2040FREIGHT
FUTURE CONDITIONS REPORT

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PBOT
PORTLAND BUREAU OF TRANSPORTATION

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Picture 1.1: Two freight trucks driving on a freeway. One white passanger vehicle is in the forefront of the photograph. [Source: Portland Bureau of Transportation (PBOT)]

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PREFACE

The 2040 Portland Freight Plan is an update of the City's Freight Master Plan adopted by the Portland City Council in 2008 and is part of a larger effort by the City of Portland's Bureau of Transportation to incorporate freight mobility considerations in execution of the agency's planning, operations, design, and implementation programs. The 2040 Portland Freight Plan will provide a strategic road map for achieving outcomes that support the City's long-term objectives for managing freight movement and commercial delivery based on the core principles of safety, mobility, economy, state of good repair, equity and the environment.

This technical report assesses and reports on the future (2040) movement of goods by truck in the City of Portland, including truck traffic volume, delay, and travel patterns. Several data sources were used in this analysis including Metro's Regional Travel Demand Model and the Freight Analysis Framework (FAF) data provided by the Federal Highway Administration (FHWA). From these data sources, locations with potentially high congestion levels and lengthy travel time delay were identified, primarily focused on non-freeway locations where truck traffic may experience regular (recurring) congested conditions on City streets. Where available, the differences between off-peak hour (12pm-1pm), PM peak hour (5pm-6pm), and all- day traffic were analyzed to better understand when issues may be occurring and to lay the groundwork for solutions that address these issues. The future 2040 conditions were also compared to existing conditions to identify where congestion is worsening, or where congestion is anticipated to occur in the future.

These analyses are critical to developing an understanding of the future impediments to freight movement and are one of many elements of the City's 2040 Portland Freight Plan, including: developing solutions and strategies to improve freight mobility; recommending freight mobility performance indicators and measures; and recommending an action plan.

The contents of this document do not necessarily reflect views or policies of the City of Portland.

Picture 3.1: A bicycle user riding on a green bike lane. A white United States Postal Service (USPS) mail truck drives in the background. [Source: PBOT]

1. INTRODUCTION

Under the existing conditions analysis, there were a number of streets in the City of Portland that show high truck volumes, affecting the movement of goods and people both within the City and through it. By 2040, the City is anticipating increased growth in both population, jobs, and e-commerce. This analysis examines the expected growth in truck traffic and where congestion will worsen or where may arise. Identifying these congested locations will help to inform the development of solutions later in this planning process.

1.1 Future Infrastructure Projects

This plan will guide the City of Portland's freight planning efforts for the next twenty years. The horizon year of this plan is 2040, which is consistent with the Metro Regional Transportation Plan (RTP) that was completed in 2018. Metro takes into account land use growth and a list of financially constrained transportation projects to model future conditions of traffic and travel patterns in 2040.

The RTP has a financially-constrained project list which includes projects that are within the estimated funding available for the 2040 time period. Many projects are identified as important, but do not fit within the funding expectation; these are included in a separate list of "strategic" projects. The Metro financially-constrained freight projects in Portland are listed in **Table 1** below. The full RTP project list is available here[1].

1 https://www.arcgis.com/apps/webappviewer/index.html?id=73e94a0343ea487e82b4830fead7c88e&extent=-13751666.1848%2C5656339.7069%2C-13586562.2037%2C5748675.6371%2C102100

Table 1. Regional Transportation Plan Financially-Constrained Freight Projects in Portland

RTP ID	PROJECT NAME	DESCRIPTION	TIME PERIOD
10218	Burgard-Lombard Street Improvements	Construct roadway improvements, including pedestrian and bicycle facilities.	2018-2027
10337	Marine Dr & 33rd Intersection Improvements	Signalize intersection to improve freight operations.	2018-2027
10340	Cornfoot Rd Corridor Improvements	Improve roadway and intersections to improve freight operations. Construct a multi-use path on the north side of Cornfoot Rd to separate pedestrians and bicyclists from motor vehicle traffic. Install guardrails where needed.	2018-2027
10363	SW Quad Access	Provide street access from 33rd Ave. into SW Quad.	2018-2027
10375	Cathedral Park Quiet Zone	Address rail switching noise related to the Toyota operations at T-4 by improving multiple public rail crossings in the St. John's Cathedral Park area.	2018-2027
10379	Marine Dr. Improvement Phase 2	Construct rail overcrossing on Marine Dr.	2018-2027
10394	Replace RR Over-crossing on 223rd Ave.	Reconstruct railroad bridge on 223rd Ave, 2000' north of I-84 to accommodate wider travel lanes, sidewalks and bike lanes; to address safety and reduce crashes the project will use proven safety countermeasures.	2018-2027
11208	T4 Modernization	Renovate operation areas at T4 to create intermodal processing areas. Rail spur relocation and expansion, grain elevator demolition, wharf removal.	2018-2027
11355	Barnes to Terminal 4 Rail	Improve Rail Access to Terminal 4.	2018-2027
11357	Terminal 6 Rail Support Yard Improvements	Increase Terminal 6 rail capacity.	2018-2027
11568	St. Johns Truck Strategy Phase II	Address pedestrian safety, bicycle safety and neighborhood livability impacts associated with cut-through truck traffic on N St Louis Ave and N Fessenden St. Construct pedestrian crossing safety and traffic calming improvements, such as curb extensions and median islands, as outlined in the St Johns Truck Strategy Phase II.	2018-2027
11570	Columbia/Alderwood Intersection Improvements	Improve intersection and install traffic signal at Columbia & Alderwood.	2018-2027
11649	T2 Redevelopment	Construct rail, rail scale, and crane modernization.	2018-2027
11651	T2 Track Reconfiguration and Siding	Construct rail loops and support siding.	2018-2027
11652	Bonneville Rail Yard Build Out	Construct two interior yard tracks at Bonneville Yard and complete the double track lead from the wye at the east end of the yard to UP Barnes Yard.	2018-2027
11653	Ramsey Yard Utilization	Connect the existing set out track along the west side of the main lead with the industrial lead near the south end to provide a location to store a unit train.	2018-2027

RTP ID	PROJECT NAME	DESCRIPTION	TIME PERIOD
11659	Rivergate Blvd. Overcrossing	Relieve a congestion point in Rivergate Industrial Area, improve rail access to TerminaL 5.	2018-2027
11743	Troutdale Airport Master Plan Transportation Improvements	Implement transportation improvements developed as part of the Troutdale Airport Master Plan.	2018-2027
11799	Suttle Rd Freight Street Improvements	Improve Suttle Rd to meet Freight District Street standards, separate rail and truck movements, provide pedestrian access to nearby bus line, and enable future T6 entrance Port project.	2018-2027
11800	Columbia Blvd Pedestrian Overpass Replacement	Replace the pedestrian overpass near George Middle School with either an at-grade crossing or a higher overpass to enable the use of Columbia Blvd as an over-dimensional freight route.	2018-2027
11841	Central Eastside Access and Circulation Improvements	Improve access and circulation in the Central Eastside by adding new signals and crossings at Hawthorne & Clay ramp, Salmon & Grand, Salmon & MLK, Washington & Grand, Washington & MLK, Ankeny & Sandy, 16th & Irving, and modifying signals at Stark & Grand, Clay & Grand, and Mill & MLK.	2018-2027
12004	Columbia Blvd Freight Improvements: Project Development	Alternatives analysis and project development to identify preferred street and intersection modifications to improve freight reliability and access to industrial properties.	2018-2027
11802	N Portland Rd over Columbia Slough Bridge Replacement	Replace the weight-restricted N. Portland Road bridge over the Columbia Slough to enable the use of N. Portland Road as an over-dimensional freight route and include a connection for the Columbia Slough Trail.	2028-2040
10331	Columbia Blvd / Railroad Bridge Replacement	Replace the existing fracture critical Columbia Blvd bridge (#078) over railroad tracks with a new structure and perform seismic upgrades on parallel bridge (#078A).	2028-2040
10376	Columbia Blvd Freight Improvements: Design/ Construction	Construct street and intersection modifications to improve freight reliability and access to industrial properties.	2028-2040
11207	T6 Modernization	Provide improvements to container terminal including crane electronics and stormwater improvements.	2028-2040
11306	T6 Second Entrance from Marine Drive	Construct 2nd entrance from Marine Drive and internal rail overcrossing to Terminal 6.	2028-2040
11307	T6 Suttle Road entrance	Access to the east end of Terminal 6 off the terminus of Suttle Road.	2028-2040
11654	Time Oil Road Reconstruction	Reconstruct Time Oil Road.	2028-2040
11801	Columbia Blvd Railroad Undercrossing Improvement	Lower the Columbia Blvd undercrossing at the UP Railroad Bridge just west of I-5 to enable the use of Columbia Blvd as an over-dimensional freight route.	2028-2040

Source: Regional Transportation Plan, 2018

2. TRUCKING DATA AND METHODOLOGY

2.1 Portland Metro Travel Demand Model Data

Travel demand data used in this report was obtained from the Metro Regional Travel Demand Model. The Metro Regional Travel Demand Model (hereafter called "the model") is a transportation forecasting model used for planning urban and regional movement of people and goods. The data were provided for the latest available model base year 2015, for the off-peak hour (12pm–1 pm), PM peak hour (5pm-6pm), and daily time periods. The model represents average weekday conditions. Model data include the following attributes, which are explained in more detail in the following sections of the report:

- Total truck volumes
- Truck volumes by vehicle type (medium truck and heavy truck)
- Congested and posted speed
- Truck vehicle miles of travel (VMT)
- Truck hours of delay
- Volume-to-capacity ratio on roadway segments
- Zonal truck origins and destinations

Although, travel time reliability is critical to freight carriers and shippers, it was not included as part of this analysis. Truck Travel time reliability for statewide and regional plans for state roadways is calculated based on the Federal Highway Administration Performance Measures 3 (FHWA PM3) recommended methodology using GPS data. GPS data and analysis were not available for this study as an input for the Metro travel demand model. Alternatively, Metro has used the SHRP C04 methodology to estimate travel time reliability to inform benefit-cost analysis for regional projects through before-after analysis of corridor or project level changes. Metro's travel time reliability calculation is based on a linear regression model using posted versus congested speed, distance to interchanges, intersection control type, number of lanes, and volume-to-capacity (v/c) ratio as inputs. Many of the metrics used in the reliability regression model have been directly included in this report, and reporting reliability using Metro's methodology would provide similar conclusions to the FHWA travel reliability methodology.

The model represents in class 5 trucks and higher, which are those with two axles and six tires or those with more than two axles based on the FHWA vehicle classification system. Although, the smaller vans/pick-ups/panels in FHWA class 3 (four tire, vehicles other than passenger cars) or passenger cars in FHWA class 2 are increasingly being used by last mile delivery companies and service providers they are not tracked as commercial vehicles in Metro's model. The difficulty of distinguishing the commercial vs. personal use of the class 2 and 3 vehicles as resulted in a lack of reliable and available data sources that would account for the smaller commercial vehicles fleet in the city of Portland. Recent on-going efforts in other cities have aimed to developed data collection methods that would fill the gap and provide a complete picture of commercial vehicles flows.

It is important to acknowledge that these estimates do not account for the potential increase of the smaller commercial fleet due to the growth of e-commerce and deconsolidation of demand as business-to-customer operations expand. Further examination of these changes in commercial fleet configuration and travel patterns is required to evaluate future traffic conditions in the Portland transportation network.

To forecast future 2040 conditions, the model uses expected household and employment growth across the region. **Table 2** shows the assumed growth from 2015 to 2040 in Portland, as well as growth in freight-related industries. The City is forecast to see a 42% growth in households and 36% growth in employment over 25 years, with the transportation, warehousing, and utilities sectors growing slightly less than the overall job total. Both Agriculture & Mining and Construction are forecast to have much higher growth rates than total employment growth, while Manufacturing is expected to decrease over the forecast period.

Table 2. Freight Analysis Framework Data Summary for Portland OR-WA (OR Part)

LAND USE CATEGORY	2040		FORECAST GROWTH		ANNUAL GROWTH
Total growth (Households + Employment)	521,471	719,227	197,756	+38%	1.5%
Number of Households	200,252	283,872	+83,620	+42%	1.7%
Employment Total	321,219	435,355	+114,136	+36%	1.4%
Agriculture & Mining	1,183	2,623	+1,441	+122%	8.1%
Construction	12,536	25,188	+12,652	+101%	6.7%
Manufacturing	17,441	15,531	-1,910	-11%	-0.7%
Transportation, Warehousing, and Utilities	11,320	13,661	+2,341	+21%	1.1%
Wholesale	10,169	15,725	+5,556	+55%	1.4%

Planned projects from the 2018 Regional Transportation Plan (RTP) are also included in the model. The financially-constrained project list from the RTP is assumed to be built by 2040 and these changes are included in the modeling assumptions.

3. COMMODITY FLOW PROJECTION

According to FHWA forecasts, the overall tonnage and value of goods transported from/to the city is projected to grow significantly by 2040[1]. The top freight commodities are highlighted from a list of Standard Classification of Transported Goods (SCTG)[2]. **Table 3** provides a summary of the commodity flow projections for years 2015, 2017 and 2040 for all modes of transportation including truck, rail, water, air, pipeline, and those categorized as "multiple modes and mail". The 2015 and 2040 data are from the FAF4 database, which is estimated based on the 2012 Commodity Flow Survey (CFS). At the time of this study, the provisional FAF5 data was released[3], which includes preliminary data for year 2017 only based on the results of the 2017 Commodity Flow Survey. The complete FAF5 data is expected to be released in full, including future forecast years, in late summer 2021. The change in national and global supply chain international trade are reflected in the two surveys. There has been some updates and refinements in the new FAF5 assumptions[4].

The 2015 (FAF4) projections and 2017 (FAF5) estimate show a 32% increase in total tonnage of freight flows from and to the Portland Metro region. However, the dollar value of the flows between 2015 and 2017 FAF remains almost constant. Differences in tonnage and dollar value might be due to changes in the price of goods, combination of total goods, or assumptions in the FAF methodology. Additionally, 16% growth in tonnage is anticipated from 2017 to year 2040. It is important to note that the FAF4 forecasts are estimated pre-COVID19 pandemic and prior to some of the major changes to global trade agreements and tariff. Adjustments might be required to account for the economic impacts of pandemic and the change in supply chain. By value, total flows nearly double between 2017 FAF5 and 2040 FAF4 which is tied more to a shift in top commodities than growth in tonnage. In comparison to 2017, more valuable commodities such as electronics and motorized vehicles are expected to be imported and exported in 2040. The region also is expected to export 18,201 thousand tons more than it imports in 2040. However, it imports a higher value goods so that imports total about $10,446 million more than exports.

Commodity forecasts in the 2006 Freight Master Plan based on 1997 data highlighted that the highest value goods were carried by air, and goods distribution with both an origin and destination within the region were moved nearly exclusively by truck. In addition, trucks were reported to carry nearly 80% of all tonnage in the region. This has remained fairly consistent as the 2040 forecasts show 77% of imports and 63% of exports carried by truck. In comparison to the 1997 data in the 2006 Freight Master Plan, there has been a shift from gas, fuel, petroleum/coal products as the most transported commodities in the region to cereal grains and nonmetallic mineral products as the highest expected volume of exports and imports in 2040.

1 The Freight Analysis Framework (FAF) is a national annual freight commodity flow database, made publicly available by the United State Department of Transportation (U.S. DOT). It is updated annually by combining data from modal freight statistics and the Commodity Flow Survey (CFS). The last CFS was conducted in 2017, however the results have not yet been published. The analysis in this section is based on the FAF4 database and 2012 CFS. FAF consists of 132 FAF regions in U.S. There are two zones in Oregon: the Oregon Metropolitan area and the rest of the state. FAF also includes eight foreign regions for imports and exports. Data is available for freight commodities carried by all modes by tonnage (in thousand tons) and value (in million dollars) for imports, exports, and total flows. In addition, the top freight commodities are highlighted from a list of Standard Classification of Transported Goods (SCTG). FAF also provides the modes of transportation used between domestic origins and destinations, and between zones of entry or exit and foreign origins or destinations.

