Portland Harbor
Marine Cargo Forecast
FINAL REPORT

PREPARED FOR

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Chapter 1. Executive Summary

Overview

The following forecast of marine cargo in the Portland Harbor was developed for the Port of Portland, to be used as input to the updated Economic Opportunities Analysis currently in development by the City of Portland. The goal of the Economic Opportunities Analysis is to evaluate the demand and supply of industrial land to meet future needs.

Cargo Overview

Portland is home to one of the four large port complexes on the Lower Columbia River, and provides public and private terminal space to a wide array of commodities.

Waterborne traffic on the Lower Columbia has exhibited a long history of growth, growing from approximately 11 million metric tons in 1964 to nearly 51 million metric tons in 2018, including growth of more than 15 million tons between 2000 and 2018.

Most of this growth was due to increased exports to foreign trade partners. Foreign exports grew from 4.3 million metric tons and 38% of the total volume in 1964, to nearly 44 million metric tons and 86% of the total volume in 2018.

Terminal Development

Prior analysis revealed that 1,297 acres of marine terminal facilities were developed on the Lower Columbia River between 1974 and 2010, a rate of approximately 36 acres per year. Since 2010, port development has continued, focusing on improvements at existing facilities as well as on the planning and development of new facilities.

Cargo Forecasts

The cargo forecasts presented in this analysis are unconstrained, which assumes that the infrastructure will be in place to handle the projected volumes when needed. The forecast process involved projecting cargo volumes for the Pacific Northwest, and then allocating these volumes to four sub-regions (i.e. Columbia River Oregon, Columbia River Washington, central Puget Sound, and Other Puget Sound/Washington Coast) based on historical market shares. In some cases adjustments were made to market share to account for short-term anomalies.

Forecasts were produced for six cargo handling groups (i.e. grain, other dry bulks, autos, breakbulks, liquid bulks, and containers). For each of the handling groups three forecasts are presented, including a reference case (i.e. base case), as well as a low and a high forecast. The high case for each handling type includes cargo volumes related to projects that are currently in the permitting process. For example, the high forecast for Other Dry Bulks includes the coal volumes associated with the proposed Millennium Bulk Terminal in Longview.

It should be noted that projecting cargo volumes for 2020 is particularly difficult, due to the impacts of tariff wars and the Covid 19 virus outbreak. The forecasts assume that both of these issues will resolve in the long run, and that by 2030 trade volumes will recover to their long-term trends.

Summaries of the forecast volume in 2040 for each commodity group include the following:

- Grain exports moving through Portland are projected to be between 5.3 million metric tons and 11.1 million metric tons, with a reference case volume of 6.9 million metric tons.
- Other dry bulks
    - Imports under all three forecast scenarios are projected to grow in the long run. Under the reference case, imports are projected rise from approximately 1.7 million metric tons in 2018 to 2.1 million metric tons in 2040. The projected low case is for minimal growth, while the high case projects 2.3 million metric tons of imports.
    - Exports are projected to grow under the reference and high cases, and to fall under the low case. Under the low case exports fall from 7.4 million metric tons to 4.1 million metric tons, while under the reference case they rise to 9.4 million metric tons and under the high case to 13.0 million metric tons.
- Autos
    - Imports are projected to grow from approximately 260,000 units in 2018 to approximately 330,000 units under the reference case and 370,000 units under the high case. Under the low case, import volumes are projected to drop slightly by 2040, to 255,000 units.
    - Exports are projected to rise faster than imports, and to grow from 54,000 units in 2018 to between 152,000 and 220,000 in 2040, with a reference case of 195,000 units.
- Breakbulks
    - Import breakbulk volumes are projected to grow substantially by 2040 under both the reference and high forecast. The low forecast projects little to no growth, while under the reference case volumes climb from less than 10,000 metric tons to 380,000 metric tons, and under the high forecast they jump to 820,000 metric tons. The reference and high cases assume that a portion, or all, of the EVRAZ steel shifts back to Portland from Vancouver.
    - Export breakbulk volumes are projected to climb from 16,000 metric tons to 74,000 metric tons under the reference case, 67,000 metric tons under the low case, and 80,000 under the high case.
- Liquid bulks
    - Waterborne movements of refined petroleum products are projected to range between 1.8 million metric tons and 2.4 million metric tons in 2040, with a reference case of 2.1 million metric tons.
    - Crude oil movements are not projected to move into or out of Portland terminals in 2040. This does not include the possibility of existing petroleum products terminals being re-purposed for shipments of crude oil, as there is no public information available regarding potential volumes.

  - Other liquid bulks are projected to move in smaller volumes, dropping from approximately 262,000 metric tons in 2018 to 224,000 under the low case, and rising to 355,000 metric tons under the reference case and to 412,000 metric tons under the high case.

- Containers
  - Under the low case Portland does not maintain ocean container service in the long run. Under the reference forecast volumes grow to approximately 58,000 TEU in 2040, and under the high case volumes grow to 67,000 TEU.
- Rail intermodal service for containers is expected to grow under all three forecast scenarios, growing from 67,000 TEU in 2018 to between 95,000 and 125,000 TEU, with a reference case of 107,000 TEU.

Chapter 2. Overview

Purpose

The City of Portland is updating the Economic Opportunities Analysis, which evaluates the demand and supply of industrial land to meet future needs. The Port of Portland is assisting the City by commissioning an update of the marine cargo forecast for the Portland Harbor. The scope of work included updating forecasts for marine cargo terminals for the years 2020, 2030, and 2040 including a reference case (i.e. base case), as well as a low and a high forecast, for each cargo handling group.

Methodology

The analysis included the following steps:

- Revision of cargo growth projections since last forecast.
- Recalibration of forecast to historical cargo flows (through latest available year).
- Update of marine cargo forecast based on the *2017 Marine Cargo Forecast and Rail Capacity Analysis (2017 Marine Cargo Forecast)* and other recent forecasts.[1]

This *2017 Marine Cargo Forecast* was the most recent regional marine cargo forecast completed. This report provided a forecast through 2035, using 2014 trade data as the most recent year. The analysis included separate projections of waterborne cargo on the Lower Columbia River in Oregon and the Lower Columbia River in Washington, as well as for other Washington regions. The current forecast used the *2017 Marine Cargo Forecast* growth rates as a starting point, and projected cargo volumes through 2040 using a base year of 2018.

The *2017 Marine Cargo Forecast* was based on a variety of sources, depending on the handling group and commodities included. These handling groups / commodities included:

- Grain,
- Other dry bulks,
- Autos,
- Breakbulks,
- Liquid bulks, and
- Containers)

Three forecasts were developed for each handling group, including a reference case (i.e. base case), as well as a low and a high forecast. The high case for each handling type includes cargo volumes related to projects that are currently in the permitting process. Forecast growth rates are based on those used in the *2017 Marine Cargo Forecast*, with updates applied where substantial changes have occurred since that report was completed. The current forecast uses a base year of 2018, while the *2017 Marine Cargo Forecast* used 2014 as the starting point.

The *2017 Marine Cargo Forecast* was developed for the Pacific Northwest as a whole, and then allocated to four sub-regions based on historical market share trends; the methodology

[1] BST Associates. 2017 Marine Cargo Forecast and Rail Capacity Analysis, August 2017. Prepared for Washington Public Ports Association and the Washington Freight Mobility Strategic Investment Board.

was used in the current analysis. In several cases the market shares were adjusted to account for recent, distinct shifts in market share that are projected to be relatively short-lived.

The Pacific Northwest is defined to include all ports on Puget Sound, the Washington Coast, and the Lower Columbia River; ports on the Oregon coast, primarily Coos Bay, are not included. The four sub-regions to which volumes were allocated include:

- Columbia River Oregon (primarily Portland, also includes Columbia and Clatsop counties),
- Columbia River Washington, (Vancouver, Kalama, and Longview),
- PSRC (ports in the Puget Sound Regional Council area, primarily Seattle, Tacoma, and Everett), and
- Other Puget Sound / Washington Coast.

The initial basis for all of the projections was trade forecasts produced by IHS Markit, which served as the reference case (i.e. the base case) for most commodities. Low case and high case forecasts were then developed using additional sources, such U.S. Department of Agriculture, U.S. Energy Information Administration, and others. The current analysis used the most recent trade data, as well as additional information gathered through interviews with Port personnel, literature searches, and other sources to update the forecasts.

These forecasts are unconstrained, which means they assume that the infrastructure needed to handle the projected volumes will be available when needed. For example, this includes marine terminals, rail infrastructure, etc. The high case for each handling type includes cargo volumes related to projects that are currently in the permitting process, such as the coal exports from the Millennium Bulk Terminal in Longview and methanol exports from the proposed Northwest Innovation Works methanol plants in Kalama and Port Westward. Other potential moves are excluded if there is no publicly available information about potential future volumes. For example, this includes potential shipments of crude oil from terminals in Portland.

It should also be noted that projecting cargo volumes for 2020 is particularly difficult, due to two extraordinary factors. The first of these is the impact of trade wars, in which the United States and its trading partners (particularly China) have levied increasingly higher tariffs on each other's products. Although progress has recently been made in resolving the underlying disputes, the speed at which resolution will translate into recovered volumes is not clear. The other factor is the impact that the Covid 19 virus outbreak will have on trade. The forecasts assume that both of these issues will resolve in the long run, and that by 2025 trade volumes will recover to their long-term trends.

Organization

This report is divided into five chapters.

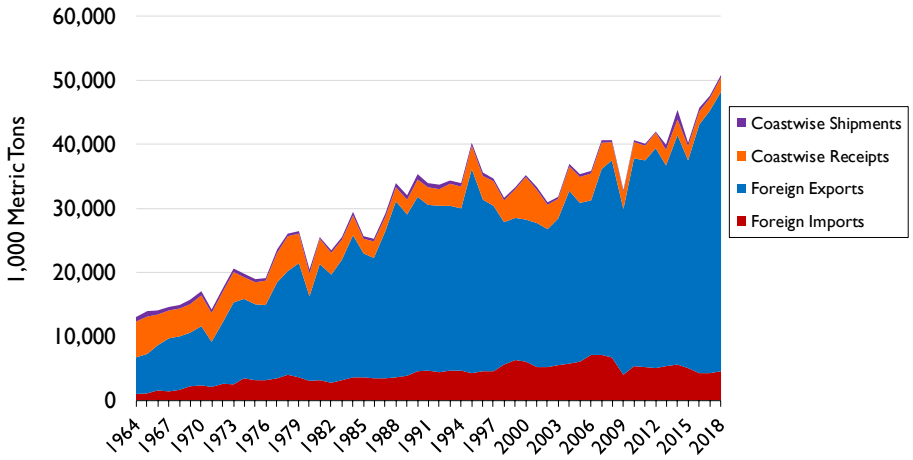
- Chapter 1 – Executive Summary
- Chapter 2 – Overview
- Chapter 3 – Cargo Trends
- Chapter 4 – Recent Terminal Developments
- Chapter 5 – Commodity Forecasts

Chapter 3. Cargo Trends

Waterborne traffic on the Lower Columbia has exhibited a long history of growth. Traffic volume in 2018 was more than 4.5 times higher than it was 1964.

As shown in Figure 2-1, most of this growth was due to exports of commodities to foreign trading partners. Foreign exports grew from 4.3 million metric tons and 38% of the total volume in 1964, to nearly 44 million metric tons and 86% of the total volume in 2018. As discussed in the next chapter, substantial public and private investments in the navigation facilities and cargo terminals on the river have made this growth possible.

Figure 2-1: Columbia River Cargo Trends, 1964-2018

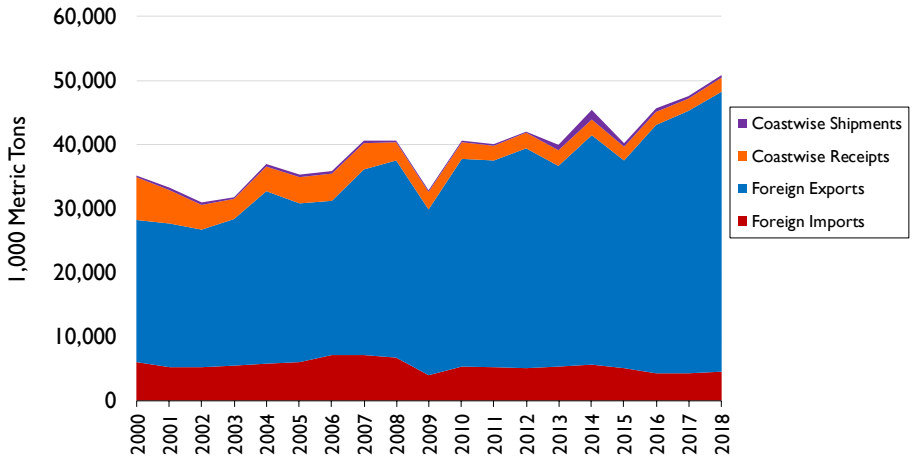


Source: U.S. Army Corps of Engineers

Figure 2-2 presents a shorter time series of waterborne cargo volumes, running from 2000 through 2018. The trend information provided later in the report uses the same time period.

