

# CHAPTER 2: GOODS MOVEMENT IN SEATTLE

## IN THIS CHAPTER:

<b>Population, Employment, and Economic Growth</b> .....	<b>14</b>
Washington is the most trade-dependent state in the nation, and Seattle sits at the center of this economy.	
<b>Seattle’s Freight Assets</b> .....	<b>22</b>
Our waterway, rail, air, pipeline, and roadway infrastructure is critical to support freight logistics and shipping.	
<b>Existing Freight Trends</b> .....	<b>34</b>
How freight moves today by truck, rail, water and air through the Seattle area.	
<b>Future Freight Trends</b> .....	<b>38</b>
How people shop, new technologies, and how we are responding to climate change are all radically transforming how freight moves.	
<b>Conclusion</b> .....	<b>44</b>

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## POPULATION, EMPLOYMENT, AND ECONOMIC GROWTH

In 2015, Seattle was home to an estimated 640,500<sup>1</sup> people and nearly 515,000<sup>2</sup> jobs. By 2035, it is anticipated that the city will grow by another 120,000 people and 115,000 jobs.<sup>3</sup> This is a portion of the Puget Sound region's anticipated employment growth from 2.1 million in 2014 to 3 million in 2040.<sup>4</sup>

The regional metropolitan planning organization, Puget Sound Regional Council (PSRC), has designated 2 Manufacturing/Industrial Centers (MICs) in Seattle, where manufacturing and industrial uses could be clustered away from residential and other commercial land uses. The MICs are supported by a well-developed intermodal transport system to accommodate marine, truck, and rail freight critical to the success and continuing job growth of manufacturing and industrial activities.

The magnitude of employment matters as it is a principal measure of regional economic activity. Overall population growth and related regional businesses and consumption generates both employment and industry growth. As population and employment grows, so will the need for goods to be delivered in an efficient manner for personal and business use.

Seattle's history and development as a major deep-water port has shaped the city and our economy. The Port of Seattle (Port) has a profound effect on freight movement in Seattle. Due to the Port and associated industries, Seattle's economy is particularly tied to freight and trade. In fact, the Port's activities reflect 443,000 jobs in the state when factoring in the farmers and manufacturers who ship products through the ports.<sup>5</sup>

Regional economic sectors, such as manufacturing and retail, are also important drivers of freight transportation in and through Seattle. Goods delivery allows retail stores to meet consumer needs and supplies local businesses with the goods they need to manufacture and develop products and services for their customers.

### **Influence of Land Use on Freight**

The City's Comprehensive Plan establishes the city's vision for land use, transportation, and growth management policy issues. Through the Comprehensive Plan, the City manages and promotes growth in specific areas following the Urban Village Strategy. This strategy designates regionally-significant urban centers and manufacturing/industrial centers (MICs) and, at a more local scale, identifies urban villages, as shown in Figure 2-1.

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<sup>1</sup>City of Seattle. July 8, 2015. A Comprehensive Plan for Managing Growth 2015-2035 | Draft.

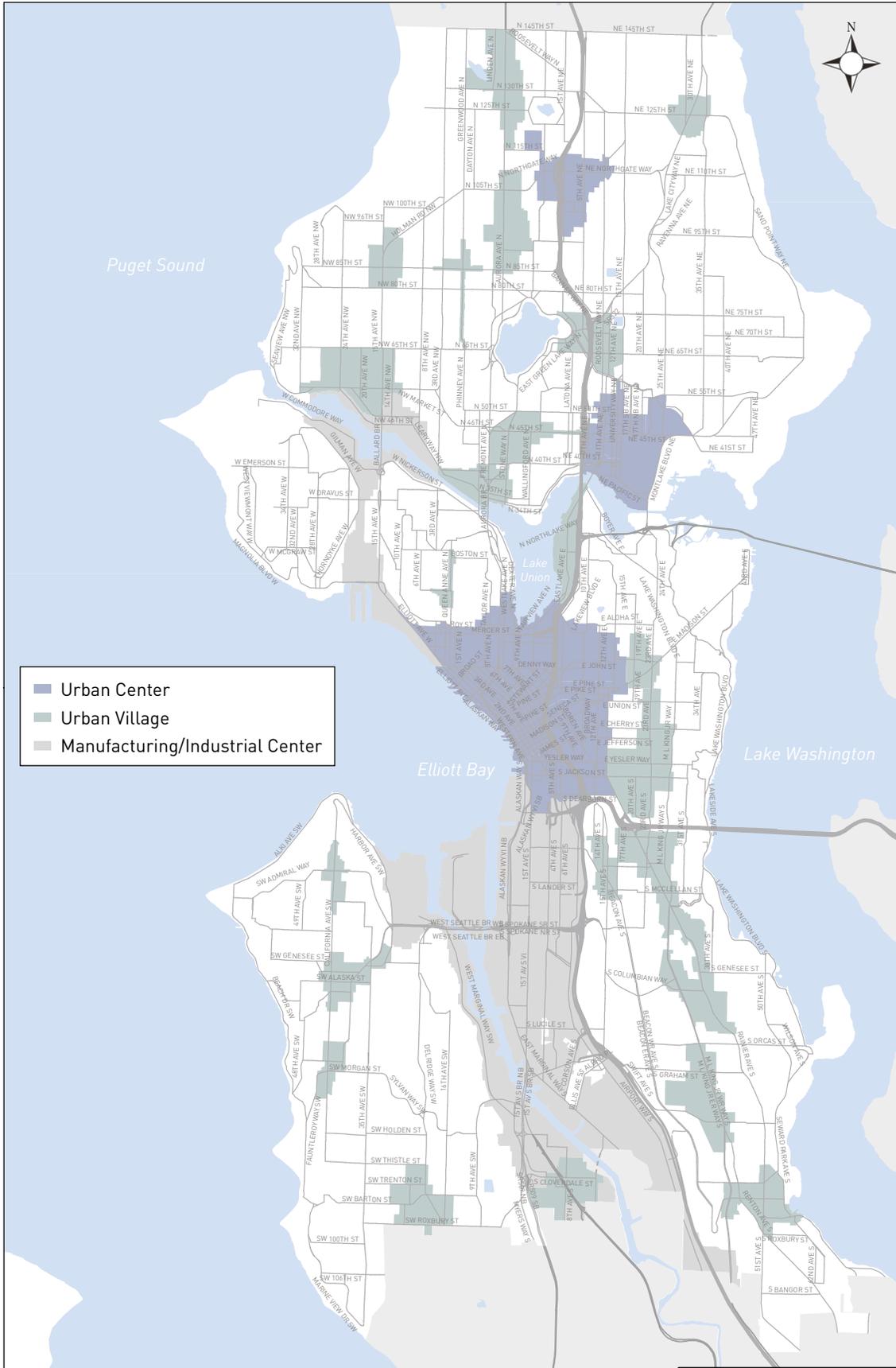
<sup>2</sup>Puget Sound Regional Council. 2014 Covered Employment Estimates by Jurisdictions.

<sup>3</sup>City of Seattle. July 8, 2015. A Comprehensive Plan for Managing Growth 2015-2035 | Draft.

<sup>4</sup>Puget Sound Regional Council. 2014 Regional Forecast. [www.psrc.org/data/forecasts](http://www.psrc.org/data/forecasts).

<sup>5</sup>NWSA. Economic Impact. <https://www.nwseaportalliance.com/stats-stories/economic-impact>.

FIGURE 2-1: SEATTLE'S URBAN VILLAGE STRATEGY



The strategy focuses most future jobs and housing growth in specific areas, and serves several purposes:<sup>6</sup>

- Accommodate Seattle’s expected growth in an orderly and predictable way
- Strengthen existing business districts and MICs
- Promote the best and most efficient use of public investments, now and in the future
- Encourage more walking and transit use in the city
- Retain the feel and character of less dense single-family neighborhoods

The Urban Village Strategy influences our transportation system, as well as freight distribution patterns and goods movement throughout the city. It requires a multimodal transportation system that provides options for all trips throughout the day, evenings and weekends.

### Manufacturing/Industrial Centers

Seattle has 2 of the Puget Sound Regional Council’s (PSRC) 8 regionally-designated MICs: Ballard-Interbay-Northend (BINMIC) and Duwamish MIC, which are also specifically identified in Seattle’s Comprehensive Plan.

The MICs were established to ensure that adequate accessible industrial land is available to promote a diversified employment base and sustain Seattle’s contribution to regional living wage job growth.

Activities on industrial lands, such as manufacturing, make significant revenue contributions to the local and regional economy. This is due in large part to these activities being net exporters of products to the U.S. and the world, and net importers of income.

In 2012, workers employed in industrial activities were paid an average annual wage of \$80,000, more than 34% above other jobs in the four county area. A large share of these higher wages is spent throughout the local and regional economy, supporting additional economic activity, or what is commonly referred to as “induced” impacts.

Industry has concentrated in the MICs due to:

- relatively large, flat sites
- access to highways, rail and port facilities
- proximity to similar uses, customers and labor force

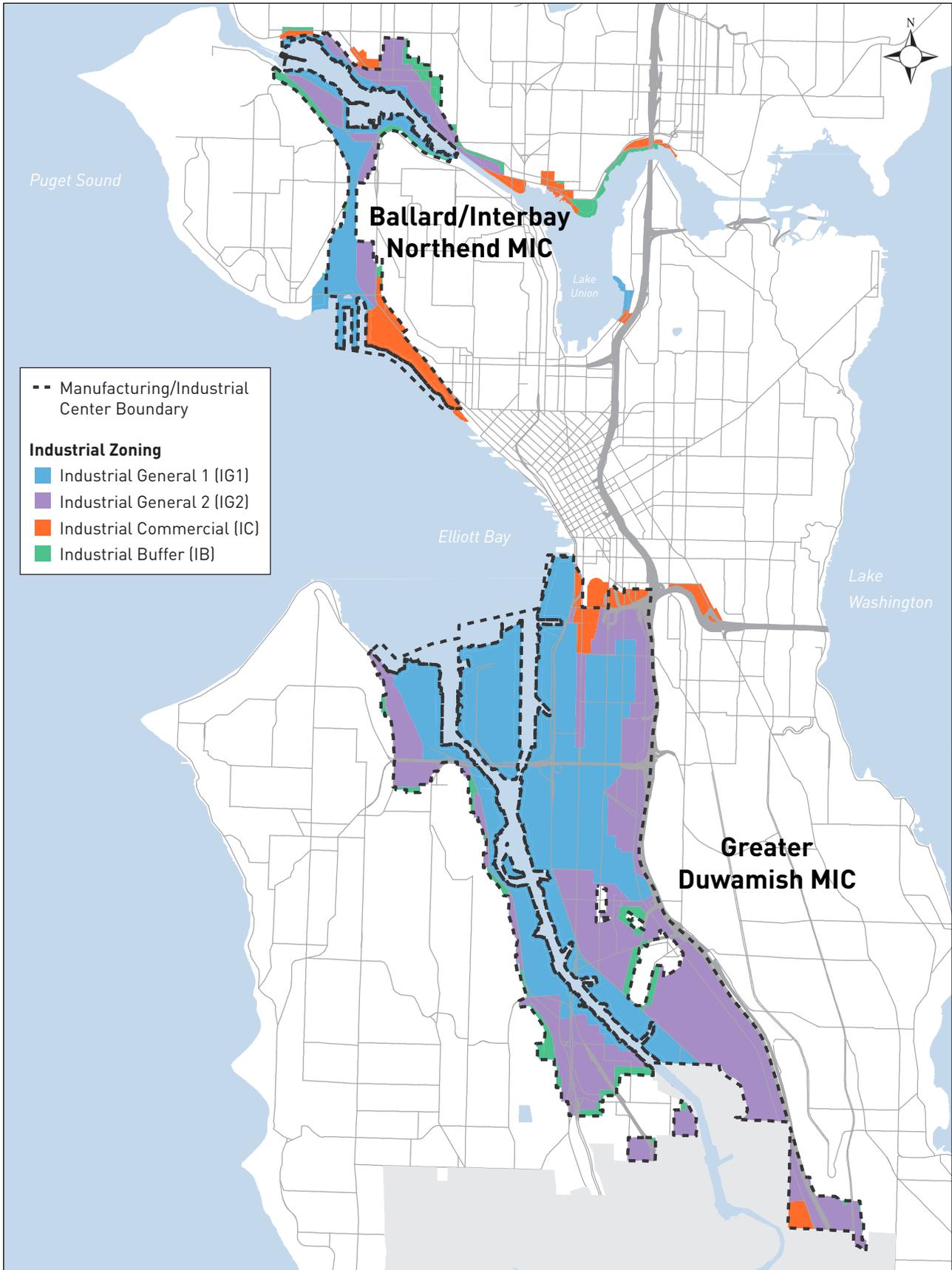
This also explains why the majority of the nearly 6,000 acres of industrially-zoned land in Seattle is within the MIC designations, shown in Figure 2-2.



