2017 Marine Cargo Forecast and Rail Capacity Analysis

Final Report

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Executive Summary

Overview

Washington sits astride a great international trade route that links our state to the world's economy. The investments that have been made to maintain and strengthen this asset pay substantial dividends in terms of supply-chain efficiencies, shipping rates and access to emerging markets. In concert with the state's transportation system, our ports provide:

- Family wage jobs, especially in industrial and agricultural sectors.
- Transport of commercial goods at substantially reduced cost.
- Cost-effective access to global markets.

The purpose of the *2017 Marine Cargo Forecast* is to assess the expected flow of waterborne cargo through Washington's port system and to evaluate the distribution of cargo through the state's transportation network, including waterways, rail lines, roads, and pipelines. The study includes forecasts of trade by commodity and cargo type from 2015 through 2035.

These forecasts are unconstrained, which means they assume that the infrastructure needed to move the cargo will be in place in time to meet the demand. However, they do provide a qualitative assessment of these factors because meeting demand will inevitably require upgrades and investment, particularly in rail capacity.

The Washington Public Ports Association (WPPA) has been involved in similar forecasting efforts since 1975, on approximately a five year basis. These reports are used as planning tools within the port community and related industries. They also alert state and local policymakers, as well as the public, to potential opportunities and constraints. The Freight Mobility Strategic Investment Board is a co-sponsor of the project.

Economic opportunities on the Pacific Rim

The first section of the report assesses the prospects for the world economy with an emphasis on the state's principal trading partners in Asia. The state's dependence on Asia is difficult to overstate. Consider the following:

- 97 percent of containers imported through Washington ports come from Asia.
- 90 percent of containers exported through the state go to Asia.

This report analyzes each region or country to identify factors impacting those areas in the short term. That information is used to make long-term projections, and to inform cargo forecasts up to the year 2035. While economic recovery from the Great Recession has been slow, the Pacific Rim continues to grow faster than most of the world.

China is especially critical to Washington, as it is to other West Coast states. For most commodities, its importance has surpassed all other Asian countries. China's economy is expected to continue growing and will soon be second only to the United States.

Washington's chief domestic trading partners, Alaska and Hawaii, are also included in the macroeconomic overview section of the report. Alaska's economy is driven by the petroleum industry and the federal government. Hawaii's is led by the tourism industry, but has a more diversified economy than Alaska. Both states are projected to grow slowly during the forecast period.

Trade opportunities in the Evergreen State

Washington ports handle a diversified range of cargoes, and the future should bring growth opportunities to the various cargo groups. Highlights of the forecast include the following:

Containers face stiff competition. International container traffic peaked in 2007 then fell sharply during the Great Recession. Volumes have since recovered some of the lost ground, but competing ports in British Columbia have gained market share at our expense. International container volumes are projected to grow, but the rate of growth will depend on the ability of local ports to compete with other regions. Growth in domestic containers (i.e. Alaska and Hawaii) is likely to be slow.

Fully assembled autos are projected to grow steadily. Auto imports dropped sharply during the great recession, and volumes have still not fully recovered. From their current level of 500,000 units, imports are projected to grow by an additional 100,000 to 250,000 units by 2035. Exports of automobiles were negligible until 2008. Since then, they have been as high as 160,000, and are projected to grow to between 320,000 and 420,000 in 2035.

Log exports are likely to level off. In the last decade log exports have grown to levels not seen in years. This sudden jump in exports has ended, but volumes remain substantially higher than they were a decade ago. Future growth is projected to be slow under the reference and high forecasts, and flat under the low. Imports of logs dropped by 75% from their peak in 2005, and are projected to remain essentially flat.

Breakbulk cargo volumes are likely to grow slowly. Metal, forest products and other breakbulk cargo will grow slowly due to containerization and structural changes in the industries that produce these cargoes. Much of the expansion will occur as ports diversify.

Grain shipments are projected to continue growing. Grain shipments saw strong growth over the past 15 years, and this growth is projected to continue. The deepening of the Columbia River Channel led to major investments in export terminals on the river, and they are well-positioned to serve the increasing demand from Asia.

Dry bulk trends will continue. Alumina has greatly decreased in importance to the region, but other commodities have increased. On the export side, potash and soda ash accounted for most of the growth, while exports of other commodities such as petroleum coke moved in steady volumes. On the import side, key commodities include building materials, fertilizer, and chemicals. Slow growth is projected for most of these commodities.

Liquid bulk will shift source. Crude by rail has replaced a share of crude from Alaska, and will likely continue to be an important source. Crude is also received by pipeline from Canada. As crude oil production decreases in Alaska, northwest refineries will replace Alaskan crude oil with a combination of rail, pipeline, and foreign waterborne sources. In addition, shipments of crude oil from the northwest will increase if proposed new shipping terminals are constructed.

Transportation: moving goods to market over road, rail and water

An efficient transportation system that integrates road, rail, and water, and air transportation is essential to meeting our state's present and future trade opportunities. This report focuses in depth on the waterborne transportation system, as well as the road and rail systems that serve the waterborne transportation system. Air transportation is not examined in this report, as there is a limited volume of waterborne cargo that moves to or from Washington marine terminals by air.

Road

Road, highway, and on-terminal truck transport is critical to Washington's ports. Heavy, midsize, and light trucks play important roles in cargo movement and goods distribution. Trucks overall comprise a relatively small portion of total road and highway traffic in the urban regions of the state. While truck traffic is expected to grow between now and 2035, auto traffic will increase even faster. In light of this competition for limited road capacity, the challenge will be to protect the functionality and reliability of the road system for truck transport. Road capacity development will be critical for continued economic growth.

Rail

Trade prosperity in our state is directly linked to the level of rail capacity serving our ports, and the amount of cargo moving to our ports by rail is forecast to increase. If several proposed new marine terminals are constructed the associated growth in rail traffic could be tremendous, but even without those projects port-related rail volumes will grow. In order to meet future demand, it is likely that additional capacity will be needed in various locations.

The state rail system consists of the mainline system and a number of short-line operations. The mainline system is the primary inland transportation component for large-volume import and export cargo moving through our ports. The short-line network consists of many small local railroads, many of which evolved as the state's rail network experienced system-wide contractions, and low-density feeder lines were abandoned by mainline operators.

Washington's mainline rail system is comprised of two competing railroads: the Burlington Northern Santa Fe (BNSF) and the Union Pacific (UP). Both operators have invested significantly in improvements and upgrades to their mainline systems, including new locomotives, new traffic control systems and substantial mainline rail bed improvements.

In general, the key mainlines are able to accommodate existing levels of traffic, and improvements made over the past decade have increased capacity. In particular, a number of projects described in previous Marine Cargo Forecasts were either constructed or are under construction, which has helped to eliminate many of the key capacity constraints. The mainline railroads have demonstrated that they are very good at adding capacity in a relatively short timeframe, if they are able to anticipate the need. State and local governments can facilitate the investments these railroads make by helping with permitting and other local issues.

Waterways

In addition to road and rail transportation, our state's waterways are critically important to international and domestic trade. The Columbia-Snake River navigation system allows Washington-grown agricultural products to move from farm to market, and creates price competition between modes of transportation. Puget Sound and the Washington Coast are vital to domestic barge trade as well as international trade.

The Columbia River deepening project has greatly benefitted shippers who use Washington and Oregon ports along the Lower Columbia by creating transportation cost savings. The recent investments in expanded capacity at grain terminals along the river are proof of the importance of this project.

From harbors in Puget Sound to dams on the Snake River, our waterways are integral to Washington's economy. Future challenges related to channel deepening, maintenance dredging and potential dam breaching must be addressed to preserve the viability of the system.

Challenges on the horizon

Washington's public ports provide economic security, opportunity and diversity to our local communities, to the state as a whole, and to the surrounding region. If we invest wisely in transportation and port infrastructure, trade will continue to flow through the state and deliver tremendous opportunity in the next two decades and beyond.

Every ship that calls in Washington provides greater choices and better prices for consumers, but it also creates opportunities for all Washingtonians: farmers who must move their crops to markets overseas; manufacturers who rely on inbound shipments for parts and materials; and countless innovators who ship their high-demand products cheaply and efficiently around the world.

Our ability to cultivate new opportunities will depend on the investments made today and tomorrow. Much of the cargo received at Washington ports is discretionary, and can move through alternative gateways; in order to preserve the shipping options available local producers, we must compete aggressively to preserve and expand access to trade routes.

Competition is especially fierce from ports in Southern California and British Columbia, as well as ports on the East and Gulf Coast. Southern California is especially attractive to shippers due to its large population base, and British Columbia has been able to offer a low-cost alternative to ports in the Pacific Northwest.

The key to maintaining and expanding our place in the global economy is to continue investing in our transportation infrastructure – beginning with an efficient, cost-effective rail system. Our state's participation in trade brings with it thousands of jobs and greater collective wealth, but it also requires investment. If we make wise choices now, our state stands to benefit from the growth on the horizon for Washington's port transportation system.

Chapter 1
Overview

Purpose

The purpose of the *2017 Marine Cargo Forecast* is to assess the expected flow of waterborne cargo through Washington's port system and to evaluate the distribution of cargo through the state's transportation network, including waterways, rail lines, roads, and pipelines. The study includes forecasts of trade by commodity and cargo type from 2015 through 2035.

These forecasts are unconstrained, which means they assume that the infrastructure needed to move the cargo will be in place in time to meet the demand. However, they do provide a qualitative assessment of these factors because meeting demand will inevitably require upgrades and investment, particularly in rail capacity.

The Washington Public Ports Association (WPPA) has been involved in similar forecasting efforts since 1975, an approximately a five year basis. These reports are used as planning tools within the port community and related industries. They also alert state and local policymakers, as well as the public, to potential opportunities and constraints. This year the Freight Mobility Strategic Investment Board is the co-sponsor of the project.

Methodology

The macroeconomic overview of various geographic regions is based on short-term analyses supplied by IHS Markit. These were supplemented with population growth comparisons based on data from the IMF, World Bank, USDA, and OECD. Trends and forecast data for GDP growth were based on information from the USDA.

The commodity forecasts were based on a variety of sources, depending on the handling group and commodities included. The initial basis for all of the projections was trade forecasts produced by IHS Markit, which served as the "reference" cases for most commodities. Low case and high case forecasts were then developed using additional sources.

These forecasts are **unconstrained**, which means they assume that the infrastructure needed to handle the projected volumes will be available when needed. The **high case** for each handling type includes cargo volumes related to projects that are currently in the permitting process, such as the Millennium Bulk Terminal in Longview, the Northwest Innovation Works methanol plant in Kalama, and the Vancouver Energy terminal in Vancouver, among others.