As shown in the figure, Lower Columbia River cargo volume increased by 44% from 2000 through 2018. Again, foreign exports led the way, increasing from 35 million metric tons to nearly 51 million metric tons.

Figure 2-2: Columbia River Cargo Trends, 2000-2018

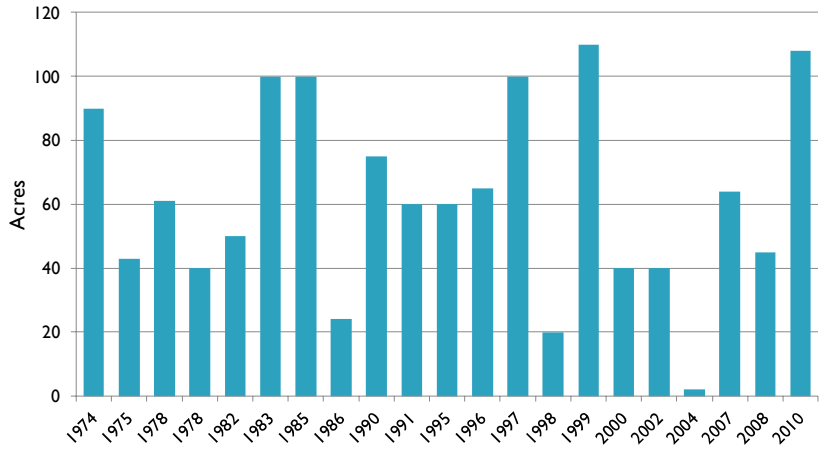


Source: U.S. Army Corps of Engineers

Chapter 4. Recent Terminal Developments

Prior analysis revealed that 1,297 acres of marine terminal facilities were developed on the Lower Columbia River between 1974 and 2010, a rate of approximately 36 acres per year.[2]

Figure 4-1: Marine Terminal Acres Developed on the Lower Columbia River (1974-2010)



Source: Lower Columbia River ports

Since 2010, port development has continued, focusing on improvements at existing facilities as well as planning and development of new facilities. Recent and planned improvements at each Port are presented below, including both public and private projects:[3, 4]

- Portland
    - Marine projects completed from 2010 to 2020:
        - Columbia Grain (2015) upgraded grain storage and handling.
        - Kinder Morgan Bulk Terminal (2013) new ship loading facilities.
        - International Raw Materials (2014) improvements to rail and storage tanks.
        - LD Commodities (2014) expanded grain storage and moving facilities. [This facility closed in 2019, and future use as a grain terminal is uncertain].
        - Rivergate Road and Rail Improvements (2012) improve road and rail access and capacity.
        - Portland Bulk Terminal (2018), second potash storage warehouse, new shiploader, upgraded vessel loading system.
    - Future infrastructure plans (next 10 to 20 years):[5]

[2] BST Associates. *West Hayden Island Marine Cargo Forecasts & Capacity Assessment Final Report*, April 2, 2010.

[3] ECONorthwest. *Impacts of Channel Deepening on the Columbia River*, June, 2015.

[4] Data from individual ports

[5] Port of Portland 2019-20 Adopted Budget.

- Implement the updated rail master plan by completing the North Rivergate Blvd. grade separation project - one of the highest priority projects to support growth over the next 10 to 20 years.
- As the Oregon non-Federal sponsor to the U.S. Army Corps of Engineers, participate in the management and maintenance of the 43-foot Columbia River navigation channel and the planning and design for the future 43-foot navigation channel on the Willamette River.
- Maintain marine terminal berths to their authorized depths.
- Complete a series of Terminal 6 infrastructure projects related to gantry crane rehabilitation and overall facility readiness.
- Develop a plan for funding the demolition of the non-operational grain elevator at Terminal 4 to make the site available for marketing and future development.
- Work with existing tenants to facilitate new business development and expansion projects.
- Private liquid bulk terminals in Portland have also made improvements. Most notably Zenith Energy upgraded from 12 railcar slots to 44 car slots in 2019/20.[6]

- Vancouver
  - Marine projects completed from 2010 to 2020:
    - United Grain Corporation (2012) enlarged storage and handling capacity
    - West Vancouver Freight Rail Access (2015) rail expansion, new loop track, and road improvement. Construction commenced in 2007 and was completed in 2018 at a cost of $251 million.
    - Terminal 5 development opportunity – port is seeking tenants for a high-volume marine terminal facility (including a diverse commodity group that could include dry bulk, liquid bulk, auto and other commodities). The terminal has 40 acres available, with an 8,500-foot-long loop track.[7]
  - Infrastructure plans for next 10 to 20 years:
    - The Port owns Columbia Gateway, a 535-acre contiguous tract of undeveloped industrial property located just west of the Port's current operations. The property is zoned heavy industrial and includes nearly a mile of direct waterfront on the Columbia River. The Port's long-term plans include development of the property as a future marine terminal, to be rail-served with the intended use of handling cargoes such as automobiles and bulk commodities. A portion of the property is expected to be made available for industrial tenants, with potential

[6] Oregon Public Broadcasting. Petroleum Terminal Expands to Allow More Oil Trains into Portland, Feb. 7, 2019.

[7] Port of Vancouver website.

uses including advanced manufacturing, assembly, warehousing, and import/export operations. [8]

- Kalama
    - Marine projects completed from 2010 to 2020:
        - Temco LLC (2015) increased capacity (grain)
        - Port of Kalama (2014-15) rail upgrades at the Port
        - Kalama Export Grain (2011) increase storage capacity
    - Infrastructure plans for next 10 to 20 years:
        - NW Innovation Works, LLC – Kalama (NWIW) and the Port of Kalama are planning to construct the Kalama Manufacturing and Marine Export Facility (KMMEF), which will consist of a methanol manufacturing facility and a new marine terminal on approximately 100 acres on the Columbia River at the Port's North Port site.
- Longview
    - Marine projects completed from 2010 to 2020:
        - Export Grain Terminal (2012), new grain terminal commenced operations.
        - Port launched $10 million Industrial Rail Corridor expansion project (2014). It is in progress for several years.
        - Port purchased the 280-acre Barlow Point property 4 miles west of the Port of Longview's main facility in 2010. Master Plan completed in 2014.
        - Port entered into an agreement with International Raw Materials (IRM) to lease the Bridgeview Terminal (consists of berths 1 and 2). IRM has committed to $1.25 million into modernization and upgrades at the 20-acre terminal.
        - First phase of Port's Berth 4 redevelopment began (2014). Port is currently negotiating with Ciner Industries to develop a soda ash terminal at Berth 4. The project would entail demolition of grain silos and provision of ship loaders, new rail track, warehouse space and associated product conveyors.
    - Capital improvement projects in 2020 and beyond:9
        - North Rail Connection Project will increase rail capacity and improve the flow of cargo within the Port's internal rail system. The project will add a total of 4,960' of new track and realign an existing 1,542' of track. This project is estimated at $4 million.
        - Port projects include continued work on expansion of the Industrial Rail Corridor, Barlow Point planning and development, Berth 6-7

[8] Port of Vancouver 2018 Revenue Bond official statement, page 27

[9] Port of Longview website

modernization and deepening, maintenance dredging Berths 1-9 among other projects.

- Millennium Bulk Terminal (2018) - new private coal terminal is still being considered.

- Columbia County
  - Marine projects completed from 2010 to 2020:
    - Teevin Brothers added a second dock at its Rainier location.
    - Global Partners is developing the Columbia Pacific Bio-Refinery at Port Westward, which ships ethanol to Hawaii and Asian markets. Global purchased the terminal in 2013 and has invested over $20 million in the terminal (construction of a new berth, and a secondary access road).[10]
    - The Port signed a lease option with NEXT Renewables in FY2019 to build a facility to produce renewable diesel. The primary feedstock to produce this fuel is reusable products such as cooking oils and animal tallow. [11]
  - Capital improvement projects in 2020 and beyond:
    - Port is rezoning 837 new rural industrial acres adjacent to the Port Westward marine terminal.[12]
    - Global Clatskanie is planning additional improvements, including additional storage tanks, pipelines, and additional rail offloading facilities.
  - NW Innovation Works is planning a new methanol plant, similar to the one planned in Kalama.

- Astoria
  - The Port upgraded Pier 1 to accommodate log exports.

As noted above, a significant share of the recently completed terminal projects involved grain terminals. Completion of the Columbia River navigation channel deepening project encouraged significant investments in capacity expansions at grain terminals on the river, and these investments increased annual export capacity from approximately 21 million metric tons to more than 37 million metric tons. As illustrated in Figure 2-1 and Figure 2-2, exports volumes have increased as a result. Specific improvements included:

- Portland - annual throughput capacity of the Columbia Export terminal was increased by 2 million metric tons (from approximately 5 million metric tons to 7 million metric tons).
- Vancouver - throughput capacity of the United Grain terminal increased by 2 million metric tons (from 4 to 6 million metric tons).

[10] https://globalclatskanie.com/, accessed February 12, 2020.

[11] https://www.oilmonster.com/company/next-renewable-fuels-inc/67769, accessed February 12, 2020.

[12] Telephone conversation with Scott Jensen, planner at Port of Columbia County, January 16, 2020.

- In Kalama, both export terminals completed projects that increased combined annual capacity from approximately 10 million metric tons to more than 14 million metric tons.
- In Longview, a new terminal was constructed, with annual throughput capacity of 8 million metric tons.

Chapter 5. Commodity Forecasts

Overview

The following chapter presents historical trends and projected cargo volumes for six commodity types / handling groups, including:

- Grain
- Other dry bulks
- Autos
- Breakbulks
- Liquid bulks, and
- Containers.

The historical trends are based on foreign import and export data from WISERTrade, and domestic shipments and receipts data from the U.S. Army Corps of Engineers.

Cargo volumes are projected for 2020, 2030, and 2040. For each commodity type / handling group three forecasts are provided, including a reference case, low case, and high case. As discussed previously, projecting cargo volumes for 2020 is particularly difficult, due to the impacts of trade wars and the Covid 19 virus outbreak. The forecasts assume that both of these issues will resolve in the long run, and that by 2030 trade volumes will recover to their long-term trends.

Forecast growth rates are based on those used in the *2017 Marine Cargo Forecast*, with updates applied where substantial changes have occurred since that report was completed. The current forecast uses a base year of 2018, while the *2017 Marine Cargo Forecast* used 2014 as the starting point.

The *2017 Marine Cargo Forecast* was developed for the Pacific Northwest as a whole, and then allocated to four sub-regions based on historical trends. Since the current analysis is an update of the 2017 forecast it uses the same methodology. For this analysis the Pacific Northwest is defined to include all ports on Puget Sound, the Washington Coast, and the Lower Columbia River; ports on the Oregon coast, primarily Coos Bay, were not included. The four sub-regions to which volumes were allocated include:

- Columbia River Oregon (primarily Portland, also includes Clatsop and Columbia counties),
- Columbia River Washington, (Vancouver, Kalama, and Longview),
- PSRC (ports in the Puget Sound Regional Council area, primarily Seattle, Tacoma, and Everett), and
- Other Puget Sound / Washington Coast.

These forecasts are unconstrained, which means they assume that the infrastructure needed to handle the projected volumes will be available when needed. For example, this includes marine terminals, rail infrastructure, etc.

Projected volumes for the sub-regions are based on historical market shares. The limitation of using this method is that, if future volumes require the construction of a new terminal, it could significantly change regional market shares. For example, when the EGT grain terminal

in Longview began operations in the last decade it caused a shift of grain market share from Columbia River Oregon to Columbia River Washington.

The high forecast scenario also takes into account cargo volumes related to projects that are currently in the permitting process, such as the Millennium Bulk Terminal in Longview and the Northwest Innovation Works methanol plants in Kalama and Port Westward. Other potential moves are excluded if there is no publicly available information about potential future volumes.

Grain and Oilseeds

Historical Trends

Grain terminals handle a variety of grains, oilseeds, and related products. These include wheat, corn, barley, soybeans, grain sorghum, and some animal feeds such as beet pulp pellets.