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<sup>6</sup>City of Seattle Department of Planning and Development. November 2013. Existing Comprehensive Plan and Duwamish M/IC Policy and Land Use Study. [www.seattle.gov/dpd/cs/groups/pan/@pan/documents/web\\_informational/p1903847.pdf](http://www.seattle.gov/dpd/cs/groups/pan/@pan/documents/web_informational/p1903847.pdf).

FIGURE 2-2: SEATTLE'S MANUFACTURING/INDUSTRIAL CENTERS



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The **BINMIC** is the region's smallest MIC at 932 acres. It has a generally smaller parcel size with a finer mix of diverse uses than other MICs. These uses span light manufacturing, maritime, food processing, warehouse uses, a rail yard, and several Port of Seattle facilities.

Port facilities in the BINMIC include Fisherman's Terminal, its largest cruise ship terminal, and a grain elevator, among other uses.

The BINMIC contains 14,200 jobs, including many that are living-wage.

The **Duwamish MIC** is the oldest and largest of the 8 designated MICs spread across the Puget Sound Region.

It covers 4,928 acres of marine and industrial lands, containing nearly 84% of total industrial-zoned land in Seattle.

The Duwamish MIC functions as a focal point for international industrial activity and is the center of the Port's primary marine shipping area, with deep-water berths, piers, shipyards, drydocks, container terminal cranes, on-dock rail, container support yards, cargo distribution and warehousing, oil and petroleum storage facilities, major railroad yards, and the King County International Airport (also known as Boeing Field).

This area contained more than 50,000 jobs in 2010.

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### Freight Generators

In Seattle and nationally, retail trade, wholesale trade, and manufacturing sectors (in that order) spend the most on freight movement and generate the most trucks, shown in Figure 2-3. They are also the top 3 employment sectors for freight-generation.

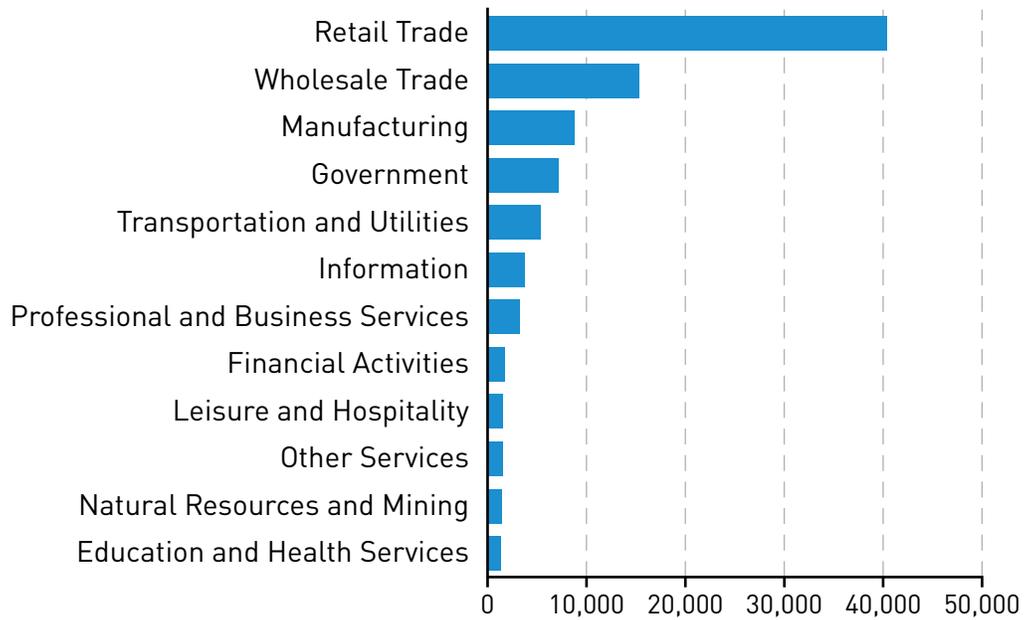
Total employment in these 3 employment sectors grew by about 10% between 2009 and 2013 (from 80,000 to 88,000 employees), mostly due to growth in the retail trade sector. A notable difference, though, is that while wholesale trade is heavily reliant on freight to supply its customers, it takes third place behind retail trade and manufacturing in terms of number of persons employed in Seattle. Figure 2-4 shows the

employment trends of these three employment categories between 2000 and 2013.

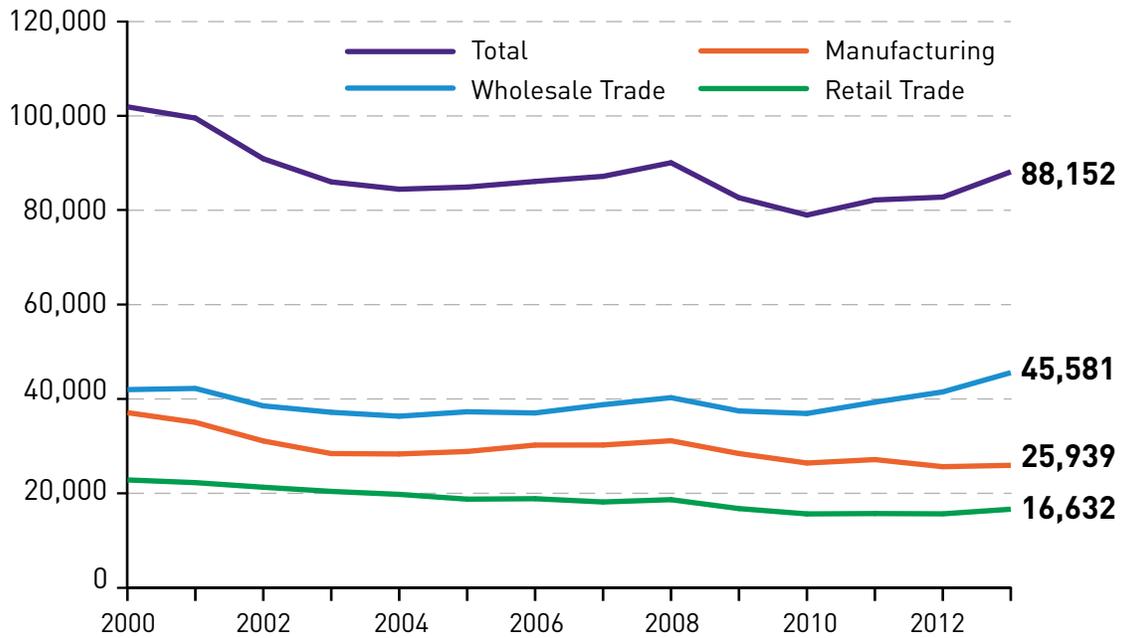
Retail trade is Seattle's largest economic sector, with more than 45,000 employees in 2013 and it generates the most freight. Most retail stores are interspersed throughout the city's urban centers and villages, and rely almost completely on trucks to get goods to and from distribution centers and warehouses.

Wholesale trade, which generates the second most freight of any employment sector, had 17,000 employees in 2013. Wholesale merchants supply products across a broad spectrum of durable and nondurable consumer and industrial products. Durable goods, such as motor vehicles

**FIGURE 2-3: U.S. INDUSTRY USE OF TRUCKING AND WAREHOUSING SERVICES<sup>7</sup> (\$ BILLIONS)**



**FIGURE 2-4: SEATTLE EMPLOYMENT IN FREIGHT-RELATED INDUSTRIES**



and parts, appliances and industrial materials, and non-durable goods, such as food, apparel and gasoline, are delivered to retail stores and other businesses.<sup>7</sup>

Manufacturing, which generates the third most freight of any industry, is also well represented in Seattle. In 2013, the manufacturing industry provided nearly 26,000 jobs in Seattle, making it second to retail in terms of employment in high freight-generating industries in the city. Outputs of manufacturing processes range from industrial materials, such as primary metals; to intermediate products, like fabricated metals; to final goods, including airplanes, food, and

apparel. Each of these products is transported to local markets and regional markets or is exported. Transportation equipment (produced by businesses such as Boeing and its local suppliers, Paccar, and local shipyards) is the largest manufacturing sector in the Seattle area.

Final goods that are manufactured, from airplanes to seafood, are more likely to be destined to markets in the U.S. or overseas than headed for local consumption. Along with many service industries, manufacturing represents the direct “exports” to the U.S. and overseas that help drive Seattle’s economy and jobs



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<sup>7</sup>US Bureau of Labor Statistics and WSP | Parsons Brinckerhoff analysis. December 2014. The Role of Freight in Seattle’s Economy.

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## Freight in Neighborhoods

One often overlooked aspect of freight movement is the need for, and the effects of, freight movement in city neighborhoods. To shed more light on freight operations and effects in residential areas, and to help inform the development of the FMP, we conducted case studies of 2 Seattle neighborhoods. While every neighborhood is unique, each needs some level of freight activity related to local retail businesses and residential deliveries.

Ballard and South Lake Union are fast growing and changing neighborhoods that include commercial and residential uses adjacent to deep-rooted manufacturing and industrial uses. Both neighborhoods have recently experienced rapid residential growth, and office and retail development. This growth has intensified the conflicts for limited street space as on-street parking and loading zone availability have become increasingly scarce, and travel congestion has worsened.

The growth in these neighborhoods has increased the demand for goods movement to and from them, while at the same time reducing the ability for freight providers to efficiently access and serve the businesses within the neighborhoods. In addition, an

increase in freight can result in actual or perceived quality of life issues for residents. Specific issues identified in the case studies for neighborhood residents and businesses include:

- **Safety:** Neighborhood residents are concerned about safety associated with increased truck volumes and speeds. The high volume of pedestrian and truck activity in South Lake Union, specifically, could increase the potential for adverse interaction and may require additional education and operational changes.
- **Noise:** Some neighbors and businesses expressed interest in shifting more deliveries to off-peak hours to keep trucks out of peak-hour traffic; however, evening noise ordinances that limit nighttime deliveries near residential areas make this challenging.
- **Loading Zones:** Available on-street loading zone capacity is extremely scarce and was cited as an issue for trucks. Enforcement of parking regulations and designation of additional truck-sized loading zones are needed in both neighborhoods.
- **Congestion:** Businesses have had to change their business practices to allow additional travel time for making and receiving deliveries.

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To address these concerns, the case studies include the following recommendations:

- Parking and loading zone issues merit further evaluation and discussion
- Current data on truck volumes, use, and connectivity should be used to develop the network

The FMP includes strategies and actions intended to improve safety, the parking and loading of goods, and congestion (described in Chapter 5), and an updated freight network map provide better access to neighborhood business districts (shown in Chapter 4).

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## SEATTLE'S FREIGHT ASSETS

Seattle's freight infrastructure is key to maintaining economic and locational competitive advantage in the region, the nation, and the world. Keeping goods moving efficiently is not just vital for Seattle's economy, but also for the region, Washington state, and other parts of the country, specifically, Alaska. Our waterway, rail, air, pipeline, and roadway infrastructure is critical to support freight logistics and shipping.