The Pacific Northwest was divided into four regions, and cargo projections were developed for each. These regions include:

- PSRC – this region includes marine terminals in King, Pierce, Snohomish, and Kitsap County, the counties included in the Puget Sound Regional Council, or PSRC.
- Puget Sound / Other Washington – this includes all ports and marine terminals on Puget Sound that are not in the PSRC region, as well as those on the Washington coast and in the Strait of Juan de Fuca.
- Lower Columbia Washington – this includes all marine terminals on the Washington side of the Columbia River, from Vancouver to the mouth of the river.

- Lower Columbia Oregon – this includes all marine terminals on the Oregon side of the Columbia River, from Portland to the mouth of the river, including those on the Willamette River.

Organization

Chapter 2 provides background on the economy in key trading regions for the Pacific Northwest.

Chapter 3 provides forecasts for waterborne cargo moving through deep-draft marine terminals.

Chapter 4 includes a description of inland navigation on the Columbia-Snake River system, and provides forecast of waterborne cargo movements on the system.

Chapter 5 provides analysis of the inland transportation modes used by marine cargo.

Chapter 6 provides an analysis of the capacity of the mainline rail system in Washington, and includes the results of the detailed rail traffic simulation model created for this analysis.

Chapter 7 provides an overview of port access issues, as well as details on the participating ports.

Acronyms and Abbreviations

Africa: World region that includes all countries in Africa.

ATCS: A system of railroad equipment designed to ensure safety by monitoring locomotive and train locations.

BNSF: BNSF Railway.

Breakbulk: Cargo that must be loaded individually, and not in containers nor in bulk.

CAGR: Compound annual growth rate.

Capesize: Vessels which are too large to pass through the Panama Canal or Suez Canal, and therefore travel around the Cape of Good Hope or Cape Horn.

CBR: Crude by rail.

China: World region that includes mainline China, Hong Kong, and Macao.

Coastwise traffic: Domestic waterborne traffic carried over the ocean, (e.g. Alaska to Puget Sound, or Columbia River to California).

DBEDT: Hawaii Department of Business, Economic Development & Tourism.

DDGS: Distiller's dried grains with solubles.

DPU: Distributed power unit (DPU) is a locomotive capable of remote-control operation in conjunction with locomotive units at the train's head end. DPUs are placed in the middle or at the rear of heavy trains (such as coal, grain, and soda ash).

Dry bulk: Free–flowing solids (such as grain) that are poured into the hold of a vessel.

Eastern Europe: World region that includes Albania, Armenia, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Georgia, Hungary, Kosovo, Latvia, Lithuania, Macedonia, Moldova, Montenegro, Poland, Romania, Russian Federation, Serbia, Slovak Republic, Slovenia, Ukraine, and former Soviet republics.

Eurozone: The geographic and economic region that consists of all the European Union countries that have fully incorporated the euro as their national currency.

FRA: Federal Railroad Administration.

GDP: Gross domestic product (GDP) is the monetary value of all the finished goods and services produced within a country's borders in a specific time period.

GDP per capita: Gross domestic product divided by population.

Grade crossing: Location where a road intersects railroad tracks.

Great Recession: The economic downturn that started with the collapse of the housing market in December 2007, and which officially ended in June 2009.

IANA: Intermodal Association of North America.

IHS Markit: Consulting firm that provides industry and trade forecasts and analysis.

IMF: The International Monetary Fund (IMF) is an organization of 189 countries, working to foster global monetary cooperation, secure financial stability, facilitate international trade, promote high employment and sustainable economic growth, and reduce poverty around the world.

Internal traffic: Vessel movements (origin and destination) which take place solely on inland waterways. An inland waterway is one that is geographically located within the boundaries of the contiguous 48 states or within the boundaries of the State of Alaska. Puget Sound is one such inland waterway, as is the Columbia/Snake River system.

Indian Sub-Continent: World region that includes Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka.

Latin America / Caribbean: World region that includes Mexico, all countries in Central America, all countries in South America, and all countries in the Caribbean.

Liquid Bulk: Free-flowing liquid cargoes that are poured into holds of tankers. Examples include crude oil, petroleum products, certain chemicals, and liquefied natural gas.

Lower Columbia Oregon: Port region on the Columbia River in Oregon, from Portland to Astoria. It includes the Ports of Portland, St. Helens, and Astoria.

Lower Columbia Washington: Port region on the Columbia River in Washington, from Vancouver to the mouth of the river. It includes the Ports of Vancouver, Kalama, and Longview.

Main line rail: Track that is used for through trains or is the principal artery of the system from which branch lines, yards, sidings and spurs are connected. It is also referred to as "mainline" rail.

Metric ton: 2204.6 pounds.

Middle East: World region that includes Bahrain, Iraq, Iran, Israel, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syria, Turkey, United Arab Emirates, and Yemen.

MRL: Montana Rail Link.

Oceania: World region that includes Australia and New Zealand, as well as Pacific island nations not included in Southeast Asia or the Indian Sub-Continent.

OECD: Organization for Economic Co-operation and Development.

Other Northeast Asia: World region that includes Japan, South Korea, North Korea, Taiwan, and Mongolia.

Other Puget Sound / Washington Coast: Port region which includes all Washington deep-draft ports not included in Lower Columbia Washington or PSRC regions.

PADD: Petroleum Administration for Defense Districts (PADDs) are five regions of the United States which are used to analyze the movement of crude oil and petroleum products throughout the nation.

PNW: Pacific Northwest (PNW) is the region that includes Washington and Oregon. Idaho is also included in some usage.

PSRC: Port region encompassing the same counties as the Puget Sound Regional Council region (King, Pierce, Snohomish, and Kitsap Counties). It includes the Ports of Tacoma, Seattle, and Everett.

RTC: Rail Traffic Controller (RTC) is a computer program that simulates the movement of trains through rail networks.

Shortline railroad: A small or mid-sized railroad company that operates over a relatively short distance relative to larger, national railroad networks. These typically fall under the FRA Class II and Class III designations.

Southeast Asia: World region that includes Brunei, Burma, Cambodia, East Timor, Indonesia, Laos, Malaysia, Papua New Guinea, Philippines, Singapore, Thailand, and Vietnam.

Subdivision: Most railroads identify each main line segment between crew change points as one subdivision.

TEU: Twenty-foot equivalent unit.

UP: Union Pacific Railroad.

USDA: U.S. Department of Agriculture.

Western Europe: World region that includes Andorra, Austria, Belgium, Channel Islands, Denmark, Faeroe Islands, Finland, France, Germany, Greece, Greenland, Iceland, Ireland, Isle of Man, Italy, Liechtenstein, Luxembourg, Malta, Monaco, Netherlands, Norway, Portugal, San Marino, Spain, Sweden, Switzerland, and the United Kingdom.

World Bank: The International Bank for Reconstruction and Development (World Bank) is an international financial institution that offers loans to middle-income developing countries.

Chapter 2
International Macroeconomic Overview

Introduction

The following chapter serves as a background discussion of the key trading partner regions for Pacific Northwest ports. The chapter begins with overviews of the trends in waterborne trade between Pacific Northwest ports and both international and domestic regions. This is followed by detailed discussions of each of the trading regions, which include summaries of the major key demographic and economic projections for the regions.

For this discussion, “Pacific Northwest” (or “PNW”) includes all ports in Washington, as well as Oregon ports located on the Columbia River.

Several sources were used to produce the macroeconomic overview. IHS Markit provided short-term analyses of the economies of various geographic regions. These were supplemented with population growth comparisons based on data from the IMF, World Bank, USDA, and OECD. Of these sources, only the OECD and World Bank project population beyond 2030. GDP growth comparisons were based on information from the USDA, which produces forecasts for the most comprehensive list of countries; however, these run only through the year 2030.

Key Observations

- Long-term world GDP growth of 3.0%.
- Most of Pacific Northwest waterborne trade is with Asia.
- Asia accounts for majority of container trade.
- China has become the biggest partner.
- China’s per capita income is projected to grow quickly, while population stabilizes.
- Other Northeast Asia is a key market.
- Southeast Asia is smaller, but growing in importance.
- Latin America is a non-containerized partner, with a growing population.
- Africa is growing, but waterborne trade with Pacific Northwest is limited.
- Alaska is dependent on the declining production of crude oil, the largest sector of Alaska’s economy. Growth prospects are not strong, unless the proposed gas pipeline is built.
- Hawaii GDP grew at approximately 2.0% per year over the past 15 years (higher than average U.S. growth of 1.6% per year), and long-term forecast growth is similar. Economy is based on tourism and government, particularly military.

Trading Regions

International Trading Partner Regions

Since 2000, two-thirds or more of the waterborne tonnage moving through Pacific Northwest ports has been related to trade with Asia. During this period, the most important change is that China has nearly overtaken the rest of Northeast Asia as the largest trading region for Pacific Northwest ports.

Table 2-1: Countries Included by Trade Region

Africa	Middle East	Other Northeast Asia	Southeast Asia
All of Africa	Bahrain	Japan	Brunei
	Iraq	South Korea	Burma
Canada	Iran	North Korea	Cambodia
Canada	Israel	Taiwan	East Timor
	Jordan	Mongolia	Indonesia
China	Kuwait		Laos
China	Lebanon	**Indian Sub-Continent**	Malaysia
Hong Kong	Oman	Afghanistan	Papua New Guinea
Macao	Qatar	Bangladesh	Philippines
	Saudi Arabia	Bhutan	Singapore
Europe	Syria	India	Thailand
All of Western and Eastern	Turkey	Maldives	Vietnam
Europe, including Russia	United Arab Emirates	Nepal	
	Yemen	Pakistan	
Latin America & Caribbean		Sri Lanka	
Mexico	**Oceania**		
All of Central America	Australia		
All of South America	New Zealand		
All of Caribbean	Pacific island nations		
	(excl Southeast Asia and		
	Indian Sub-Continent)		

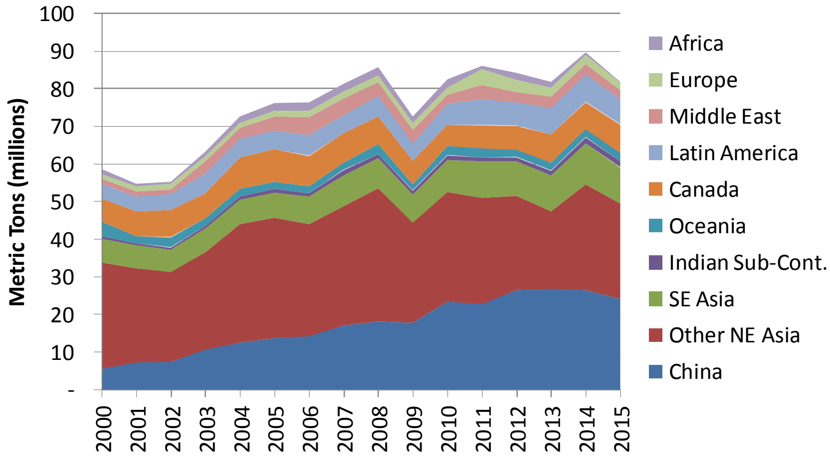
The share of trade moving between the Pacific Northwest and China grew from less than 10% in 2000 to more than 29% in 2015, while the share moving to and from other Northeast Asia dropped from more than 48% to 31%. During this period PNW-China trade grew from 5.5 million metric tons to 24.1 million metric tons, while PNW-Other Northeast Asia trade fell from 28.3 million metric tons to 25.6 million metric tons (see Figure 2-1).