Wheat, corn, and soybeans account for most of the grain and oilseed volume.

- Wheat is primarily used for human consumption.
- Coarse grains (corn, barley, and sorghum) are primarily used as animal feed.
- Soybeans are used both for animal feed and for human consumption

International competition for exports is intense

- For wheat, the U.S. competes with Canada and Australia, among other countries. China is an especially important export market.
- For coarse grains, main competitors include Brazil, Argentina, and others. Pacific Northwest ports also compete U.S. ports on the Gulf of Mexico.
- For soybeans, there is strong competition from Brazil and Argentina.

On the U.S. West Coast, most grain and oilseed exports move through terminals on the Lower Columbia River; the region accounted for approximately 70% of West Coast exports in each year from 2013 through 2018.

Lower Columbia River exports of grain and oilseeds grew from 14.3 million metric tons in 2000 to 31.6 million metric tons in 2018. Volumes tend to fluctuate from year to year, depending on annual harvest and other factors, but the long-term trend has been one of strong growth. (see Figure 5-1.)

Portland's share of the U.S. West Coast market fell from approximately 23% in 2000 to 10% in 2018. During this same period, the Lower Columbia River share of U.S. grain exports was the same at the beginning and end of the period (i.e. 74%), although it dropped below 60% in the middle of that period. Portland's share of the Lower Columbia market fell from nearly 45% in 2000 to less than 20% from 2015 through 2018.

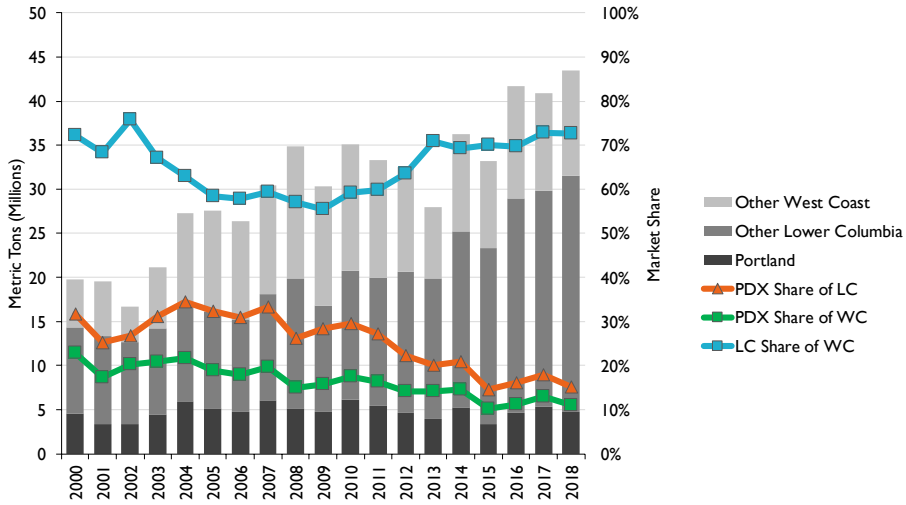
The decline in Portland's market share of grain exports is due to several factors. The first of these is the additional export terminal capacity that was added to the Lower Columbia River in the past decade, particularly in Washington. One entirely new facility was completed in Longview, and capacity upgrades were completed at both terminals in Kalama and the terminal in Vancouver. Portland's largest terminal also received capacity upgrades.

At the same time that export terminal capacity was being added in the region, Portland lost some of its capacity when the LD Commodities Portland terminal ceased operations. This facility was offered at auction, and although that auction was cancelled, future use of the

property as a grain export terminal is questionable. In addition, the volumes exported through the other small terminal in Portland (TEMCO) has been sharply reduced in recent years, and the long-term future of this terminal is in doubt.

Another factor in Portland's declining market share is the product mix handled at each terminal. Wheat accounts for a larger share of the grain exports at Portland than at other ports, and wheat export volumes have increased more slowly than other major commodities, such as corn and soybeans.

Figure 5-1: Trends in Grain Exports, 2000-2018



Source: WISERTrade

From 2000 through 2018, Portland export volume ranged between approximately 3.5 million metric tons and 6.7 million metric tons, and averaged 4.7 million tons. In the most recent five years (i.e. 2014 through 2018), Portland's export volume averaged 4.2 million metric tons, and ranged between 3.4 million and 5.3 million metric tons.

These volumes represent grain moving in bulk through West Coast export terminals. In addition to these bulk exports, there is increasing competition from grain moving in containers. In 2000 this represented less than 1.0 million metric tons, but the volume has grown steadily, and by 2018 nearly 8.4 million metric tons of grain was exported in containers from the West Coast. This is twice the volume that moved through Portland in 2018, and is equivalent to the capacity of a modern bulk export terminal. The majority of this containerized grain moves through ports in Southern California.

Forecast

Under all three forecast cases, Portland's 2020 grain export volumes are projected to remain low, due to the closure of one of the two small export terminals and to lower than average volumes moving through the Columbia Export terminal. After 2020 volumes are projected to recover from this historically low level.

- Under the low case the volumes will grow to 5.32 million metric tons in 2040.

- Under the reference case, the volume of grain exported through Portland is projected to reach nearly 6.86 million metric tons in 2040, which is slightly higher than the historical maximum.
- Under the high case, Portland's volume is projected to reach 11.14 million metric tons. As described above, these forecasts are unconstrained, and assume that the necessary infrastructure will be in place to handle the projected volumes. To reach this volume, Portland would need additional terminal capacity.
- The annual growth rates for Portland for 2018 through 2040, shown in Table 5-1, are higher than those for the Lower Columbia River region as a whole, due to unusually low volumes Portland handled in 2018.
- Current trade issues (tariffs, Covid 19 virus outbreak) are assumed to be relatively short-lived, and by 2025 volumes are projected to return the levels projected in the 2017 WPPA Marine Cargo Forecast.

Table 5-1: Portland Grain Forecast (Mil. Metric Tons)

		History			Forecast			Compound Annual Growth Rate	
Direction	**Case**	**2000**	**2010**	**2018**	**2020**	**2030**	**2040**	**2000-2018**	**2018-2040**
Imports	Low				-	-	-		0.00%
	Reference	-	-	-	-	-	-	0.00%	0.00%
	High				-	-	-		0.00%
Exports	Low				2.28	4.98	5.32		1.45%
	Reference	4.54	6.14	3.88	2.28	5.98	6.86	-0.87%	2.62%
	High				2.28	8.57	11.14		4.91%
Total - Portland	Low				2.28	4.98	5.32		1.45%
	Reference	4.54	6.14	3.88	2.28	5.98	6.86	-0.87%	2.62%
	High				2.28	8.57	11.14		4.91%
Total - Lower Columbia	Low				24.37	24.88	26.62		-0.81%
	Reference	14.30	20.77	31.86	24.56	29.90	34.30	4.55%	0.34%
	High				24.75	38.56	50.11		2.08%
Portland Share of Lower Columbia	Low				9.3%	20.0%	20.0%		
	Reference	31.7%	29.6%	12.2%	9.3%	20.0%	20.0%		
	High				9.2%	22.2%	22.2%		

Source: BST Associates

The high forecast is similar to that prepared for the *Portland and Vancouver Harbor Forecast Update* in 2012, while the low forecast is somewhat lower.[13] The main driver for the difference in the current low forecast versus the 2012 forecast is in Portland's assumed market share of the Lower Columbia River. The current low forecast assumes that the two small elevators in Portland eventually close, and that the Columbia Export terminal does not pick up their volumes.

The reference case and high case assume that, in the long run, the mix of commodities handled by Portland terminals becomes similar to that handled by the region in total.

[13] BST Associates. Portland and Vancouver Harbor Forecast Update Final Report, February 2012.

Specifically, under these forecasts the share of Portland's grain tonnage from wheat is assumed to decline while the share due to corn, soybeans, and other higher-growth commodities is assumed to increase.

The majority of grain and oilseeds exports on the Lower Columbia River arrives by rail. Modern grain terminals are designed to handle shuttle trains consisting of 110 cars or more, and railroad pricing gives preference to these facilities. Portland has three export terminals, but only one of these, Columbia Export at the Port of Portland, has the rail capacity to handle such trains. The other two elevators have limited rail capacity and are much smaller than the Columbia Export terminal. As discussed above, one of these two small terminals is currently not in operation, and both are likely to cease operations in the long run.

The remaining grain exports arrive by barge. The current grain forecasts do not include receipts of grain by barge as a separate category, because nearly all of the grain that moves by barge is destined for export, and including these barge volumes would represent a double-count. For the purpose of land use planning, the barge movements of grain do not generate demand for land beyond that used by the export terminals.

Approximately of 10% to 20% of all Lower Columbia River grain exports arrives at terminals by barge. For the Lower Columbia River combined, an average of approximately 6.8 million tons of export grain and oilseed was received by barge from 2014 through 2018. The volume moving by barge has dropped since the early 1990s, when barge volumes averaged more than 9.2 million metric tons per year. Wheat typically accounts for approximately 90% of the grain received by barge, and barge receipts account for 30% to 40% of all Lower Columbia River wheat exports.

The mix of grain and oilseeds currently handled by Portland terminals is heavily weighted toward wheat, with approximately 90% of Portland's grain export volume due to wheat. Barging is relatively more important to Portland than to the other Lower Columbia ports. Portland's reliance on barged receipts of grain will be an issue to watch as operation of the Snake River dams is reviewed, and the potential for dam breaching is considered. The forecast assumes that the dams are not breached, and that barge transportation continues along the Columbia-Snake River system.

Other Dry Bulks

Other Dry Bulks Imports

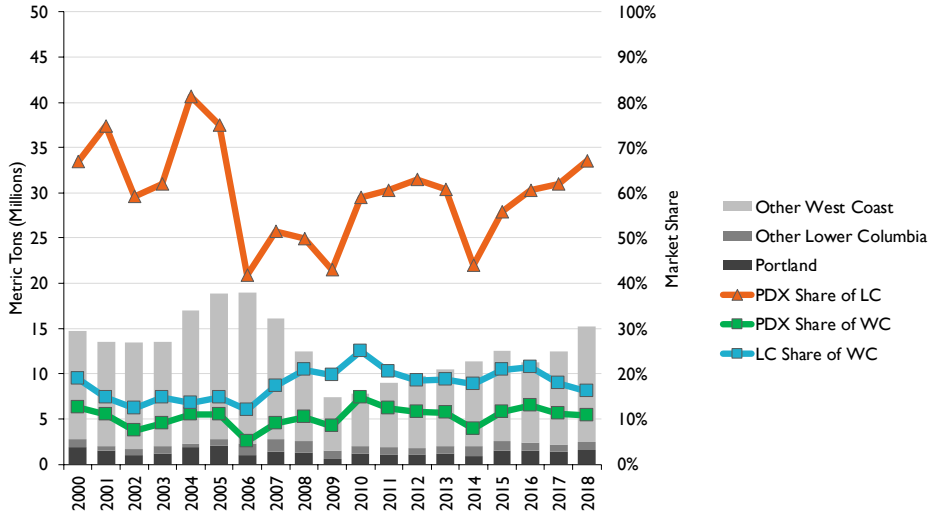
Alumina once accounted for most dry bulk import tonnage in the Pacific Northwest. For decades the region was home to ten aluminum smelters, but this number has now dropped to only two, and the closure of most of the smelters has significantly reduced imports of alumina. Dry bulk imports are now dominated by construction-related commodities, such as gypsum, limestone, and cement. Fertilizers and chemicals account for most of the remaining import tonnage.

On the Lower Columbia River, approximately 75% of imported dry bulk commodities are building materials, including gypsum, limestone, cement, and aggregates. These low-value commodities are typically imported as close to the construction market as possible, in order to minimize transportation costs. Because Portland is the center of population (and construction) in the region, Portland accounts for the largest share of dry bulk imports in the Lower Columbia River area.

On the West Coast, import dry bulks are also dominated by construction materials. Portland's share of the West Coast is relatively small, and is essentially proportional to the population of the hinterland served by Portland versus that served by other ports.

Because construction activity levels are linked to the general economy, import volumes of construction materials are also tied to the economy. As illustrated in Figure 5-2, the imports of dry bulks were strong during the early and mid-2000s, but dropped sharply during the recession. After bottoming out in 2009, imports of dry bulks increased in most years, on the West Coast as well as on the Lower Columbia River and in Portland.

