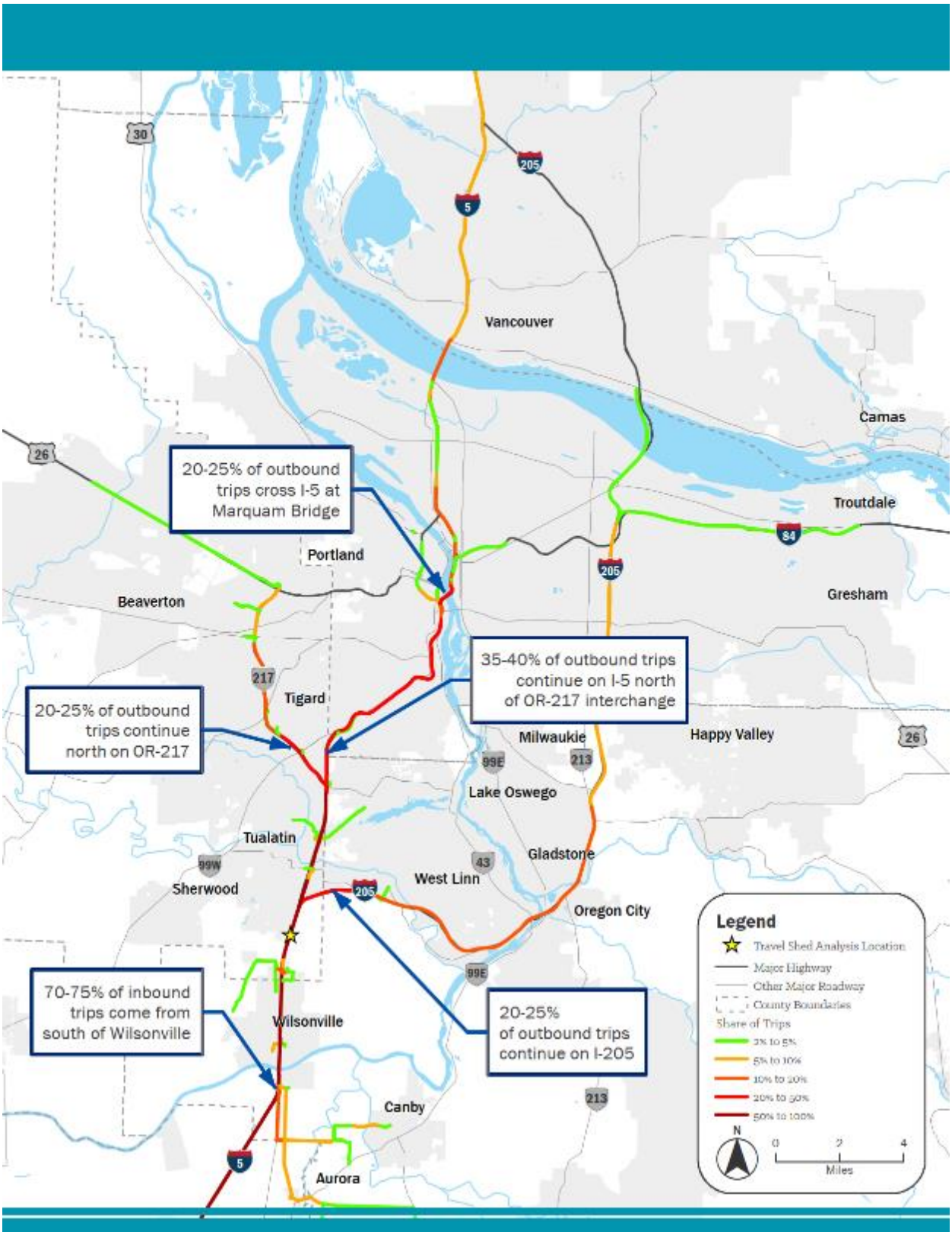


Figure E-12. I-5 Southbound between I-205 and SW Elligsen Road