2 Freight Analysis Framework Version 4 User's Guide, 2015

3 National Transportation Research Center. Freight Analysis Framework 5. Bureau of Transportation Statistics and the Federal Highway Administration. https://faf.ornl.gov/faf5/dtt_total.aspx

4 https://www.bts.gov/sites/bts.dot.gov/files/2021-02/FAF5-User-Guide.pdf

Table 3: FAF Data Summary for Portland OR-WA (OR Part)

	2015 (FAF4)		2017 (FAF4)			
Total Origin	79,518	120,799	96,272	104,880	122,176	246,753
Total Destination	88,238	110,181	124,950	124,506	134,586	210,781
Total Flow	167,756	230,980	221,222	229,386	256,762	457,53
Growth (%) *	-	-	-	-	**16%**	**99%**
Total Imports	2,927	11,603	4,463	13,213	9,762	39,456
Total Pass-Through Imports	1,032	6,233	2,258	8,103	4,195	12,923
Total Exports	9,078	6,108	13,364	6,087	27,963	29,010
Total Pass-Through Exports	2,718	1,994	5,831	3,737	6,839	4,710

Table source: FAF4 and FAF5 database

Notes:

*Percent Growth is a comparison in total flows between 2017 (FAF5) and 2040 (FAF4) data.

Pass-through imports and exports are those that are imported via Portland but have origins or destinations outside of Oregon.

The figures shown throughout the remainder of this chapter represent data for the Portland metro region and based on the FHWA FAF5 database.

Imports

The top commodities imported to the Portland metro region are shown in Figure 3 1 and Figure 3 2. The most imported commodity by tonnage is non-metallic mineral products and by value is motorized vehicles. The top imported commodities do not change between 2017 to 2040, though the total tonnage and value of each increases in that timeframe. There is a large expected increase in transport equipment, which was not in the top ten imports in 2017. Additionally, furniture imports are anticipated to be more prominent in 2040 compared to 2017.

Figure 3-1: Top 10 Import Commodities by Tonnage, 2040

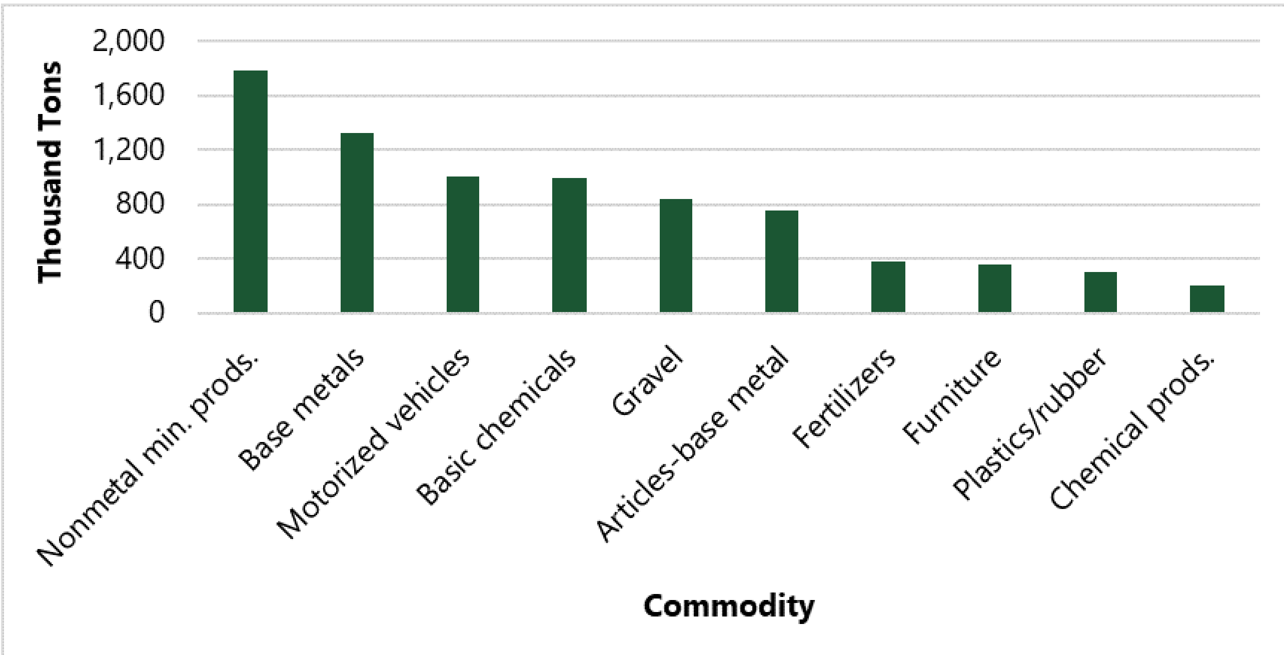
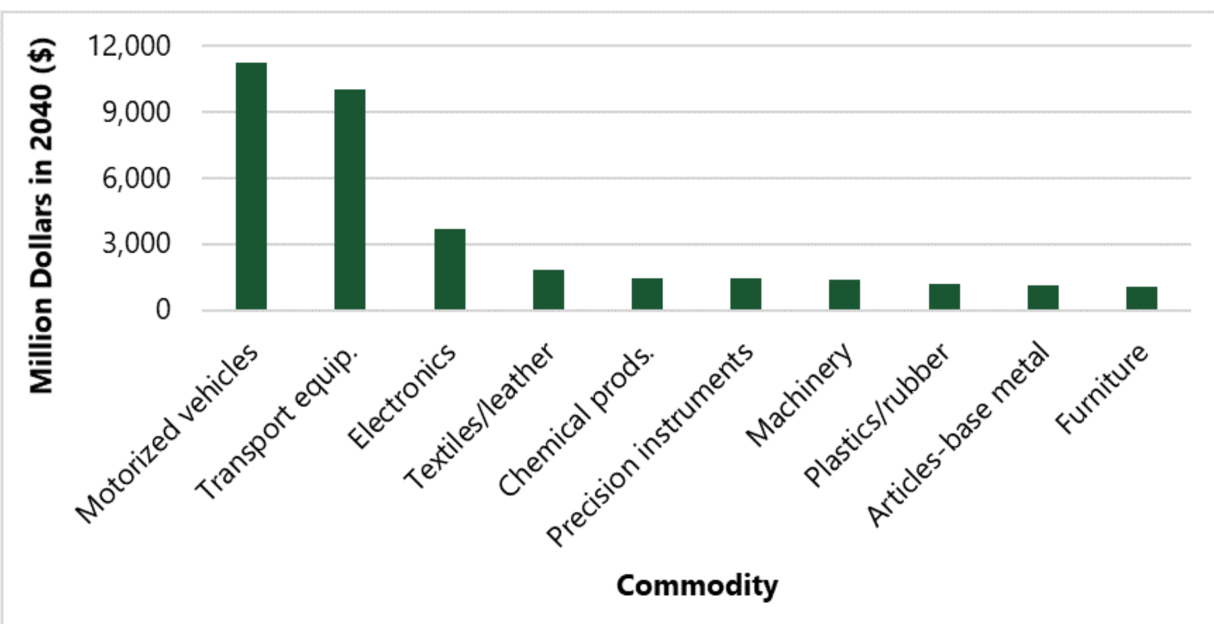


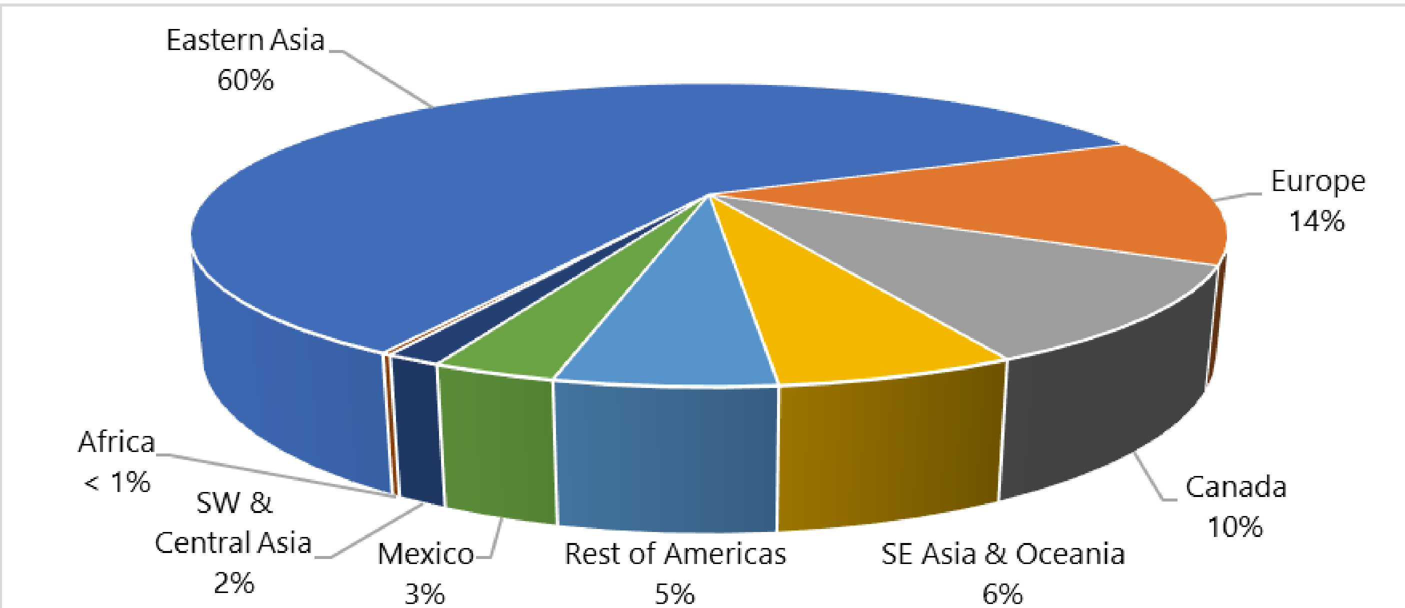
Figure 3-2: Top 10 Import Commodities by Value, 2040



Top Foreign Origins

About 60% of the imports to the Portland region are anticipated to come from Eastern Asia in 2040 as depicted in **Figure 3-3**, which is a 9% increase from 2017. This is as a result of a decrease in imports from other regions namely, Europe, Canada, SW & Central Asia and Mexico.

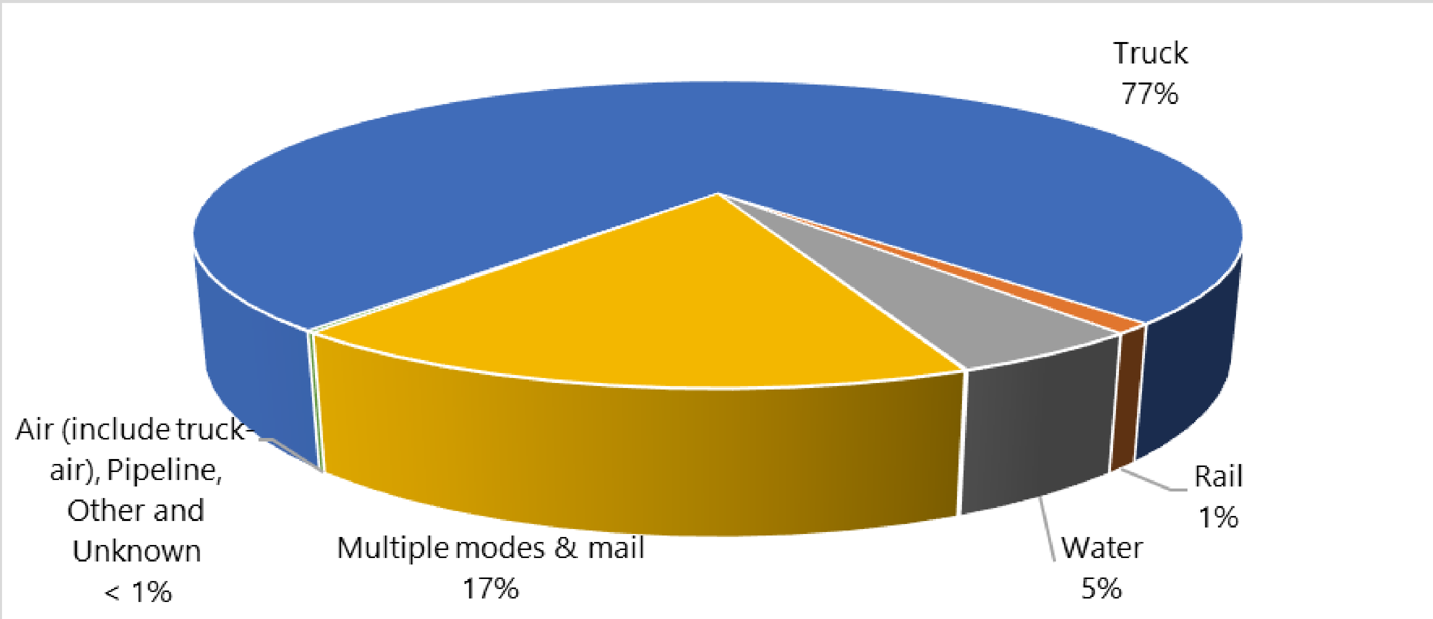
Figure 3-3: Import Commodities Foreign Origins by Tonnage, 2040



Source: Bureau of Transportation Statistics and the Federal Highway Administration. National Transportation Research Center. 2017. *Freight Analysis Framework 5*. https://faf.ornl.gov/faf5/dtt_total.aspx

As illustrated in **Figure 3-4,** almost 77% of the aforementioned imports are expected to be distributed by trucks from the port to their final destinations which is a 7% decrease compared to 2017 FAF5 data. In 2017, 12% of imports to the Portland region were moved by water, but in 2040 this is expected to drop to 5% and the multiple modes category increases by 16%.

Figure 3-4: Domestic Mode of Transportation for Imports by Tonnage (%), 2040



Exports

As shown in **Figure 3-5**, cereal grains are expected to be the most exported commodity by tonnage in 2040 which was also true in 2017. By value, the dominant commodity switches from motorized vehicles in 2017 to electronics in 2040 (**Figure 3-6**). The total motorized vehicles by value do not decrease in 2040, but the electronics increase from around $500 million in 2017 to $12,000 million in 2040.