Figure 5-2: Trends in Other Dry Bulk Imports, 2000-2018



Source: WISERTrade

Other Dry Bulks Exports

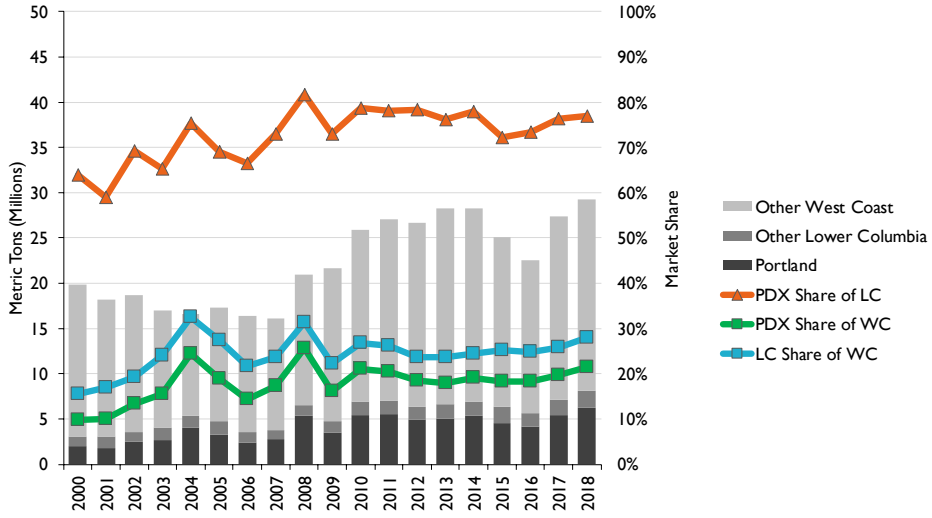
Major dry bulk export commodities include minerals, fertilizers, petroleum coke, and scrap metal. On the Lower Columbia River, soda ash (a mineral) and potash (a fertilizer) account for more than 90% of dry bulk export tonnage, and most of the tonnage is shipped through facilities at the Port of Portland.

Soda ash is mined in southwest Wyoming, which has some of the richest natural deposits in the world. These mines are located near the Union Pacific Railroad mainline, which provides an efficient and direct route to the export terminal in Portland. Growing world demand for soda ash has led to increasing export volumes for Portland, where exports increased from 2.1 million metric tons in 2008 to 3.7 million metric tons in 2018.

Potash is primarily mined in Saskatchewan, and Portland began handling this commodity in the mid-2000s. World demand for potash has also been increasing, and Portland potash exports increased from less than 1.4 million metric tons in 2004 and 2005 (the first years of exports from Portland) to 2.7 million metric tons in 2018.

As illustrated in Figure 5-3, Portland's share of all dry bulk exports on the Lower Columbia River (excluding grain and oilseeds) has ranged between 70% and 80% for more than a decade. The Lower Columbia River share of West Coast dry bulk exports increased over the past decade, growing from less than 24% in 2009 to more than 32% in 2018. Portland's share of the West Coast drove this growth, with Portland's share of the West Coast climbing from approximately 16% in 2009 to more than 25% in 2018.

Figure 5-3: Trends in Other Dry Bulk Exports, 2000-2018



Source: WISERTrade

Forecast

Imports of other dry bulks are projected to decrease in 2020 under all three forecast scenarios, but to grow in the long run. The range of projected future volumes is relatively tight, and is primarily based on construction growth, which is tied to long-run economic growth. The impacts from current economic disruptions, including punitive tariffs and the Covid-19 outbreak, are assumed to be relatively short-lived.

- Under the low case, imports are projected to decline slightly in 2020, but to grow between 2020 and 2030, and between 2030 and 2040, with growth averaging 0.1% per year from 2018 through 2040.
- Under the reference case, imports are project to rise from 1.66 million metric tons in 2018 to 2.08 million metric tons in 2040.

- Under the high case, imports are projected to rise to 2.31 million metric tons in 2040.

The exports forecast shows a wider range of projected volumes than imports, with much of the variance due to potential changes in soda ash exports. Portland currently handles exports for ANSAC (the American Natural Soda Ash Corporation), which is a consortium of three soda ash producers. One of these three has announced plans to leave the consortium, and may seek its own export terminal in the region, potentially in Longview. The soda ash forecast assumes that this company shifts its exports out of Portland between 2020 and 2030 under the low scenario, but remains in Portland under the reference and high scenarios.

All three forecast scenarios show dry bulk export volumes decreasing between 2018 and 2020. This is due primarily to 2018 export volumes that were substantially higher than the historical trend, and the assumption that exports will fall back to the long-term trend.

- Under the low forecast, export volumes decline from 7.38 million metric tons in 2018 to 4.11 million metric tons in 2040. This assumes loss of a portion of soda ash exports from Portland, and low growth for the remaining soda ash and for potash.
- Under the reference case, dry bulk exports are projected to grow from 7.38 million metric tons in 2018 to 9.35 million metric tons in 2040. This case assumes that Portland does not lose a portion of its soda ash exports to another location.
- Under the high case, Portland retains the soda ash exports from all three ANSAC members, and growth rates for soda ash and potash are higher than under the reference case.

As with dry bulk imports, current trade issues (tariffs, Covid 19 virus outbreak) are assumed to be relatively short-lived, and volumes are projected to return the levels forecasts in the *2017 Marine Cargo Forecast*.

Table 5-2: Portland Other Dry Bulks Forecast (Mil. Metric Tons)

		History			Forecast			Compound Annual Growth Rate	
Direction	**Case**	**2000**	**2010**	**2018**	**2020**	**2030**	**2040**	**2000-2018**	**2018-2040**
Imports	Low	1.85	1.16	1.66	1.54	1.61	1.69	-0.63%	0.10%
	Reference				1.60	1.91	2.08		1.04%
	High				1.63	2.06	2.31		1.53%
Exports	Low	1.97	5.44	7.38	6.58	3.96	4.11	7.62%	-2.62%
	Reference				6.48	8.24	9.35		1.09%
	High				7.81	10.42	12.96		2.60%
Total - Portland	Low	3.82	6.60	9.03	8.12	5.57	5.81	4.89%	-1.99%
	Reference				8.08	10.16	11.44		1.08%
	High				9.44	12.48	15.27		2.42%
Total - Lower Columbia River	Low	5.85	9.23	11.84	10.56	9.82	10.29	3.99%	-0.64%
	Reference				10.71	13.67	15.38		1.20%
	High				12.08	60.38	63.82		7.96%
Portland Share of Lower Columbia River	Low	65.3%	71.4%	76.3%	76.9%	56.7%	56.4%		
	Reference				75.4%	74.3%	74.3%		
	High				78.2%	20.7%	23.9%		

Source: BST Associates

Portland's share of Lower Columbia River dry bulk exports grew from 65.3% in 2000 to 76.3% in 2018, mainly due to the growth in potash and soda ash exports. Under the reference forecast Portland's share of the Lower Columbia is projected to remain essentially the same, but is projected to fall under both the low and the high forecasts.

The decline in market share under the low forecast results from a portion of Portland's potash exports shifting to Longview. This shift is projected to result in a decline in Portland's total dry bulk tonnage.

The decline in market share under the high forecast results from the assumption that the Millennium Bulk Terminal will begin to export coal, which will significantly increase total dry bulk tonnage on the Lower Columbia River. Although Portland's market share is projected to fall under the high forecast, Portland's dry bulk tonnage is projected to grow substantially.

The low forecast for dry bulk movements is substantially lower than the one prepared for the *Portland and Vancouver Harbor Forecast Update* in 2012. The current reference case forecast is 11% higher than the 2012 low case, while the current high case is roughly 15% lower than the 2012 high case. The main driver of the differences between the two forecasts is the volumes associated with planned terminal projects in the region that were included in 2012 but are no longer planned, such as a coal export terminal planned for Port Westward in 2012, which contributed to the regional dry bulk total tonnage.

Internal Movements

In addition to foreign imports and exports of dry bulk commodities, Portland terminals also receive building materials by barge from locations on the river system. Historically, Ross Island was one of the primary sources of barged sand and gravel, but that quarry has ceased operation. The largest source is now the Santosh aggregate plant, located near Scappoose, Oregon.

Between 2000 and 2018 the volume of sand and gravel received by barge in Portland ranged between 1.1 million metric tons and 2.7 million metric tons, and averaged approximately 1.8 million metric tons per year. Over the most recent five years (2014 through 2018), the barge receipts averaged more than 1.5 million metric tons per year, and ranged between 1.2 million and nearly 1.8 million metric tons.

Autos

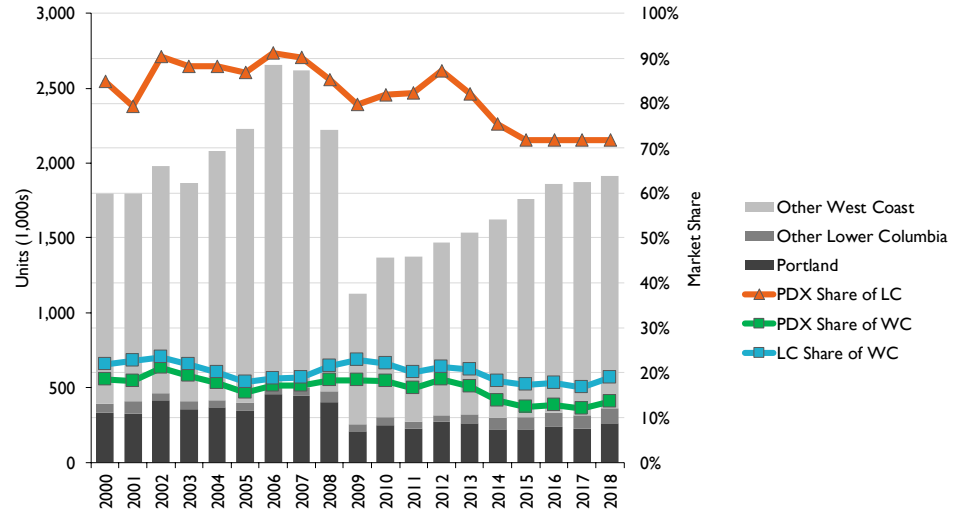
Auto Imports

West Coast automobile imports were essentially the same in 2018 as they were in 2003, but the period from 2000 through 2018 saw much volatility in imports of automobiles. From 2000 through 2006 the number of vehicles imported grew from approximately 1.8 million to more than 2.6 million, and then started a decline that accelerated during the height of the recession, and from which it took years to recover. After dropping to approximately 1.1 million units in 2009 volumes started to recover, but import volumes are still lower than during the peak years prior to the recession. (See Figure 5-4).

On the Lower Columbia River auto imports saw a similar pattern, growing through 2006 and then falling during the recession, followed by growth but not full recovery. Ports on the Lower Columbia River (Portland and Vancouver) handled an average of approximately 20% of West Coast auto imports from 2000 through 2018, although that share slipped to approximately 18% from 2014 through 2018.

From 2000 through 2018, Portland accounted for an average of 82% of Lower Columbia auto imports and 17% of West Coast imports. Portland import volume grew from approximately 334,000 units in 2000 to a high of 456,000 in 2006, before dropping to just 206,000 units in 2009. Since 2010 Portland has averaged 242,000 import units per year.

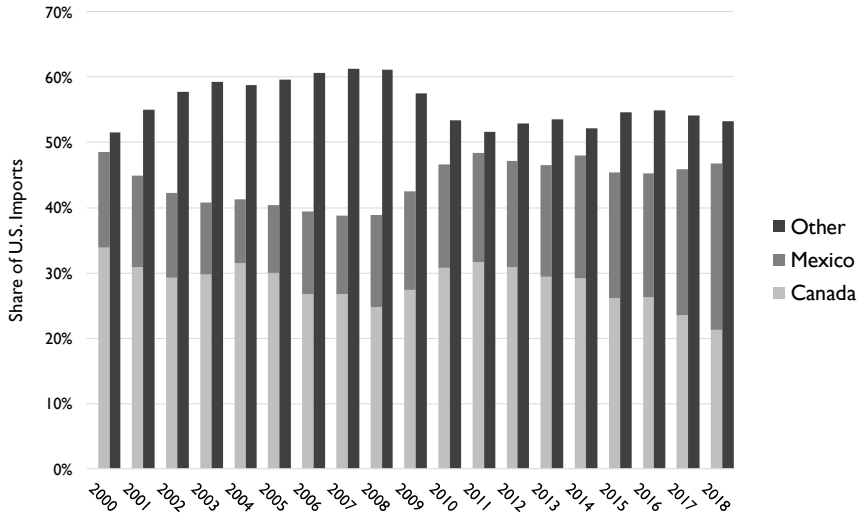
Figure 5-4: Trends in Auto Imports, 2000-2018



Source: WISERTrade

One of the main factors that has prevented West Coast auto imports from reaching their past high volumes is a shift in the origin of imports to the United States. As shown in Figure 5-5, the share of U.S. auto imports from Canada and Mexico is larger than it was prior to the recession, while the share of imports from overseas is lower. U.S. waterborne imports of autos peaked at 4.5 million units per year in 2006 and 2007, but averaged 4.2 million units per year from 2015 through 2018. In contrast, overland moves (i.e. from Canada and Mexico) grew from 2.8 million to 2.9 million units in 2005 and 2006, to an average of nearly 3.6 million units per year from 2015 through 2018.