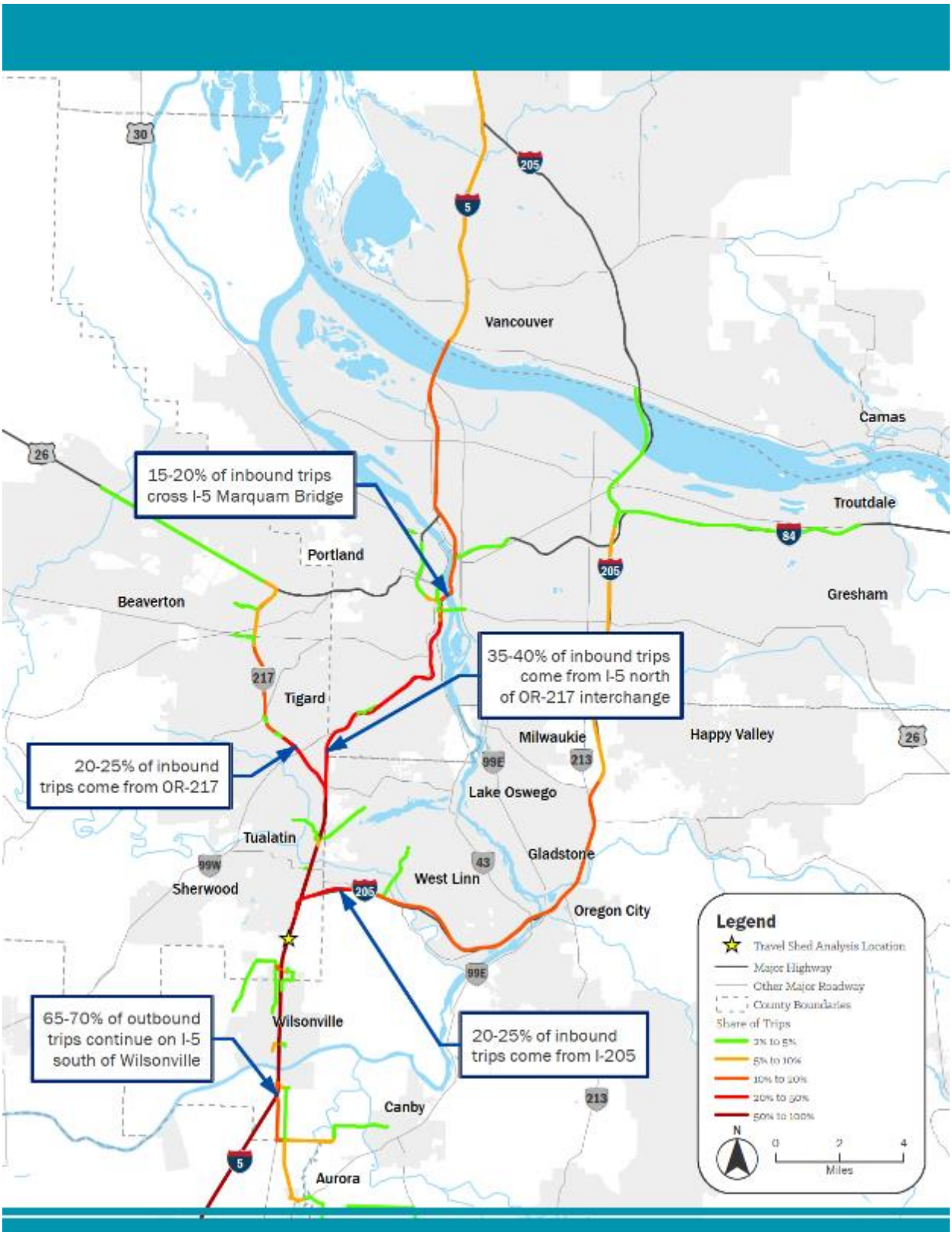


Figure E-13. I-205 Northbound between OR 212 and OR 224