Figure 3-5: Top 10 Export Commodities by Tonnage, 2040

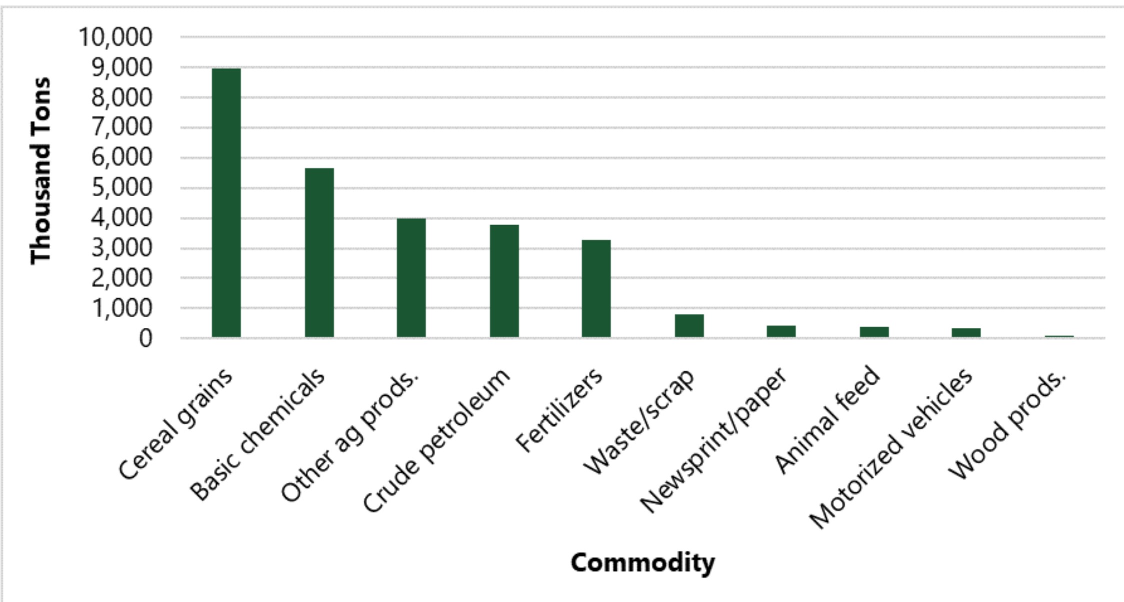
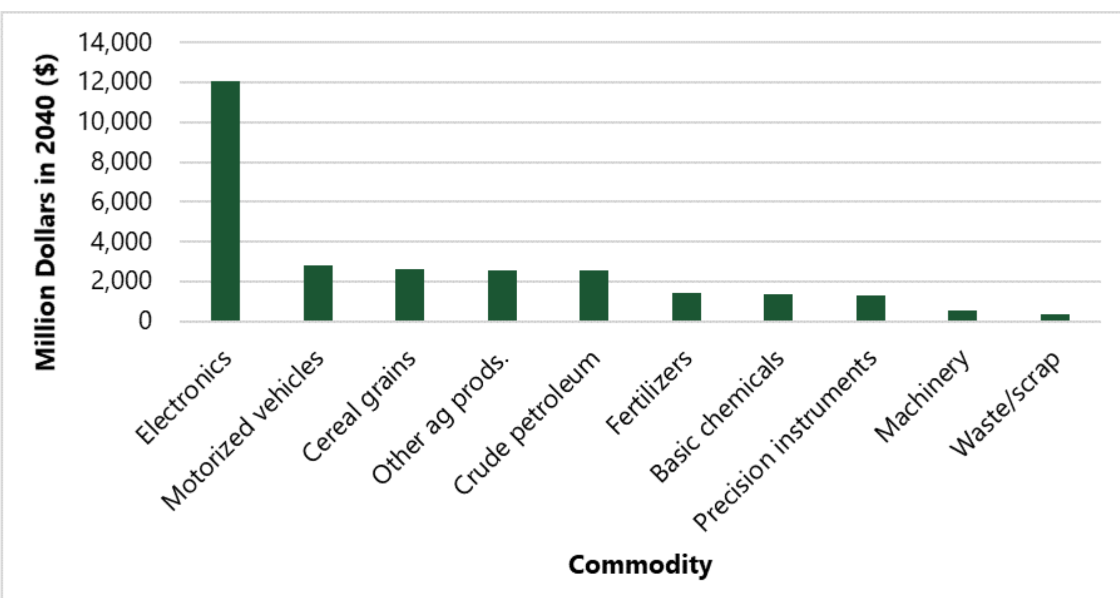


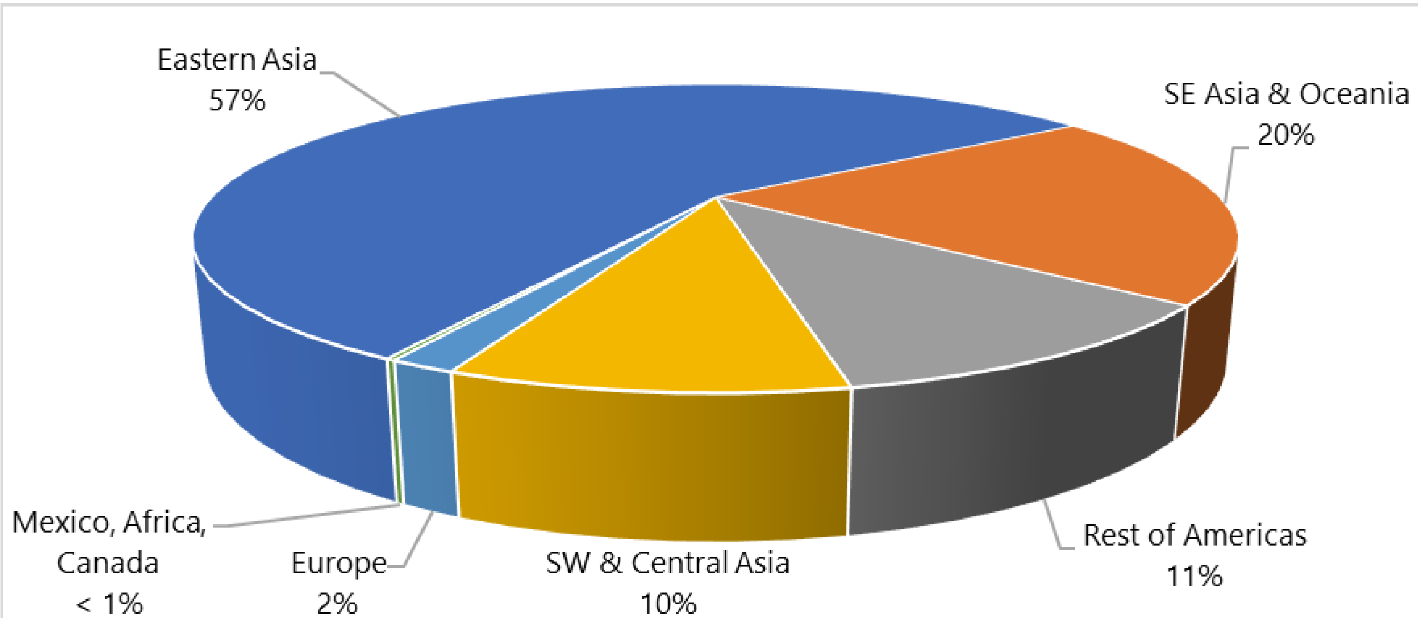
Figure 3-6: Top 10 Export Commodities by Value, 2040



Top Foreign Destinations

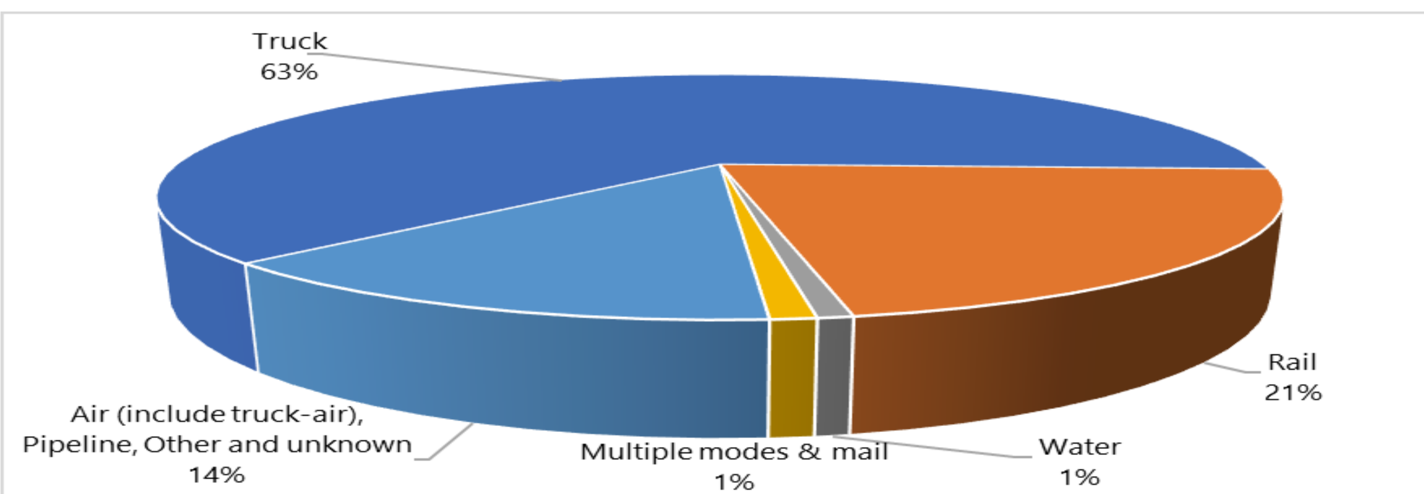
As reported by the 2040 FAF4 data, approximately 57% of the exports (by tonnage) from the Portland region are destined for Eastern Asia and 20% to SE Asia & Oceania as shown in Figure 3 7. By 2040, the Portland region expects a 13% increase for exports to Eastern Asia and an 11% decrease in exports to the SE Asia & Oceania region compared to 2017 FAF5 data.

Figure 3-7: Export Commodities Destinations by Tonnage (%), 2040



About 63% of exports are projected to be transported within the US by truck, which is represents a 6 % decrease from 2017. While in 2017, 16 % were moved by water and less than 1% by air/pipeline/other, in 2040 this shifts to only 1% by water and 14 %by air/pipeline/other as shown in Figure 3 8.

Figure 3-8: Domestic Modes of Transportation for Exports by Tonnage (%), 2040



3.1 Vehicle Miles of Travel

Based on the model, a total of 71,200 off-peak (12pm-1pm), 37,200 PM peak (5pm-6pm), and 981,800 daily truck vehicle miles of travel (VMT) were calculated for all roadway segments within the City of Portland in 2040. This includes City streets, state highways and interstate routes. This represents an increase in total daily truck VMT of 61% over 2015 as shown in Table 4. This is a substantial increase reflecting both the increase in total commodity flows, and trucking activates required by logistic operations.

Table 4: City Wide Truck VMT Growth

YEAR	OFF-PEAK HOUR	PM PEAK HOUR	DAILY
2015	45,100	23,300	609,600
2040	71,200	37,200	981,800
GROWTH (%)	**58%**	**60%**	**61%**

Truck VMT during the off-peak hour is almost twice that of the PM peak hour. This may be because of higher truck volumes during the off-peak hour, and because there is less congestion on roadways during the off-peak hour period and trucks can travel farther distances. In addition, trucks try to travel earlier in the day and avoid evening peak when they will experience longer delays. **Table 5** below shows truck VMT distribution by roadway type, while **Table 6** shows the change in total truck VMT for each roadway type between 2015 and 2040. The model assumes about 29 miles of new roadways will be built by 2040, with 10 miles of new freeway, 22 miles of new local/collectors, and removal of 3 miles of ramps. These totals may not exactly match the built infrastructure as some smaller roadways may not be captured in the model.

Table 5: Truck VMT (%) Distribution by Roadway Type (2040)

ROADWAY TYPE	PERCENTAGE OF TOTAL LANE MILES IN THE MODEL	OFF-PEAK HOUR	PM PEAK HOUR	DAILY
Freeway/Highways	13%	70%	64%	70%
Arterial	7%	10%	12%	9%
Collector & Local	77%	18%	22%	19%
Ramps	3%	2%	2%	2%
Total	*100%*	*100%*	*100%*	*100%*

Table source: Metro Regional Travel Demand Model, analysis by Fehr & Peers

Table 6: 2040 Truck VMT Total by Roadway Type (and % Growth from 2015)

ROADWAY TYPE	OFF-PEAK HOUR	PM PEAK HOUR	DAILY	PERCENTAGE OF DAILY VMT
Freeway/Highways	50,117 (+53%)	23,792 (+56%)	685,044 (+57%)	70%
Arterial	6,727 (+70%)	4,390 (+58%)	91,435 (+65%)	9%
Collector & Local	13,026 (+75%)	8,395 (+72%)	188,034 (+78%)	19%
Ramps	1,286 (+44%)	645 (+39%)	17,325 (+43%)	2%
Total	**71,156 (+58%)**	**37,221 (+60%)**	**981,838 (+61%)**	**100%**

Table source: Metro Regional Travel Demand Model, analysis by Fehr & Peers
Note: Percentages indicate VMT growth on each roadway type from 2015 to 2040

About 70% of truck vehicle miles of travel are shown along freeways, even though freeways only form approximately 13% of the total centerline miles in the model. This is attributed to the design of freeways being more accommodating to truck travel than other roadway types, as well as facilitating external-external (through) travel. Relative to 2015 conditions, in 2040 there is a slight decrease projected in the proportion of truck travel along freeways throughout the day particularly during the off-peak hour, though total VMT increases.

Arterial roadways make up only 7% of total roadways in the model and carry 9% to 12% of the truck VMT. Truck VMT is projected to grow more in the off-peak hour on arterials than the PM peak hour or daily total VMT, which is likely due to trucks changing their delivery patterns to avoid the more congested conditions during peak times.

The greatest percentage growth in VMT is seen on local and collector roads. Naturally, as freeways and arterials get more congested, traffic will spread to lower class roadway segments, unless there are prohibitions for truck access where there is more capacity. While local and collector roads make up most of the roadway centerline miles in the City, most local and collector roads are not built for heavy and frequent truck traffic and most are not a part of the citywide freight network. A daily VMT increase of 78% on these local roads could have serious impacts on neighborhood traffic circulation, road maintenance, health, and safety, if not properly managed. Additionally, local and collector roads, in particular, are expected to also have an increased flow of smaller commercial vehicles running last-mile operations as the demand for goods and services increase at the household level. Further detailed examination of model results and future land use growth along each roadway is required to evaluate the traffic conditions at each local and collector roads.

Picture 4.1: *White freight trailers sitting at a loading dock, where goods are unloaded and loaded for transport. [Source: Chris Yunker]*

3.2 Truck Volume projection

Analysis of future truck volume in Portland relies on the data from Metro's travel demand model as it provides estimated truck volume for all major roads in the City as well as for different time periods.

Daily Truck Volume

Future daily truck volume from the Metro model is shown in **Figure 3-9** and **Figure 3-10** and the model-estimated growth in daily truck traffic from 2015 to 2040 is shown in **Figure 3-11** and **Figure 3-12.** As discussed in the previous sections both FAF data and Metro model project significant growth in freight flows and trucking activities in Portland metro area daily truck VMT is estimated to grow 61% citywide and much of this growth is expected to be on local and collector roadways. This growth is spread out across the City, though its affects may be felt more heavily in areas such as Downtown Portland where constrained right of ways limit the physical expansion of the roads to accommodate this growth.

The model shows the heaviest 2040 truck traffic on the interstates, as well as truck traffic on designated freight streets such as:

- US 30 (3,000 trucks per day (tpd))
- Columbia Boulevard (2,000 tpd)
- NE Lombard Street (1,000 tpd)
- SE Powell Boulevard (600 tpd)
- McLoughlin Boulevard (1,700 tpd)
- Martin Luther King Jr Boulevard (800 tpd).

However, some areas of the City show truck traffic on local truck access streets that may not be designed for a high volume of trucks. **Table 4** lists local access streets where the model is predicting over 100 trucks daily in 2040. 100 daily trucks was used as a threshold for local streets as this can also be thought of as about one truck every 10 minutes if those 100 trucks are distributed evenly across the day (5 a.m. to 9 p.m.). Knowing that the model does not capture smaller delivery vehicles, and that these truck volumes are not distributed evenly, this is a conservative estimate to look at the local streets with the relatively highest truck volumes compared to others across the City.

Table 7: Local Truck Access Streets with Over 100 Daily Trucks in 2040

LOCATION	CITY QUADRANT	2015 TRUCK VOLUME	2040 TRUCK VOLUME	% CHANGE
W Burnside Street west of NW 23rd Avenue	Downtown	110	270	>100%
W Burnside Street east of I-405	Downtown	100	360	>100%
NW Everett Street	Downtown	280	610	>100%
NW Glisan Street	Downtown	50	140	>100%
NW Couch Street	Downtown	10	160	>100%
Naito Parkway	Downtown	290	730	>100%
NW 23rd Avenue	Downtown	70	140	100%
SW Jefferson Street	Downtown	60	140	>100%
SW Clay Street	Downtown	140	290	>100%
SW Market Street	Downtown	110	320	>100%
SW 12th Avenue	Downtown	110	330	>100%
SW 13th Avenue	Downtown	70	210	>100%
N Albina Avenue	North	160	210	30%
N Portsmouth Avenue	North	770	780	1%
N Willis Boulevard	North	120	180	50%
N Saint Louis Avenue	North	10	410	>100%
N Fessenden Street	North	50	700	>100%
N Halleck Street/N Kilpatrick Street	North	110	160	50%
N Alberta Street west of I-5	North	450	550	20%
N Peninsular Avenue	North	80	110	30%
N Greeley Avenue	North	80	120	40%
NE Prescott Street	Northeast	100	200	100%

LOCATION	CITY QUADRANT	2015 TRUCK VOLUME	2040 TRUCK VOLUME	% CHANGE
NE Shaver Street	Northeast	160	330	>100%
NE Glisan from I-205 to the city limits	Northeast	60	180	>100%
NE Marine Drive east of I-205	Northeast	930	1650	80%
SE Milwaukie Avenue	Southeast	300	490	60%
SE Johnson Creek Boulevard	Southeast	200	300	50%
SW Taylors Ferry Road	Southwest	40	140	>100%
SW 30th Avenue	Southwest	30	410	>100%

In Downtown Portland, the 2040 truck travel patterns are similar to what was seen in the existing conditions, with the heaviest truck traffic on the local streets listed in **Table 7.** Truck traffic in Downtown is potentially due to deliveries to the businesses, with short detours off the freeways to City streets. All local streets identified in the table had over 100% growth from 2015 truck volumes, and the largest growth in total truck volume occurred on sections of SW Naito Parkway.