As stated in the introduction, the FMP focuses on goods movement by truck, as that is the mode the City has the most ability to influence. However, our ability to provide reliable truck travel to and from the region's port facilities, airports, and intermodal terminals is critical to the city's livability and economic health. Our freight assets are detailed in this section, and include:

- Seattle's roadway network
- Waterways and the Port of Seattle
- Railroads and intermodal facilities
- The Olympic Pipeline

## Seattle's Freight Roadway Network

Nearly all of the streets under the City's jurisdiction, whether designated for freight or not, are used by trucks picking up and delivering goods. The City has an existing network of arterial streets that accommodate freight movements throughout the city and connect major freight generators. These are designated as Major Truck Streets (MTS), shown in Figure 2-5.

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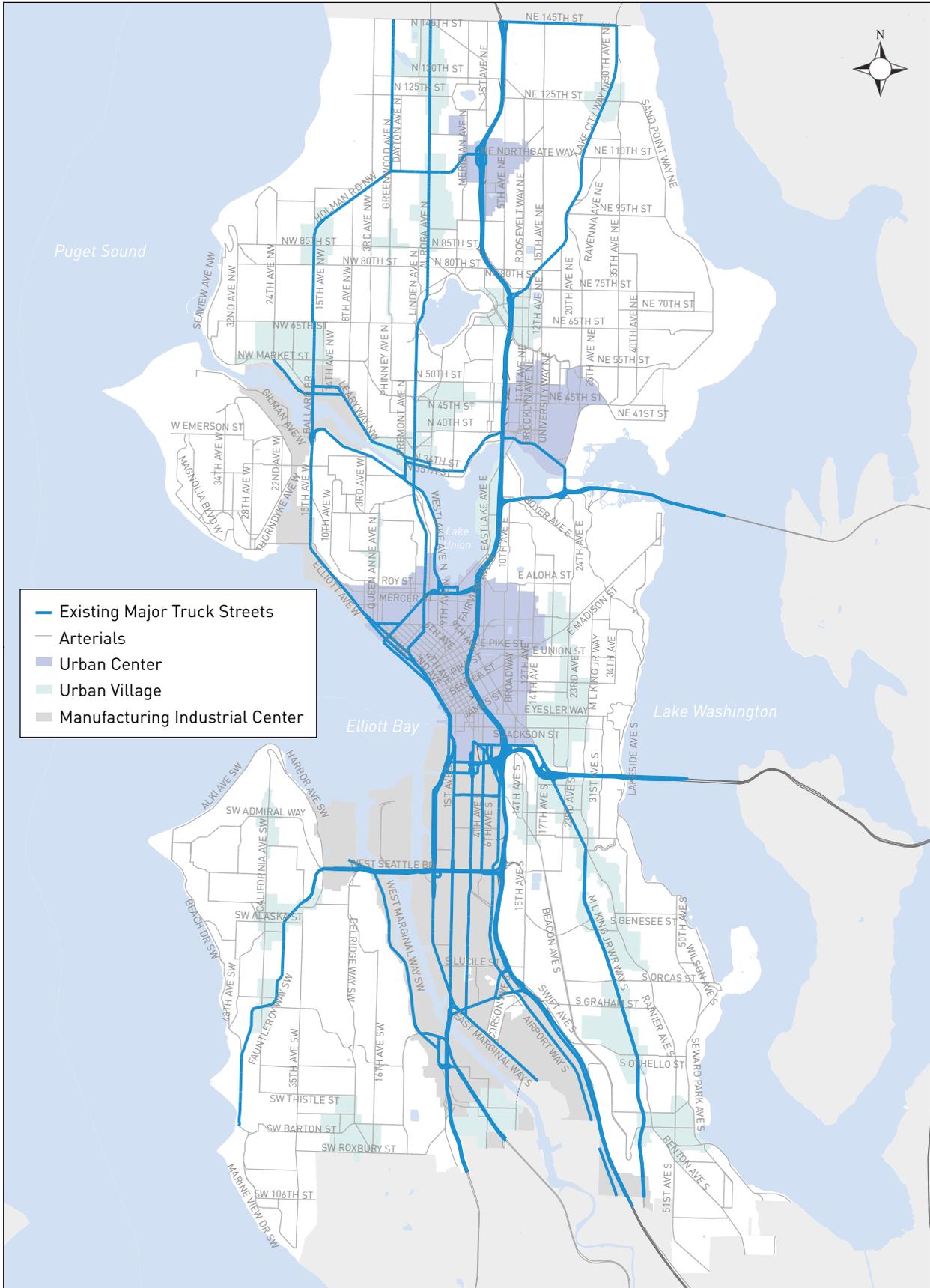
## The Olympic Pipeline

The Olympic Pipeline is a 400-mile interstate pipeline system that transports gasoline, diesel, and jet fuel from 4 Puget Sound refineries to Seattle's Harbor Island, Seattle-Tacoma International Airport, Renton, Tacoma, and Vancouver, Washington, and Portland, Oregon.

Source: [www.olympicpipeline.com/](http://www.olympicpipeline.com/)

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**FIGURE 2-5: EXISTING MAJOR TRUCK STREETS**



The MTS network was adopted as part of Seattle’s 2005 *Transportation Strategic Plan* (TSP), and as such, is incorporated into the city’s Comprehensive Plan. As described in the TSP, an MTS is defined as an “arterial street that accommodates significant freight movement through the City, and connects to and from major freight traffic generators.” State routes and highways are also included in the network.

### Over-Legal and Heavy Haul networks

Supplementing the MTS, and distributed throughout the city, are specific routes that provide for oversized and overweight trucks, referred to as “over-legal.” Permits are required to operate these vehicles on designated over-legal streets.

The over-legal network is shown on Figure 2-6. In general, these routes can accommodate trucks with larger loads that require a 20-foot-wide by 20-foot-high envelope, although specific segments may not handle both excess width and height dimensions.



Every vehicle that meets the over-legal specifications, which includes an exceedance of the maximum weight, height, width, and/or length (as specified by state and city laws) is required to obtain a permit to transport goods using the city’s street network.

In October 2015, the City of Seattle approved legislation (Ordinance 124890) that established a Heavy Haul network of city streets to allow heavier cargo containers to be transported between the Port of Seattle, industrial businesses, and rail yards with appropriate permits. This new network is shown on Figure 2-7.

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### Heavy Haul Legislation

The heavy haul legislation comes with more than just roadway designations. The measure also provides a framework and funding to repair and build roadways within the network, calls for semi-annual safety inspections of heavy haul trucks, and aligns city weight regulations with those of the state and other municipalities across the country. The over-legal permitting system was difficult for freight providers to adhere to, and it resulted in many violations. While there is also a permitting process to use the heavy haul network, and weight restrictions still apply, the process is greatly simplified and the amount of violations has noticeably decreased. Costs of the measure will be shared by the City and the Port of Seattle.

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FIGURE 2-6: OVER-LEGAL NETWORK