Figure 5-5: Source of U.S. Auto Imports, 2000-2018



Source: WISERTrade

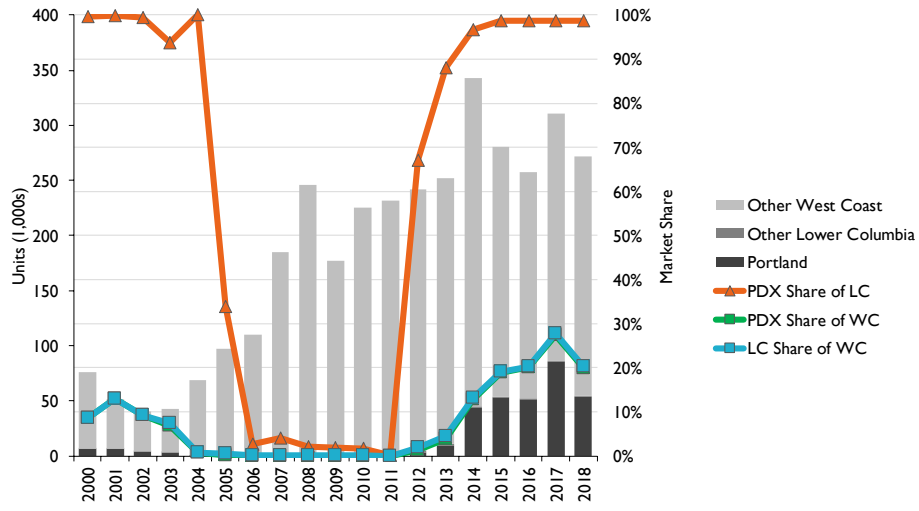
Auto Exports

Portland is the only port on the Lower Columbia River that handles auto exports, and exports have been a growth sector in recent years. As illustrated in Figure 5-6, very few autos were exported from Portland or the Lower Columbia River prior to 2012, but after a slow start in that year export volumes grew to an average of nearly 58,000 units per year from 2014 through 2018.

West Coast auto exports grew from the 2003 through 2013, with a relatively short-lived impact from the recession (in 2009.) After peaking in 2013, however, exports dropped in three of the four years from 2015 through 2018.

The growth in auto exports from Portland has increased Portland's share from essentially 0% of West Coast exports to 20% or more in recent years.

Figure 5-6: Trends in Auto Exports, 2000-2018



Source: WISERTrade

Forecast

The forecasts of automobile movements used projections from the U.S. Energy Information Administration (EIA), in addition to the IHS Markit forecast. Specifically, these forecasts incorporated EIA projections of light vehicle sales in the United States.

Total automobile movements through Portland are forecast to grow under all three scenarios. Imports are projected to drop somewhat between 2018 and 2020, but to grow after that. Exports are projected to grow between 2018 and 2020, and to continue growing. (See Table 5-3).

Portland auto imports are projected to grow from approximately 260,000 in 2018 to nearly 330,000 under the reference case and nearly 370,000 units under the high case. Under the low case, slow growth is forecast from 2020 through 2030, followed by a slow decline from 2030 to 2040. Under the low case Portland imports are projected to decline by a small share, falling from 260,000 units in 2018 to 255,000 units in 2040.

Exports of automobiles from the U.S. are projected to rise faster than imports, which is one of the main factors driving the Portland export forecast. Another important factor is that FCA (Fiat Chrysler Automobiles) recently shifted their export operation from the Port of Grays Harbor to Portland, and the forecast assumes that FCA will continue to operate from Portland. Ford, Honda, and Toyota also export from Portland. Portland exports are projected to grow from approximately 54,000 units in 2018 to between 152,000 and 220,000 units in 2040.

Portland is center of the Lower Columbia River auto trade, and Portland's share of total movements was 75.4% in 2018. Under all three forecast scenarios Portland is projected to maintain a market share of 70.3%.

Table 5-3: Portland Automobile Forecast (Mil. Units)

		History			Forecast			Compound Annual Growth Rate	
Direction	**Case**	**2000**	**2010**	**2018**	**2020**	**2030**	**2040**	**2000-2018**	**2018-2040**
Imports	Low				0.21	0.26	0.26		-0.1%
	Reference	0.33	0.25	0.26	0.23	0.29	0.33	-1.4%	1.1%
	High				0.25	0.31	0.37		1.6%
Exports	Low				0.06	0.11	0.15		4.8%
	Reference	0.01	0.00	0.05	0.07	0.13	0.20	12.4%	6.0%
	High				0.07	0.13	0.22		6.6%
Total - Portland	Low				0.28	0.37	0.41		1.2%
	Reference	0.34	0.25	0.31	0.30	0.42	0.52	-0.4%	2.3%
	High				0.32	0.67	0.59		2.9%
Total - Lower Columbia River	Low				0.39	0.54	0.58		1.5%
	Reference	0.40	0.30	0.42	0.42	0.62	0.74	0.2%	2.7%
	High				0.44	0.65	0.83		3.2%
Portland Share of Lower Columbia River	Low				70.1%	67.8%	70.3%		
	Reference	85.1%	81.6%	75.4%	71.3%	67.8%	70.3%		
	High				72.3%	67.8%	70.3%		

Source: BST Associates

This forecast for automobile movements is substantially lower than the one prepared for the *Portland and Vancouver Harbor Forecast Update* in 2012. A number of factors contributed to differences between the forecasts.

The first of these, as discussed above, is that there has been a shift in foreign origins of U.S. auto imports. The share of imports moving overland (i.e. from Canada and Mexico) has grown over the past decade, displacing imports arriving by water.

Another factor contributing to the lower forecast is that Portland lost market share relative to both the U.S. West Coast and to the United States.

The third factor is that the U.S. Energy Information Administration (EIA) substantially revised its forecast of light vehicle sales in the United States (the EIA forecasts are key components of the models used in both the 2012 forecast and the current forecast). Specifically, the EIA growth rates for the period of 2020 to 2035 dropped from 0.92% per year to only 0.07% per year, or essentially no growth.

Breakbulks

Pacific Northwest breakbulk and neobulk cargo includes forest products, machinery, and metal products.

Breakbulk Imports

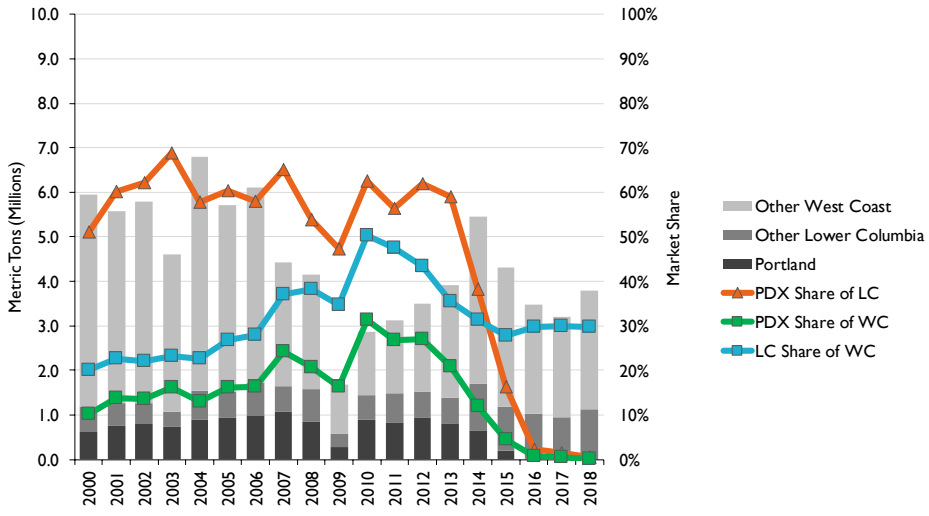
The Lower Columbia River region has a strong metal products industry, and one of the most important breakbulk imports is iron and steel products. Breakbulk import tonnage is dominated by iron and steel, such as coil, bars, pipe, rail and other products, which are used by local/regional firms as inputs to manufacturing and construction. In addition to steel, other breakbulk imports include forest products and machinery/equipment.

On the West Coast, imports of breakbulk cargoes have trended downward since 2000, although volumes fluctuate widely from year to year. Between 2000 and 2018 the highest volume of breakbulk imports was 2004, when 6.8 million tons of breakbulks were imported through West Coast ports. The lowest volume was during the height of the recession.

On the Lower Columbia River, breakbulk tonnage averaged approximately 1.3 million metric tons per year between 2000 and 2018, with a high of 1.7 million and a low of 0.6 million metric tons. The Lower Columbia River accounted for between 20% and 50% of West Coast breakbulk imports during this period, and averaged 30% from 2014 through 2018.

In Portland, breakbulk import volumes averaged 0.8 million metric tons between 2000 and 2014, but dropped below 0.1 million metric tons from 2016 through 2018. Portland's share of West Coast breakbulk imports grew from approximately 10% in 2000 to 31% in 2010, but dropped to less than 1% from 2016 through 2018. Portland's share of the Lower Columbia River generally ranged between 50% and 70% from 2000 through 2013, and then declined sharply as volumes fell.

Figure 5-7: Trends in Breakbulk Imports, 2000-2018



Source: WISERTrade

The primary reason for the decline of breakbulk imports in Portland was the loss of two major steel customers. The first of these was the EVRAZ Oregon Steel Mill in the Rivergate district, which shifted its imports to Vancouver. The second was steel rail for railroads, which shifted to Stockton, California, when a new facility was developed that was capable of handling

longer sections of rail. As discussed below, the imports of rail are unlikely to return to Portland, but re-establishing the EVRAZ steel account presents a strong potential opportunity over the next few years.

In addition to metal products, other breakbulks that move through ports on the Lower Columbia River included wind turbines, project cargo, oversize equipment, and a variety of other products. In terms of tonnage, however, metal products accounted for 95% to 100% of breakbulk imports between 2000 and 2018.

Breakbulk Exports

In the Pacific Northwest, breakbulk exports consist primarily of forest products, including lumber, pulp and paper. On the Lower Columbia River, forest products accounted for more than 95% of export breakbulk tonnage between 2000 and 2018. On the West Coast, breakbulk exports were also dominated by forest products, which accounted for 70% to 90% of exports between 2000 and 2018. Machinery and equipment accounted for most of the remaining breakbulk export tonnage, while metal products generally accounted for less than 10%.

West Coast breakbulk exports saw little downturn during the recession, and grew from less than 0.6 million metric tons in 2000 to more than 1.8 million metric tons in 2011. After 2011, however, West Coast breakbulk export tonnage declined in each year. Most of this decline was due to a drop in exports of logs[14] and lumber, but falling pulp and paper exports also contributed to the drop.

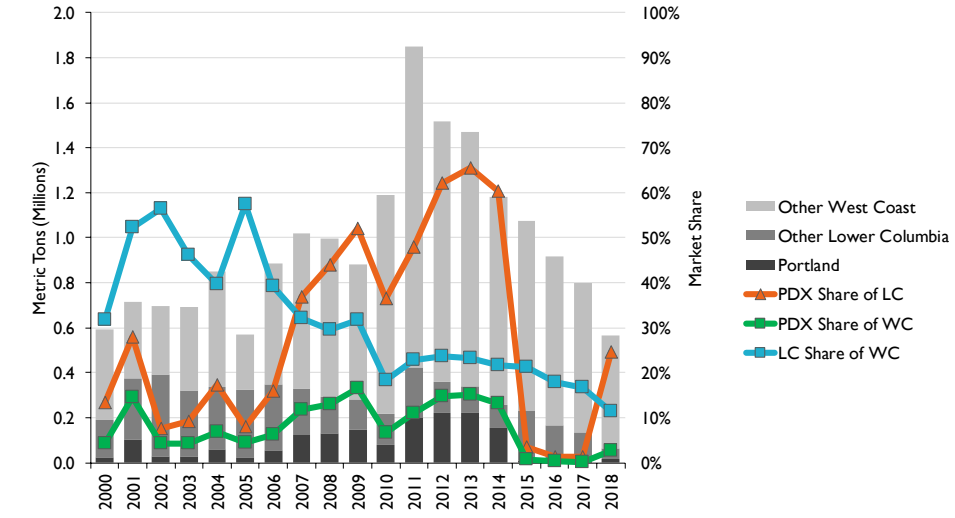
The Lower Columbia River saw its share of breakbulk exports fall from nearly 60% in 2002 and 2005, to less than 20% in 2010. After climbing back above 23% in 2012 and 2013, the Lower Columbia River share of breakbulk exports dropped steadily, and reached a low of 11% in 2018.