As noted in **Table 7**, In North Portland, over 500 trucks per day are forecast along N Portsmouth Avenue and N Lombard Street, similar to existing conditions. Unlike the existing conditions, however, over 500 trucks per day are also forecast to travel between the St. John's Bridge and N Portland Avenue using N Saint Louis Avenue, and N Fessenden Street, which are local streets. This traffic may be diverting from higher designation freight routes due to congestion. In this area of North Portland, there are no north/south designated freight streets outside of I-5 and Highway 99W, so any trucks that need to travel north or south will likely choose one of the aforementioned local streets.

In Northeast Portland a few local streets including Shaver Street and Prescott Street see a growth in truck traffic in 2040. NE Marine Drive is expected to see the largest total growth in trucks in this region of the City.

In Southwest Portland, SW Beaverton Hillsdale Highway is projected to experience the largest increase in truck traffic with 700 new daily trucks in each direction, an 87% increase. SW 30th Avenue shows an over 1000% increase in truck traffic, going from an estimated 30 trucks daily in 2015 to just over 400 in 2040.

Southeast Portland is expected to see increased truck volumes on truck routes between 2015 and 2040. SE Powell Boulevard, SE Holgate Boulevard, SE Woodstock Boulevard, and SE 82nd Avenue are all projected to see an over 100% increase in truck volumes from 2015 to 2040. SE Foster Road is not anticipated to experience as large a percentage increase but is expected to increase from 80 to 110 trucks daily. SE Holgate Boulevard from Cesar E Chavez Boulevard to SE 52nd Avenue is anticipated to experience an increase from 60 to 200 trucks daily and SE 52nd Avenue between SE Holgate and SE Powell Boulevard shows an increase from 45 daily trucks in 2015 to 160 daily trucks in 2040.

When examining the overall truck traffic patterns, most of the streets that carry over 100 daily truck trips under existing conditions also carry over 100 daily truck trips in 2040. Additionally, as shown in **Figure 3-11** and Figure **3-12**, many City streets such as NE Fremont Street and SE Stark Street are expected to experience over 100% growth in truck traffic, however since the existing volume is very low, total truck traffic would still be less than 100 daily trucks. This growth could still impact neighborhood traffic circulation and infrastructure and requires more detailed analysis based on observed truck data.

Figure 3-9: 2040 Daily Truck Volumes (N)

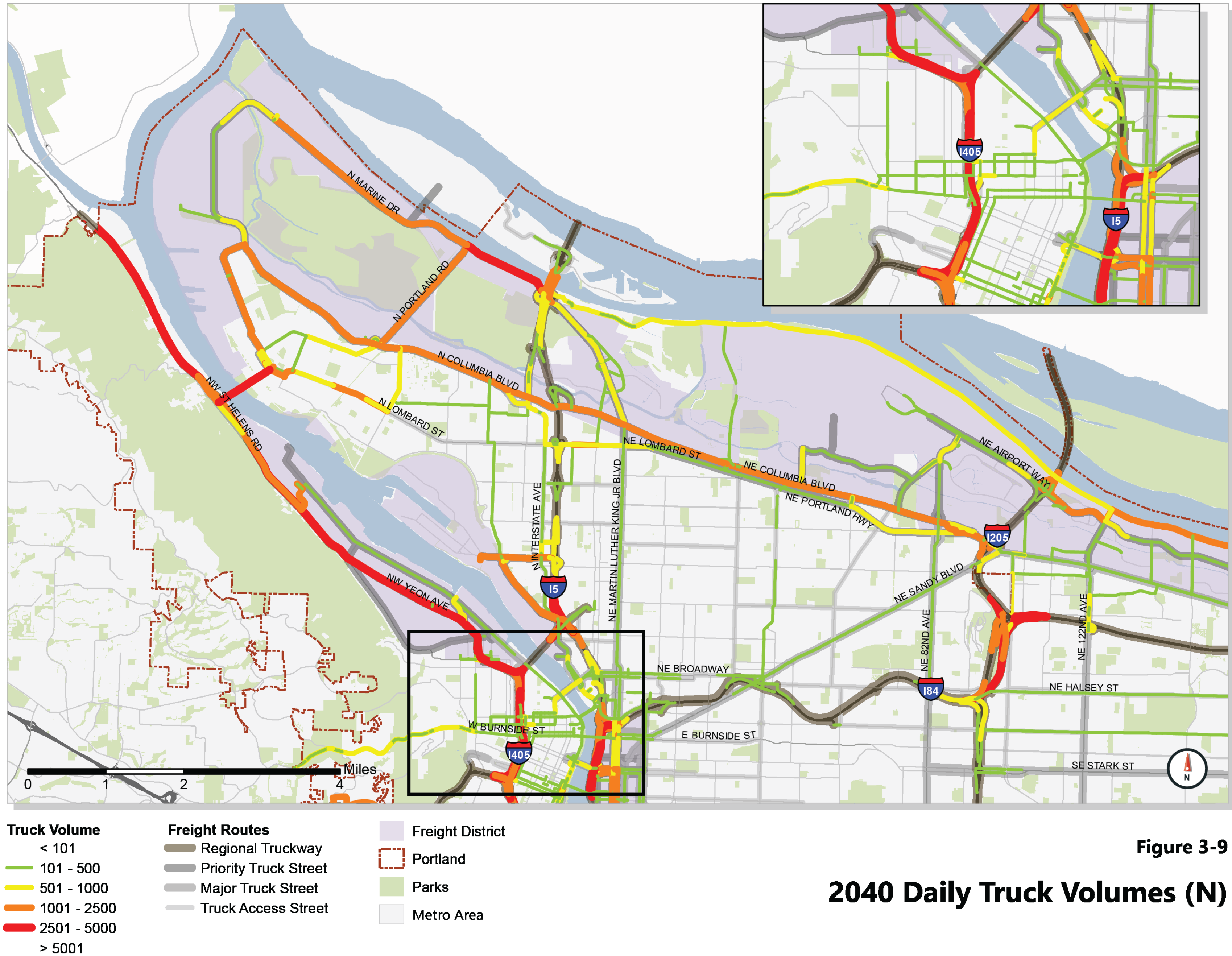
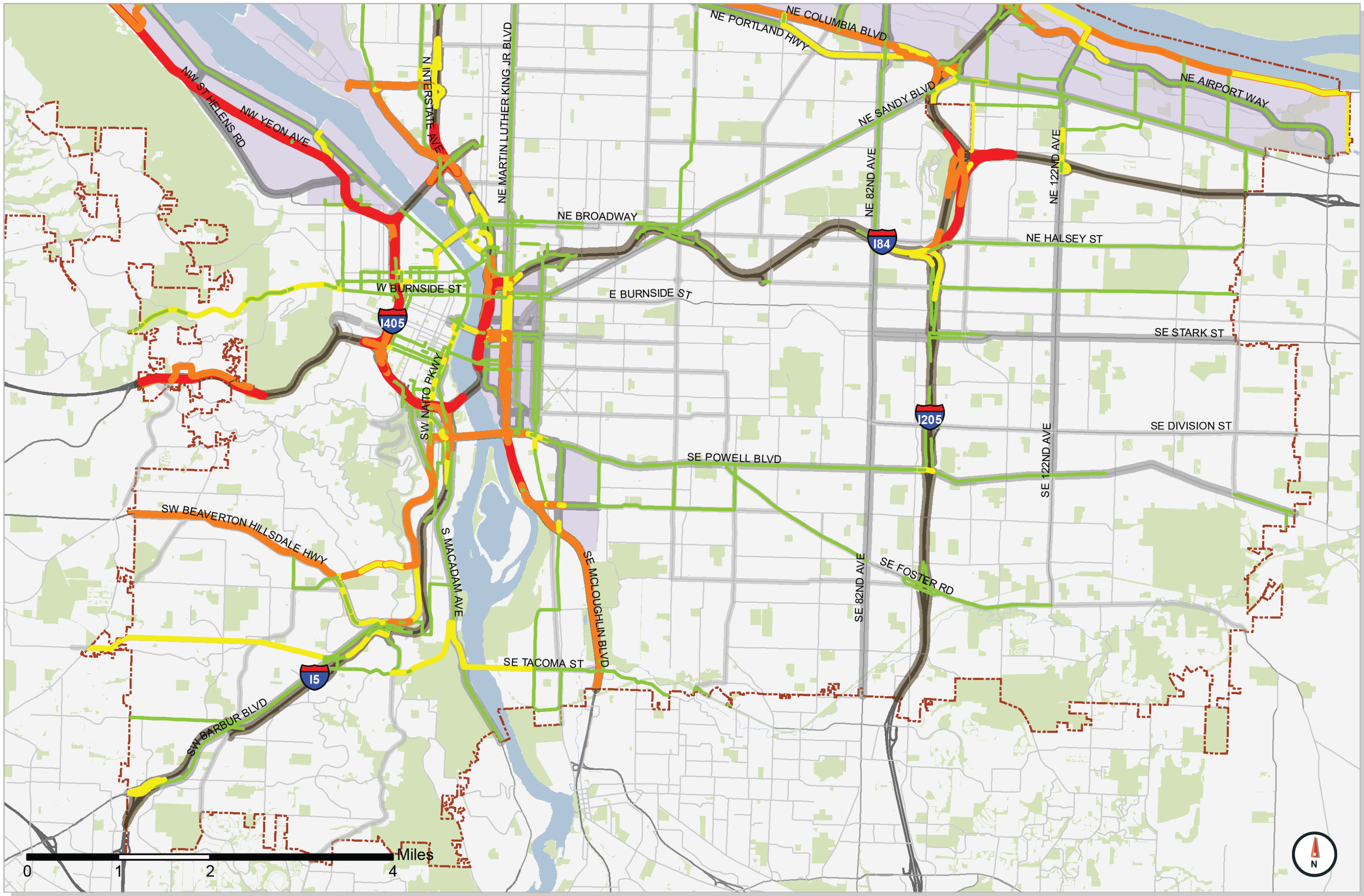


Figure 3-9

2040 Daily Truck Volumes (N)

Figure 3-10: 2040 Daily Truck Volumes (S)



Truck Volume
- < 101
- 101 - 500
- 501 - 1000
- 1001 - 2500
- 2501 - 5000
- > 5001

Freight Routes
- Regional Truckway
- Priority Truck Street
- Major Truck Street
- Truck Access Street

- Freight District
- Portland
- Parks
- Metro Area

Figure 3-10

2040 Daily Truck Volumes (S)

Figure 3-11. Growth in Daily Truck Traffic from 2015 to 2040 (N)

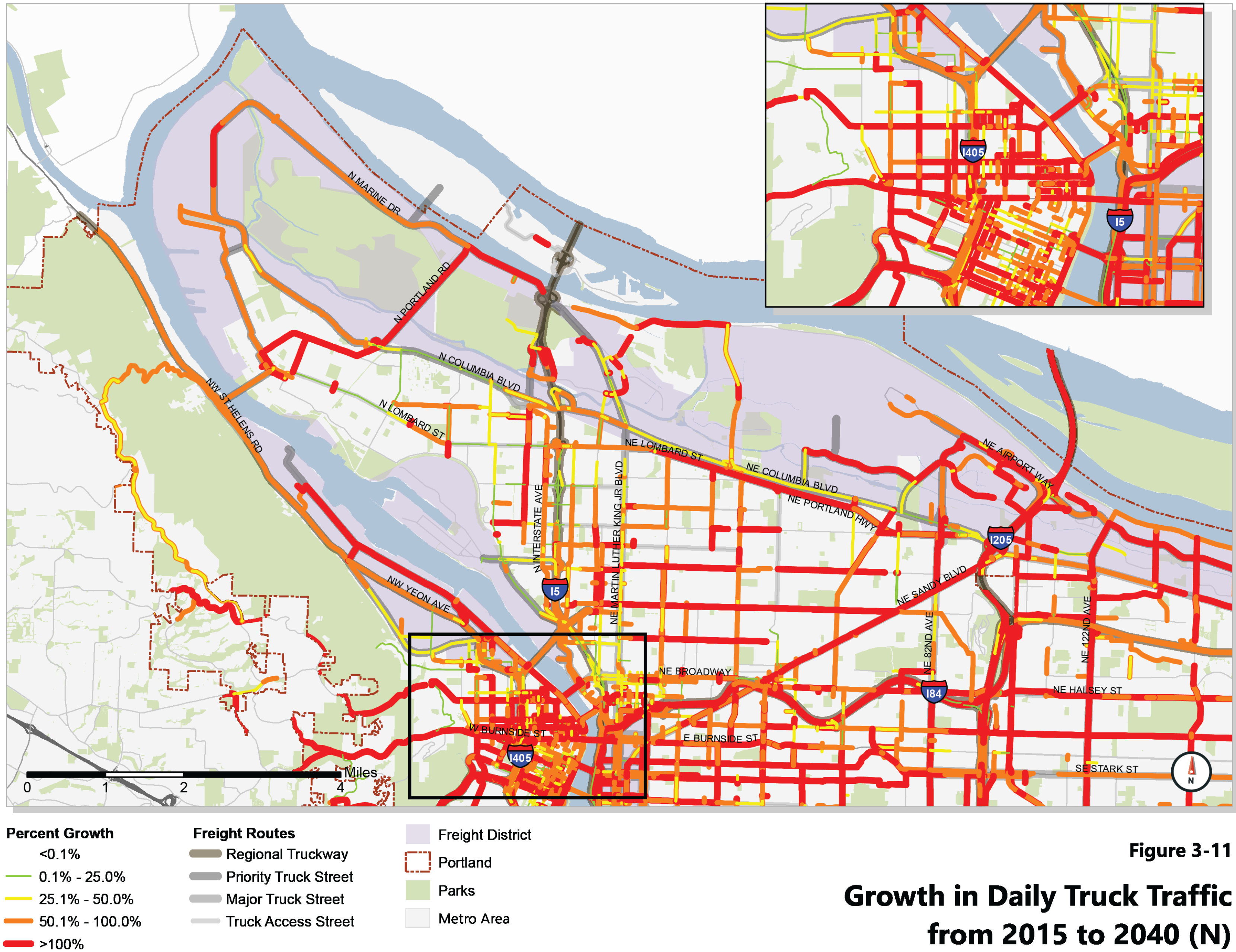


Figure 3-11

Growth in Daily Truck Traffic from 2015 to 2040 (N)

Figure 3-12. Growth in Daily Truck Traffic from 2015 to 2040 (S)