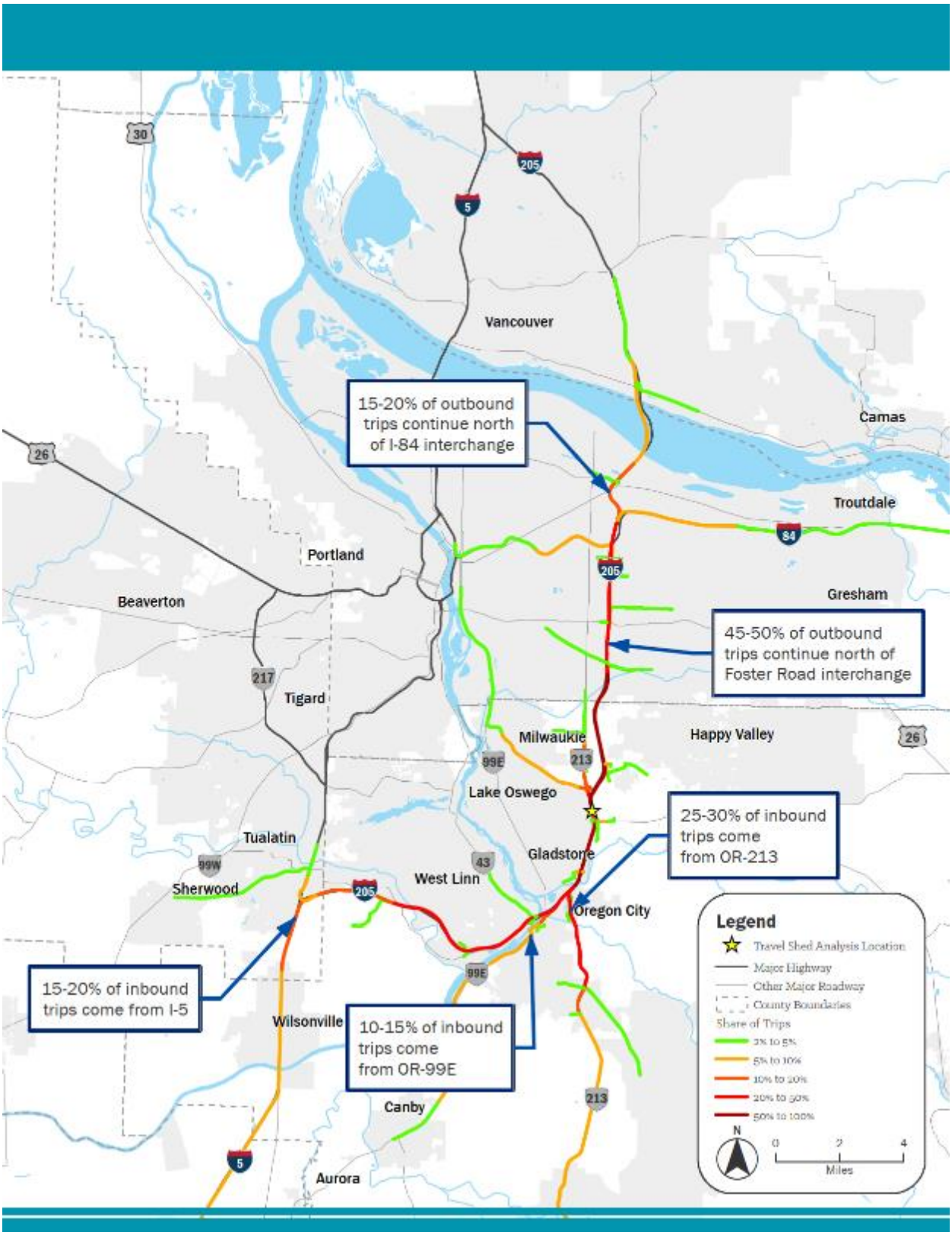


Figure E-14. I-205 Southbound between OR 212 and OR 224