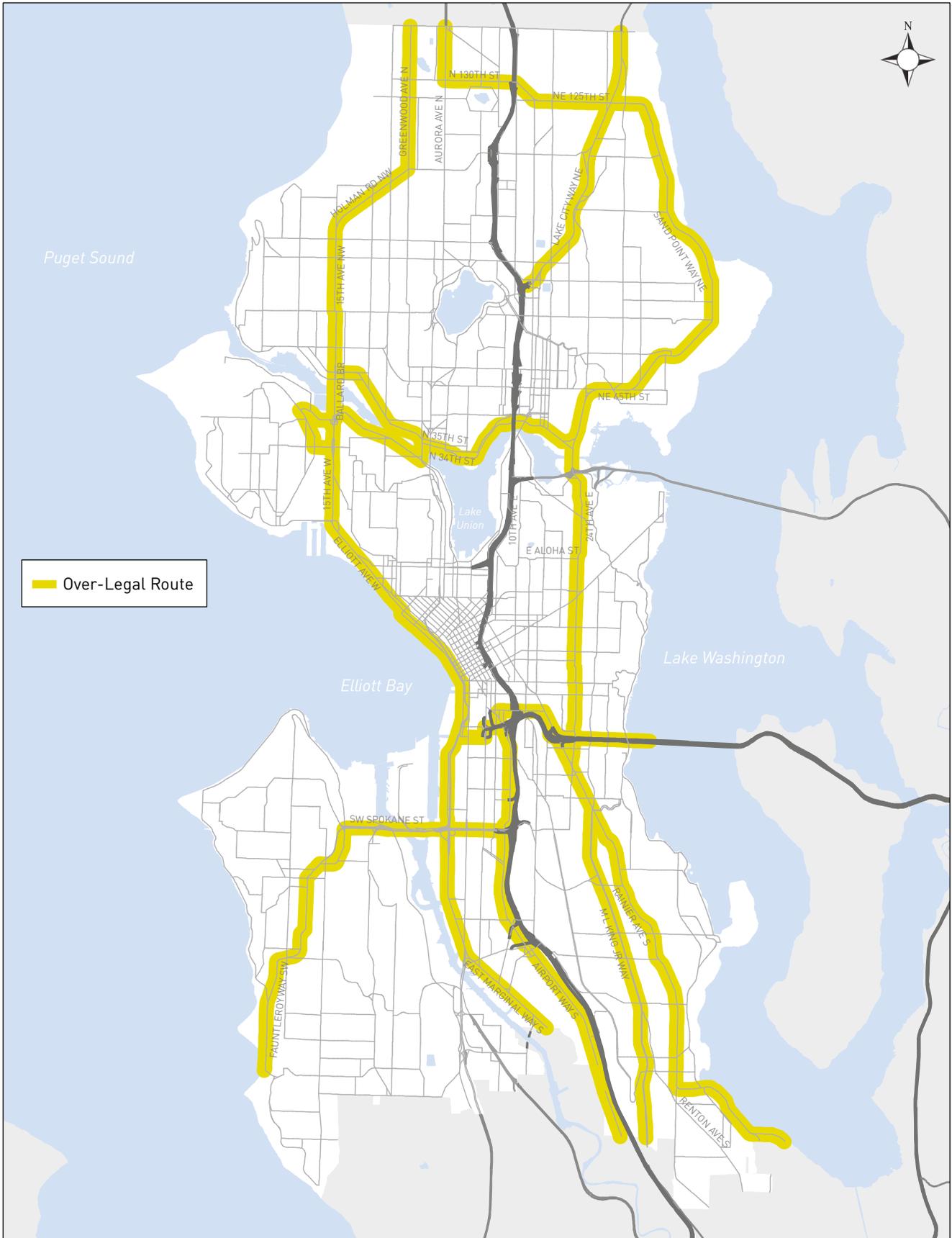
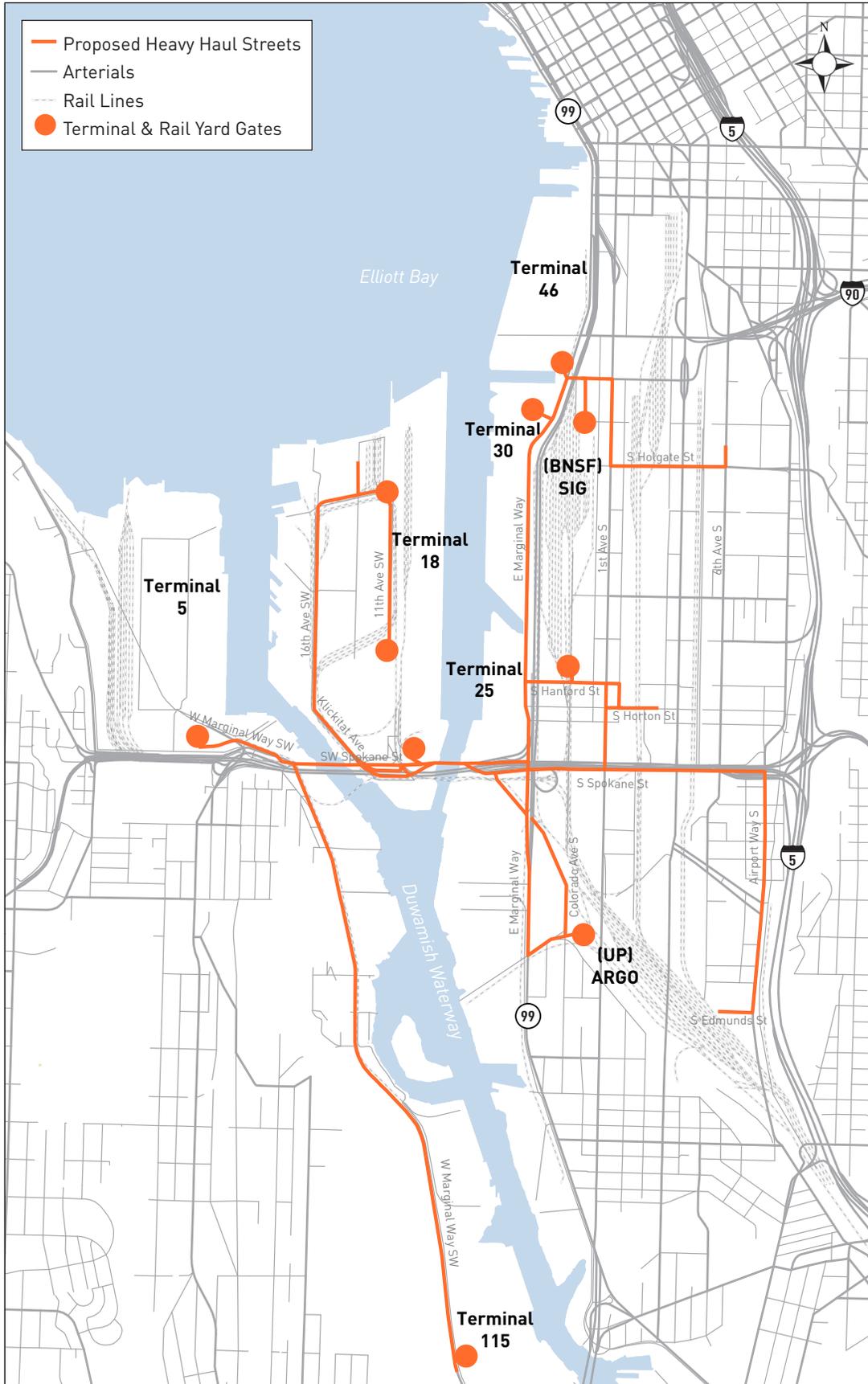
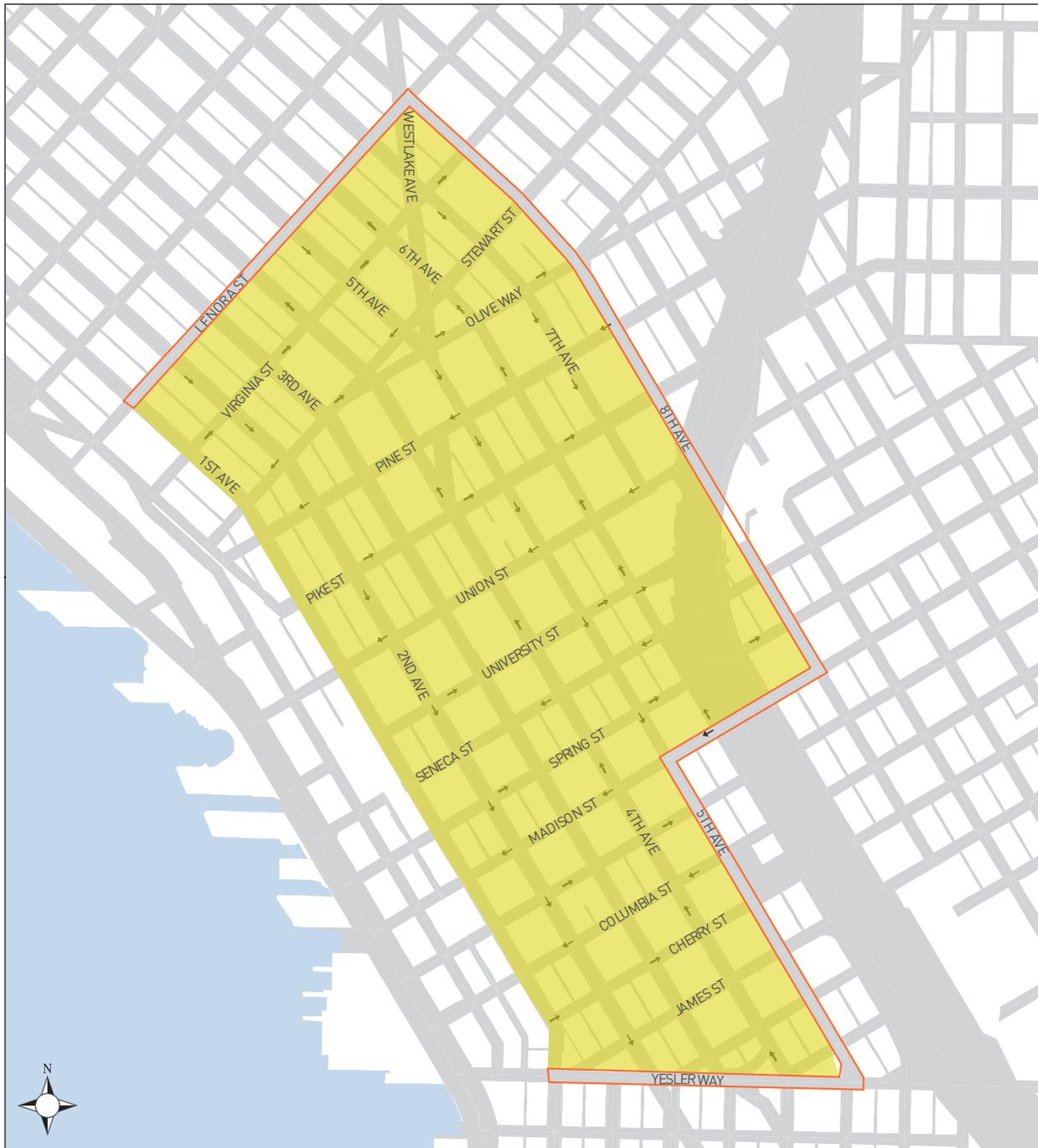


FIGURE 2-7: HEAVY HAUL NETWORK



**FIGURE 2-8: DOWNTOWN TRAFFIC CONTROL ZONE**



The Downtown Traffic Control Zone is depicted by the area shaded in yellow. Freight restrictions in this highly- congested area are necessary for traffic management (per Seattle Municiple Code 11.14.165).

Restrictions include:

- Vehicles over 30 feet in length are restricted Monday through Saturday between the hours of 6:00 AM and 7:00 PM. Special permission is required.
- Over-legal loads are not permitted in the Downtown Traffic Control Zone between the hours of 6:00 AM and 7:00 PM, Monday through Friday.
- Special permits must be obtained for any movement in this area.
- State permitted over-legal loads and vehicles must also obtain a special one-day permit for movement in the Downtown Traffic Control Zone.

### Downtown Traffic Control Zone

Due to heavy congestion, the movement of large trucks is restricted in the core of the city. In the Downtown Traffic Control Zone (shown in Figure 2-8), vehicles of 30 feet or longer may operate by permit on weekdays between 9 AM and 3 PM, and without a permit from 7 PM to 6 AM. Curfews are in effect from during weekday peak traffic periods (6 AM to 9 AM, and from 3 PM to 7 PM). With a permit, oversized loads may travel in the zone from 7 PM to 6 AM.

### Waterways and the Port

Historically, water transport has been the largest carrier of freight, as virtually any material can be moved by water.

Seattle is set along Elliott Bay, a natural deep-water port that has facilitated maritime activities throughout Seattle’s existence. The Duwamish Waterway, at the south end of Elliott Bay, is a hub of activity that supports cargo handling and storage, marine construction, ship and boat manufacturing, concrete manufacturing, paper

and metals fabrication, food processing, and other industrial uses.

The 8-mile Lake Washington Ship Canal connects the freshwaters of Lake Union and Lake Washington with the saltwater inland sea of Puget Sound through the Hiram Chittenden Locks. The locks accommodate a 20-foot water difference between the 2 bodies of water and are the largest and most heavily used on the West Coast.

The Port has numerous facilities throughout the city that are located on Puget Sound and other navigable waterways, as shown on Figure 2-9. Facilities include container terminals, general-purpose marine/cargo terminals, commercial and recreational moorage, industrial and commercial properties, a grain terminal, and cruise ship terminals. The Port also operates Fishermen’s Terminal and the Maritime Industrial Center along the Lake Washington Ship Canal. Fishermen’s Terminal provides freshwater moorage to the Northwest commercial fishing fleet.<sup>8</sup>



<sup>8</sup>Port of Seattle. Commercial Marine. [www.portseattle.org/Commercial-Marine/Pages/default.aspx](http://www.portseattle.org/Commercial-Marine/Pages/default.aspx).

The Seattle region's deep-water ports are an international gateway for imports and exports from the state's agricultural and manufacturing businesses. Cargo destined for, or originating in, the Pacific Northwest, including agricultural

products and supplies or products from manufacturing businesses, is mostly transported to the Port by truck. Goods traveling longer distances, such as agricultural products from the Midwest, predominantly come by rail.<sup>9</sup>



## THE NORTHWEST SEAPORT ALLIANCE

In August 2015, the ports of Seattle and Tacoma joined forces to unify their management of marine cargo facilities and business to strengthen the Puget Sound gateway and attract more marine cargo and jobs for the region. Their combined operations are now referred to as the Northwest Seaport Alliance (NWSA).

The NWSA promotes economic development of marine cargo terminal operations with unified business retention and recruitment, coordinated marine terminal planning and operations, and the ability for coordinated capital investments,

which will help to improve utilization of terminal capabilities and the opportunity to reduce operating costs. Much of the containerized cargo imported through these ports is transferred to and from rail at or near the port terminals for transport to the U.S. interior. This import system provides for infrastructure and lowers the cost of Washington state exports to the world.

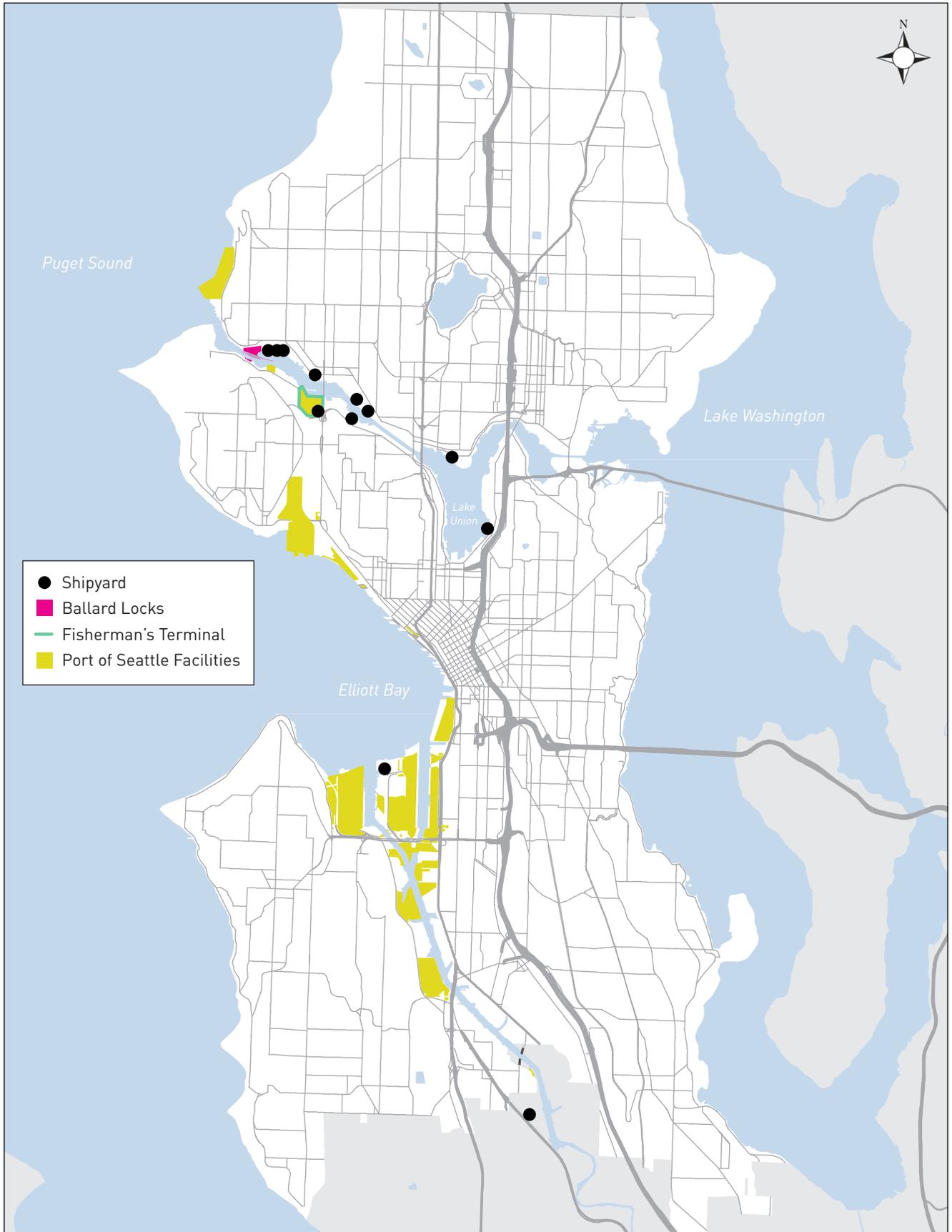
Source: The Northwest Seaport Alliance.  
[www.nwseaportalliance.com/about](http://www.nwseaportalliance.com/about).