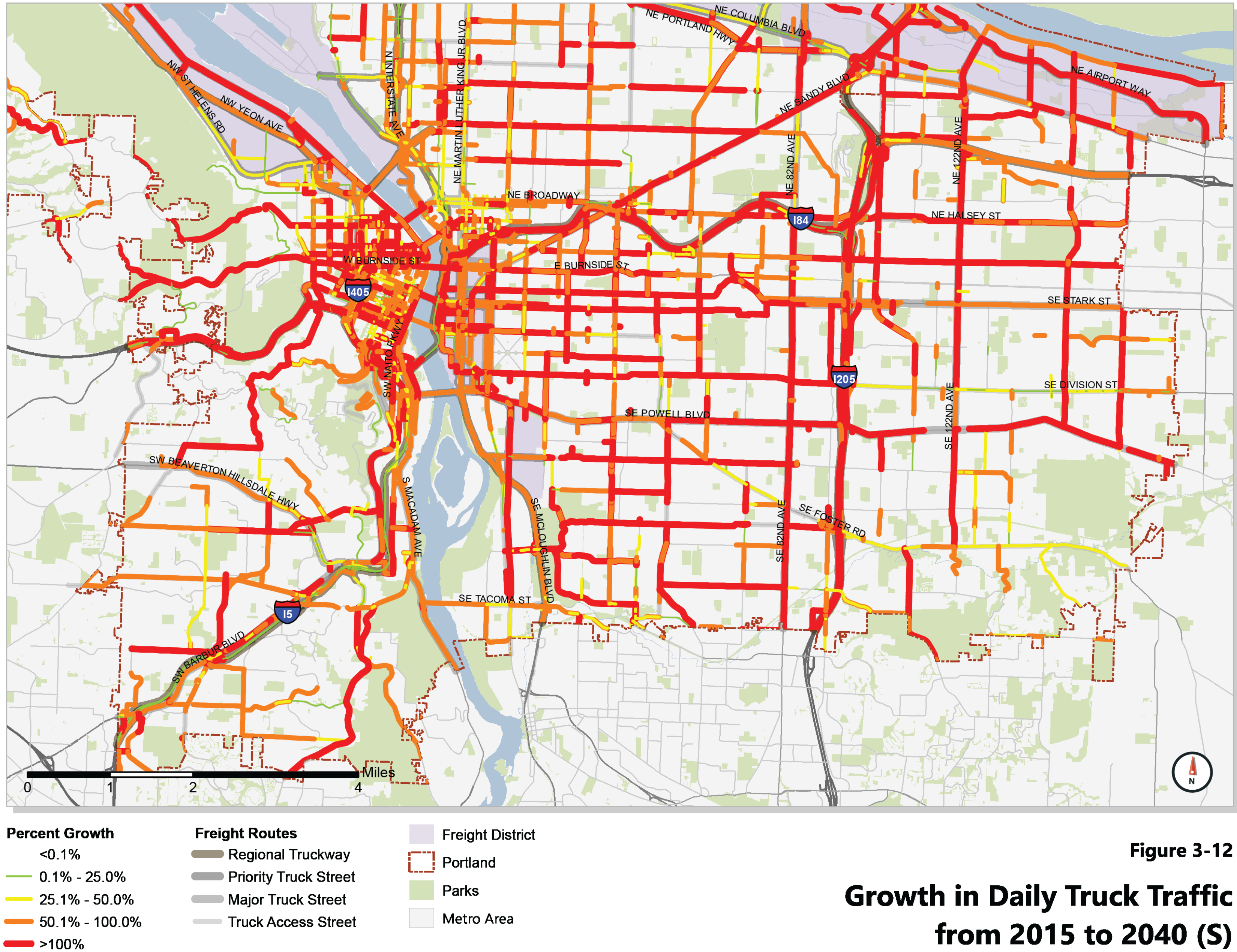


Figure 3-12

Growth in Daily Truck Traffic from 2015 to 2040 (S)

PM Peak hour and Off-Peak hour Volume

As shown in **Figure 3-13** and **Figure 3-14**, the future off-peak and PM peak hour volumes tend to be highest on the freeways, followed by the major freight routes. Truck traffic is also concentrated in the freight district, including Columbia Boulevard and the Central Eastside Industrial District. Modeled truck volumes are generally higher during the future off-peak hour than the evening peak hour. These trends are similar to the truck traffic patterns found under existing conditions. Most trucks in the model utilize designated freight streets, however, in the PM peak and off-peak hour more than 20 trucks per hour are shown on the following local truck service only streets in **Table 8**. 20 trucks per hour was used as a threshold for local streets as this can also be thought of as about one truck every three minutes if those 20 trucks are distributed evenly across the hour. Knowing that the model does not capture smaller delivery vehicles, and that these truck volumes are not distributed evenly, this is a conservative estimate to look at the local streets with the relatively highest truck volumes compared to others across the City.

Table 8: Locations with more than 20 trucks per hour

LOCATION	OFF-PEAK HOUR	PM PEAK HOUR
N Portsmouth Avenue[1]	X	X
N Fessenden Street	X	X
NE Shaver Street[1]	X	
W Burnside Street[2]	x	X
NW Everett Street[1]	x	X
SW Clay Street[1]	x	
SW Market Street[1]	x	X
SE Milwaukie Avenue[3]	x	X
N Marine Drive east of I-5	x	X
SE Johnson Creek Boulevard[1]	x	
N Saint Louis Avenue[3]		X
SW 30th Avenue		X

1 This location did not have over 20 trucks in the peak and off-peak hours in 2015 but is projected to in 2040.
2 This location did not have over 20 trucks in the off-peak hour in 2015 but is projected to in 2040.
3 This location did not have over 20 trucks in the peak hour in 2015 but is projected to in 2040.

There is anticipated to be less peak hour truck traffic on N Portsmouth Avenue than was seen in existing conditions, though these trucks may have shifted to N Saint Louis Avenue/N Fessenden Street instead.

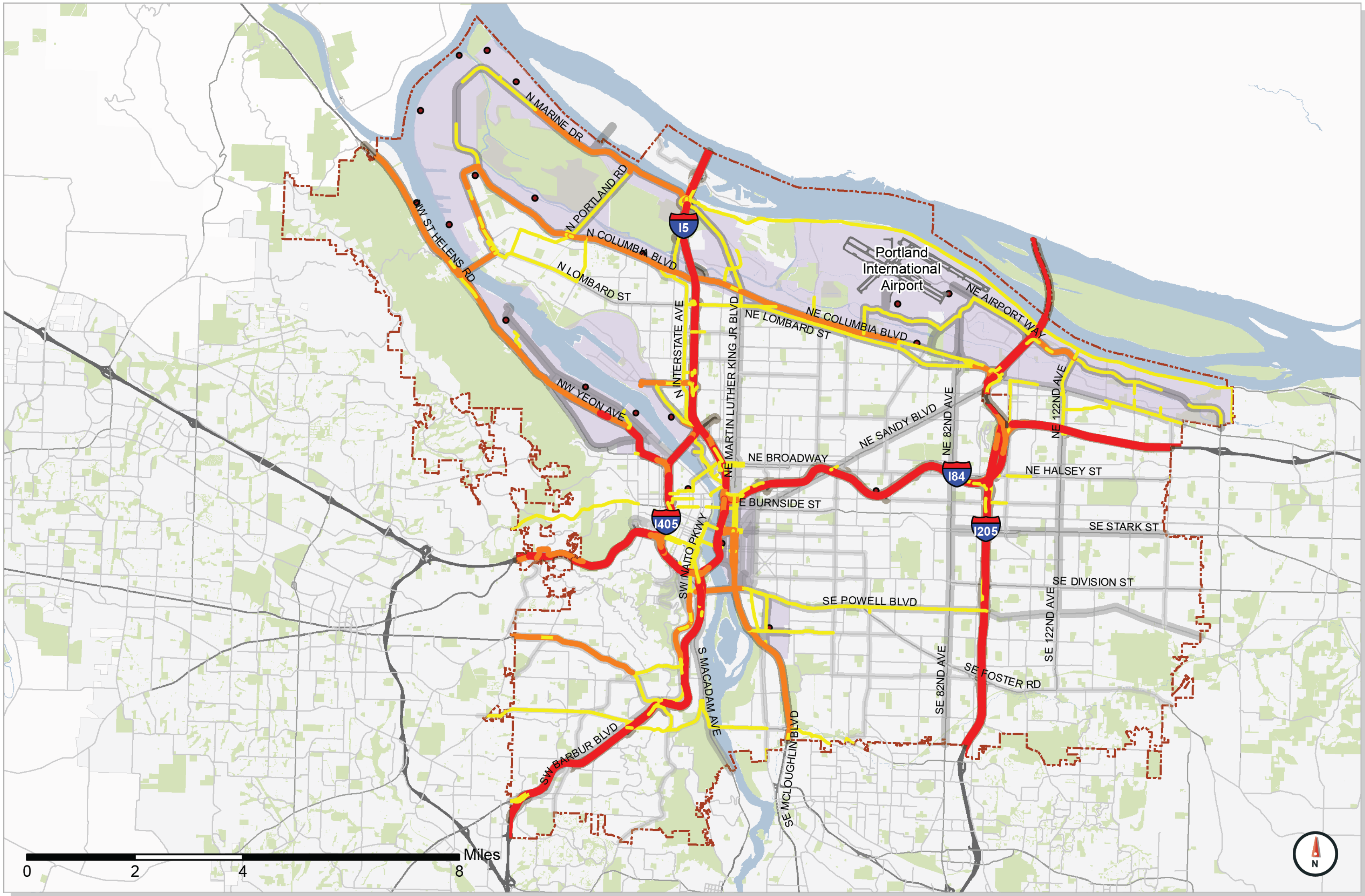
The 2015 and 2040 PM peak hour volumes and growth for some of the key truck corridors on City streets are shown in **Table 9** below. All of these locations show an increase in PM peak truck volumes between 2015 and 2040. Marine Drive and the Ross Island Bridge are projected to see the highest increase in truck traffic between 2015 and 2040.

Table 9: High Volume City Streets, PM Peak Hour Comparison

LOCATION	2015	2040	CHANGE (%)
Marine Drive east of I-205	63	117	86%
Ross Island Bridge	55	101	84%
US 30 between Terminal 2/NW industrial area outwards from City	149	256	72%
Lombard/Columbia Blvd. between I-5 and Rivergate	26	44	69%
St. Johns Bridge	218	359	65%
OR 99E between inner southeast industrial area and Milwaukie	70	110	57%
Airport Way west of I-205	21	28	33%
Swan Island/Albina area access to/from I-5	70	89	27%
Lombard/Columbia Blvd. between I-5 and the Airport	86	95	10%

Note: Volumes are reported as bi-directional truck volumes for the 5-6pm peak hour

Figure 3-13: 2040 Off-Peak Hour Truck Volumes



Future Truck Volume
- 0 - 20
- 21 - 100
- 101 - 250
- 251 - 850

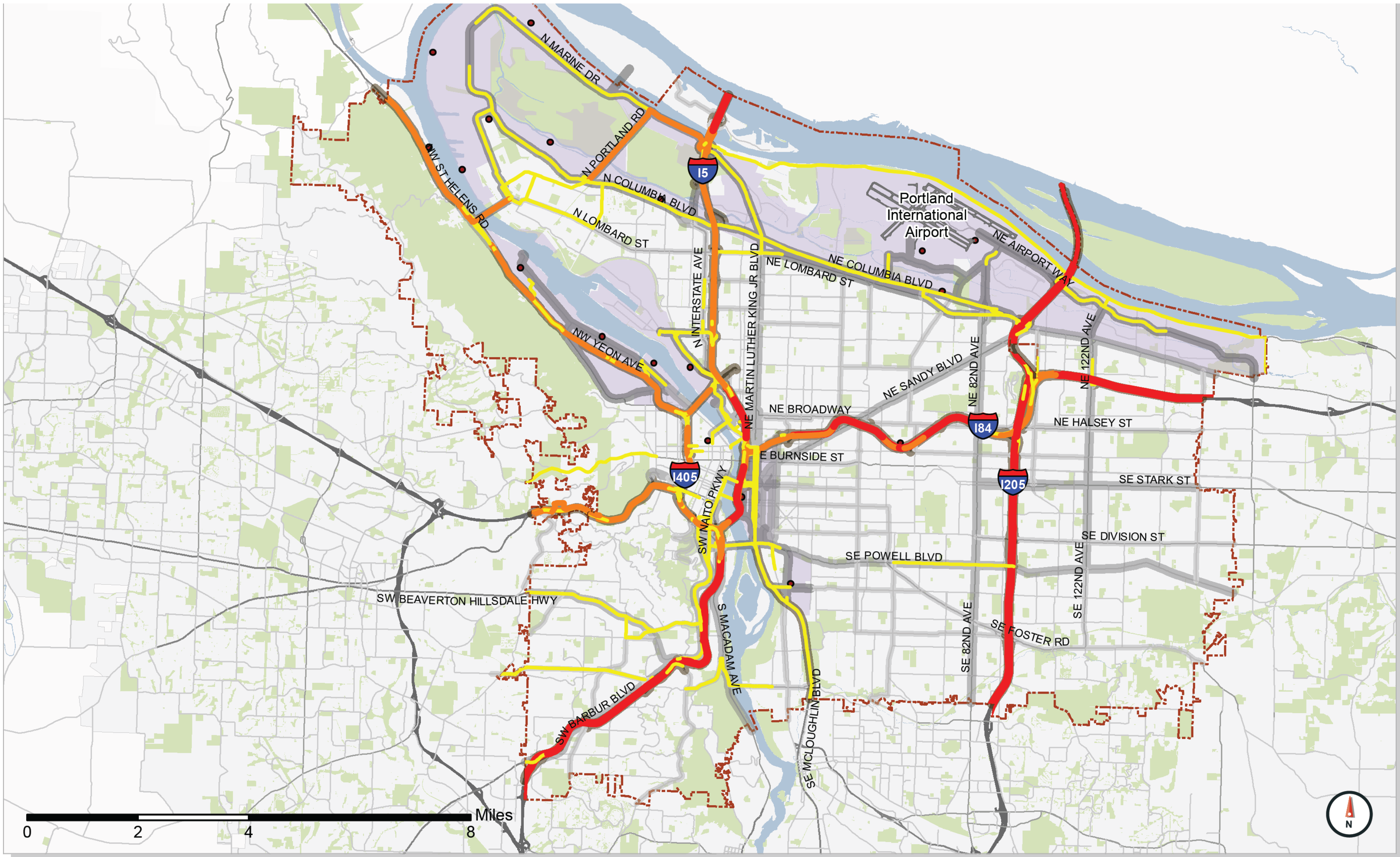
Freight Routes
- Regional Truckway
- Priority Truck Street
- Major Truck Street
- Truck Access Street

- Freight Facilities
- Freight District
- Portland
- Parks
- Metro Area

Figure 3-13

2040 Off-Peak Hour Truck Volumes

Figure 3-14: 2040 Peak Hour Truck Volumes



Future Truck Volume
- 0 - 20
- 21 - 100
- 101 - 250
- 251 - 500

Freight Routes
- Regional Truckway
- Priority Truck Street
- Major Truck Street
- Truck Access Street

- Freight Facilities
- Freight District
- Portland
- Parks
- Metro Area

Figure 3-14

2040 Peak Hour Truck Volumes

Picture 5.1: Aerial image of a divided freeway under an overhead bridge. Multiple white freight trucks and passanger vehicles of varying sizes and colors are driving through the freeway. [Source: ODOT]

3.3 Truck Traffic Percentage of Total Traffic

Table 10 shows the average truck percentage on different roadway types in the Portland area. As with existing conditions, based on the Metro model data, in 2040 freeways will see the highest percentage of truck traffic followed by arterials then collectors and, finally, local roads. However, between 2015 and 2040, the average truck percentage is expected to increase on all roadway types in both the off-peak and the peak hours, with greater increases in the off-peak. By 2040, trucks are expected to represent over 12% of traffic on freeways during the off-peak hour, up from 9% in 2015. The average truck percentage under future conditions for all street segments in Portland is 1.8% during the peak hour and 3.3% during the off-peak hour .

Table 10: Model Average Truck % by Roadway Type[1]

ROADWAY TYPE	OFF-PEAK HOUR		PEAK HOUR	
	2015	2040	2015	2040
Freeway	9.4%	12.4%	3.7%	5.1%
Arterial	7.6%	9.5%	4.6%	5.2%
Collector & Local	2.0%	2.5%	1.2%	1.5%

Table source: Metro Regional Travel Demand Model, Fehr & Peers

1 Average truck percentages are weighted by segment length.

As seen in **Figure 3-15**, North Portland is expected to have the highest off-peak truck percentages in 2040. Non-freeway roadway segments outside of the freight district with a truck percentage of total traffic greater than 12% are identified below. A threshold of 12% is used as this is the expected average off-peak truck percentage on freeways and would indicate local roadways with truck percentages much higher than is expected regionally on collector and local roads. Half of the roadway segments did not carry more than 12% trucks in 2015 but are expected to in 2040. Those locations are designated below with an asterisk.