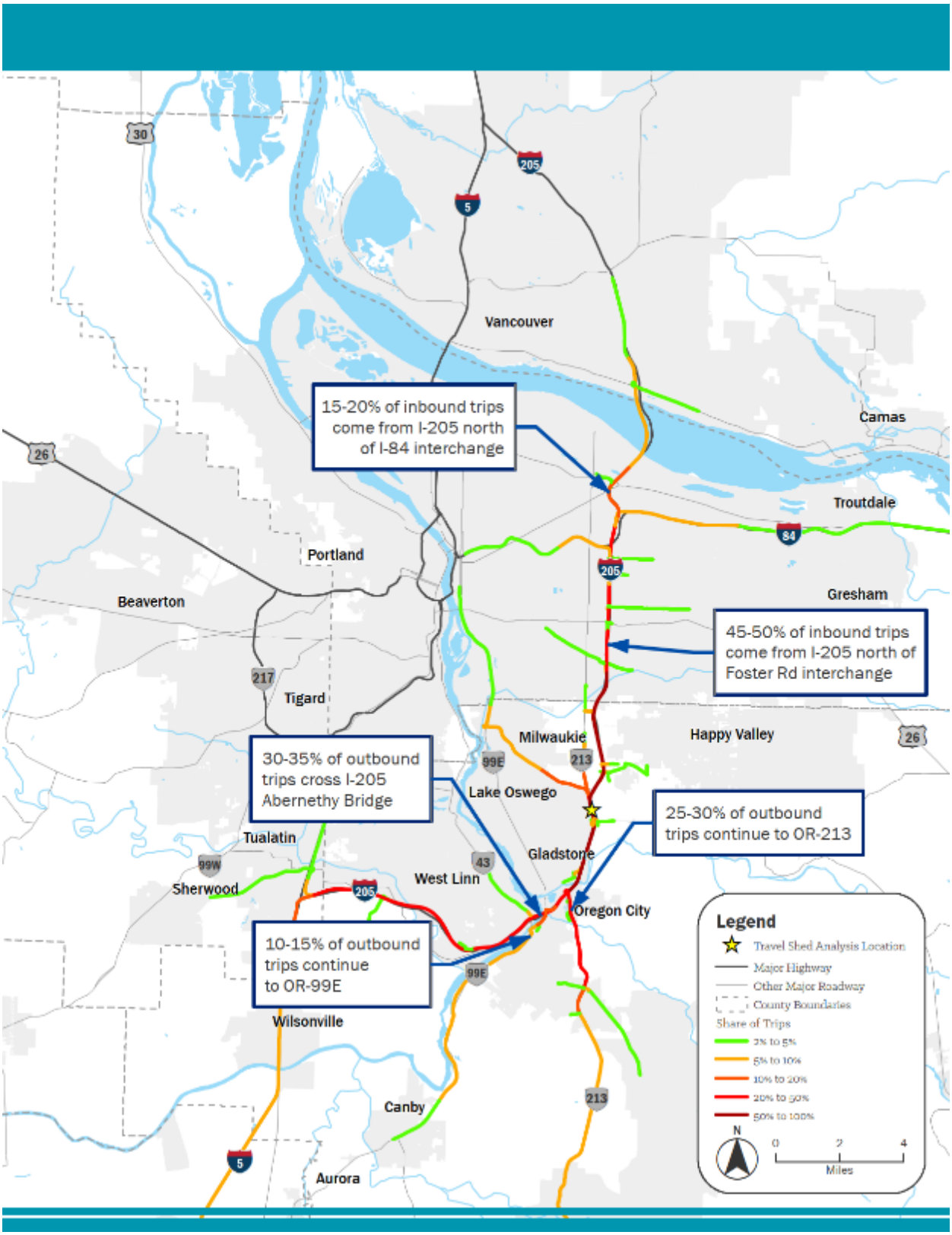


Figure E-15. I-205 Northbound between SE Washington Street and SE Division Street