Portland's share of the Lower Columbia River was generally less than 20% from 2000 through 2006, but rose sharply from 2006 through 2013. After peaking at nearly 66% in 2013, Portland's share of Lower Columbia breakbulk exports dropped below 5% from 2015 through 2017. In 2018 Portland accounted for approximately 25%. Portland's share of West Coast breakbulk exports generally ranged between 5% and 15% from 2000 through 2014, but dropped below 1% from 2015 through 2017.

Breakbulk woodpulp accounted for most of the growth in Portland breakbulk exports, as well as most of the subsequent decline. Lumber also contributed to the rise and fall in breakbulk volumes, but lumber tonnage was generally less than half that of pulp.

[14] Logs were evaluated as a separate commodity handling group in the 2017 Marine Cargo Forecast. They are included in breakbulks in this forecast, as in prior forecasts for the Port of Portland. Portland has never been a major log exporter and Portland is not expected to export logs in this forecast.

Figure 5-8: Trends in Breakbulk Exports, 2000-2018



Source: WISERTrade

Breakbulk Forecast

Portland breakbulk volumes are projected to grow substantially by 2040 under both the reference and high forecast.

Imports are projected to drive the growth, led by increases in steel imports. The reference and high cases both assume that the EVRAZ steel returns to Portland before 2025, while the low forecast assumes that it stays in Vancouver. Under the reference forecast half of the steel returns, and under the high forecast all of it returns.

Other potential growth markets include machinery and equipment, projects cargoes, oversize cargoes and a variety of other products. The Port is actively marketing Terminal 6 for breakbulk cargoes, and is pursuing a number of opportunities. In addition to steel, potential import cargoes include wind energy equipment and project cargo, among other. Potential export cargoes include transportation equipment (such as heavy trucks and other work vehicles), recreational vehicles (trailer, motor homes, etc.), and others.

Table 5-4: Portland Breakbulk Forecast (Mil. Metric Tons)

		History			Forecast			Compound Annual Growth Rate	
Direction	**Case**	**2000**	**2010**	**2018**	**2020**	**2030**	**2040**	**2000-2018**	**2018-2040**
Imports	Low	0.61	0.90	0.01	0.01	0.01	0.01	-22.1%	0.8%
	Reference				0.01	0.35	0.38		20.1%
	High				0.01	0.74	0.82		24.3%
Exports	Low	0.03	0.08	0.02	0.02	0.06	0.07	-2.5%	6.8%
	Reference				0.02	0.06	0.07		7.2%
	High				0.02	0.06	0.08		7.7%
Total - Portland	Low	0.63	0.98	0.02	0.03	0.06	0.07	-16.9%	5.6%
	Reference				0.03	0.41	0.45		14.6%
	High				0.03	0.80	0.90		18.2%
Total - Lower Columbia River	Low	1.38	1.66	1.19	1.14	1.33	1.44	-0.8%	0.9%
	Reference				1.23	1.50	1.70		1.6%
	High				1.31	1.59	1.85		2.0%
Portland Share of Lower Columbia River	Low	45.9%	59.1%	1.9%	2.5%	4.7%	5.2%		
	Reference				2.4%	27.6%	26.6%		
	High				2.3%	50.7%	48.3%		

Source: BST Associates

As discussed above, the drop in Portland's share of the Lower Columbia breakbulk market was due almost entirely to the EVRAZ slab steel import account moving across the river to Vancouver. This steel is processed at the EVRAZ rolling mill in the Rivergate area, near the Port of Portland's Terminal 6. When the Vancouver contract expires in the next few years there is a strong likelihood of this account moving back to Portland, due to the proximity of the mill to Terminal 6 and the potential to reduce trucking costs.

The projected market shares shown in Table 5-4 are based primarily on what happens with the EVRAZ account. Under the low forecast the EVRAZ steel remains in Vancouver, under the reference forecast half of the steel returns to Portland, and under the high forecast all of the EVRAZ steel returns to Portland.

Liquid Bulks

Waterborne liquid bulk traffic in the Lower Columbia River primarily consists of refined petroleum products, crude oil, and other liquid bulks (e.g. animal fats, vegetable oils, chemicals, and fertilizers). For this analysis, waterborne liquid bulk traffic is divided into external trade and internal trade. These are defined as follows:

- External trade is waterborne moves that pass through the mouth of the Columbia river. Inbound external moves include both foreign imports and coastwise receipts (i.e. movements from other U.S. domestic coastal ports). Outbound external moves include both foreign exports and coastwise shipments.
- Internal trade includes shipments and receipts that move entirely within the Columbia-Snake River system. This includes shipments from Portland to terminals located elsewhere on the system, receipts in Portland from other river system terminals, and traffic that moves within the Portland harbor.

External movements accounted for an average of approximately two-thirds of Portland liquid bulk movements during the most recent five-year data period (i.e. 2014 to 2018). Internal movements accounted for the other third.

Refined Petroleum Products

According to the 2018 Biennial Energy Report, Oregon is almost entirely reliant on out of state production to meet its transportation fuel needs. Nearly all of these fuels arrive via pipeline, vessel, or barge. According to the 2018 report:

- "Less than 2 percent of transportation fuels consumed in Oregon were produced in-state.
- "Over 90 percent of the petroleum products delivered to and consumed in Oregon comes from four refineries in Washington state. Transportation fuels are delivered to six Portland-area terminals via the Olympic Pipeline, by barge, and to a lesser extent by rail. These terminals receive, store, blend, and transfer petroleum products. The Portland region has a demand of about 200,000 to 210,000 barrels a day.
- "Some of this product flows in a pipeline south to Eugene and to Portland International Airport. The Eugene distribution hub serves southern, central, and eastern Oregon.
- "Eastern Oregon is also served by hubs in the Tri-Cities area, Moses Lake, and Spokane.
- "Additional small amounts of petroleum products come by tanker from California and Pacific Rim Countries." [15]

The Olympic Pipeline runs from the refineries on Puget Sound to Portland, and has distribution terminals located at Bayview (Mount Vernon), Seattle, Renton, Sea-Tac Airport, Tacoma, Spanaway, Olympia, and Vancouver in Washington, as well as Linnton and Portland in Oregon. This line carries gasoline, diesel fuel and jet fuel. Annual throughput capacity of the Olympic Pipeline is approximately 4.6 billion gallons, and this capacity is allocated among

[15] Oregon Department of Energy. Biennial Energy Report Submitted to the Oregon Legislature, November 2018.

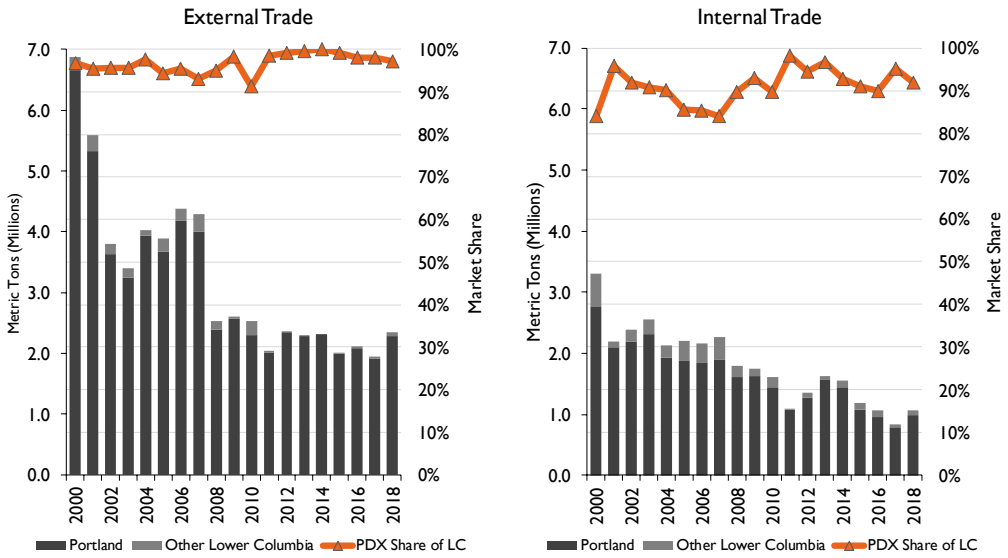
the different terminals. The pipeline carries a relatively large share of the refined products shipped to the Portland area.

In addition to distributing fuels by truck, the petroleum terminals in Portland ship petroleum products up the Columbia/Snake River system via barge, send jet fuel to Portland International Airport by via a separate pipeline, and ship fuels to a terminal in Eugene via another pipeline. The fuels shipped to Eugene are then distributed as far as portions of Eastern Oregon.

As shown in Figure 5-9, Portland's share of the Columbia River external petroleum products market ranges between 90% to 100%. Waterborne petroleum traffic levels were exceptionally high in 2000 and 2001, because the Olympic Pipeline was closed for several years following a catastrophic fire. After the pipeline restarted, waterborne petroleum product traffic averaged 4.0 million metric tons from 2002 to 2007, but declined to an average of 2.3 million metric tons per year from 2008 to 2018.

Internal river movements of petroleum products also peaked in 2000 but fell in 2001. Internal movements of petroleum products averaged 2.3 million metric tons from 2002 to 2007, but declined to 1.4 million metric tons per year from 2008 to 2018. Portland's share of Columbia River internal petroleum products averaged 93% from 2008 to 2018.

Figure 5-9: Trends in Portland Petroleum Product Marine Traffic



Source: BST Associates

From 2014 through 2018, external waterborne movements of petroleum products through Portland terminals averaged 1.4 million metric tons of gasoline (45% of the total), 1.3 million metric tons of distillate fuel oil (42% of the total), 0.2 million metric tons of jet fuel (8% of the total), 0.1 million metric tons of lube oil and grease (4% of the total) and 0.06 million metric tons of residual fuel oil (2% of the total).

Overall petroleum product consumption in Oregon peaked in 1999 at 71.5 million barrels, and then declined to 62.8 million barrels in 2012. Consumption then increased gradually, reaching 65.9 million barrels in 2017 (i.e. 8% below the peak in 1999). In Oregon, consumption per capita has steadily fallen, but this is offset by population growth. Consumption responds to relative prices as well as to new technology (hybrid cars, electric cars, et al.), improved mass

transit, and ride-sharing. In addition, in the case of Portland, shipments of petroleum products upriver must compete on price with products delivered by pipeline to terminals in Eastern Washington.

As shown in Table 5-5, projected external waterborne shipments and receipts of refined products are projected to range between 1.8 million metric tons and 2.4 million metric tons in 2040:

- Low case: 1.8 million metric tons (-0.10% per year growth from 2018 to 2040),
- Reference case: 2.1 million metric tons (-0.33% per year growth),
- High case: 2.4 million metric tons (0.28% per year growth).