• Columbia Boulevard west of NE Martin Luther King Jr Boulevard and from NE 60th Avenue to I-205

- N Lombard Street west of the N McKenna Avenue
- N Marine Drive from east of NE 122nd Avenue
- N Fessenden Street from N Allegheny Avenue to N Columbia Way*
- N Portsmouth Avenue from N Lombard Street to N Columbia Boulevard
- N Peninsular Avenue
- NW St Helens Road (US 30) north of I-405
- N Interstate Avenue between N Fremont Street and N Skidmore Street
- Sections of N Going Street connection I-5 to the Swan Island Industrial District*
- SE 17th Avenue from SE Powell Boulevard to SE Holgate Boulevard*
- SE Holgate Boulevard from SE McLoughlin Boulevard to SE 17th Avenue*
- SW Barbur Boulevard from SW 4th Avenue to SW Capitol Highway*
- N Tillamook Street east of N Interstate Avenue
- The east end of NE Prescott Street*
- NE Shaver Street from NE 122nd Avenue to NE 141st Avenue*
- NW Hoyt Street from NW Broadway to NW 12th Avenue *
- SW Canyon Court from SW Skyline Boulevard and SW Zoo Road

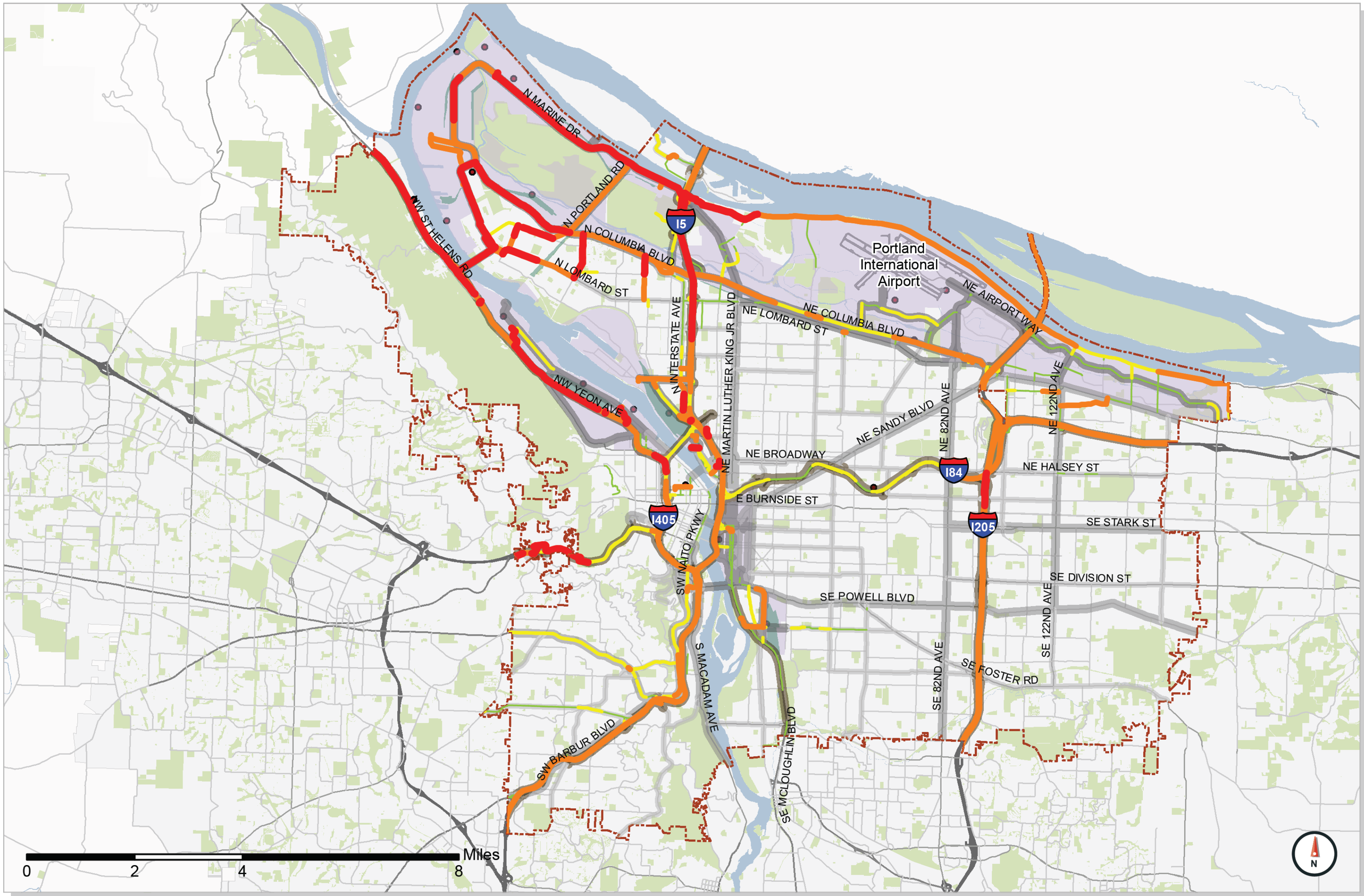
In the PM peak hour, there are fewer areas with truck percentages greater than 12% than in the off-peak hour as can be seen in **Figure 3-16**. This is likely due to slightly lower truck and higher passenger vehicle volumes during the PM peak, which results in a lower truck percentage of total traffic. Many of these streets also have a high truck percentage in the off-peak.

Streets with a truck percentage greater than 12% in the peak hour are:

- N Marine Drive just west of N Portland Road
- Columbia Boulevard west of N Portland Road
- N Lombard Street from N Ida Avenue to Marine Drive
- N Denver Avenue from N Ainsworth Street to N Killingsworth Street*
- N Killingsworth Street from N Greeley Avenue to N Denver Avenue*
- Sections of NW St Helens Road (US 30) between I-405 and NW Kittridge Avenue*
- NW St Helens Road (US 30) north of the St. Johns Bridge
- N Interstate Avenue between N Fremont Street and N Skidmore Street
- N Tillamook Street east of N Interstate Avenue*
- SW Canyon Court from SW Skyline Boulevard and SW Zoo Road
- SW 30th Avenue from SW Beaverton Hillsdale Highway to SW Capitol Highway

Seven of the eleven locations were also mentioned as heavy truck corridors under the existing conditions report. The off-peak and peak truck percentages generally increased on most roadway segments from 2015 to 2040, especially on the interstates, and the off-peak saw greater increases than the peak hour.

Figure 3-15: 2040 Off-Peak Hour Truck Percentage



Future Truck Percent
- < 5.0%
- 5.1% - 8.0%
- 8.1% - 12.0%
- 12.1% - 20.0%
- > 20.0%

Freight Routes
- Regional Truckway
- Priority Truck Street
- Major Truck Street
- Truck Access Street

- Freight Facilities
- Freight District
- Portland
- Parks
- Metro Area

Figure 3-15

2040 Off-Peak Hour Truck Percentage

Figure 3-16: 2040 Peak Hour Truck Percentage

Figure 3-16

2040 Peak Hour Truck Percentage

3.4 Travel Time and Delay

Typically, locations with significant delay occur where the ratio of congested speed to posted speed is less than 0.5, meaning vehicles are traveling less than 50% of the posted speed. Non-freeway locations in the off-peak hour that show speeds less than 50% of the posted speed tend to be short sections of roadway near intersections or interstate ramps. These include sections of SE Powell Boulevard, Naito Parkway, SE Division Street, S Macadam Avenue north of the Sellwood Bridge, and SE Tacoma Street at the Sellwood Bridge among others shown in Figure **3-17.**

Locations where the speed is projected to be less than 50% of the posted speed during peak hour are shown in Figure **3-18**. Many of the designated freight streets such as SE Powell Boulevard, SE Foster Road, SW Beaverton-Hillsdale Highway, and NE Columbia Boulevard show slow speeds, which affects truck travel times and may incurred in delayed deliveries. Congested conditions are likely contributing to the relatively low volumes of trucks during the evening peak hour compared to the off-peak estimated by the model, as trucks traveling during less congested periods will experience shorter travel times and fewer delays.

Picture 6.1: *A person walking in front of a blue Amazon delivery vehicle exiting a parking garage. [Source: Tony Webster]*

Figure 3-19 and **Figure 3-20** present off-peak and PM peak hour cumulative truck hours of delay[1] on roadway segments under future conditions. Cumulative truck delay in excess of 60 minutes is seen on most freeways and highways including I-5, I-84, I-205 and US 26 during both the PM peak and off-peak periods. However, this condition is more prevalent during the peak hour. City streets with cumulative truck delay in excess of 15 minutes in the off-peak hour include:

- Capitol Highway*
- S Tacoma Avenue
- SE Powell Boulevard*
- NW St Helens Road (US 30) near the St. John's Bridge*
- The east end of the St. John's bridge

Locations marked with an asterisk represent newly identified congested segments in 2040.

In the evening peak hour City streets with cumulative truck delay in excess of 15 minutes include:

- Capitol Highway*
- S Tacoma Avenue
- SE Powell Boulevard*
- NW St Helens Road (US 30) near the St. John's Bridge
- The St. John's bridge
- W Burnside Street*

1 Delay in the travel model is calculated as total cumulative hours of delay experienced by all trucks traveling over a segment, when the volume-to-capacity ratio exceeds 0.9 on that segment.

The total cumulative truck delay by roadway segment type is shown in Table 11. As highlighted in **Figure 3-19** and **Figure 3-20**, freeways experience the most delay in Portland. Compared to 2015, the freeways experience the largest total increase in delay but there is an increase in truck hours of delay for all roadway types in 2040 in both PM peak and off-peak hours.

Table 11: Total Cumulative Truck Hours of Delay by Roadway Type

ROADWAY TYPE	OFF-PEAK HOUR			PEAK HOUR		
	2015	2040	% CHANGE	2015	2040	% CHANGE
Freeway	22.3	64.7	190%	51.6	94.2	83%
Arterial	0.7	5.1	629%	3.5	10.5	200%
Collector & Local	1.5	3.9	160%	3.5	9.5	171%

Table source: Metro Regional Travel Demand Model, analysis by Fehr & Peers.
* Cumulative Truck hours of delay when v/c exceeds 0.9.

These totals capture the delay only when the volume-to-capacity (v/c) ratio is greater than 0.9. The v/c ratio compares the traffic volume along a roadway to its estimated capacity available to accommodate traffic volume and traffic movements, and a v/c of 0.9 approximates a fairly congested condition. While **Table 11** shows the worst conditions in the City, the total cumulative delay for trucks under less congested conditions is much higher than this.

Picture 7.1: A white freight truck driving through a congested freeway. Multiple black and white cars occupy the lane to the left of the truck. [Source: Oregon Department of Transportation (ODOT)]

Figure 3-17: 2040 Off-Peak Hour Congested Speed Relative to Posted Speed

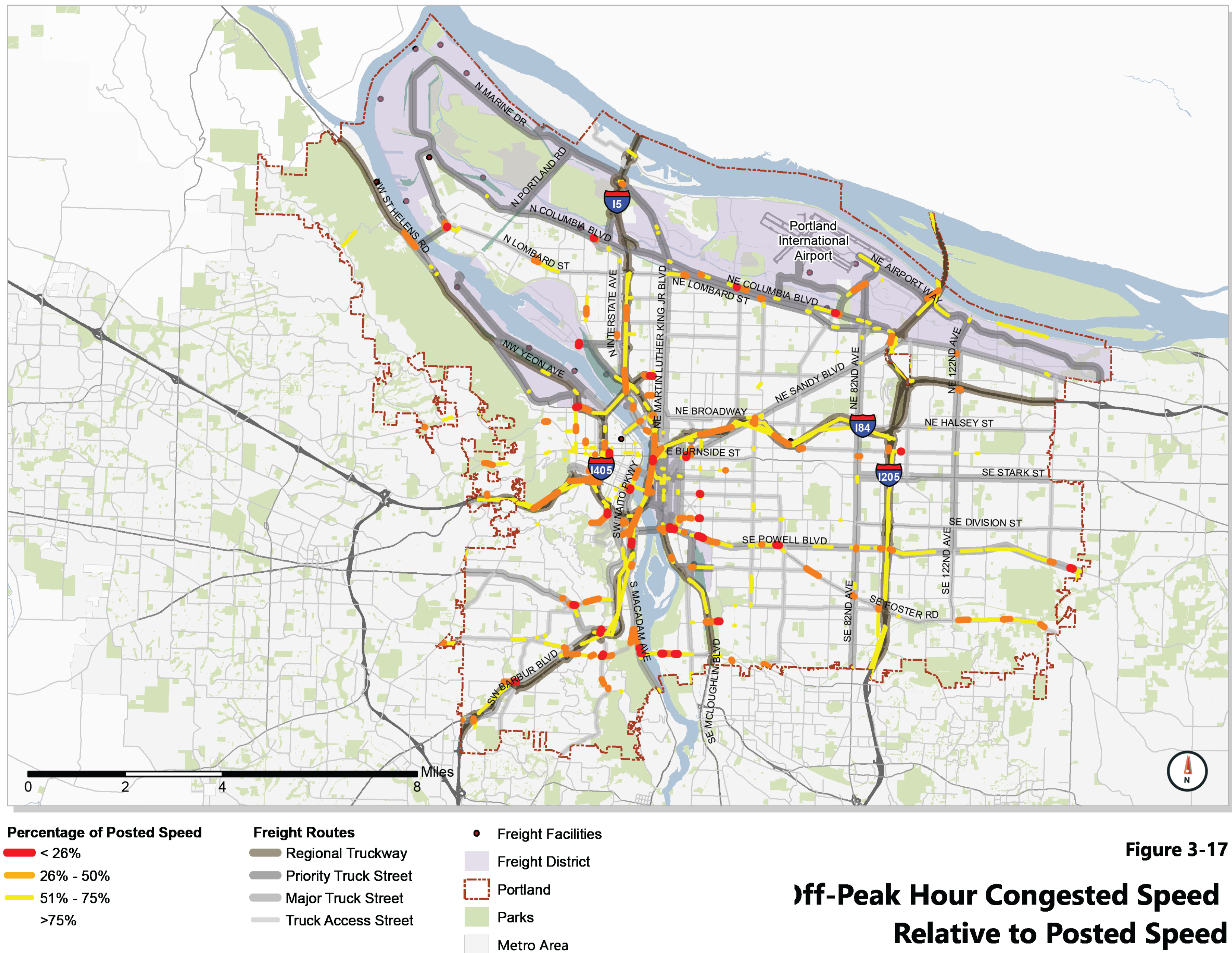
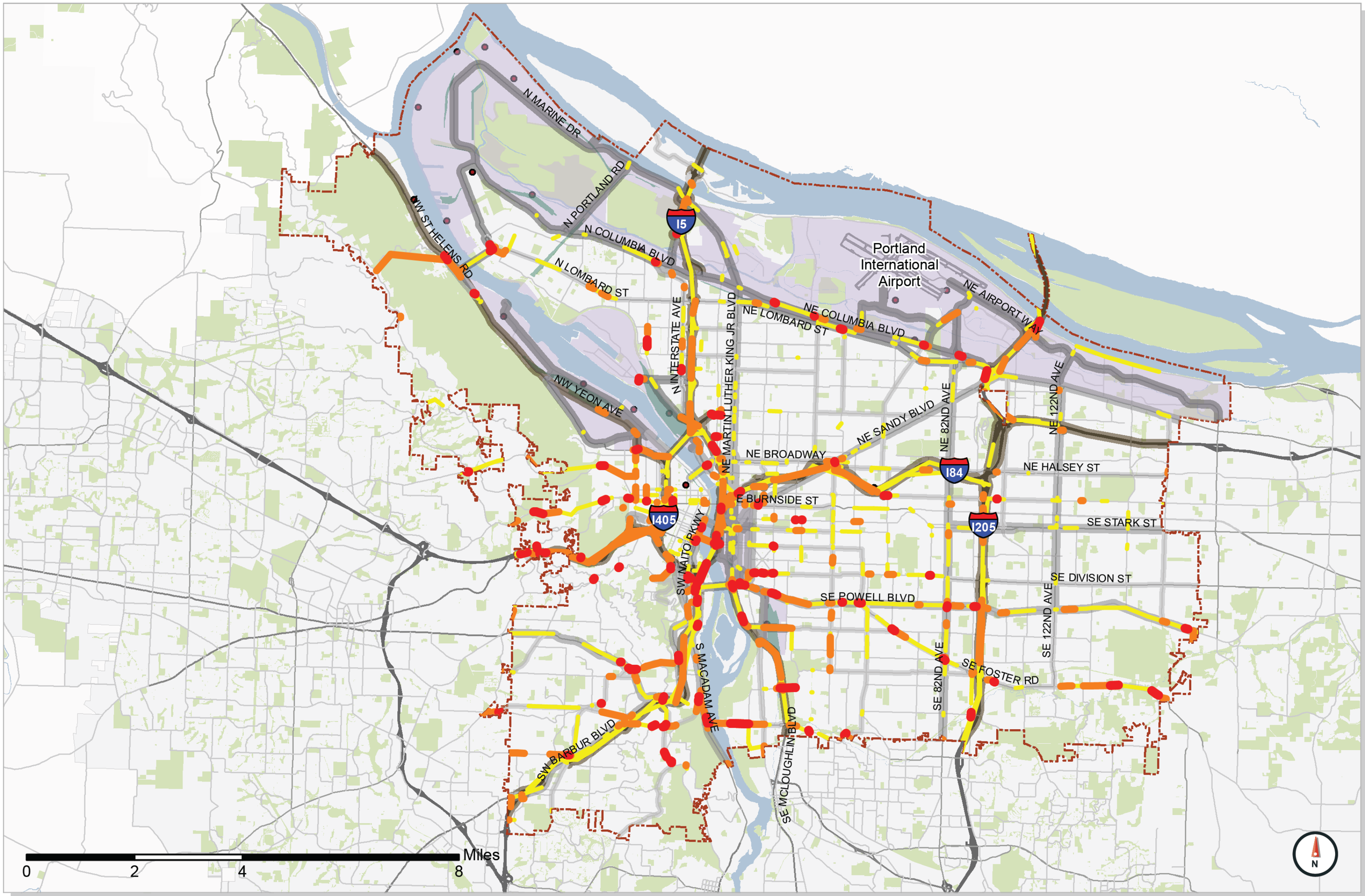