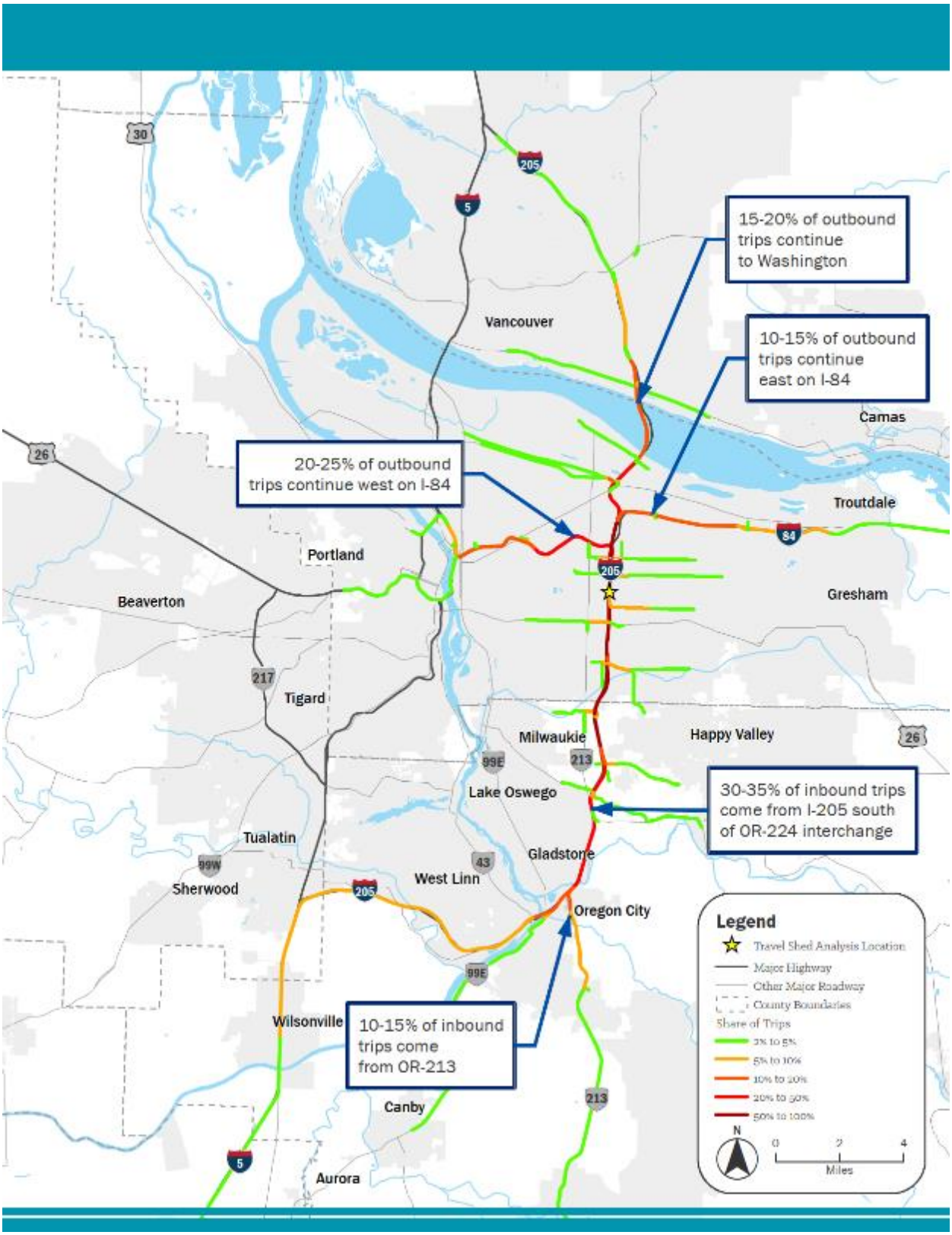


Figure E-16. I-205 Southbound between SE Washington Street and SE Division Street