Note: The 2 ports continue to own their own facilities. We refer to the Port of Seattle in this document, as we are focusing on the history and effects within the City of Seattle.

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<sup>9</sup>FHWA Freight Analysis Framework Database and WSP | Parsons Brinckerhoff analysis. September 2014. The Role of Freight in Seattle's Economy. p. 27-28.

FIGURE 2-9: SEATTLE'S MARITIME ASSETS



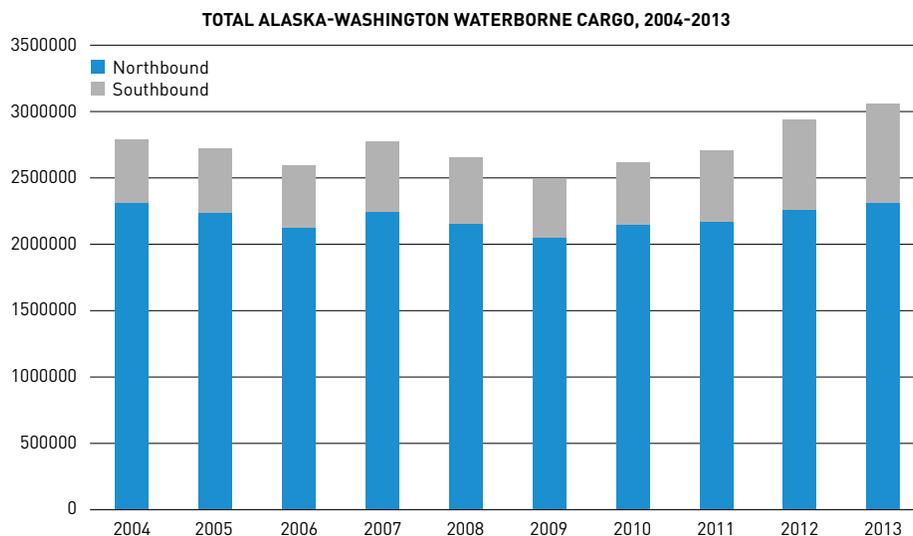
## Seattle-Alaska Freight and Port Connection

Alaska's distant-water commercial fishing fleet is based in Puget Sound, which has a significant local economic impact. Many ships are serviced and provisioned along the Lake Washington Ship Canal and at the Port of Seattle's Terminal 91. Alaska relies on Seattle-area barges to bring products and necessities to allow for Alaskan west coast livelihood. Many of the barge operations that service Alaska are located along the Duwamish River.

Shipments to Alaska from the Puget Sound include household and other consumer goods, construction materials, and a broad range of supplies and materials to support business and industry in Alaska. Figure 2-10 shows waterborne cargo between Alaska and Washington over the last 10 years. (While Puget Sound-specific data is not available, it can be assumed that the vast majority

of waterborne cargo transported between the 2 states moved through Puget Sound.) As shown, northbound cargo is 4 to 5 times higher than domestic imports from Alaska. Seafood accounts for the bulk of these southbound shipments, with lesser amounts of household goods, recyclables, and scrap materials comprising the remainder. Innovation in environmental sustainable practices by the local maritime industry has allowed the Washington and Alaskan fisheries to go from nearly endangered to some of the best managed in the world.

The fishing industry is not the only industry benefiting from the Seattle-Alaska connection. Cruise facilities located at Bell Street Pier and Smith Cove serve nearly 1 million passengers each year for cruises to Alaska. In total, each vessel call generates almost \$2.5 million for the local economy (Port of Seattle. 2015).



Source: McDowell Group. February 2015. Ties that Bind: The Enduring Economic Impact of Alaska on the Puget Sound Region, p. 14. [www.seattlechamber.com/docs/default-source/Events-and-Programs-Documents/ties-that-bind-report-feb-2015.pdf?sfvrsn=2](http://www.seattlechamber.com/docs/default-source/Events-and-Programs-Documents/ties-that-bind-report-feb-2015.pdf?sfvrsn=2).

## Railroads and Intermodal Facilities

Intermodal facilities are locations where freight transfers between travel modes, including port facilities, rail yards, and airports. Freight can transfer at these locations between ship and truck or railcar; between truck and plane; between truck and railcar; or sometimes from one rail carrier to another. Transfers between rail and plane can also happen, but are rare.

Within Seattle there are on-dock intermodal facilities at Port terminals, as well as facilities involved in rail intermodal shipments.

### Railroads

Two Class I railroads have railroad track networks in Seattle: the Burlington Northern Santa Fe Railway (BNSF) and the Union Pacific Railroad (UP). Class I railroads have a yearly operating revenue of \$475.75 million or more. BNSF operates two intermodal terminals in Seattle, the Balmer Yard and the Seattle International Gateway (SIG), as well as the South Seattle terminal in Tukwila. The BNSF mainline extends north-south through Seattle, and is in a doubled-tracked tunnel built in 1905 through downtown.

UP operates the Seattle Argo Terminal. The UP mainline only operates south of downtown and parallels BNSF. These are shown in Figure 2-11.

Railroads cooperate closely with marine/maritime-going freight. They are most competitive with long-distance trucking and barge transport.

### Airports

The King County International Airport (KCIA, or Boeing Field) is the only airport within the city's boundary, as shown on Figure 10. KCIA is the third-largest airport in the Pacific Northwest and the 29th ranking national airport for cargo. KCIA is a major economic center and supports



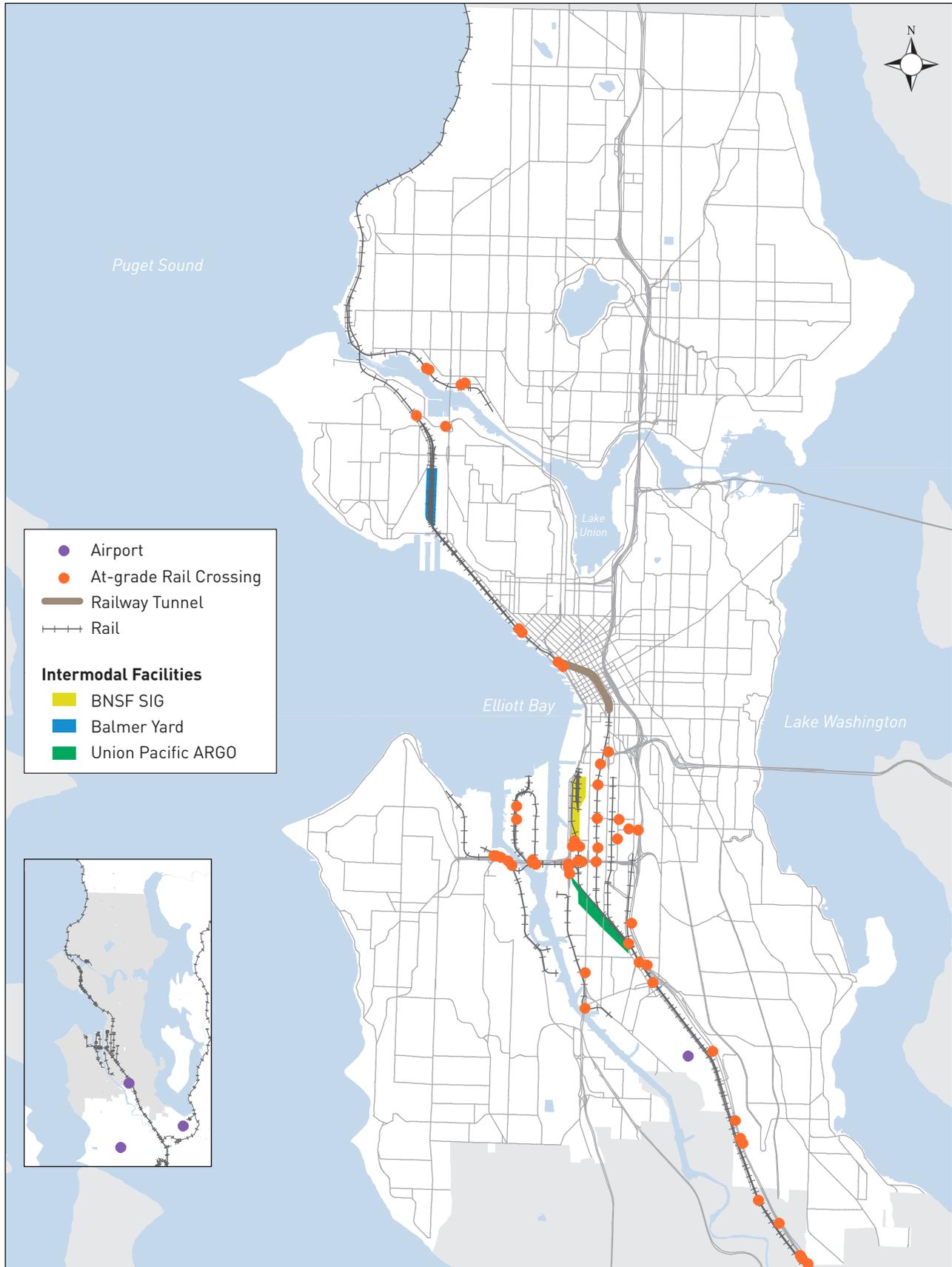
significant economic activity in terms of direct (5,100) and indirect (16,000) jobs with 150 companies located at the airport. The Boeing Company has been a central part of both KCIA's operations and the regional economy, and its presence attracts a significant number of auxiliary manufacturing businesses.<sup>10</sup> Several large air cargo carriers, including UPS and FedEx, also have facilities at or near the KCIA.

Two other airports, the Renton Municipal Airport and the Seattle-Tacoma (Sea-Tac) International Airport, are nearby to Seattle. In 2013, Sea-Tac was 21st in the nation in terms of total cargo volume, shipping 293,000 metric tons. High-value exports include commercial aerospace, high-tech manufacturing, fresh seafood products, and certain agricultural products (such as cherries and red raspberries to Asia).

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<sup>10</sup>King County Department of Transportation and King County International Airport - Boeing Field. August 2014. King County International Airport Strategic Plan 2014-2020.

FIGURE 2-10: RAIL, INTERMODAL AND AIRPORT FACILITIES



## EXISTING FREIGHT TRENDS

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Trucks carried \$334 billion of Washington State's total freight volumes, according to data released by the Federal Highway Administration (FHWA).<sup>11</sup>

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### How Truck Freight Moves Today

A significant proportion of the freight industry is reliant on our road network to transport goods. In 2011, 68.5% of freight tonnage and 80.7% of freight-related revenue in Washington was transported by truck.<sup>12</sup>

Further, nearly half of all goods exported from Seattle-region ports originate in Washington. Most of these goods travel to the ports via truck (44.2%) or rail (41.6%). The remaining 14.2% corresponds to pipeline, barge or ship, and mainly reflects crude petroleum activity. The Midwest accounts for the next largest origin of Seattle port exports and, given the longer distances, most of these arrive by rail.<sup>13</sup>

With so much of the Seattle economy reliant upon truck movements, our roadway infrastructure is critical to the local, regional, and state economy.