Table 5-5: Portland Petroleum Product Forecast (External Market, Mil. Metric Tons)

		History			Forecast			Compound Annual Growth Rate	
Direction	Case	2000	2010	2018	2020	2030	2040	2000-2018	2018-2040
	Low				1.88	1.81	1.78		-1.03%
Inbound	Reference	6.48	2.29	2.24	1.98	1.97	2.07	-5.74%	-0.36%
	High				2.23	2.23	2.36		0.24%
	Low				0.05	0.05	0.05		0.46%
Outbound	Reference	0.19	0.01	0.04	0.05	0.05	0.05	-7.80%	0.98%
	High				0.06	0.06	0.06		1.83%
	Low				1.93	1.86	1.83		-1.00%
Total	Reference	6.66	2.30	2.28	2.03	2.02	2.12	-5.79%	-0.33%
	High				2.29	2.29	2.42		0.28%

Source: BST Associates

Crude Oil

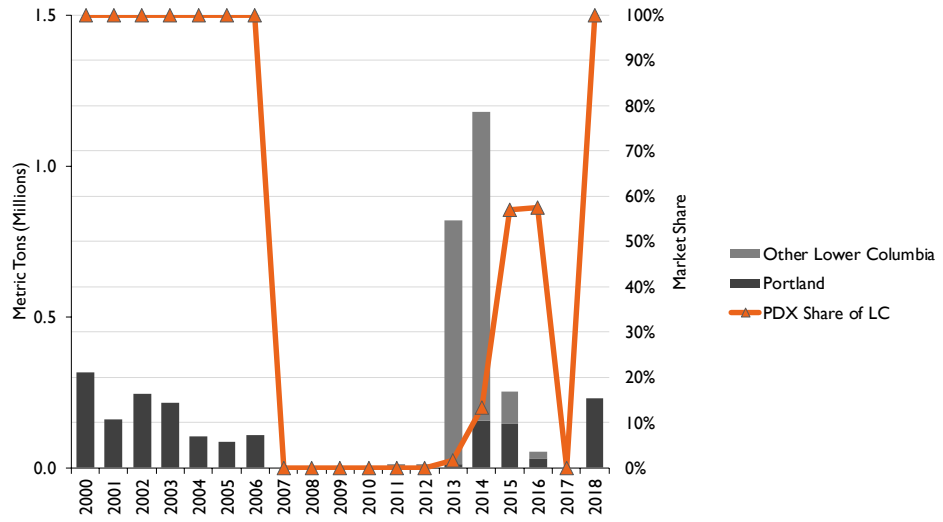
Trends in the movement of crude oil on the Lower Columbia River are illustrated in Figure 5-10. Crude oil was imported to Portland for manufacture of asphalt until 2006, with 85,000 tons and 200,000 tons imported annually. Asphalt production ended in 2006, which resulted in Portland waterborne crude oil imports disappearing entirely in 2007.

Outbound shipments of crude oil from the Lower Columbia River started in 2011 and 2012, at first moving in very small volumes (i.e. 11,000 to 12,000 metric tons per year). Crude oil shipments began to surge in 2013 and 2014, reaching 808,000 metric tons in 2013 and peaking at 1.1 million metric tons in 2014, before falling to 251,000 metric tons in 2015 and 51,000 metric tons in 2016. All of this outbound crude arrived by rail at Lower Columbia River terminals, and was shipped coastwise to domestic oil refineries in Washington and California.

A total of 2.3 million metric tons of crude oil were shipped from the Lower Columbia River from 2011 through 2016. Approximately 88% of this crude was shipped from Port Westward (near Clatskanie, OR), while Portland accounted for the remaining 12%, or 287,000 metric tons.

No crude oil was shipped by water from the Lower Columbia River in 2017. Shipments from Portland resumed in 2018, and this included 32,000 metric tons of coastwise shipments as well as 196,000 metric tons of foreign exports (primarily moving to China and South Korea). Port Westward saw no waterborne movement of crude oil in 2018.

Figure 5-10: Trends in Lower Columbia Crude Oil Traffic



Source: Corps of Engineers

Looking forward, it is unclear what will happen with exports and coastwise shipments of crude oil from Columbia River terminals.

Zenith Energy, which acquired a Willamette River terminal in Portland (from Arc Logistics), shipped crude oil from 2014 to 2018, but it is unknown if these shipments will continue in the future. In 2016, the City of Portland enacted Fossil Fuel Terminal Zoning Amendments that were designed to restrict the development and expansion of bulk fossil fuel terminals, by limiting the expansion of storage capacity and by restricting the use of storage tanks to refined products. The direct transfer of oil from rail cars to ship (without intermediate storage) is allowed, however, and Zenith has expanded its rail handling system from a 14-car loading capacity to 44-car loading capacity.

On the Lower Columbia River, several proposals to ship crude oil from other facilities have been cancelled, including the Vancouver Energy Terminal and the NuStar Terminal (both located at the Port of Vancouver). At Port Westward, Global Partners did ship crude oil from its terminal in the past, but it is unclear whether they will resume crude oil shipments in the future.

As a result of this uncertainty, crude oil shipments are not included in the low, reference or high forecasts.

Table 5-6: Portland Crude Oil Forecast (Foreign and Domestic, Mil. Metric Tons)

		History			Forecast			Compound Annual Growth Rate	
Direction	Case	2000	2010	2018	2020	2030	2040	2000-2018	2018-2040
Inbound	Low	0.31	-	-	-	-	-	-100.0%	NM
	Reference				-	-	-		NM
	High				-	-	-		NM
Outbound	Low	0.01	-	0.23	-	-	-	23.09%	-100.00%
	Reference				-	-	-		-100.00%
	High								-100.00%
Total	Low	0.31	-	0.23	-	-	-	-1.76%	-100.00%
	Reference				-	-	-		-100.00%
	High				-	-	-		-100.00%

Source: BST Associates

Other Liquid Bulks

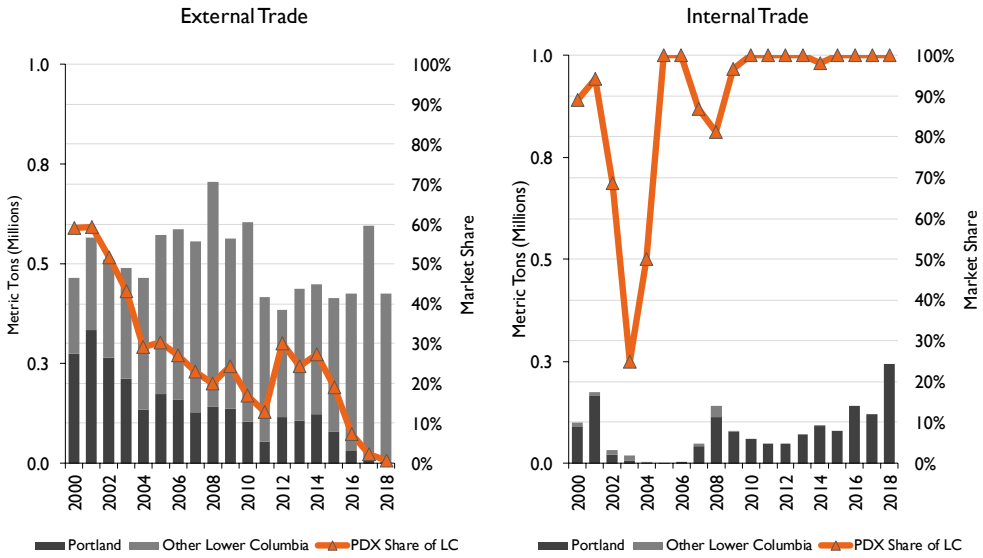
Other liquid bulks include animal fats, vegetable oils, chemicals, fertilizers, and methanol. Portland's external movements of these products declined from a peak of 335,000 tons in 2001 to just 2,600 tons in 2018. During this decline Portland's share of the Lower Columbia River experienced significant volatility but generally tended downward, falling from around 60% in 2000 to essentially 0% in 2018.

Internal movements of other liquid bulks, however, increased to 240,000 tons in 2018, and Portland's market share of internal traffic has been near 100% since 2010. (See Figure 5-11).

The following changes occurred in Portland from 2000 to 2018:

- Alcohols – development of an ethanol plant in Boardman in 2007 changed the flow of waterborne trade through Portland, switching from external sources to internal river sources.
- Ammonia – receipts disappeared in 2017. J. R. Simplot has since leased the ammonia storage tanks at its Rivergate Terminal to CF Industries Holdings, and CF plans to export anhydrous ammonia to Pacific Rim countries. However, the expected volumes are not publicly available.
- Asphalt – as noted above, asphalt production ceased in Portland in 2006, which eliminated coastwise shipments of this product.
- Other products (e.g., naphtha and sodium hydroxide) – waterborne movements have occurred sporadically, but have gradually disappeared.

Figure 5-11: Trends in Portland Other Liquid Bulks Traffic



Source: Corps of Engineers

As shown in Table 5-7, by 2040 external waterborne movements of other liquid bulk products through Portland terminals are projected range from approximately 240,000 metric tons to 412,000 metric tons.

- Low case: 223,700 metric tons (-0.76% per year growth from 2018 to 2040),
- Reference case: 354,800 metric tons (1.34% per year growth),
- High case: 412,400 metric tons (2.03% per year growth).

Table 5-7: Portland Other Liquid Bulk Product Forecast (Total Market, Mil. Metric Tons)

		History			Forecast			Compound Annual Growth Rate	
Direction	**Case**	**2000**	**2010**	**2018**	**2020**	**2030**	**2040**	**2000-2018**	**2018-2040**
Inbound	Low	0.28	0.16	0.25	0.17	0.21	0.21	-0.64%	-0.77%
	Reference				0.26	0.33	0.33		1.25%
	High				0.29	0.37	0.37		1.73%
Outbound	Low	0.44	0.11	0.01	0.01	0.01	0.01	-18.53%	-0.67%
	Reference				0.02	0.02	0.02		3.08%
	High				0.03	0.04	0.04		6.33%
Total	Low	0.72	0.26	0.26	0.18	0.22	0.22	-5.43%	-0.76%
	Reference				0.28	0.35	0.35		1.34%
	High				0.32	0.41	0.41		2.03%

Source: BST Associates

These forecasts are based on the current mix of other liquid bulks moving through Portland terminals. However, new ventures could change the forecast. As an example, the Port of Portland is planning to adopt a sustainable aviation fuels strategy that will entail adding biodiesel to jet fuel. Under this proposal 10% of the jet fuel would be replaced with biodiesel

by 2028, increasing to 25% in 2035 and 50% in 2050.[16] This would have the impact of reducing jet fuel movements and increasing biodiesel fuel movements. It is currently unknown how the biodiesel products will be sourced.[17]

Other Columbia River ports currently handle the following products:

- Sodium hydroxide is imported at the Port of Vancouver for domestic manufacturers.
- Toluene is imported by chemical plants at the Port of Kalama.
- Ethanol is shipped from the Global Partners facility at Port Westward (Port of Columbia County) to domestic and foreign destinations.
- Planned projects at other ports:
    - NEXT Renewable Fuels at Port Westward is planning production of 50,000 barrels of biofuels per day at full capacity, with the recycled materials and the finished product moving in and out by ship. The tonnage estimates and ramp up schedule are not currently known.
    - Methanol plants are proposed at the Port of Kalama and the Port Westward, which would use natural gas as a feedstock. Each of the plants would produce approximately 10,000 metric tons of methanol per day (or approximately 3.4 million metric tons per year, per plant), all of which would be exported by water.

Summary of Liquid Bulks

Combined total tonnages for petroleum products, crude oil, and other liquid bulks that move in and out through the mouth of the Columbia River are shown in Table 5-8.

Portland has historically accounted for most of these liquid bulk movements; this is projected to be the case under the low and reference forecasts, but not under the high forecast. As discussed above, the high forecast includes exports of methanol from Kalama and Port Westward.

Portland liquid bulk tonnage is projected to grow under all three forecast scenarios, with growth rates ranging between 0.7% per year and 1.6% per year. Growth rates for the Lower Columbia River are projected to range between 0.4% per year and 6.7% per year.

[16] C&S Companies. PDX Sustainable Aviation Fuel Infrastructure Evaluation, FINAL REPORT, for the Port of Portland, September 2018.

[17] SeQuential Pacific Biodiesel, which produces biodiesel from used cooking oil from local restaurants and businesses in Salem, could be a source.

Table 5-8: Portland Total Liquid Bulk Forecast (Total Market, Mil. Metric Tons)

		History			Forecast			Compound Annual Growth Rate	
Direction	**Case**	**2000**	**2010**	**2018**	**2020**	**2030**	**2040**	**2000-2018**	**2018-2040**
Inbound	Low	7.00	2.32	2.28	2.41	2.75	2.65	-6.0%	0.7%
	Reference				2.45	2.94	2.93		1.2%
	High				2.49	3.10	3.25		1.6%
Outbound	Low	0.25	0.01	0.01	0.02	0.10	0.11	-17.8%	13.0%
	Reference				0.02	0.13	0.16		14.9%
	High				0.02	0.16	0.17		15.2%
Total - Portland	Low	7.25	2.33	2.28	2.42	2.85	2.76	-6.2%	0.9%
	Reference				2.46	3.07	3.09		1.4%
	High				2.51	3.26	3.42		1.8%
Total - Lower Columbia River	Low	7.58	3.01	2.93	2.98	3.28	3.22	-5.1%	0.4%
	Reference				3.20	4.34	4.62		2.1%
	High				3.35	11.24	12.32		6.7%
Portland Share of Lower Columbia River	Low	95.7%	77.3%	78.0%	81.3%	86.6%	85.6%		
	Reference				76.9%	70.8%	66.8%		
	High				74.8%	29.0%	27.8%		

Source: BST Associates

There are several key differences between this forecast and the Portland and Vancouver Harbor Forecast Update in 2012.