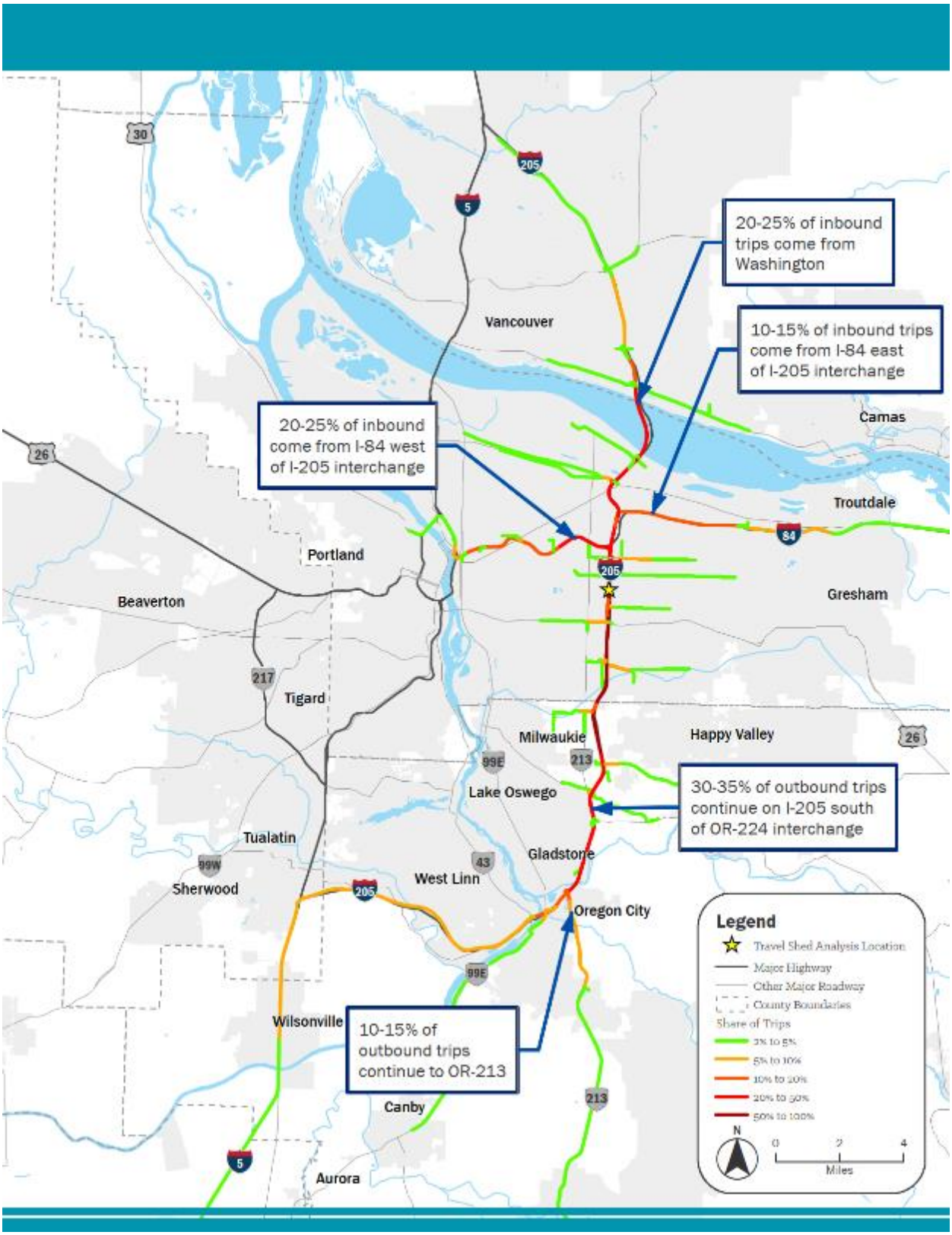


Figure E-17. I-205 Northbound between NE Sandy Boulevard and NE Prescott Street