### Types of trucks

There are a variety of types of freight trucks traveling on our roadways, each with their own unique design characteristics. Truck characteristics that most influence the design of roads and other transportation facilities are weight and distribution over axles, dimensions (width and height), and turning radius.



The American Association of State Highway and Transportation Officials (AASHTO) has classified the most common sized trucks on U.S. roadways based either on the overall length of the vehicle (buses and single unit trucks) or vehicle wheel base (tractor-trailers). The classifications include:

- SU-30: 30-foot wheelbase, single-unit vehicles typical of most local delivery vehicles
- WB-40 and WB-50: small tractor trailers with wheelbases in the 40-foot and 50-foot range
- WB-67: 67-foot wheelbase long-haul trucks, sometimes called the interstate design vehicle, which have an overall length on the order of 74-feet

Figure 2-12 shows the typical dimensions of the most commonly used AASHTO design vehicles.

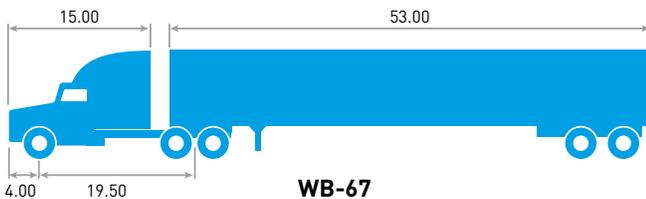
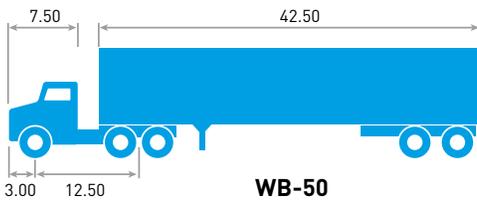
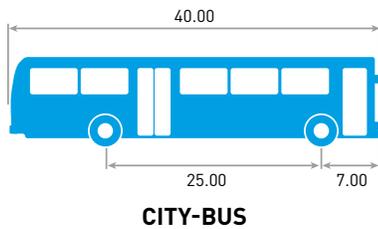
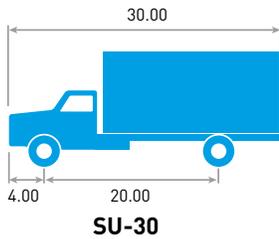
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<sup>11</sup>Bob Costello, Chief Economist, American Trucking Association. Washington State Freight Advisory Committee. May 2014. Washington State Freight Trends & Policy Recommendations or Air Cargo, Freight Rail, Ports & Inland Waterways, & Trucking. [www.fmsib.wa.gov/fac/20140602-FINALComplete%20Folio\\_for%20printer5-7-14.pdf](http://www.fmsib.wa.gov/fac/20140602-FINALComplete%20Folio_for%20printer5-7-14.pdf).

<sup>12</sup>Washington State Freight Advisory Committee. May 2014. Washington State Freight Trends & Policy Recommendations. [www.fmsib.wa.gov/fac/20140602-FINALComplete%20Folio\\_for%20printer5-7-14.pdf](http://www.fmsib.wa.gov/fac/20140602-FINALComplete%20Folio_for%20printer5-7-14.pdf)

<sup>13</sup>FHWA Freight Analysis Framework Database and WSP | Parsons Brinckerhoff analysis. September 2014. The Role of Freight in Seattle's Economy. p. 27-28.

**FIGURE 2-11: TYPICAL VEHICLE DESIGNS (AASHTO<sup>14</sup> CLASSIFICATIONS)**



### Existing truck volumes

SDOT has collected truck volume data at more than 620 locations on certain arterials for the past 4 years. This data has been instrumental in the development of the FMP network, and also used to create the City’s first truck volume map, shown in Figure 2-13. The map shows existing average daily truck volumes. Roadways with higher truck volumes have a correspondingly thicker line weight.

As shown in Figure 2-13, all major roads in Seattle carry some trucks, and many of them carry high volumes. For example, the following streets on the MTS network carry more than 1,500 trucks a day, which is considered a very high volume within the city:

- N 145th Street west of I-5
- 4th Avenue S in Duwamish MIC area
- West Marginal Way SW
- 1st Avenue S in Duwamish MIC area
- 15th Avenue W, south of the Ballard Bridge

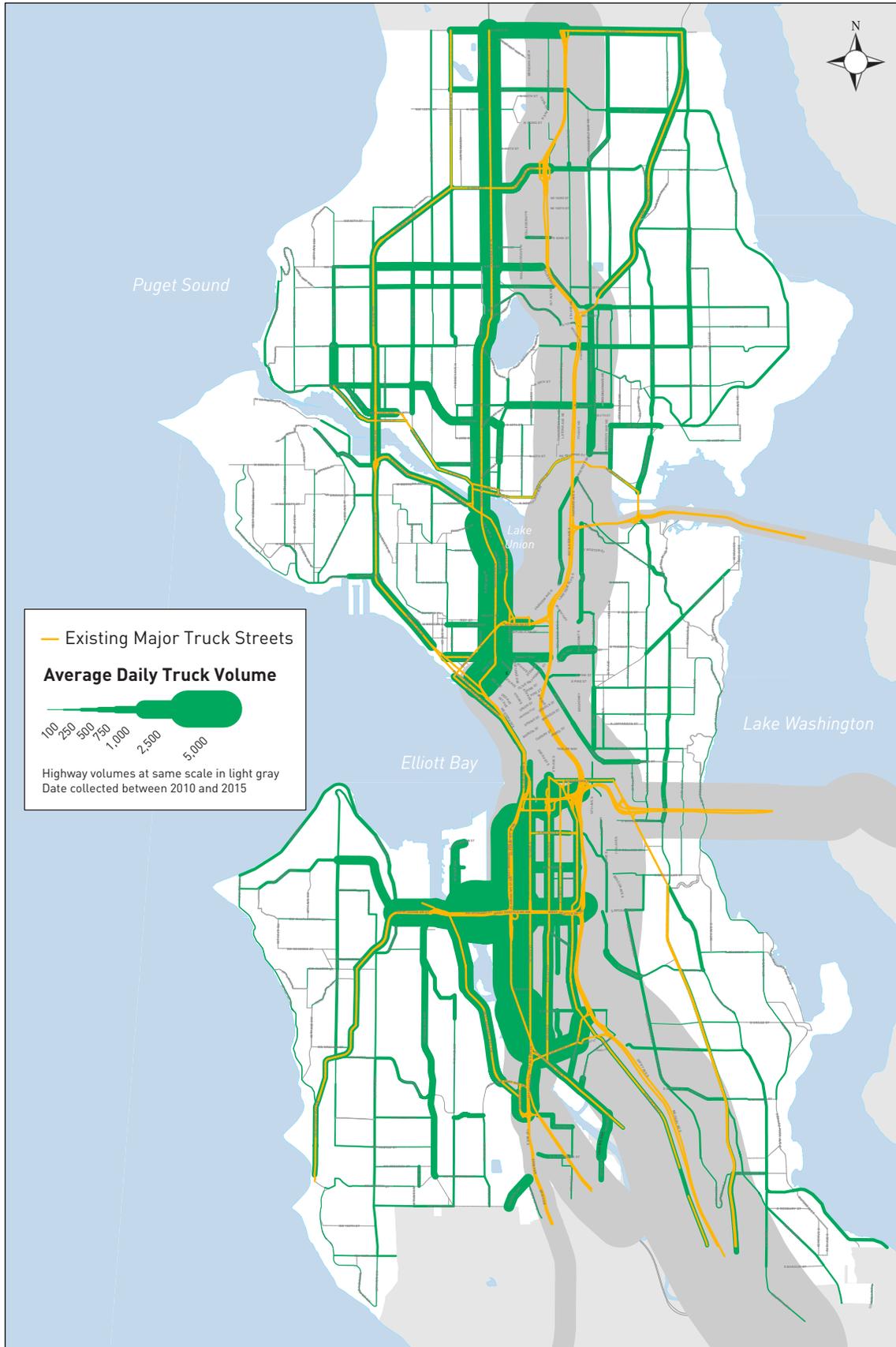
There are also a large number of streets that carry more than 1,000 trucks a day, which constitutes a high volume. Many of these connect logical freight destinations but are not on the current MTS, for example:

- 85th Street between SR 99 and 15th Avenue NW
- Fremont Avenue N, north of the Fremont Bridge
- E Olive Way, east of I-5
- N 50th Street, west of I-5

This mismatch between the volumes of freight and the old freight designation suggested that the current MTS network was in need of an update. The new proposed network and its rationale are described in Chapter 4.

<sup>14</sup>FHWA Freight Analysis Framework Database and WSP | Parsons Brinckerhoff analysis. September 2014. The Role of Freight in Seattle’s Economy. p. 27-28.

FIGURE 2-12: AVERAGE DAILY TRUCK VOLUMES ON SEATTLE'S ROADWAY NETWORK



City streets and residential neighborhoods with high volumes of truck size WB-40 and above experience a higher ratio of environmental and quality of life impacts. In dense, compact urban environments, large trucks can be intimidating for people walking and riding bicycles. Truck size and volumes were both considered when developing the network.

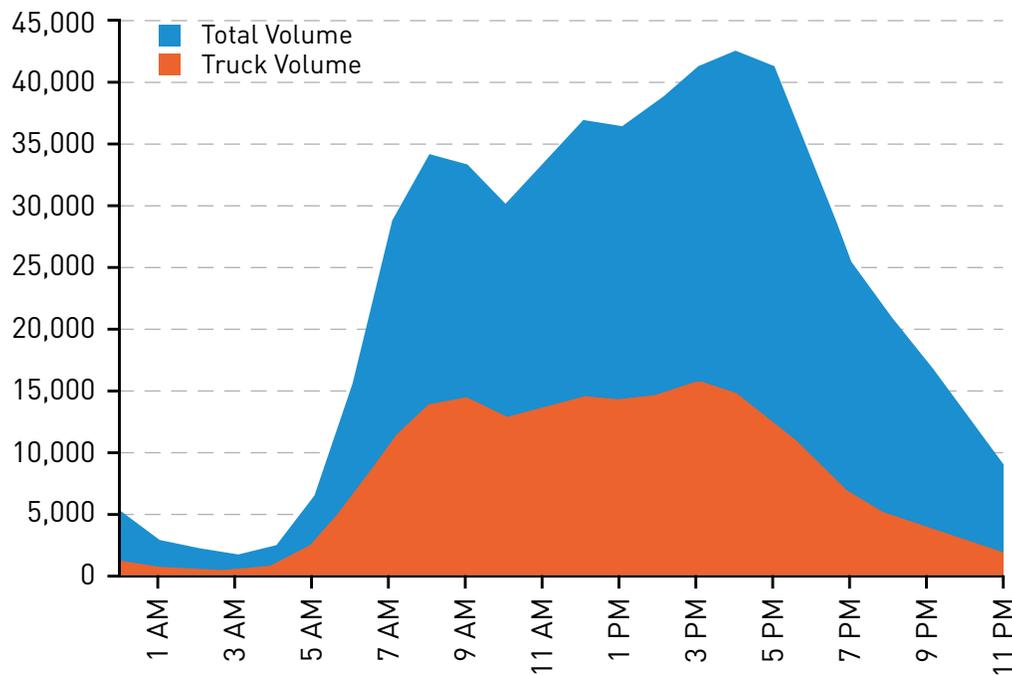
Time of day is also an important factor when looking at truck volumes. Truck volumes typically peak in the morning between 8 AM and 9 AM and stay relatively constant until the end of the evening rush hour period around 7 PM, as shown in Figure 2-14. This varies from non-truck volumes, which typically have a distinct morning and afternoon peak. The generally high overall truck traffic throughout the day is likely a result of trucks taking advantage of lower mid-day congestion levels combined with the large number and variety of freight-generating industries in Seattle that operate throughout the day.