Figure 3-18: 2040 PM Peak Hour Congested Speed Relative to Posted Speed



Percentage of Posted Speed
- < 26%
- 26% - 50%
- 51% - 75%
- >75%

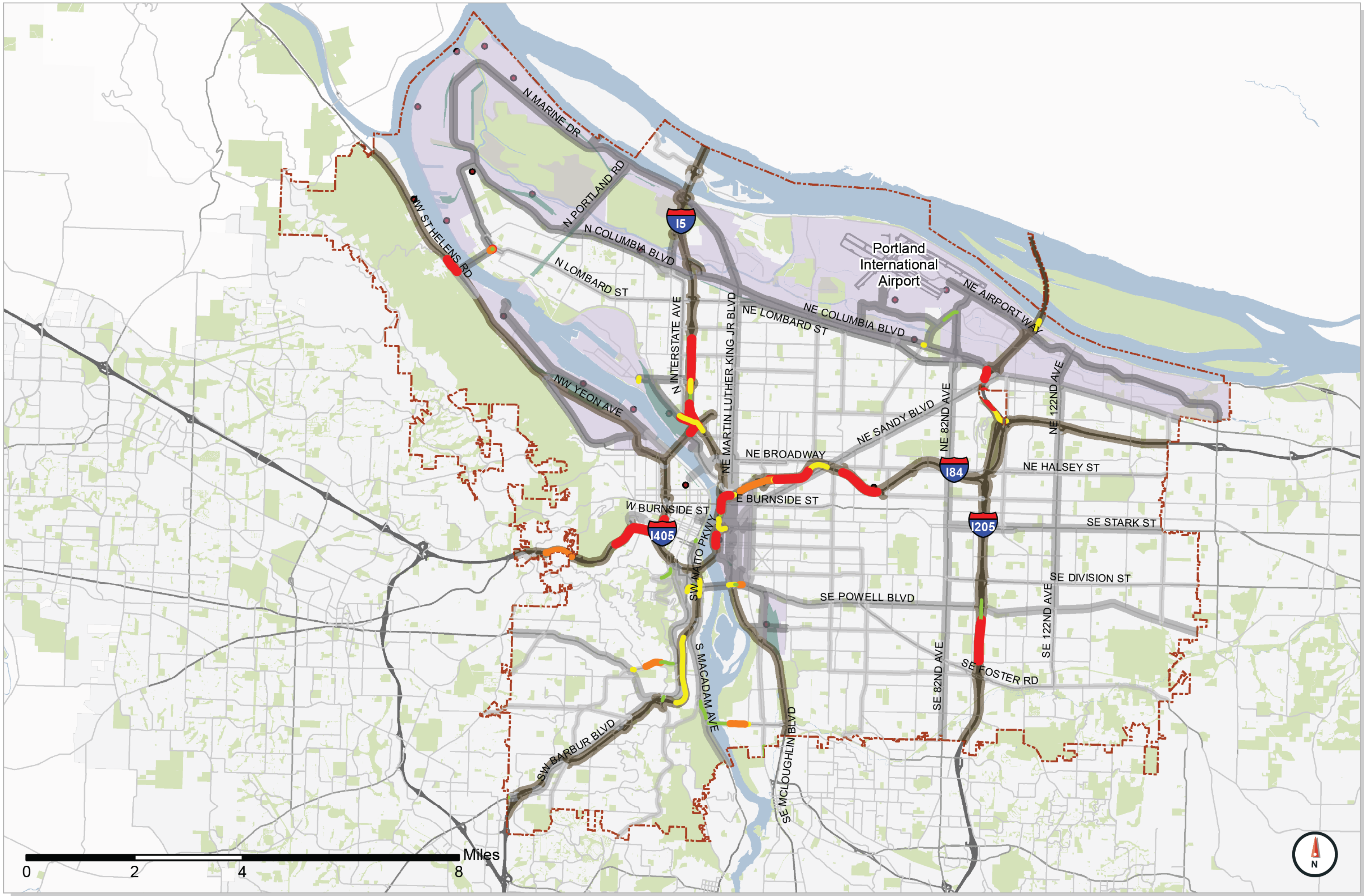
Freight Routes
- Regional Truckway
- Priority Truck Street
- Major Truck Street
- Truck Access Street

- Freight Facilities
- Freight District
- Portland
- Parks
- Metro Area

Figure 3-18

2040 Peak Hour Congested Speed Relative to Posted Speed

Figure 3-19: 2040 Off-Peak Hour Truck Delay



Truck Delay (minutes)
- <3
- 4 - 10
- 11 - 20
- 21 - 30

Freight Routes
- Regional Truckway
- Priority Truck Street
- Major Truck Street
- Truck Access Street

- Freight Facilities
- Freight District
- Portland
- Parks

Figure 3-19

2040 Off-Peak Hour Truck Delay

Figure 3-20: 2040 PM Peak Hour Truck Delay

Figure 3-20

2040 Peak Hour Truck Delay

3.5 Volume to Capacity Ratio

The volume-to-capacity (v/c) ratio is a measure of the level of congestion on a roadway that compares the traffic volume along a roadway to its estimated capacity available to accommodate traffic volume and traffic movements. A v/c approaching 1.0 is generally an indicator of congested conditions, including delays and queuing. V/c is a valuable performance measure, particularly for state and regional analysis. The City might need a more detailed analysis based on historic speed and travel time data from INRIX, HERE or other similar data source. The Metro model reports the v/c ratio of each roadway segment for each time period, and a summary of the v/c by roadway type is shown in **Table 12** below. Also included are the minimum and maximum v/c ratios to provide a measure of variability and also insight on the best and worst conditions along the roadway segments during the analyzed time periods.

Compared to the 2015 model, the average v/c ratio on all roadway types increases in 2040 for both PM peak and off-peak periods. The off-peak hour v/c increases more than PM peak period between 2015 and 2040, and the arterials, collectors, and local roadways are expected to see the greatest change. Off-peak v/c ratios for arterials and collectors/local streets are expected to increase by 27% and 28%, respectively over this timeframe. This corroborates the increase in truck VMT that is expected on the local and collector roadways, discussed in section 3.1 above, and could impact local neighborhood circulation. Increase in v/c is a result of growth in both trucks and passenger vehicles since both total vehicle volume and truck percentage of traffic are expected to increase in 2040.

Table 12: Volume to Capacity Ratio by Roadway Type

ROADWAY TYPE	OFF-PEAK HOUR		PM PEAK HOUR		CHANGE IN AVERAGE V/C (2015-2040)	
	AVERAGE	MAX	AVERAGE	MAX	OFF-PEAK HOUR	PM PEAK HOUR
Freeway	0.76	1.34	0.83	1.49	+12%	+8%
Arterial	0.57	1.43	0.66	1.94	+27%	+19%
Collector & Local	0.25	1.54	0.34	1.83	+28%	+22%

Table source: Fehr & Peers

4% of roadway miles in Portland's modeled network have v/c ratios greater than 0.95 in the evening peak hour in 2040. In total, 63.52 miles of roadway have a v/c ratio of greater than 0.95 in the PM peak hour and 17.75 miles have a v/c ratio of greater than 0.95 in the off-peak hour. Most of the congested segments are on US 26, I-5, I-405, I-205 and I-84 and their on- and off-ramps. During the off-peak, these freeways have more segments with a v/c ratio over 0.95 under existing conditions. During the evening peak hour, future conditions appear to deteriorate less on freeways than on lower designated streets, but freeways still have many segments with a v/c ratio over 0.95 as is seen in existing conditions.

Table 13 shows locations on City streets that have a v/c ratio of 0.95 or higher in 2015 and 2040. These locations are also shown in **Figure 3-21** and Figure **3-22**.

Many of the locations with a v/c ratio over 0.95 in 2040 were not identified in the 2015 model as having a v/c ratio over 0.95, indicating that conditions are worsening on many City streets in 2040. Figure 3 23 and Figure 3 24 show the locations with the greatest increase in v/c ratio between 2015 and 2040, including:

- NW Germantown Road
- N Portland Road
- NE Dekum Street
- NE Marine Drive
- W Burnside Street
- E Burnside Street
- SE Belmont Street
- SE Holgate Road
- SE Foster Road
- SE 72nd Avenue
- SE 82nd Avenue
- SW Terry's Ferry Road

In the off-peak, many of the locations with a large increase in v/c still have a total 2040 v/c less than 0.95, such as NE Marine Drive at the eastern City limits, SE Foster Road at the eastern City limits, and SE 82nd Avenue between SE Foster Road and SE Powell Boulevard. Similarly, in the evening peak hour, N Portland Road and many small road segments in SE Portland show v/c increases of over 0.3 while still staying under the v/c threshold of 0.95.

Picture 8.1: *Various passangers aboard the Portland Aerial Tram. One passanger holds onto a handrail. [Source: ODOT]*

Table 13: Locations with v/c of greater than 0.95

LOCATION	V/C RATIO OVER 0.95 IN 2015	V/C RATIO OVER 0.95 IN 2040
US 30 at the St. Johns Bridge	PM Peak hour	**Off-peak and PM peak**
SW Capitol Highway east of Beaverton-Hillsdale Highway	PM Peak hour	**Off-peak and PM peak**
SE Tacoma Street and the Sellwood Bridge	Off-peak and PM peak	**Off-peak and PM peak**
S Macadam Avenue north of the Sellwood Bridge	PM Peak hour	**Off-peak and PM peak**
SE Bybee Road at Mcloughlin Boulevard	PM Peak hour	**Off-peak and PM peak**
SE Holgate Boulevard at SE 17th Avenue	no	**Off-peak and PM peak**
SE Powell Boulevard at SE 8th Avenue	Off-peak	**Off-peak**
SE Powell Boulevard at SE 104th Avenue	no	**Off-peak**
NE Alderwood Road west of NE 82nd Avenue	no	**Off-peak**
NW Germantown Road	PM Peak	**PM Peak**
St. Johns Bridge	no	**PM Peak**
NW Cornell Road from the western City limits to NW 23rd Avenue	no	**PM Peak**
Sections of W Burnside Road west of Downtown	PM Peak	**PM Peak**
SW Naito Parkway from the Hawthorne Bridge to the Morrison Bridge	no	**PM Peak**
The Hawthorne Bridge	no	**PM Peak**
S Multnomah Boulevard between SW 30th Avenue and I-5	PM Peak	**PM Peak**
SW Taylors Ferry Road between SW 48th Avenue and 99W	PM Peak	**PM Peak**
SE Tacoma Street between SE 32nd Avenue and SE McLoughlin Boulevard	PM Peak	**PM Peak**
SE Powell Boulevard between SE 20th Avenue and SE 33rd Avenue	PM Peak	**PM Peak**

Note: Items in Bold indicate a new congested location relative to 2015 conditions.