Southeast Asia's share of Pacific Northwest waterborne trade grew slowly over the last 15 years, increasing from 10.8% in 2000 to 11.7% in 2015, but the total tonnage carried in this trade grew from 6.3 million metric tons to 9.5 million metric tons.

Canada and Latin America account for most of the remaining trade. Between 2000 and 2015, Canada's share of waterborne tonnage fell from 10.3% to 9.2%, while Latin America's grew from 6.9% to 8.2%. Despite the decline in market share, PNW-Canada waterborne tonnage grew from 6.0 million metric tons in 2000 to 7.5 million metric tons in 2015, while the PNW-Latin America trade grew from 4.0 million metric tons in 2000 to 6.7 million metric tons in 2015.

No other region accounted for more than 3% of Pacific Northwest tonnage in 2015. Total Pacific Northwest waterborne trade grew for the Middle East (from 1.4 million metric tons to 2.4 million metric tons), Europe (from 1.2 million metric tons to 2.0 million metric tons), and the Indian Sub-Continent (from 0.7 million metric tons to 1.6 million metric tons). Total Pacific Northwest waterborne trade fell for Oceania (from 3.9 million metric tons to 2.3 million metric tons) and for Africa (from 1.3 million metric tons to 0.2 million metric tons).

Figure 2-1: PNW Waterborne Trading Partners – Total Trade



Source: BST Associates using WISERTrade data

For containerized trade, eastern Asia (i.e. China, Other Northeast Asia, and Southeast Asia) represents the key trading area for Pacific Northwest ports. From 2000 through 2015, eastern Asia accounted for between 88.6% and 94.2% of Pacific Northwest containerized trade[1].

During this period China became the largest container market for the Pacific Northwest, as measured in full international TEU. China's share of PNW container trade grew from 34.5% in 2000 to 51.6% in 2015, while Other Northeast Asia's share fell from 45.5% to 27.9% and Southeast Asia's share fell from 13.3% to 9.2%.

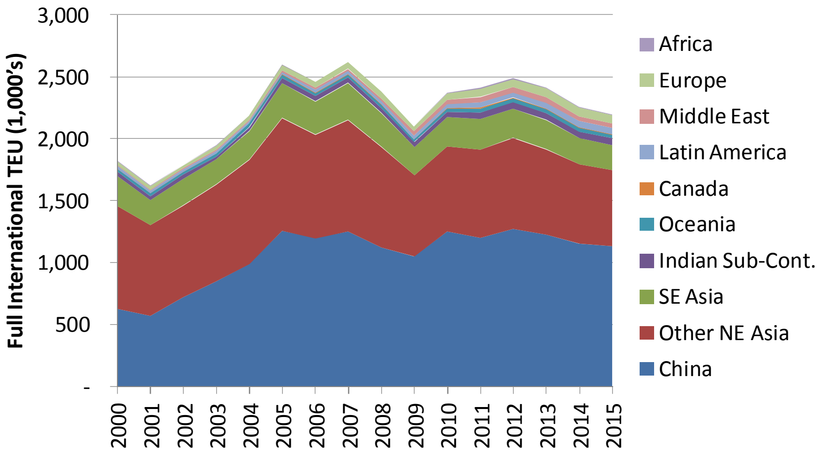
The total volume of full containers moving between China and the Pacific Northwest grew from 628,000 TEU in 2000 to as much as 1.27 million TEU in 2012, but declined to 1.13 million TEU in 2015. Container volume between the PNW and Other Northeast Asia grew from 828,000 in 2000 to a peak of 912,000 in 2005, but declined to 612,000 in 2015. Container volume between the PNW and Southeast Asia grew from 242,000 in 2000 to a peak of 280,000 in 2005, but dropped to 201,000 in 2015 (see Figure 2-2).

The remaining world regions currently account for a limited share of Pacific Northwest container trade, but container volumes with many of these regions grew between 2000 and 2015. For example:

- Trade with the Indian Sub-Continent grew from 33,000 TEU to 55,000 TEU
- Oceania grew from 25,000 TEU to 30,000 TEU
- Latin America grew from 23,000 TEU to 52,000 TEU,
- Middle East grew from 11,000 TEU to 38,000 TEU, and
- Europe grew from 27,000 TEU to 67,000 TEU.

[1] Container volume is measured in twenty-foot equivalent units, or "TEU".

Figure 2-2: Pacific Northwest International Containerized Trade



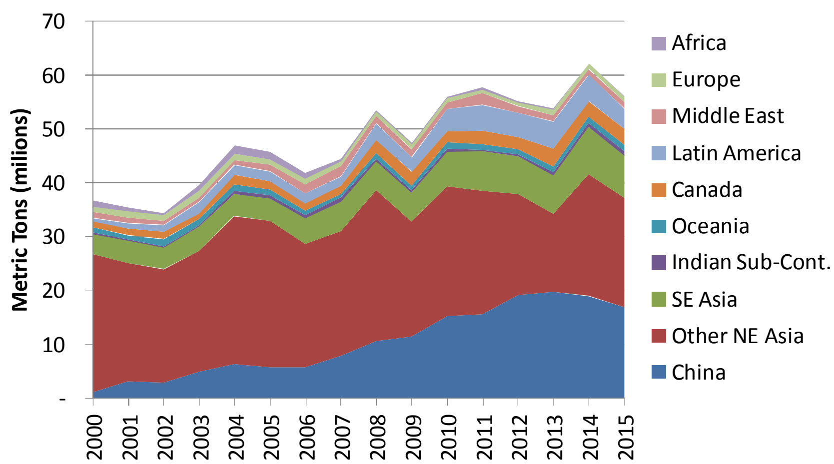
Source: BST Associates using PIERS data

Eastern Asia (i.e. China, Other Northeast Asia, and Southeast Asia) also accounts for most of the non-containerized cargo moving through Pacific Northwest ports. From 2000 through 2015, eastern Asia's share of Pacific Northwest non-containerized cargo averaged 81.0%.

Latin America and Canada are the largest non-Asian trading partners (for non-containerized trade). Latin America's share grew from 1.7% in 2000 to 6.6% in 2015, and reached as high 9.3% in 2013. Canada's share grew from 3.2% in 2000 to 5.4% in 2015, reaching as high as 6.3% in 2013.

Total non-containerized tonnage grew for each trading partner region, with the exceptions of Other Northeast Asia and Africa. Non-containerized trade with China jumped from 1.1 million metric tons in 2000 to more than 19.0 million metric tons from 2012 through 2014, before falling to 16.9 million metric tons in 2015 (due primarily to a short-term drop in grain exports in 2015). Non-containerized trade with Southeast Asia grew from 3.8 million metric tons in 2000 to 7.9 million metric tons in 2015. In contrast, non-containerized trade between the PNW and Other Northeast Asia dropped from 25.6 million metric tons in 2000 to 20.3 million metric tons in 2015 (see Figure 2-3).

Figure 2-3: Pacific Northwest International Non-Containerized Trade



Source: BST Associates using WISERTrade data

Table 2-2 summarizes the shifting market shares for Pacific Northwest waterborne trade, by world region.

Table 2-2: Summary of Pacific Northwest Trade Share by World Region

	Containerized (% of TEU)		Non-Containerized (% of Metric Tons)		Total (% of Metric Tons)	
Region	2000	2015	2000	2015	2000	2015
China	34.5%	51.6%	2.9%	30.2%	9.4%	29.4%
Other Northeast Asia	45.5%	27.9%	69.8%	36.1%	48.2%	31.2%
Southeast Asia	13.3%	9.2%	10.5%	14.0%	10.8%	11.7%
Indian Sub-Cont.	1.8%	2.5%	0.9%	1.4%	1.2%	1.9%
Oceania	1.4%	1.3%	2.4%	2.1%	6.6%	2.8%
Canada	0.0%	0.1%	3.2%	5.4%	10.3%	9.2%
Latin America	1.2%	2.4%	1.7%	6.6%	6.9%	8.2%
Middle East	0.6%	1.7%	2.9%	2.2%	2.4%	3.0%
Europe	1.5%	3.0%	2.5%	1.7%	2.0%	2.5%
Africa	0.2%	0.3%	3.2%	0.2%	2.2%	0.2%

Source: BST Associates using WISERTrade data

World Economic Trends

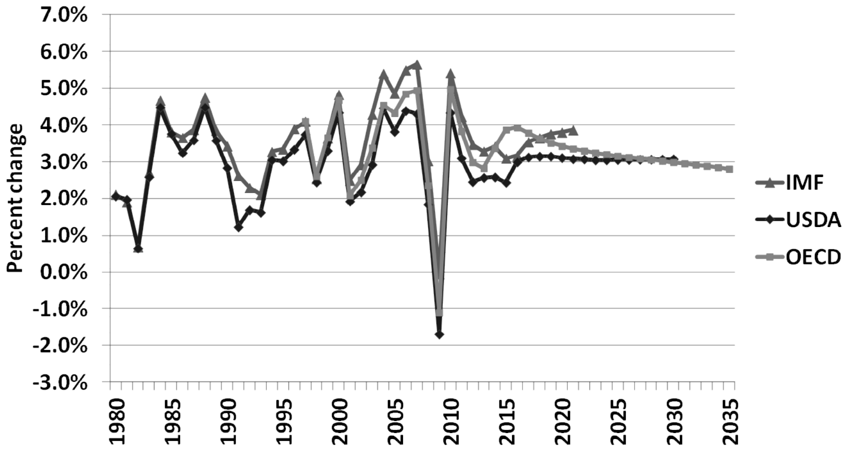
World gross domestic product (GDP) grew at average annual rate of 3.5% per year from 1980 through 2015, according to data from the International Monetary Fund (IMF). During the 1980's, annual GDP growth averaged 3.2%, an average that was weighed down by very slow growth from 1980 through 1982. The year 1982 was especially bad for the world economy, with GDP growth of less than 0.7%. In contrast, annual growth did not drop below 3.6% from 1984 through 1989, and reached as high as 4.7% in both 1984 and 1988.