Seattle-area shippers and receivers depend on trucks to provide timely, reliable service. As described, most roadways in the metro area experience some level of congestion, particularly in the morning and evening peak travel periods. This congestion increases cost and decreases reliability of truck freight service.

### How Rail, Water and Air Freight Moves Today

Freight traveling to or from railyards, seaports, and airports is often transported by truck, making effective integration between these other freight modes and trucks important in the overall freight chain. Understanding the demands and needs of these other freight modes allows us to better provide truck access and focus key infrastructure investments toward projects that facilitate mutual intermodal benefits.

**FIGURE 2-13: SEATTLE TRAFFIC PATTERNS BY TIME OF DAY**



Railroad freight transportation is typically used for longer-distance movements. For instance, rail is the principal mode of transportation for agricultural products originating in Minnesota and Illinois destined for export from Seattle's Port facilities. Rail is also primarily used to carry the majority of international imports from the Port facilities to other states.<sup>15</sup>

As such, the ports provide a gateway for national and regional goods movement, especially to and from Asian countries. Imports flow into the region and feed both local wholesale and retail trade portions of the supply chain, helping meet consumer and business demand. A significant share of waterborne imports is destined to U.S. inland regions. Whether to local regions or more distant locations, the cargo is moved by the local transportation service industry with employment and incomes contributing to the local economy.<sup>16</sup>

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In 2013, the Port of Seattle handled a total of 1.6 million 20-foot equivalent unit (TEU) containers. In the past 10 years, the ratio of TEUs per container has remained relatively steady at 1.74; therefore, the 2013 volume translates to roughly 900,000 full and empty containers.

Port of Seattle, 1st Quarter, Annual Operations Report. May 2014

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Keeping discretionary cargo moving through the Port of Seattle is not only important for global commerce, but it also benefits Washington's agriculture

industry. For example, ships bringing in imports from Asia provide capacity for agricultural products from Eastern Washington to be shipped back to Asia on the return trip. This activity translates to a substantial volume of freight trucks accessing the Port of Seattle facilities. In 2013, an average day at the Port of Seattle had about 2,700 trucks entering the 4 container terminals, which generated a total of 5,400 one-way truck trips per day.<sup>17</sup>

As discussed, virtually any material can be moved by water, but water transport becomes impractical when materials need to be delivered quickly. The use of air freight can create competitive advantages, such as much shorter transit times. Air freight carriers provide shipping for commodities that usually have high values per unit or are very time-sensitive. In 2010, 60,000 tons of air cargo were imported through the Seattle region.<sup>18</sup>

## FUTURE FREIGHT TRENDS

This section explores freight industry trends and how growth will affect reliability of our roadway and other freight networks. How people shop, new technologies, and how we are responding to climate change are all radically transforming how freight moves. We need to understand these trends in order to plan an effective transportation system.

### Speed to Market

Speed to market is one of the most important factors in supply chain design and execution, as it influences mode selection by commodity type. There are profound changes occurring in the supply chains and logistics systems used to get goods to consumers, including electronic markets and direct delivery.

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<sup>15</sup>2012 FHWA Freight Analysis Framework Database and WSP | Parsons Brinckerhoff analysis. December 2014. The Role of Freight in Seattle's Economy.

<sup>16</sup>2012 FHWA Freight Analysis Framework Database and WSP | Parsons Brinckerhoff analysis. December 2014. The Role of Freight in Seattle's Economy.

<sup>17</sup>Port of Seattle, 1st Quarter, Annual Operations Report. May 2014.

<sup>18</sup>FHWA. 2015. Freight Management and Operations. Freight Analysis Framework. [http://ops.fhwa.dot.gov/FREIGHT/freight\\_analysis/faf/index.htm](http://ops.fhwa.dot.gov/FREIGHT/freight_analysis/faf/index.htm).

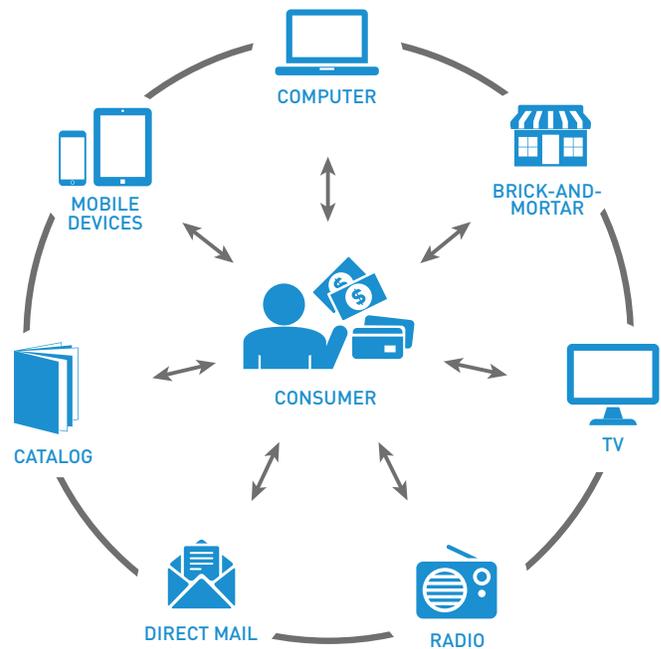
Urban delivery services have been challenged by just-in-time (JIT) deliveries, which have led freight business deliveries to make more efficient trips with smaller shipments and vehicles to dense mixed-use areas.<sup>19</sup> The costs of a missed delivery due to congestion, road closures, or other reasons are high given the JIT nature of production. Any delay slows the entire assembly process or can leave store shelves without stock.

## Retail Trends

The way retail goods are transported is shifting as online shopping, also known as e-commerce, has changed how people are buying goods and services and searching for the best price. People increasingly purchase online and have goods delivered directly to their home, rather than buying from a traditional brick-and-mortar store. The competition between traditional and online retailers has resulted in a further trend called “omni-channel” retail. Omni-channel retail provides the consumer with the ability to shop through many possible methods, including mobile devices, computers, brick-and-mortar, television, radio, direct mail and catalog. This shift is intensifying the trend to smaller shipments throughout the city.

E-commerce is influencing logistics approaches for goods providers, such as Macy’s and Home Depot. Macy’s, for example, has begun operating 500 of its stores as mini-distribution centers for e-commerce.<sup>20</sup> These storefronts not only provide goods for those shopping on location, but also serve as a mini-warehouse for goods purchased online by consumers for delivery. Combined distribution approaches and merging of the fulfillment cycle can be used to maximize customer flexibility and offer a competitive

## OMNI-CHANNEL RETAIL



advantage. Already customers can order products online and pick them up in stores. Alternatively, a customer might view and purchase a product in store, then have the product delivered to their home on the same day.

Other potential future trends could contribute to an increase in the types of delivery vehicles. Transportation network companies (e.g., Uber and Lyft) that move people also have an interest in transporting goods as their vehicles move about cities. In addition, the advent of driverless vehicles could result in an increase in delivery trips if total costs decline as a result of reductions in labor (driver) costs. Delivery of products using bicycle fleets has also increased in cities, allowing fast and reliable service where vehicle congestion hinders truck movement.

<sup>19</sup>National Cooperative Freight Research Program. January 2012. Report 14. Understanding Urban Goods Movement. [http://onlinepubs.trb.org/onlinepubs/ncfrp/ncfrp\\_rpt\\_014.pdf](http://onlinepubs.trb.org/onlinepubs/ncfrp/ncfrp_rpt_014.pdf).

<sup>20</sup>Antonio Regalado. November 2013. MIT Technology Review. It's all e-commerce now. [www.technologyreview.com/news/520786/its-all-e-commerce-now/](http://www.technologyreview.com/news/520786/its-all-e-commerce-now/).

As a result, truck transportation patterns and truck size and type are likely to change, while the total volume of goods moved will likely rise along with increasing consumer demands for goods. Distribution centers may shift from national or larger regions to smaller geographies. This could reduce the proportion of long distance trips and increase the proportion of shorter trips. In any case, we are likely to see more small trucks or other vehicles making deliveries in our neighborhoods.

### Fuel Costs and Advances in Vehicle Technology

The cost of fuel is a significant proportion of many freight provider’s operating costs. With increasing variability and spikes in fuel costs, there have been significant advances in vehicle technology. Rising fuel costs and new technologies are affecting modal decisions today, and these trends are anticipated to continue into the future.

About half the annual cost of operating an aircraft is attributed to the cost of fuel. Therefore, as oil prices increase, which they are anticipated to do over the next few decades, air cargo freight will likely grow at a slower rate than other freight modes. Also, there will likely be a shift to air freight increasingly incorporated into multimodal supply chains that offer a better balance between cost and time. Still, according to Boeing’s forecast of air cargo freight for the Seattle area, air freight is expected to continue to grow at rate of 3% to 5% (tripling) over the next two decades.<sup>21</sup>

Both rail and truck freight providers are seeking ways to make their fleets more efficient. UPS is making substantial financial and operational investments in liquid natural gas (LNG) vehicles and infrastructure in the United States. The company Freewheel uses a bicycle fleet to deliver goods to local businesses in Seattle, and partnered with Amazon to pilot bike delivery



UPS CARGO CRUISER, SOUCE: [WWW.FLEETSANDFUELS.COM](http://WWW.FLEETSANDFUELS.COM)

<sup>21</sup>Washington State Freight Advisory Committee. May 2014. Washington State Freight Trends & Policy Recommendations or Air Cargo, Freight Rail, Ports & Inland Waterways, & Trucking. [www.fmsib.wa.gov/fac/20140602-FINALComplete%20Folio\\_for%20printer5-7-14.pdf](http://www.fmsib.wa.gov/fac/20140602-FINALComplete%20Folio_for%20printer5-7-14.pdf).

within a day and within an hour in urban centers. Amazon is also testing drones, and submitted an official request to the Federal Aviation Administration (FAA) for their use. BNSF and UP railways recently invested in locomotives that are more fuel efficient. BNSF has also invested in fuel-efficient technology at its intermodal facilities.<sup>22</sup> These investments lower their day-to-day operational costs, which in turn, allows them to reduce transporting costs. It is possible that, as the rail industry becomes more efficient, it may become an even more prominent long-distance transport alternative to trucking or barging.

The emergence of connected and automated freight vehicle technology will increase the safety and, to a smaller degree, the efficiency of trucking in the short term. For safety and reliability reasons, these technologies are expected to be in wide use in the freight industry soon. Technologies available today include automatic and emergency braking, evasive steering support, and traffic jam assist. Other technologies are in testing and their release is anticipated in the near future.

## Climate Change

Seattle will be affected by climate change. The most significant changes projected in the Pacific Northwest will be to temperature, precipitation, and sea level.<sup>23</sup> The 2012 Seattle Community Greenhouse Gas Emissions Inventory found that road transportation contributed the largest share of Seattle's core emissions at 64%. Of that percentage, freight contributed 19%.<sup>24</sup> Seattle's Climate Action Plan offers recommendations to reduce freight emissions by increasing the efficiency of the roadway, minimizing congestion, decreasing passenger vehicle trips, and supporting programs that promote cleaner trucks.<sup>25</sup>

The support of alternative freight modes, such as bicycle delivery, may increase to deliver goods in dense, congested areas of the City. Bicycle deliveries produce zero emissions, are nimble, accommodate loads of up to 300 pounds per unit, and have few parking challenges during delivery. The maintenance and operational costs of bicycle delivery fleets are also lower than for trucks.

The need for a resilient transportation system and infrastructure will be crucial to allow for disaster relief and response to extreme events. If an extreme event were to occur and damage a major roadway, traffic would shift to already overloaded infrastructure. There are more than 900 bridges within the city of Seattle. Over 149 of them are maintained by the City. Damage to these would impair emergency services and the economy. As it is, during high-heat times, steel expands, which can damage some older structures, and SDOT must cool its 3 bascule bridges to ensure that they can be opened and closed.