- The 2012 forecast included internal movements, i.e. movements that occur entirely within the Columbia-Snake River system. For the most part these shipments and receipts move through the same Portland terminals as the external trade.
- The 2012 forecast included tonnage for ports on the Oregon Coast, which the current forecast does not. The earlier forecast included liquified natural gas exports from Coos Bay, which totaled 5 million metric tons under the high forecast and 2.5 million metric tons under the mid-range forecast.
- Methanol was not included in the 2012 forecast.

Containers

U.S. Pacific Northwest container trade is centered at the Northwest Seaport Alliance (NWSA), i.e., the Port of Seattle and the Port of Tacoma. Portland was historically a smaller player in the container trade, but lost most of its container service in 2015. However, a new weekly trans-Pacific liner service (SM Lines) started in Portland in 2020.

Container Trends and Forecast

U.S. Pacific Northwest (US PNW) container traffic increased between 2001 and 2005, growing from 3.1 million TEU to 4.3 million TEU (including full and empty imports, exports, and domestic containers). Since 2005, container volumes have remained between 3.3 million TEUs and 3.8 million TEUs. International container traffic that moves through ports in the US PNW is dominated by trade with Asia, especially China. The US PNW is facing a very competitive environment, and has experienced a sustained drop in container market share. Much of this competition has come from ports in British Columbia (BC):

- US PNW share of US West Coast (USWC) container traffic declined from 21.9% in 2000 to 15.9% in 2018,
- If British Columbia is included, US PNW share of US and Canadian West Coast container traffic declined from 16.8% in 2000 to 11.8% in 2018.

NWSA container volumes have declined due to a loss of inland intermodal markets. A major reason for this is the cost differential relative to ports in BC; including ocean, port, and rail costs it is $400 to $600 cheaper per container to move through BC vs. the NWSA.[18] This loss of intermodal market share has caused NWSA to focus on attracting the maximum number of local and regional containers.

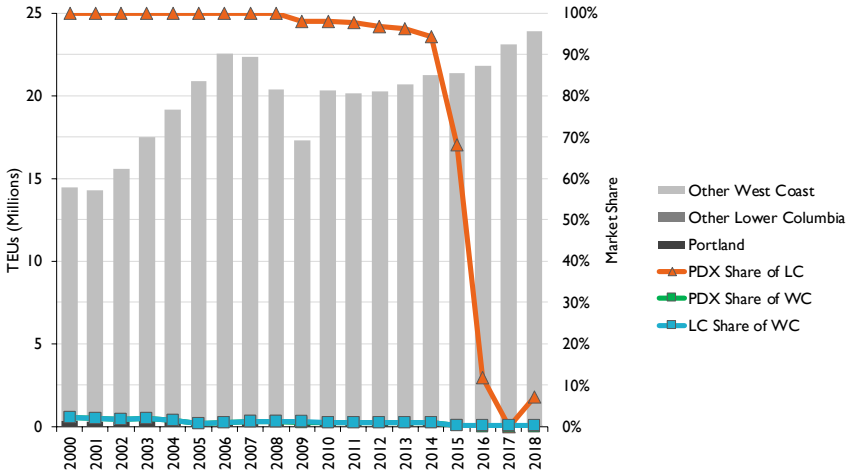
Portland's container traffic grew from 290,000 TEUs in 2000 to a peak of 340,000 TEUs in 2003, and Portland's share of US PNW traffic increased from 9.2% to 9.5%; during this period Portland's share of the USWC remained at about 2.0%. Portland's container traffic declined steadily from 2003 to 2014, dropping to 165,000 TEUs. By 2014 Portland's share of US PNW and USWC container traffic had declined to 4.6% and 0.8%, respectively. Portland container volume dropped to 23,000 TEUs in 2015, and then disappeared entirely in 2017.

A key reason for the loss of container traffic was a long-running dispute between the terminal operator and labor, which led to delays in moving cargo and increased costs to shippers.

Compounding the problem for Portland was a rapid increase in the size of container vessels. The Columbia River navigation channel provides 43 feet of water depth, but the newest container vessels draw more than 50 feet of water. In addition, the container lines have increasingly focused on load centering, in which container traffic is funneled through only a few select ports.

[18] NW Seaport Alliance blames cheaper Canada rail for market share loss, Journal of Commerce Jul 23, 2018

Figure 5-12: Trends in International Container Traffic



Source: PIERS

Other ports on the Lower Columbia River also provide limited container service. For example, Rainier, Oregon is the base of operation for container barge service to Hawaii, which Sause Brothers started in 2009. In addition, the ports of Longview and Vancouver sporadically handle containers. Portland's share of the Lower Columbia River market fell from 99% - 100% from 2000 to 2009, to 94% - 97% from 2009 to 2014, and then to 0% in 2017.

Local/Regional Market Size

Portland's local container market mainly consists of an area that includes Oregon, southern Idaho, and the barge system serving Southeast Washington and Northern Idaho. Products in this market area can move either via Columbia River ports (primarily the Port of Portland) or container ports in Puget Sound.

Figure 5-13: Port of Portland Container Market Area

Source: Port of Portland

Recent estimates of the size of the Portland container market include the following:

- The Port of Portland estimates that the local/regional market served by Portland is as follows:
    - Trans-Pacific trade route is approximately 238,000 full TEUs
    - Other trade routes (mainly Europe and Oceania, among others) is approximately 28,000 full TEUs
    - Combined routes are estimated 266,000 full TEUs.[19]
- The Tioga Group estimated the Oregon container market served by Portland in 2014 was:
    - Portland - North Willamette = 93,600 full TEUs (47% of total containers)
    - Middle Willamette = 66,500 full TEUs (33% of total containers)
    - Southern Oregon = 4,400 full TEUs (2% of total containers)
    - Central Oregon = 32,200 full TEUs (16% of total containers)
    - Eastern Oregon = 3,200 full TEUs (2% of total containers)
    - Oregon Total = 199,900 full TEUs[20]

Tioga's analysis indicated that, in 2014, Port operations at T6 were able to capture:

- 38% of potential exports (39,000 full TEUs),
- 70% of potential imports (66,000 full TEUs),
- 53% of total imports and exports (105,000 full TEUs).

Container Vessel Size

The increasing size of container ships is a key factor that is negatively impacting Portland's ability to attract a new container carrier. The 8,000 to 10,000 TEU vessels that began calling the Pacific Northwest in 2009 draw 48 feet or more when fully loaded. The Columbia River navigation channel, however, is maintained to a depth of 43 feet. Other types of ships (such as bulk carriers that move grain) have not seen such an increase in size, and are generally not limited by the 43-foot channel.

The adoption of larger vessels has led to a reduction in the number of ports at which a ship calls on each voyage, which means that more containers are handled during each vessel call. This has increased the pressure on ports to improve terminal capacity and throughput. In order to accommodate the larger vessels, significant investments are required in port infrastructure, including:

- Longer berths,
- Larger container cranes,
- Increased water depth in channels and alongside berths (51 feet or more), and
- Additional on-dock rail to quickly move cargo off dock.

[19] Port of Portland data includes full import and export containers based on PIERs data.

[20] Tioga Group. Trade and Logistics Report: Concepts and Business Case Analysis, February 2016.

The consolidation of shipping lines into fewer and larger alliances gives the carriers significant leverage in negotiating with ports, due to the amount of cargo they control. It also limits any individual carrier's reliance on any particular port or terminal.

However, despite the compelling reasons to switch to larger vessels, smaller vessels still comprise a large share of the vessel calls on international routes. For example, PNW ports report that around 31% of vessels are still relatively small (i.e., up to 5,000 TEUs).

A recent report prepared for Port Metro Vancouver (PMV) explored the expected vessel distribution with and without the proposed Roberts Bank Terminal 2 that is currently in the planning stages.[21] The report concluded that smaller vessels (i.e. 2,500 to 4,500 TEU) will likely continue to be operating in the PNW container trade in 2035, despite the rapid shift to larger vessels by most carriers. This size of vessel is well within the operating specifications of Columbia River navigation channel.

Ocean Service Forecast

The Port of Portland and its partners (State of Oregon, private sector firms) have worked hard to overcome past difficulties, and these efforts have produced some success. Swire Shipping began calling at the Port of Portland with a breakbulk/container service in January 2018, and SM Lines started a new weekly trans-Pacific container service to Portland in 2020.

Under the reference and high forecast scenarios, container service is projected to average 25 calls per year in 2020 and to increase to 50 calls per year (weekly service) for the forecast period. This level of service may result in 2040 container volumes of 58,400 TEU under the reference forecast and 67,100 TEU under the high forecast. Under the low forecast, container service would cease by 2030.

Table 5-9: Portland Ocean Container Trade (1,000 TEU)

		History			Forecast			Compound Annual Growth Rate	
Direction	Case	2000	2010	2018	2020	2030	2040	2000-2018	2018-2040
Imports	Low				10.0	-	-		-100.00%
	Reference	69.5	85.1	0.9	10.0	20.1	25.7	-21.49%	10.94%
	High	-	-	-	10.0	21.7	27.1		11.26%
Exports	Low	-	-	-	12.5	-	-		-100.00%
	Reference	221.5	96.3	0.2	12.5	28.1	34.7	-32.00%	17.16%
	High	-	-	-	12.5	30.9	40.9		17.79%
Total	Low	-	-	-	22.5	-	-		-100.00%
	Reference	290.9	181.1	1.1	22.5	48.2	58.4	-26.60%	13.20%
	High	-	-	-	22.5	51.2	67.1		13.69%
Portland Share of Lower Columbia River	Low				64.7%	0.0%	0.0%		
	Reference	99.7%	97.1%	8.8%	64.7%	76.6%	77.2%		
	High				64.7%	81.4%	88.7%		

Source: BST Associates, IHS Markit

As discussed above, Portland historically accounted for nearly all of the container traffic on the Lower Columbia River, but that changed when Portland lost international container

[21] Mercator. Roberts Bank Terminal 2 Container Vessel Call Forecast Study, prepared for Metro Port Vancouver, November 2018.

service. Small number of containers occasionally move through Longview or Vancouver, and Saint Helens has regular container barge service to Hawaii.

With the two new container services that have started over the past two years, Portland's share of Lower Columbia River container traffic is projected to be 64.7% in 2020. Portland's share may climb to between 77.2% and 88.7% in 2040 under the reference and high growth cases; if Portland service is discontinued then Portland's share may drop to zero. Essentially all of the remaining projected container volume on the Lower Columbia River is from the service to Hawaii from Rainier.

Intermodal Service Forecast

BNSF Railroad began operating an intermodal service from T6 in 2018, with an estimated 66,800 TEUs (full and empty) in 2018 and 84,300 TEUs in 2019.[22] This intermodal service reduces costs to local shippers by moving ocean containers between Portland and Seattle/Tacoma by rail instead of truck. Reduction of truck traffic (especially older trucks) is a key part of the NWSA's strategy to improve air quality.

This intermodal service is expected to grow under all three forecast scenarios:

- Low scenario: 2040 volumes of 94,600 TEUs (average growth from 2018 at 5.0% per year; please note that the ramp up from 2018 to 2019 was steep and that growth rate from 2019 to 2040 is estimated at 0.4% per year)
- Reference scenario: 2040 volumes of 107,000 TEUs (average growth from 2018 at 6.9% per year; 0.8% from 2019 to 2040)
- High scenario: 2040 volumes of 125,400 TEUs (average growth from 2018 at 7.7% per year, 1.3% from 2019 to 2040)

Table 5-10: Portland Intermodal Container Trade at T6 (1,000 TEU)

		History			Forecast			Compound Annual Growth Rate	
Direction	Case	2000	2010	2018	2020	2030	2040	2000-2018	2018-2040
TEUs (1,000s)	Low				81.2	83.5	94.6		5.00%
	Reference	89.7	3.3	66.8	82.0	88.4	107.0	-6.90%	6.90%
	High	-	-	-	82.9	94.7	125.4		7.70%
Metric Tons (millions)	Low	-	-	-	0.6	0.7	0.8		5.00%
	Reference	0.7	0.0	0.5	0.7	0.7	0.9	-7.50%	6.90%
	High	-	-	-	0.7	0.8	1.0		7.70%

Source: BST Associates, IHS Markit

[22] Journal of Commerce. BNSF begins Portland container rail shuttle, Jan 08, 2018