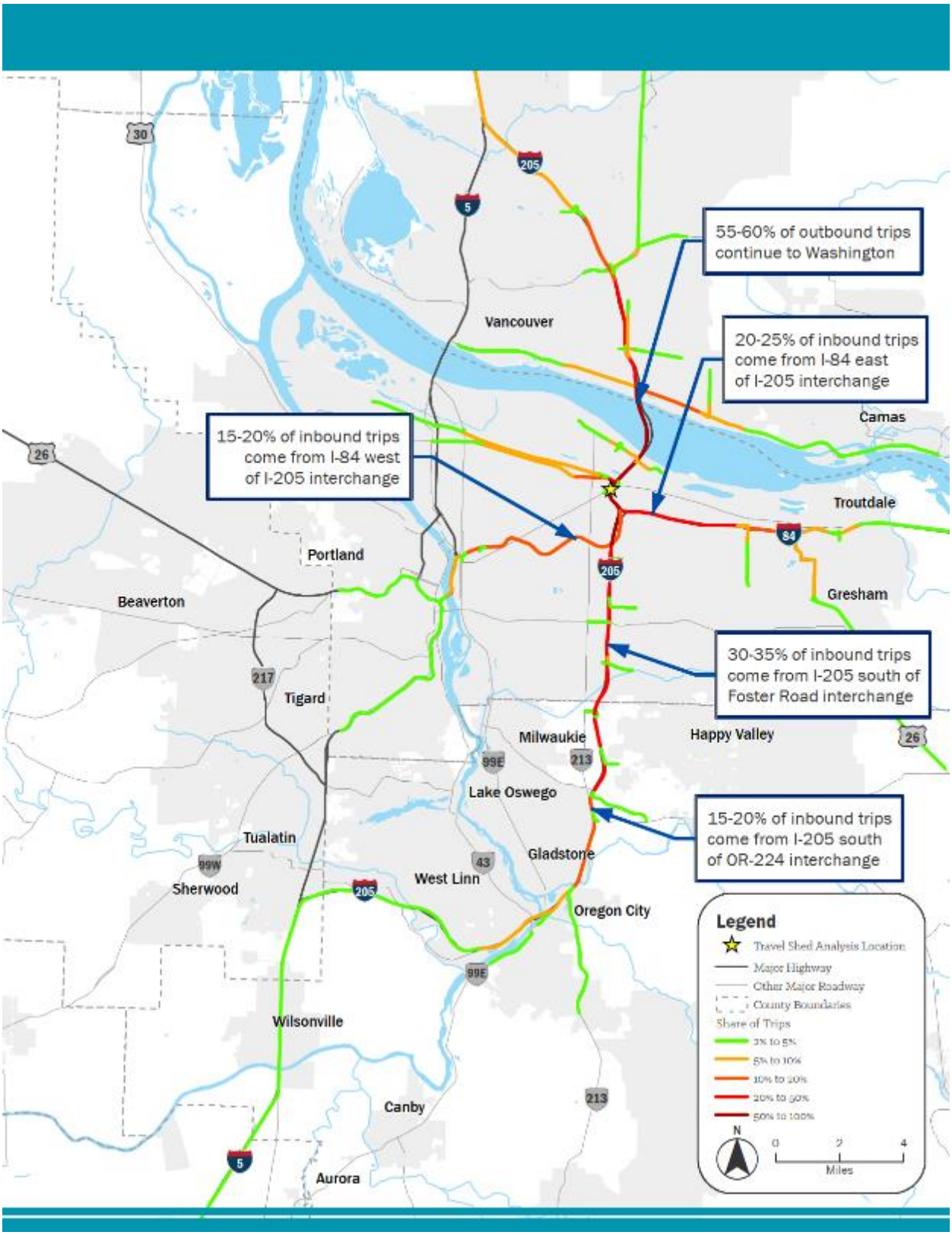


Figure E-18. I-205 Southbound between NE Sandy Boulevard and NE Prescott Street