During the 1990's annual growth in GDP averaged 3.1%. Overall, the decade witnessed steadier growth than the 1980's, with minimum annual growth of 2.1% and maximum of 4.1%.

For most of the 2000's, world GDP growth was substantially higher than during the previous decades, due in large part to growth in China. GDP growth averaged 4.3% from 2000 through 2008, and only dropped below 3.0% in 2001 and 2002. In contrast, GDP growth in both 2006 and 2007 was higher than 5.5%. In 2009 the world economy fell into the deepest recession in decades, and world GDP growth actually fell into negative territory. However, world GDP growth returned in 2010, and has been 3.0% or higher in each year since.

Over the short term (i.e. 2016 through 2021), the IMF is projecting that world GDP growth will average 3.6% per year. In the longer run, both the USDA and OECD project that world GDP growth will average approximately 3.0% per year (see Figure 2-4).

Figure 2-4: GDP Growth - World

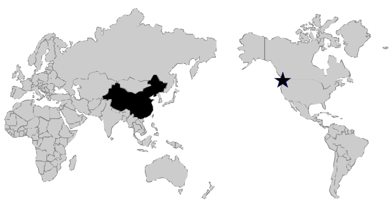


Source: IMF, USDA, OECD

Regional Growth

The following sections describe key economic factors for each of the world regions, including data on population growth, GDP growth, and other factors. GDP figures are presented in 2010 dollars, as developed by the USDA. [2]

China



China has developed into the most important market for Pacific Northwest waterborne trade over the past several decades, and is likely to grow in importance. A huge population base with rising per-capita income represents a key opportunity for the Pacific Northwest.

Chinese economic growth has been slowing from the high levels seen during the past two decades. GDP was projected to be 6.5% in 2016, which, while low by recent Chinese standards, is substantially higher than world average. According to IHS Markit, this moderation means China will be less of a growth engine for Asia and the rest of the world in the coming years. This will be particularly true for commodity and energy-intensive sectors because more of China's growth will come from services than from industry and construction.

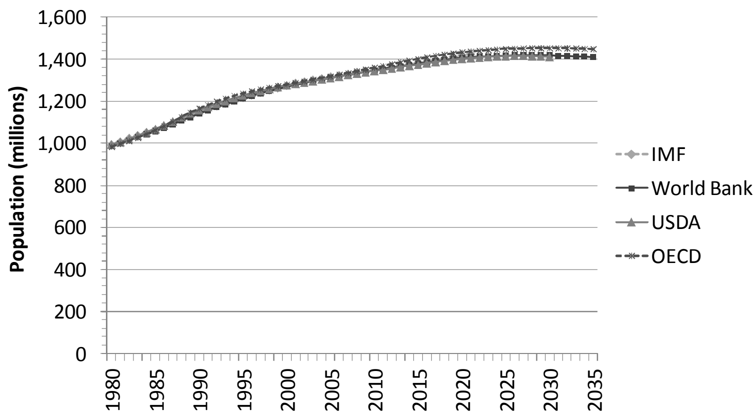
According to IHS Markit, future risk in China is tied to the government's response to changing economic conditions. Until the market-driven correction of the Chinese stock market in mid-2015, it appeared that Chinese policy embraced structural reforms at a modest pace. However, the government's response to the stock market correction raised questions about the Chinese leadership's comfort level with true market outcomes in the economy, and it is unclear how this will play out over time.

China's population reached one billion people in 1980, and has continued to grow since then. It took just seven years for China to add another 100 million people, and six years to add the next 100 million. Since reaching 1.2 billion in 1993, however, China's population growth has slowed. It took ten years (until 2003) to add the next 100 million people, and the population is not projected to reach 1.4 billion until 2016 or 2017.

Multiple sources project that 1.4 billion represents the peak of China's population, and that by the late 2020's the population will actually start to decline slowly (see Figure 2-5).

[2] USDA developed these figures using data from World Bank World Development Indicators, International Financial Statistics of the IMF, IHS Markit, and Oxford Economic Forecasting, as well as estimated and projected values developed by the USDA Economic Research Service, all converted to a 2010 base year.

Figure 2-5: Population Growth - China

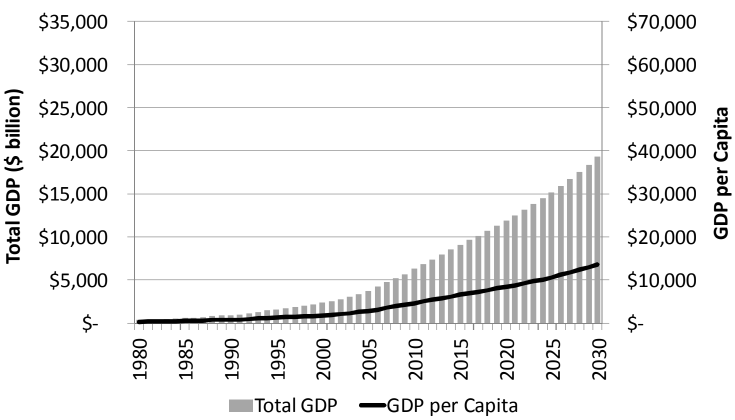


Source: IMF, World Bank, USDA, OECD

Total GDP for China doubled approximately every five years, between 1980 and 2010. Over the entire 30 year period, China's GDP jumped from $396 billion to $6.297 trillion (measured in 2010 US dollars). On a per capita basis, GDP grew from $398 per person to $4,684 per person.

GDP growth in China, which had been averaging between close to 10% per year, began to slow after 2010. From 2015 through 2030 it is projected to average approximately 5.0% per year, which is substantially higher than the world average (see Figure 2-6).

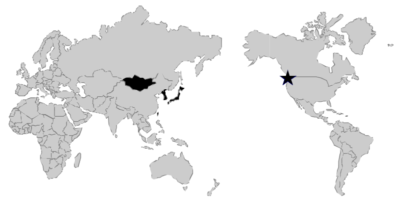
Figure 2-6: GDP Growth - China



Source: USDA

Because GDP is forecast to grow faster than population, however, per capita GDP should continue to rise. Between 2010 and 2015 per capita GDP in China grew from $4,684 to $6,603; it is projected to reach $8,478 by 2020, $10,733 by 2025, and $13,696 by 2030 (as measured in 2010 dollars). This increased buying power makes China a growing opportunity for trade with the Pacific Northwest.

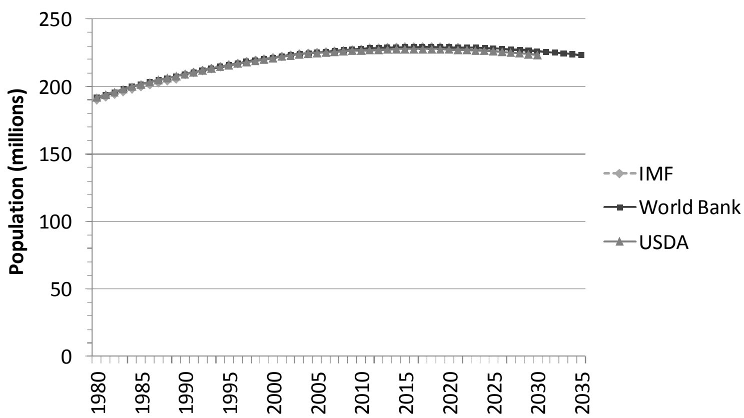
Other Northeast Asia



Northeast Asia (excluding China) was the largest waterborne trading region for Pacific Northwest ports in 2015, as it has been for decades. Although total trade volume between the PNW and Other Northeast Asia (i.e. Japan, South Korea, North Korea, Taiwan, and Mongolia) is likely to be surpassed by that between the PNW and China, the region will continue to be a critical trading partner.

A major reason for trade volume with China overtaking that of Other Northeast Asia is that the population of Other Northeast Asia has apparently peaked, and is projected to begin a slow decline. As illustrated in Figure 2-7, the population of the region has peaked at approximately 229 million, and is projected to begin declining slowly; between 2025 and 2035 it is projected to drop by approximately 0.5% per year. The population of Other Northeast Asia is currently approximately one-sixth of that of China, down from approximately one-fifth in 1980.

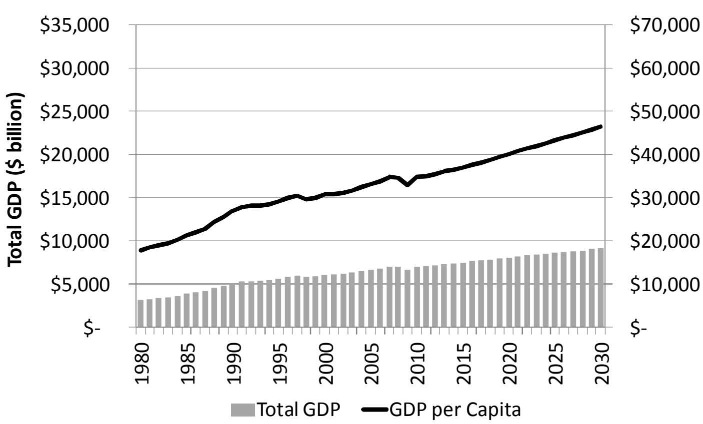
Figure 2-7: Population Growth – Other NE Asia



Source: IMF, USDA, OECD

GDP growth in Other Northeast Asia averaged 5.0% per year during the 1980's, but dropped to just 1.8% per year during the 1990's and to 1.4% during the 2000's. The regional economy slowed even more between 2010 and 2015, dropping to an average of 1.2% per year (see Figure 2-8).