Figure 3-21: 2040 Off-Peak Hour Volume to Capacity Ratio

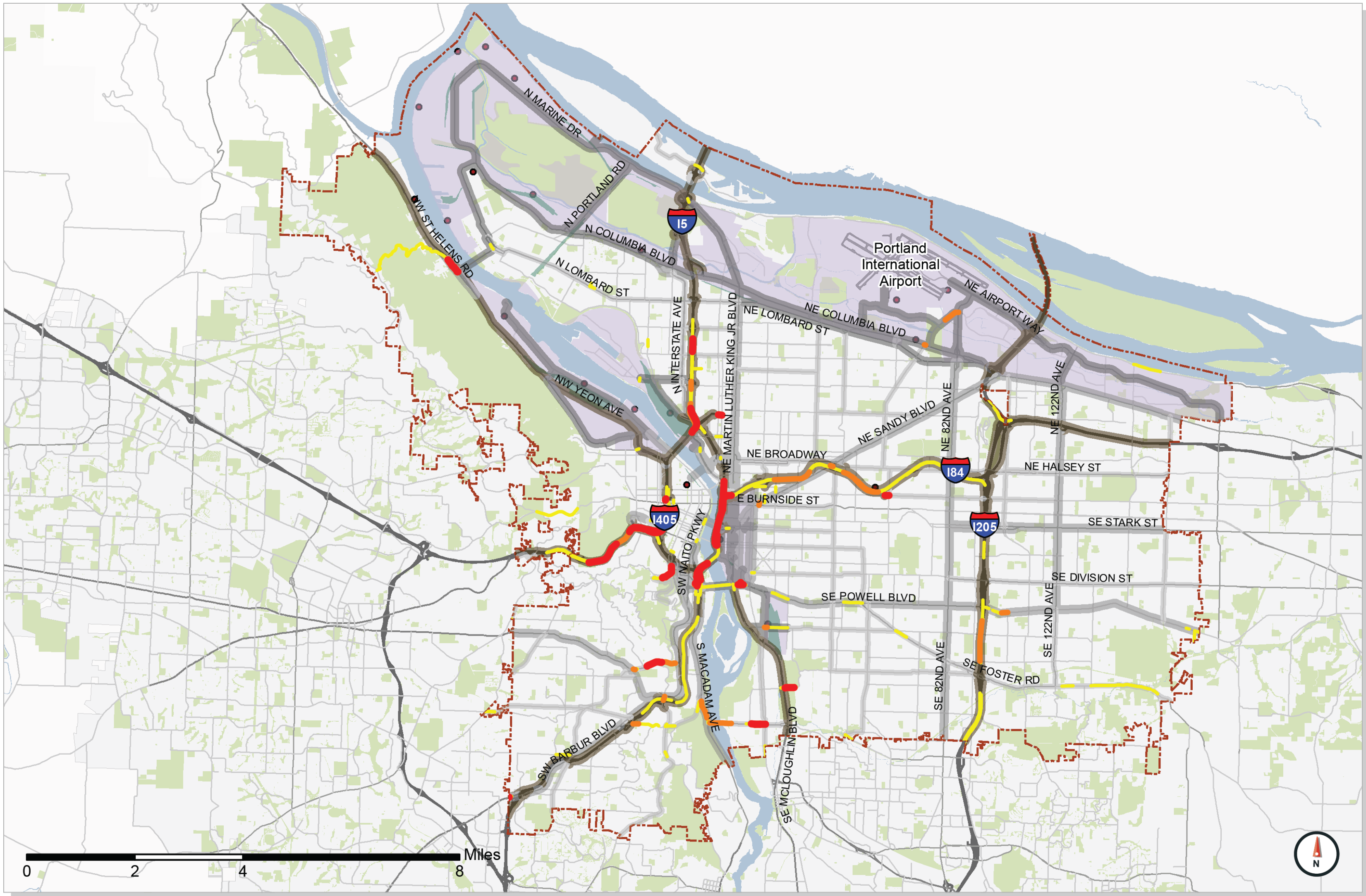
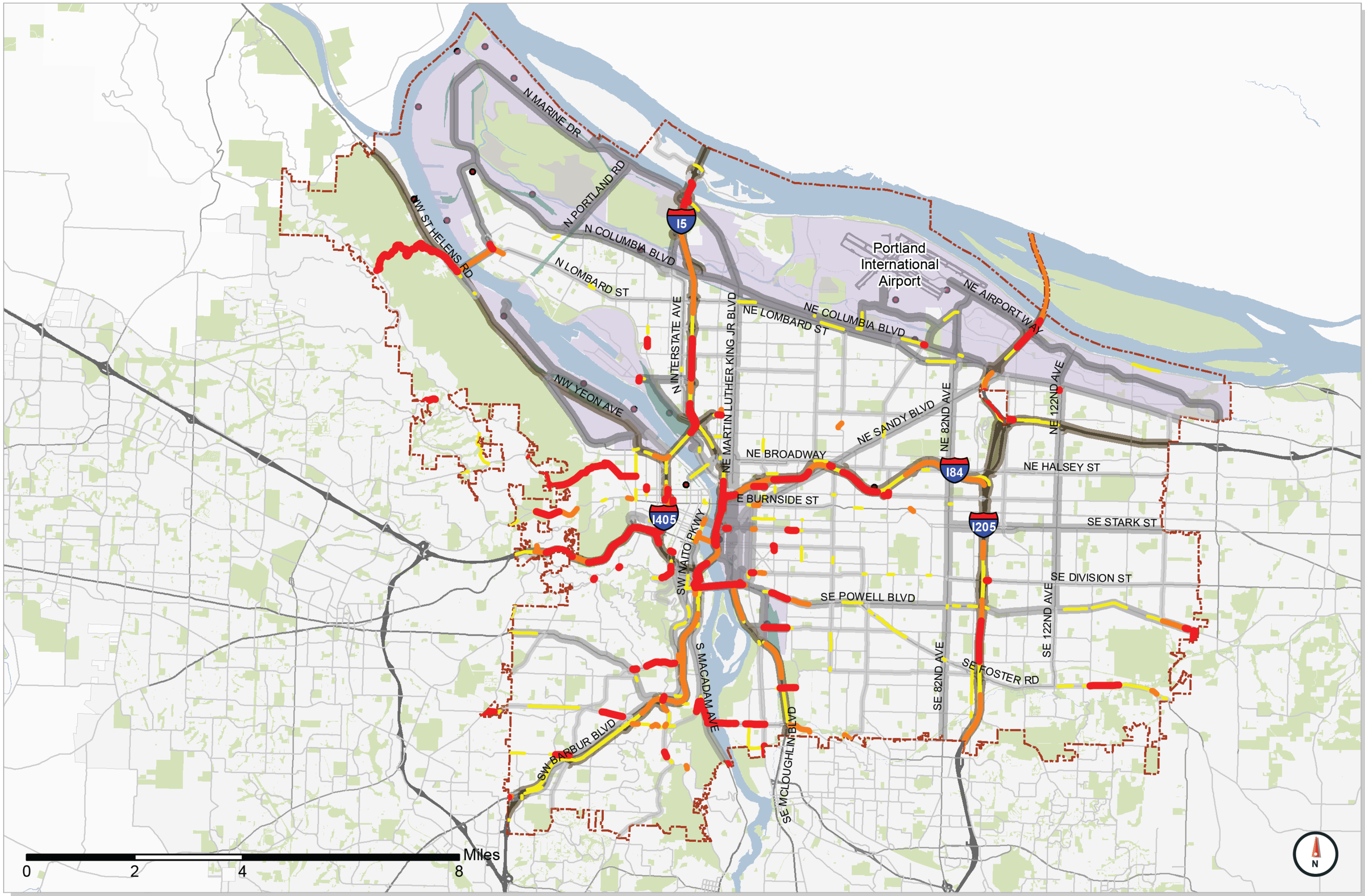


Figure 3-21

2040 Off-Peak Hour Volume to Capacity Ratio

Figure 3-22: 2040 PM Peak Hour Volume to Capacity Ratio



V/C Ratio
- < 0.85
- 0.85 - 0.95
- 0.95 - 1.00
- > 1

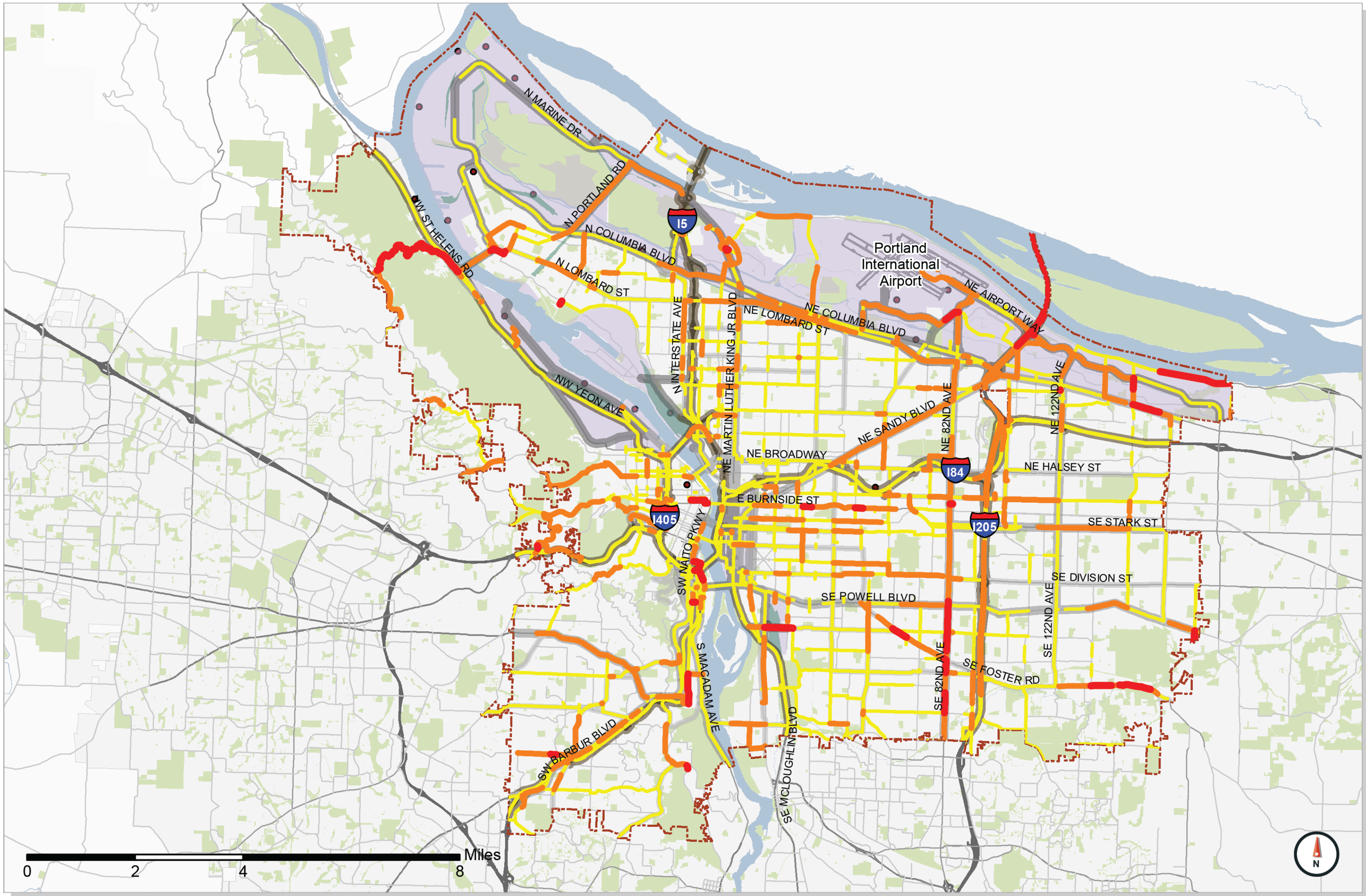
Freight Routes
- Regional Truckway
- Priority Truck Street
- Major Truck Street
- Truck Access Street

- Freight Facilities
- Freight District
- Portland
- Parks

Figure 3-22

2040 Peak Hour Volume to Capacity Ratio

Figure 3-23. Change in Off-Peak Hour Volume to Capacity Ratio from 2015 to 2040



Change in V/C
- < 0.05
- 0.05 - 0.15
- 0.16 - 0.30
- 0.31 - 0.65

Freight Routes
- Regional Truckway
- Priority Truck Street
- Major Truck Street
- Truck Access Street

- Freight Facilities
- Freight District
- Portland
- Parks
- Metro Area

Figure 3-23

Change in Off-Peak Hour Volume to Capacity Ratio from 2015 to 2040

Figure 3-24. Change in PM Peak Hour Volume to Capacity Ratio from 2015 to 2040

Figure 3-24

Change in Peak Hour Volume to Capacity Ratio from 2015 to 2040

4. SUMMARY OF FINDINGS

FAF4 predicts a 16% increase in total tonnage of imports and exports through the Portland Metro region from 2015 to 2040. As a result of this and the rise in home deliveries, total daily truck (class 5 and higher) VMT is expected to increase 61% between 2015 and 2040.

In general, truck volumes, congestion, v/c, and delay all are expected to increase between 2015 and 2040. Metro's model also estimates an increase of personal vehicle volume, contributing to the congestion seen in the 2040 model. These delays, where significant, can impact freight costs, economic competitiveness and increase emissions. **Table 14** summarizes the key findings for the 2040 analysis.

Picture 9.1: *A woker operating a Toyota forklift in a warehouse.. The worker is lifting a pallet of brown, stretch-wrapped boxes. [Source: U.S. Department of Agriculture]*

Table 14: Summary of Key Findings

S PERFORMANCE MEASURE	KEY FINDINGS
Truck VMT	• Daily truck VMT is expected to increase 61% by 2040. • Daily, off-peak, and peak hour truck VMT is expected to increase the most (72%-78%) on collector and local roads between 2015 and 2040. • Most of the truck VMT was observed on freeways
Truck Volume	• Daily truck volumes in 2040 are concentrated on the interstates and major truck corridors such as Columbia Boulevard. • Local access streets, especially those in Downtown Portland, North Portland, and NE Portland also see large increases in daily truck traffic. • Modeled truck traffic tends to be higher during the off-peak hour than the PM peak hour. • Many of the local streets that have over 20 trucks in the 2040 off-peak or PM peak hour did not have over 20 trucks hourly in 2015.
Truck share of total traffic	• Truck percentage of total traffic in the PM peak and off-peak hours increases from 2015 to 2040 for all roadway types. • The average truck percentage under future conditions for all street segments in Portland is 1.8% during the PM peak hour and 3.3% during the off-peak hour. • The off-peak generally saw greater increases in truck percentage for 2040 than the PM peak hour.

Travel time and delay	• Non-freeway locations in the off-peak hour that show speeds less than 50% of the posted speed tend to be short sections of roadway near intersections or interstate ramps. • In the PM peak hour, many of the designated freight streets show slow speeds. • Cumulative truck delay in excess of 60 minutes is seen on most freeways and highways including I-5, I-84, I-205 and US 26 during both the PM peak and off-peak periods. • Cumulative truck hours of delay increased the most on arterials in both the PM peak hour and off-peak hour.
V/C Ratio	• The average v/c ratio on all roadway segments types increases in 2040 for both PM peak and off-peak periods. • Collectors and local roads are predicted to have the largest percent increase in v/c (22%-28%) • 4% of roadway miles (63.52 total miles) in Portland's modeled network have v/c ratios greater than 0.95 in the PM peak hour in 2040. • Many of the locations with a v/c ratio over 0.95 in 2040 were not identified in the 2015 model as having a v/c ratio over 0.95.

Source: Metro Regional Travel Demand Model, Fehr & Peers

Through the future 2040 conditions analysis, local truck access streets with higher levels of truck activity in the City of Portland are identified. The worst congestion is generally projected on the interstates and in the PM peak hour, and truck activity is anticipated to be concentrated on the interstates and major truck routes such as:

- Columbia Boulevard
- N Lombard Street
- St. John's Bridge
- N Portland Road
- N Interstate Avenue
- NW St. Helens Road (US 30)
- SW Beaverton Hillsdale Highway
- SW Capitol Highway
- SE Powell Boulevard
- SE Tacoma Street/Sellwood Bridge

These locations with high truck activity don't always correlate to high delay or congestion, and the conditions can vary along the corridor. For example, SE Tacoma Street experiences a v/c ratio over 1.0 in both the off-peak hour and PM peak hour but is not on one of the highest volume truck corridors. On the other hand, the west end of N Columbia Boulevard has high truck volumes and truck percentage but has a v/c ratio of under 0.85. Total vehicle volume and congestion, along with land use and the built infrastructure, affect truck movement around and through the City.

Table 15 lists the City streets that are designated as local truck access only but are expected to have high truck activity and/or delay in 2040. The identification of these locations will inform the recommendations and improvements to the City's designated truck routes in the next steps of this planning process.

Table 15: Local Truck Access Streets with High Truck Activity or Delay

LOCATION	>100 DAILY TRUCKS	>20 PM PEAK HOUR TRUCKS	>20 OFF-PEAK HOUR TRUCKS	>12% TRUCKS IN THE PM PEAK HOUR	>12% TRUCKS IN THE OFF-PEAK	V/C >0.95 IN PM PEAK HOUR	TRAVEL TIME DELAY IN PEAK HOUR
W Burnside Street	X	X	X			X	
NW Everett Street	X		X				
NW Glisan Street	X						
NW Couch Street	X						
NW 23rd Avenue	X						
Naito Parkway	X	X	X				
SW Clay Street	X		X				
SW Market Street	X	X	X				
SW 12th Avenue	X						
SW 13th Avenue	X						
SW Jefferson Street	X						
N Portsmouth Avenue	X	X	X		X		
N Saint Louis Avenue	X	X					
N Fessenden Street	X	X	X		X		
N Albina Avenue	X						
N Willis Boulevard	X						
N Halleck Street/N Kilpatrick Street	X						
N Alberta Street west of I-5	X						
NE Glisan from I-205 to the city limits	X						
NE Marine Drive	X	X	X	X	X		

N Peninsular Avenue	X				X		
NE Prescott Street	X				X		
NE Shaver Street from NE 122nd Avenue to NE 141st Avenue	X		X		X		
SW Canyon Court from SW Skyline Boulevard and SW Zoo Road				X	X		
SW Taylors Ferry Road	X						X
SW 30th Avenue	X	X		X			
SE Milwaukie Avenue	X	X	X				
SE Johnson Creek Boulevard	X		X				
N Greeley Avenue	X					X	X
NW Germantown Road						X	
NW Cornell Road from the western City limits to NW 23rd Avenue						X	
N Denver Avenue from N Ainsworth Street to N Killingsworth Street				X			
N Killingsworth Street from N Greeley Avenue to N Denver Avenue				X			

Source: Metro Regional Travel Demand Model, Fehr & Peer Note: Only those locations designated as Local truck access only are listed here.