Climate change considerations will weigh in our planning for freight facilities and infrastructure, and will help us address effects on communities impacted by higher freight volumes.

## Future Truck Freight Volumes

As stated earlier, the number of people and jobs in Seattle is expected to grow substantially by 2035. Forecasts indicate an anticipated 22% increase in total citywide employment between 2014 and 2035.

Growth in population and employment suggests that we can expect a corresponding increase in demand for goods movement within Seattle. In fact, employment in high freight-generating sectors of wholesale and retail trade are expected

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<sup>22</sup>BNSF. BNSF and the Environment. [www.bnsf.com/communities/bnsf-and-the-environment/](http://www.bnsf.com/communities/bnsf-and-the-environment/).

<sup>23</sup>City of Seattle. Office of Sustainability and the Environment. Adaptation Planning. [www.seattle.gov/environment/climate-change/adaptation-planning](http://www.seattle.gov/environment/climate-change/adaptation-planning).

<sup>24</sup>City of Seattle. April 2014. 2012 Seattle Community Greenhouse Gas Emissions Inventory. [www.seattle.gov/Documents/Departments/OSE/2012%20GHG%20inventory%20report\\_final.pdf](http://www.seattle.gov/Documents/Departments/OSE/2012%20GHG%20inventory%20report_final.pdf).

<sup>25</sup>City of Seattle. June 2013. Climate Action Plan. [www.seattle.gov/Documents/Departments/OSE/2013\\_CAP\\_20130612.pdf](http://www.seattle.gov/Documents/Departments/OSE/2013_CAP_20130612.pdf).

to grow even faster than other industries, or 64%, during the same period. These local employment trends translate into a compounded annual growth rate of slightly less than 2% for freight within the region between now and 2035.<sup>26</sup> National and international trade forecasts project total freight tonnage from, to, and within the Seattle region to grow 2.2% per year through 2040.<sup>27</sup>

Considering local and global trends together, this plan assumes a 2% average annual growth in freight volumes on Seattle streets. We developed different growth rates for various areas within Seattle based on the location of employment in freight-generating industries. Depending on their location, this approach assigned growth between 1.0% and 2.5% to most streets within the city. Streets within the immediate vicinity of Port terminal facilities were assigned a 3.5% a year growth rate and regional roadways were assigned

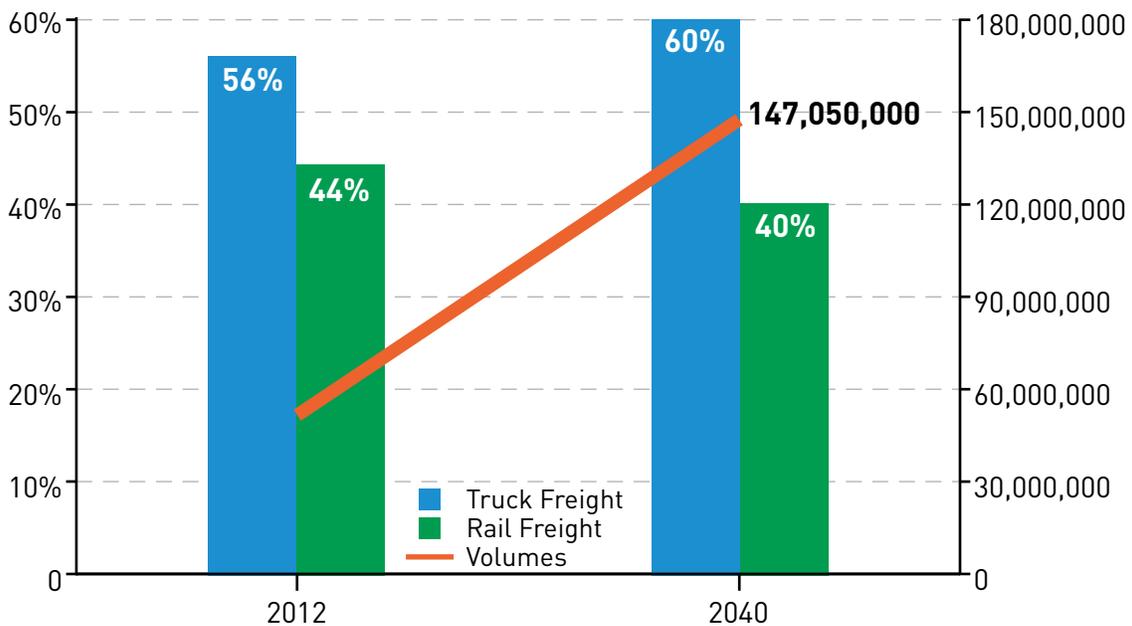
growth based on the PSRC regional travel model. Future volumes are shown in Figure 2-15.

The majority of highways and major arterials in the city experience congestion in the morning and evening peak periods today. Current travel forecasts show traffic congestion worsening throughout the city in the future. Additional roadways will exceed capacity in the future, and traffic delays will spread to other times of day and parts of the city. As congestion worsens citywide, goods movement will become more challenging, both in terms of mobility and travel time reliability.

### Future Rail, Maritime and Air Volumes

Like truck freight, rail, maritime, and air freight will also continue to grow into the future.<sup>28</sup> Increased oil prices could slow the growth in air cargo freight. However, a tripling of air freight is anticipated in the Seattle area over the next 20 years.<sup>29</sup>

**FIGURE 2-14: FREIGHT VOLUMES ASSOCIATED WITH INTERNATIONAL TRADE, 2012 AND 2040<sup>32</sup>**



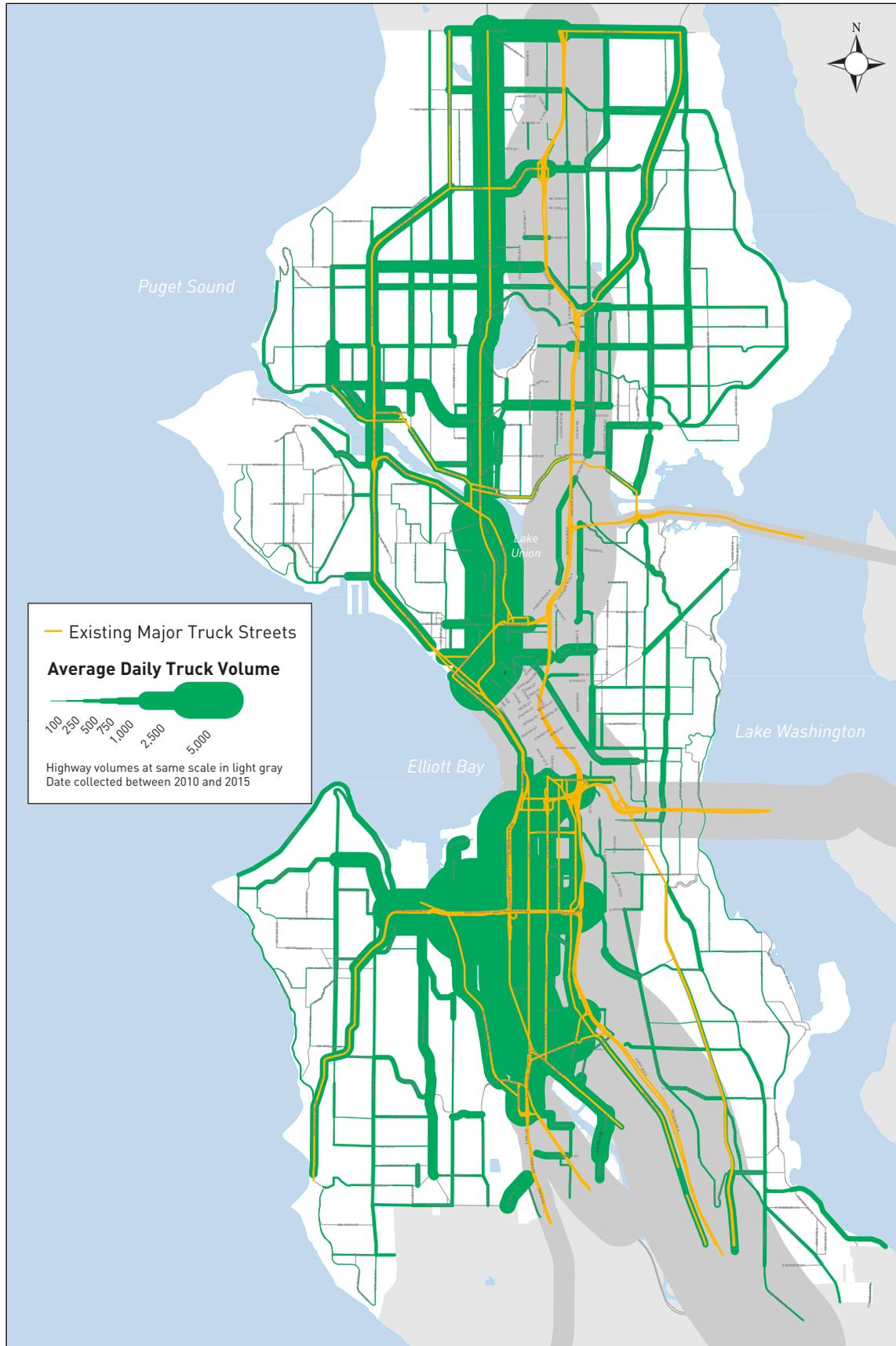
<sup>26</sup>WSP | Parsons Brinckerhoff. December 2014. The Role of Freight in Seattle’s Economy.

<sup>27</sup>FHWA. 2015. Freight Management and Operations, Freight Analysis Framework. [http://ops.fhwa.dot.gov/FREIGHT/freight\\_analysis/faf/index.htm](http://ops.fhwa.dot.gov/FREIGHT/freight_analysis/faf/index.htm).

<sup>28</sup>FHWA Freight Analysis Framework data.

<sup>29</sup>Washington State Freight Advisory Committee. May 2014. Washington State Freight Trends & Policy Recommendations or Air Cargo, Freight Rail, Ports & Inland Waterways, & Trucking. [www.fmsib.wa.gov/fac/20140602-FINALComplete%20Folio\\_for%20printer5-7-14.pdf](http://www.fmsib.wa.gov/fac/20140602-FINALComplete%20Folio_for%20printer5-7-14.pdf).

FIGURE 2-15: FUTURE AVERAGE DAILY TRUCK VOLUMES ON SEATTLE'S ROADWAY NETWORK



Rail and truck freight movements are the most competitive of modes. While rail freight is expected to grow in the future, an increasing share of the volume of imports and exports through the Seattle area transported by rail is projected to shift to truck.<sup>30</sup> Figure 2-16 shows that freight imported or exported through our ports will triple between 2012 and 2040. During that same timeframe, the shares of freight transported by truck will increase in relation to rail. However, while the share of total freight imports and exports that is handled by rail will decrease, rail is still projected to carry more than double the amount of freight in absolute volume by 2040 than it carries today.

With freight rail use increasing, at-grade rail crossings will be closed more and more frequently. Today, between 65 and 85 rail movements occur each week day on the BNSF mainline at-grade rail crossings in the South Downtown (SODO) neighborhood. Based on expected growth in rail freight, one can easily assume that this number could double by 2040.

## CONCLUSION

Seattle's expected population and employment growth and the associated demand for freight and goods movements will put additional stress on our transportation system and the relevance of sustaining freight mobility. With the substantial growth in truck volumes projected in the coming years, traffic congestion experienced today during the peak periods will worsen and spread into other times of day. With a vast truck freight network (including intermodal facilities) within the city limits, the City has the ability to enhance the local and regional network performance with targeted investments in the truck freight system.

Global climate change is also a real threat to the city's transportation system. The ability of the freight industry to respond and adjust to environmental changes will be critical to economic stability. Further, the continued innovation within the transportation industry toward more sustainable technologies and less reliance upon fossil fuels will help Seattle reduce its overall impact on the environment.

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<sup>30</sup>FHWA Freight Analysis Framework data and WSP | Parsons Brinckerhoff analysis. December 2014. The Role of Freight in Seattle's Economy.