Figure 2-8: GDP Growth – Other Northeast Asia



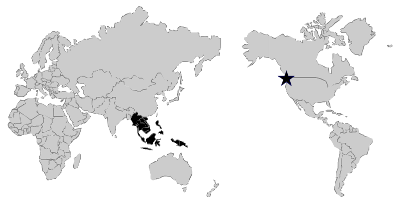
Source: USDA

Total regional GDP grew by approximately $2.0 trillion between 1980 and 1990 (from $3.1 trillion to $5.1 trillion), but by only $1.0 trillion between 1990 and 2000, and by less than $1.0 trillion between 2000 and 2010. Regional GDP growth is projected to continue averaging approximately $1.0 billion per year from 2010 through 2020, as well as from 2020 through 2030.

GDP per capita grew from $17,900 in 1980 to $36,900 in 2015, and is projected to grow to $46,500 by 2030.

In 1980 Japan accounted for more than 90% of regional GDP, followed by South Korea (5%) and Taiwan (2%). In 2015, Japan's share of regional GDP dropped to approximately 76%, while Korea's grew to 17% and Taiwan 7%. By 2030 Japan is projected to account for 71% of regional GDP, Korea 21%, and Taiwan 7%.

Southeast Asia

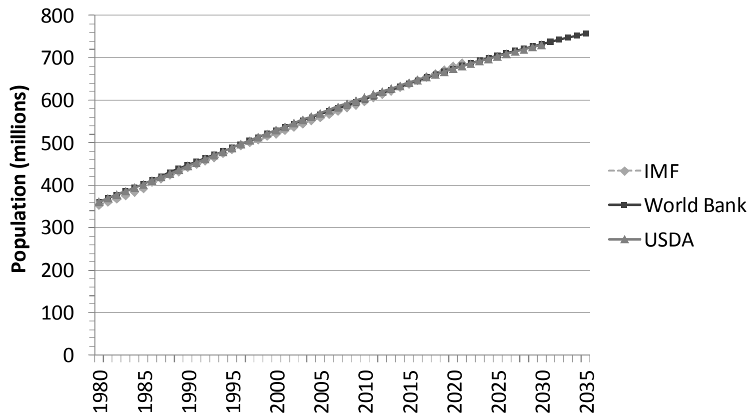


According to IHS Markit, ineffectual macroeconomic policies and political scandals in Southeast Asia[3] are negatively impacting regional economies. Several currencies fell to post-Asian-crisis lows in 2015, while external demand floundered. The mounting threat is that without adequate stimulus or reform, domestic demand in the region will suffer, further weighing on growth.

Despite the current problems, Southeast Asia has the potential to become a more important trading partner for the Pacific Northwest. It is currently the third-largest market for Washington ports, and projected population growth and GDP per capita mean that there will be more people with more money to spend on imported goods.

The population of Southeast Asia grew by 75% between 1980 and 2015, from approximately 358 million in 1980 to 640 million in 2015 (see Figure 2-9). This growth in population (281 million) was higher than the total population of Other Northeast Asia (excluding China). Despite an expected slowdown in the growth rate, the population of Southeast Asia is projected to reach 757 million by 2035. This increase of 117 million people is roughly equivalent to one-third of the current U.S. population.

Figure 2-9: Population Growth – Southeast Asia



Source: IMF, USDA, OECD

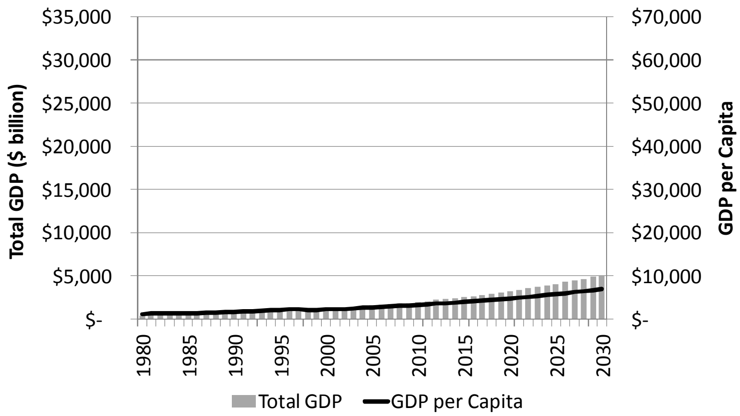
Total GDP for Southeast Asia is substantially lower than that of Other Northeast Asia, but is growing at a much faster rate. In 1980, the GDP of Southeast Asia was $439 billion, which was only 14% of Other Northeast Asia's GDP. By 2015, GDP in Southeast Asia had increased to nearly $2.6 trillion, which was equivalent to 34% Other Northeast Asia's GDP. By 2030 Southeast Asia is projected to reach approximately $5.1 trillion, or nearly 56% that of Other Northeast Asia.

GDP growth has outpaced population growth in Southeast Asia, which means that GDP per capita has also increased. Between 1980 and 2015, per capita GDP jumped from $1,214 to $2,986; by 2030 it is projected to reach $6,951 (see Figure 2-10). The increasing per capita GDP makes Southeast Asia an increasingly important trading region for the Pacific Northwest. As discussed above, Southeast Asia saw its share of Pacific Northwest waterborne trade grow from 10.8% in

[3] Southeast Asia includes: Brunei, Burma, Cambodia, East Timor, Indonesia, Laos, Malaysia, Papua New Guinea, Philippines, Singapore, Thailand, and Vietnam

2000 to 11.7% in 2015, while waterborne tonnage grew from 6.3 million metric tons to 9.5 million metric tons.

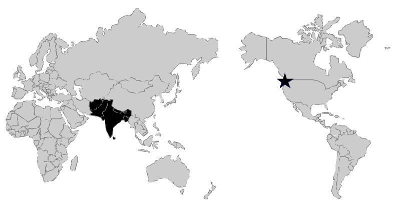
Figure 2-10: GDP Growth – Southeast Asia



Source: USDA

Indonesia has long been the largest economy of the region, and consistently accounted for approximately 38% of regional GDP between 1980 and 2015. The Philippines had the second largest economy in 1980, but has dropped to fifth. Thailand is now the second largest, followed by Malaysia and Singapore. Combined, these top five economies account for nearly 87% of regional output. By 2030 this share is projected to drop only slightly, to 84%.

Indian Sub-Continent



The Indian Sub-Continent accounts for a limited share of Pacific Northwest waterborne trade, but this share grew from 1.2% in 2000 to 1.9% in 2015. Total tonnage also grew during this period, increasing from 0.7 million metric tons to nearly 1.6 million metric tons. With a population that continues to grow by 100 million people every four to five years, the region represents an opportunity for increased trade with the Pacific Northwest.

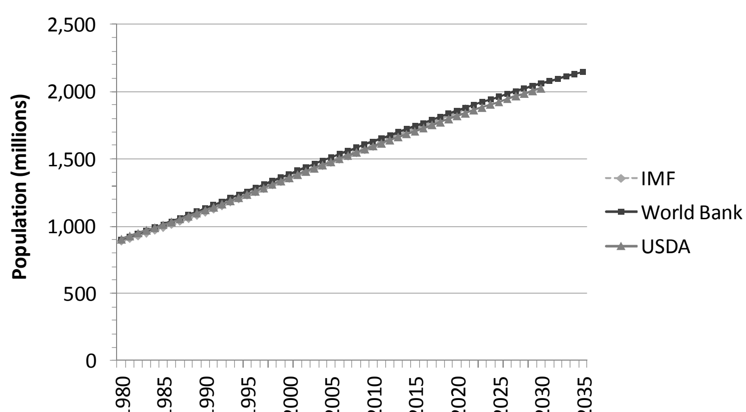
IHS Markit is not optimistic about the short-term prospects for economic growth in the Indian Sub-Continent region. India, which had been a brighter spot in Asia, appears to not have the ability to meaningfully lift growth. In the long run, however, population growth and increasing per-capita GDP may lead to additional demand for imported commodities.

The population of the Indian Sub-Continent surpassed the combined population of China and Other Northeast Asia around the year 2010, and that gap is projected to grow over the next several decades.

The population of the Indian Sub-Continent grew from approximately 900 million in 1980 to 1.1 billion in 1990, climbed past 1.3 billion in 2000, and reached 1.6 billion in 2010. By 2015 in was greater than 1.7 million. Although the rate of growth is projected to slow slightly, the addition of 100 million people every four to five years will result in a population greater than 2.1 billion by 2035 (see Figure 2-11).

Indian has by far the largest share of the sub-continent's population. India's 1.3 billion people accounted for 75% of the total in 2015. By 2035, India's projected population of 1.6 billion will still account for nearly 75% of the total.

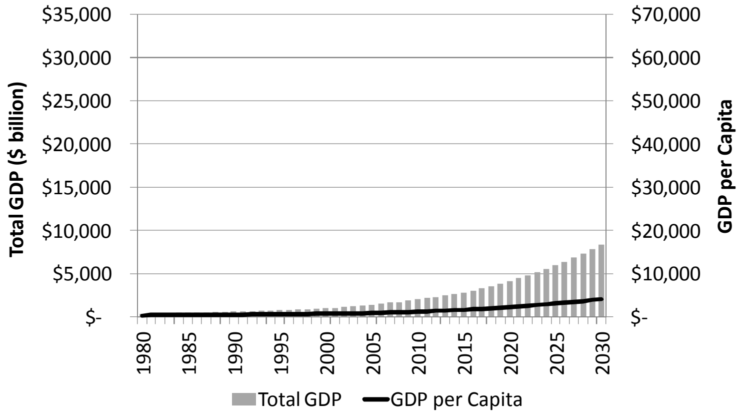
Figure 2-11: Population Growth – Indian Sub Continent



Source: IMF, USDA, OECD

From 1980 through 2000, the total GDP for the Indian Sub-Continent was approximately 85% the size of Southeast Asia's. Beginning in 2000, however, the Indian Sub-Continents began to grow more quickly, and by 2009 the region's output was larger than that of Southeast Asia; by 2015 this margin had grown to more than 11%. This trend is projected to continue, with the region's economy projected to be 64% larger than that of Southeast Asia by 2030 (see Figure 2-11).

Figure 2-12: GDP Growth – Indian Sub-Continent



Source: USDA

Despite the growth in total GDP, the fast expansion of the Indian Sub-Continent's population means that per capita GDP will lag behind that of its neighbors. Per capita GDP was only one-third that of Southeast Asia's from 1980 through 2000. By 2015 it reached 42% of Southeast Asia's, and by 2030 is projected to reach 59%, or $4,137 per person.

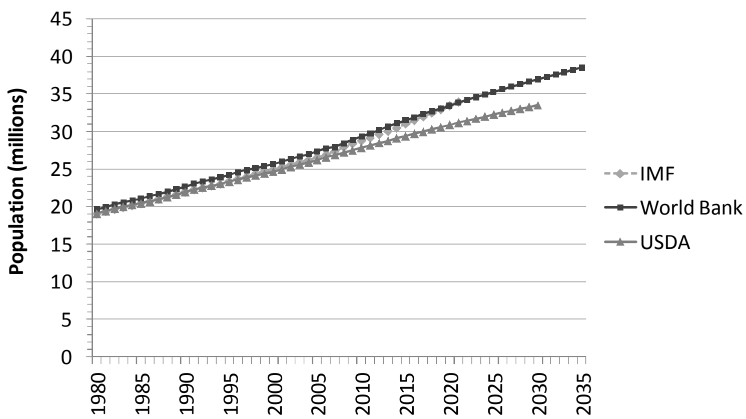
India's economy is projected to grow faster than that of the rest of the sub-continent. In 2015, India accounted for 83% of regional GDP, and is projected to account for 87% in 2030. Per capita GDP in India was $1,889 in 2015, compared to a regional average of $1,673. In 2030 India is projected to have per capita GDP of $4,976, compared to a regional average of $4,137.

Oceania

Oceania accounts for approximately 10% of Pacific Northwest waterborne tonnage, a share that remained relatively stable between 2000 and 2015.

Oceania has the smallest population of the regions included in this analysis: the 31 million in Oceania in 2015 is equivalent to just 2.2% of China's population and 1.8% of the Indian Sub-Continent's population. As illustrated in Figure 2-13, Oceania is projected to add approximately 8 million people between 2015 and 2035.

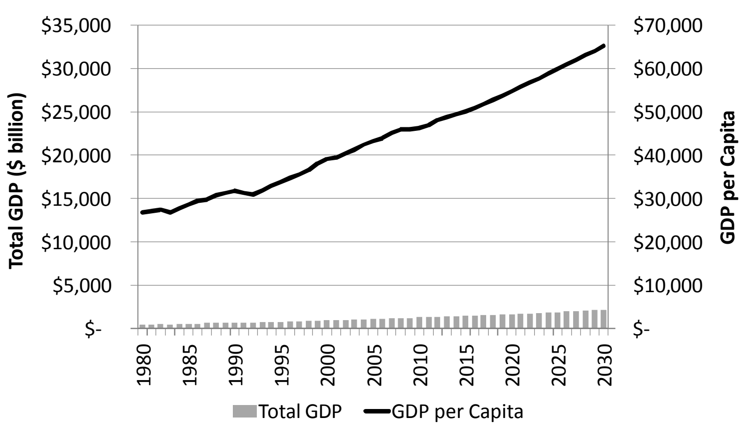
Figure 2-13: Population Growth – Oceania



Source: IMF, USDA, OECD

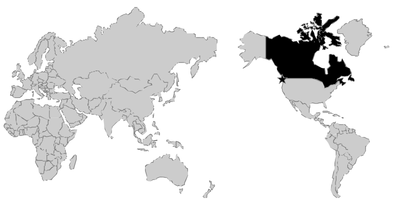
GDP per capita in Oceania is nearly the same as in the United States, while the population is approximately 9% as large. With similar growth rates, per capita GDP in Oceania is projected to remain roughly equivalent to that of the U.S. through 2030 (see Figure 2-14).

Figure 2-14: GDP Growth – Oceania



Source: USDA

Canada

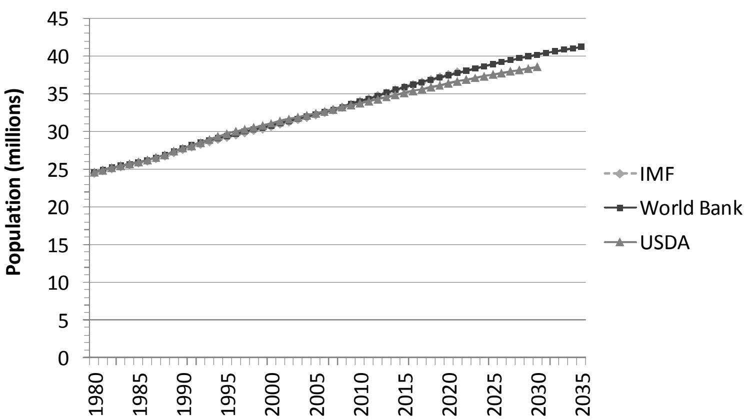


For Pacific Northwest ports, Canada is the largest waterborne trading region outside of Asia. Canada's share of PNW waterborne trade dropped from 10.3% in 2000 to 9.2% in 2015, but total tonnage grew from 6.0 million metric tons to 7.5 million metric tons over the same period.

Canada's population has been approximately 11% the size of the U.S. population for a number of decades, and this is projected to continue through 2035. The population of Canada grew by approximately 11 million between 1980 and 2015, rising from 24.5 million to 35.6 million. During the same period the population of the United States grew from 229.5 million to 323.8 million.

As illustrated in Figure 2-15, over the next 20 years the population of Canada is projected to grow by another 5.6 million, to 43.6 million.

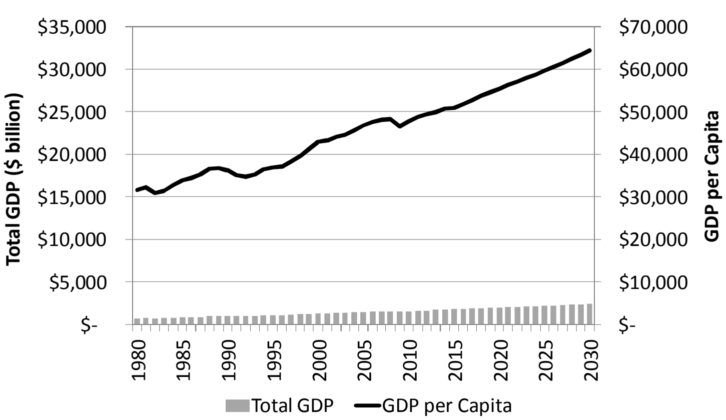
Figure 2-15: Population Growth – Canada



Source: IMF, USDA, OECD

In 2015, GDP per capita in Canada ($51,000) was nearly the same as that in the United States ($51,800). This similarity is projected continue from 2015 through 2030, with Canada's 2030 GDP per capita of $64,500 only slightly lower than the U.S. average of $67,100 (see Figure 2-16).

Figure 2-16: GDP Growth – Canada



Source: USDA

Latin America/Caribbean

Latin America accounted for 8.2% of Pacific Northwest waterborne tonnage in 2000, up from 6.9% in 2000. With income growing faster than population the region could grow in importance for the Pacific Northwest, but political and economic problems will need to be solved for the region to meet its potential.

According to analysis from IHS Markit, political and economic problems in Brazil are dragging down regional growth, and the outlook for Brazil is not very encouraging. The end of the supercycle of high commodity prices and cheap credit has raised the importance of ongoing structural economic problems in the region. Argentina, Brazil, and Venezuela have been hit especially hard.

Despite these problems, IHS is relatively positive about the long-term prospects for Latin America. The macroeconomic fundamental conditions have improved substantially. For example, fiscal policies are being implemented to reduce fiscal deficits and public debt, and flexible exchange-rate regimes have translated into relative exchange-rate stability. Most of the countries enjoy positive trade balances and some of them even post current-account surpluses. Latin American economies are well positioned to continue on the path of moderate growth, provided the rest of the world does not fall again into recession.

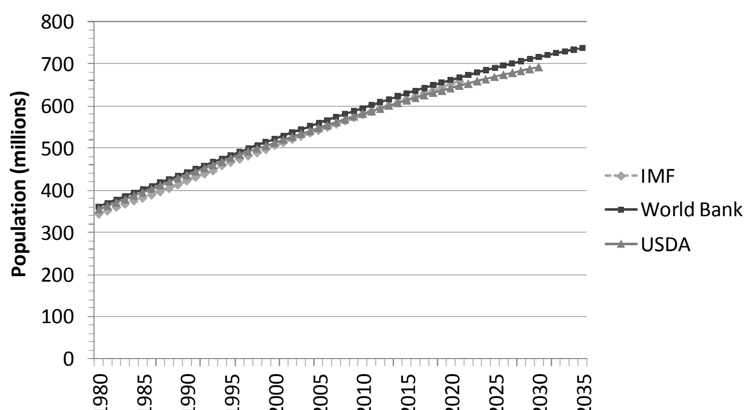
The outlook for Mexico's economy is one of cautious optimism, due to its linkages with the U.S. economy. Acceleration of economic growth in the United States will continue to lift the speed of Mexican economic growth.

The region encompassing Latin American and the Caribbean saw its population grow by 75% between 1990 and 2015. Over this period the population grew from 353 million to 619 million, an increase of more than 266 million.

Despite the rate of growth starting to slow, the population is expected to add another 118 million people between 2015 and 2035 (see Figure 2-17).

With approximately 205 million people, Brazil has the region's largest population, accounting for approximately one-third of the regional total. Mexico's population of 127 million is the next largest, with approximately one-fifth of the total. More than half of the regional population is in Brazil or Mexico.

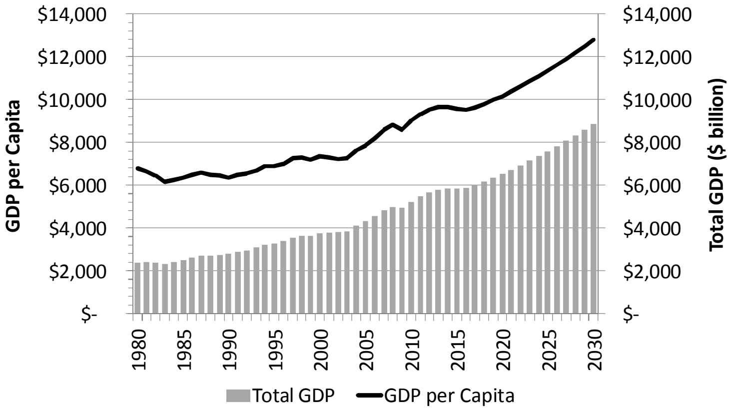
Figure 2-17: Population Growth – Latin America/ Caribbean



Source: IMF, USDA, OECD

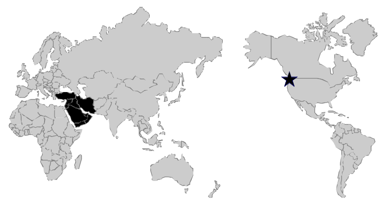
Regional GDP is projected to grow faster than population over the long run, which will lead to increasing per capita GDP (see Figure 2-18).

Figure 2-18: GDP Growth – Latin America/Caribbean



Source: USDA

Middle East



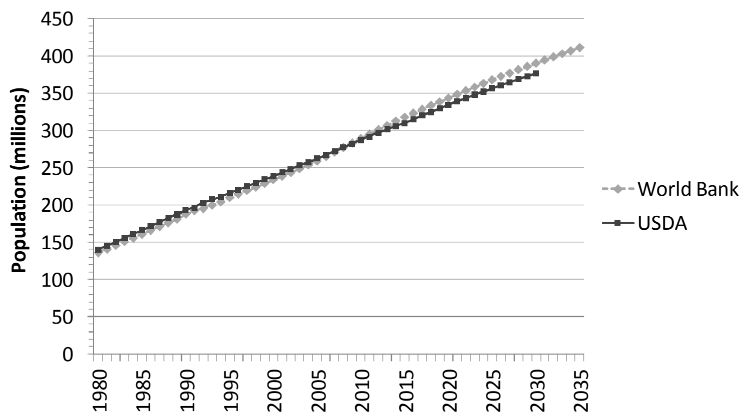
The Middle East is a relatively small waterborne trading partner for Pacific Northwest ports, accounting for approximately 3.0% of waterborne tonnage in 2015.

According to IHS Markit, low oil prices will limit economic growth in the Middle East[4]. Oil prices were projected to grow from approximately $30 per barrel in 2015 to $49 per barrel in 2017, but there is further downside risk to the outlook. Prices for other commodities have also fallen (including metals, minerals, and agricultural products), and projected global growth of 3% could lead to soft world demand for oil. Political instability is also a major concern, with conflicts in Syria, Yemen, and Libya, and threats from the Islamic State across the Middle East.

The population of the Middle East grew steadily between 1980 and 2015, adding an average of 25 million people every five years, to a total of approximately 315 million in 2015. The population is projected to continue growing at approximately the same pace and to reach approximately 410 million in 2035 (see Figure 2-19).

Iran and Turkey are the largest countries in the region, each with a population of approximately 80 million in 2015. These two countries accounted for more than half of the regional population in 2015, and are projected to continue to account for approximately half through 2035.

Figure 2-19: Population Growth – Middle East

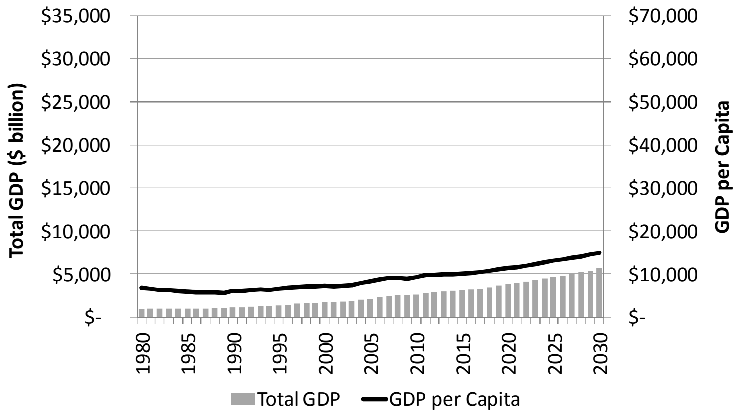


Source: IMF, USDA, OECD

Total GDP of the Middle East grew from approximately $1.0 trillion 1980 to $3.2 trillion in 2015, and is expected to grow to $5.7 trillion in 2030. GDP per capita grew much more slowly than total GDP. While total GDP grew by 330% between 1980 and 2015, GDP per capita only grew by 150% (see Figure 2-20).

[4] Middle East includes: Bahrain, Iraq, Iran, Israel, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syria, Turkey, United Arab Emirates, and Yemen.

Figure 2-20: GDP Growth – Middle East



Source: USDA

Europe

Europe is a relatively small trading region for Pacific Northwest ports, accounting for 2.5% of waterborne trade in 2015. However, this represented an increase over the 2.0% share in 2000, and total waterborne tonnage grew from nearly 1.2 million metric tons in 2000 to 2.0 million metric tons in 2015. Because GDP per capita is also relatively high in Europe, especially Western Europe, the region presents some potential for trade growth with the Pacific Northwest.

According to IHS Markit, global growth concerns and financial market weakness are currently hampering Eurozone economic activity. This is in spite of several positive factors, including low oil and commodity prices, a competitive euro, increased European Central Bank (ECB) stimulus, and more growth-oriented fiscal policies in a number of countries. Economic growth for the region has averaged 2% or less for several years, and growth of 1.7% to 1.8% was projected for 2016 and 2017.

The impact on Pacific Northwest waterborne trade due to Britain exiting the European Union is likely to be quite limited. As illustrated above, Europe in total accounts for less than 3% of total Pacific Northwest waterborne tonnage, and approximately 3% of waterborne traffic.

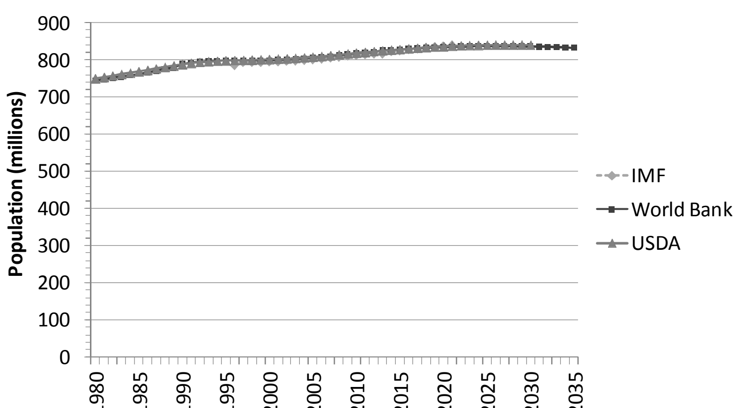
Central European economies are doing better than the Eurozone, and prospects are good for continued strong growth.

As illustrated in Figure 2-21, Europe's population has essentially reached its peak, and will eventually experience a slow decline.

The region's population grew at less than 0.5% per year between 1980 and 2015, while growing from approximately 746 million to 827 million. The population is projected to grow by a total of 1.4% between 2015 and 2027 (i.e. an additional 12 million people), but then start to decline.

Europe's projected population in 2035 is approximately 832 million, an increase of less than six million from 2015, and a decrease of more than six million from its peak in 2027.

Figure 2-21: Population Growth – Europe



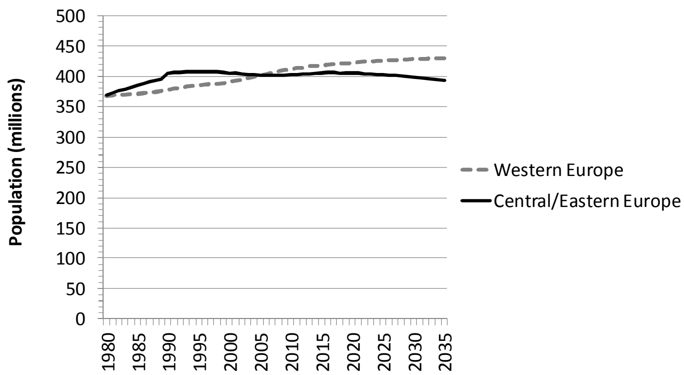
Source: IMF, USDA, OECD

Population growth trends are much different in Western Europe than in Central/Eastern Europe. As illustrated in Figure 2-22, the population of Central/Eastern Europe has been falling since approximately 1995, and is expected to continue to decline. After topping out at 408 million in

1993-1995, the region's population dropped to 402 million in 2007, but recovered to 406 million in 2015. By 2035, however, the population is projected to drop to 393 million.

In contrast, the population of Western Europe grew from 368 million in 1980 to 418 million in 2015, and is projected to reach 430 million by 2035. The population of Western Europe surpassed that of Central/Eastern Europe in 2006, and continues to grow larger.

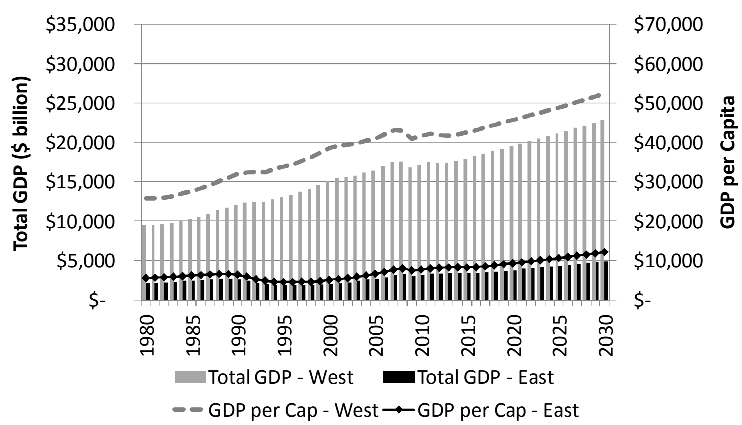
Figure 2-22: Population Growth – Europe Sub-Regions



Source: World Bank

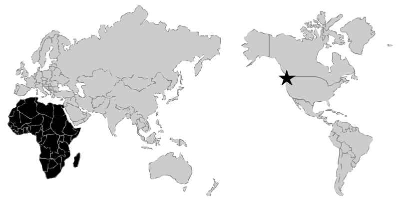
In 2015 the economy of Western Europe was more than 6.25 times larger than that of Central/Eastern Europe, as measured by total GDP. By 2030 this ratio is expected to decrease but still be large, with the GDP of Western Europe 4.65 times larger than that of Central/Eastern Europe (see Figure 2-23).

Figure 2-23: GDP Growth – Europe



Source: USDA

Africa



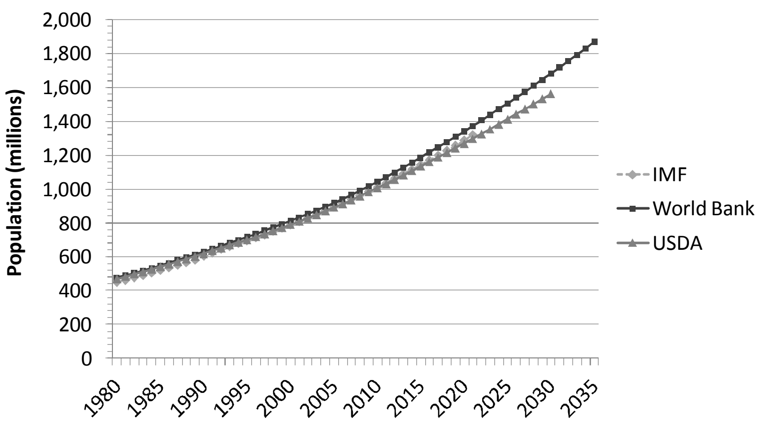
Africa is a very small market for waterborne trade with Pacific Northwest ports, and this is not likely to change substantially over the next 20 years. Africa accounted for just 0.2% of total Pacific Northwest waterborne tonnage in 2015, down from 2.2% in 2000. Total tonnage grew from 1.3 million metric tons in 2000 to 3.2 million metric tons in 2006, but dropped to only 0.2 million metric tons in 2015.

According to IHS Markit, political instability and regional conflicts in North Africa jeopardize the regional growth outlook. In Sub-Saharan Africa, low prices for commodities produced in the region have hampered growth. In recent years China has been especially involved in Africa, and has made substantial investments in infrastructure. The slowing of China's economy will decrease the demand for commodities, however, and may also limit how much China invests in the region. Across the region, exports of primary commodities account for more than 90% of total exports.

Africa is the only world region where population growth is not projected to slow over time. Between 1980 and 1985 the population of Africa grew by approximately 71 million people. Between 2010 and 2015 the five-year growth was nearly twice as high, with 135 million people added to the population, and from 2030 to 2035 the population is forecast to jump by 248 million (see Figure 2-24).

By 2035 the population of Africa may reach nearly 1.9 billion people, making it larger than any region except the Indian Sub-Continent. The increase in population in Africa is also projected to be much greater than in other regions. Africa's 20-year projected population increase is 716 million, compared with 420 million for the Indian Sub-Continent, 118 million for Latin America, and only 44 million for China.

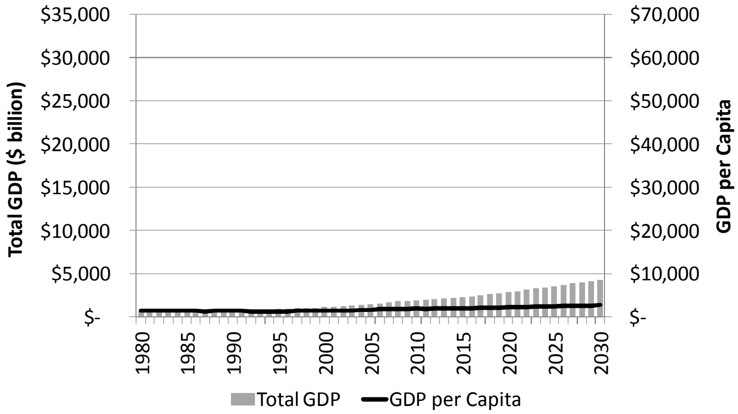
Figure 2-24: Population Growth – Africa



Source: IMF, USDA, OECD

The fast-growing population will limit how fast per-capita GDP grows. Over the long run (i.e. 2015 through 2030), GDP is only projected to grow from $2,000 per capita to $2,800 per capita (see Figure 2-25).

Figure 2-25: GDP Growth – Africa



Source: USDA

Summary of International Trends

The United States has been the world's largest economy for many decades, and is likely to continue to be so. The biggest changes have occurred in the rankings of the next largest economies.

In 2000, the second, third and fourth largest economies were Japan, Germany and France, while China was the fifth largest. By 2015 China had surpassed Japan as the second-largest economy, followed by Japan, Germany and France. India was not in the top 10 in 2000 but ranked as the world's seventh-largest economy in 2015, despite its relatively low per capita GDP (see Table 2-3).

By 2030, India is projected to have the third-largest economy, following the United States and China. Japan is projected to be the fourth-largest, followed by Germany, the United Kingdom, and France.

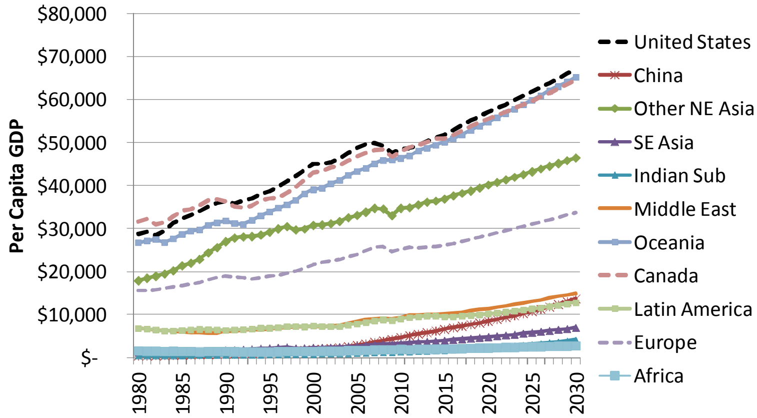
Table 2-3: Country GDP Rank: Top Ten in Real U.S. Dollar Terms

2000	2015	2030
United States	United States	United States
Japan	China	China
Germany	Japan	India
France	Germany	Japan
China	France	Germany
Italy	United Kingdom	United Kingdom
United Kingdom	India	France
Brazil	Brazil	Brazil
Canada	Italy	Canada
Spain	Canada	Italy

Source: USDA

Despite having what is now the world's second-largest economy, China's GDP per-capita is still relatively low. GDP per capita in China is lower than all regions except Africa, the Indian Sub-Continent, and Southeast Asia. It is rising fast, however, and by 2030 is projected to also be higher than that of Latin America and nearly as high as that of the Middle East (see Figure 2-26 and Table 2-4).

Figure 2-26: Per Capita GDP Growth by Region



Source: IMF, USDA, OECD

Table 2-4: Summary of GDP per Capita (in 2010 dollars)

Region	2000	2005	2010	2015	2020	2025	2030
China	$1,870	$2,860	$4,680	$6,600	$8,480	$10,730	$13,700
Other Northeast Asia	$30,760	$33,090	$34,770	$36,920	$40,170	$43,250	$46,490
Southeast Asia	$2,310	$2,720	$3,310	$3,990	$4,820	$5,830	$6,950
Indian Sub-Continent	$780	$980	$1,310	$1,670	$2,280	$3,120	$4,140
Middle East	$7,390	$8,390	$9,360	$10,150	$11,420	$13,100	$14,970
Oceania	$39,070	$43,300	$46,370	$50,150	$54,850	$59,900	$65,250
Western Europe	$38,500	$40,950	$41,630	$42,550	$45,670	$48,850	$52,370
Eastern Europe	$5,050	$6,600	$7,710	$8,230	$9,290	$10,610	$12,130
Latin America /Carib.	$7,360	$7,870	$9,020	$9,550	$10,170	$11,350	$12,800
Africa	$1,470	$1,690	$1,930	$2,030	$2,270	$2,540	$2,790
Canada	$42,980	$46,790	$47,810	$50,980	$55,510	$59,660	$64,470

Source: USDA

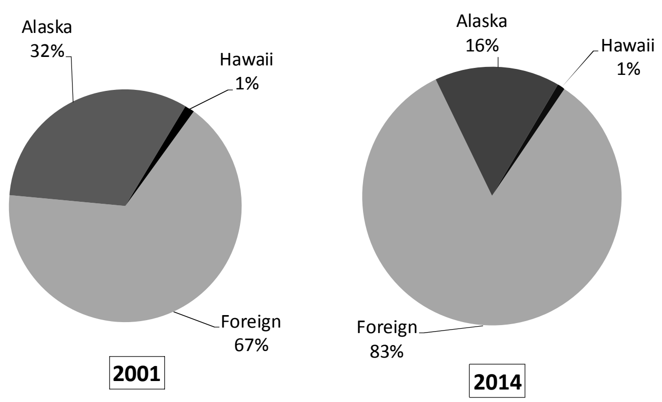
Alaska and Hawaii

A substantial portion of Pacific Northwest waterborne cargo moves to and from domestic locations, primarily Alaska and Hawaii. In 2001, domestic trade accounted for approximately one-third of Pacific Northwest waterborne cargo; by 2014 (most recent year for which data is available) this share had dropped to approximately one-sixth (see Figure 2-27).

As measured in tonnage, Alaska accounted for most of the domestic trade. Crude oil accounted for most of this tonnage, and as crude oil production has dropped in Alaska, so has Alaska's share of Pacific Northwest waterborne trade declined. Alaska accounted for 32% of this trade in 2001, but only 16% in 2014.

Hawaii has consistently accounted for approximately 1% of Pacific Northwest waterborne trade.

Figure 2-27: Relative Size of PNW Foreign and Domestic Trade



Source: U.S. Army Corps of Engineers data

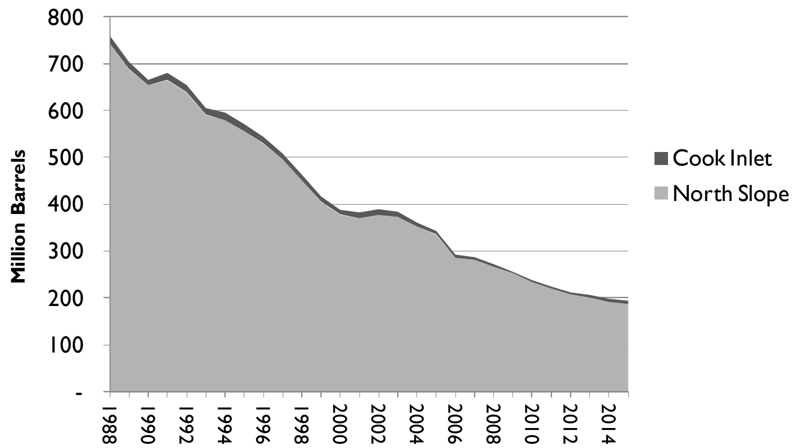
The following sections describe the economy of Alaska and Hawaii, and discuss the implications for waterborne trade with the Pacific Northwest.

Alaska

The economy of Alaska consists of three relatively equal parts: oil production, government (largely funded by oil revenues), and everything else (tourism, fisheries, other sectors). The decline in oil production and oil prices has significantly impacted the Alaskan economy. Future trade volumes are expected to decline and then stabilize.

As shown in Figure 2-28, production of oil in Alaska has been in decline since the peak year of 1988. Statewide production in that year totaled nearly 760 million barrels; by 2001 it had dropped to half of that volume (i.e. 382 million barrels), and by 2015 it had fallen in half again (i.e. to 193 million barrels). Alaskan oil production will continue to decline, unless large new oil discoveries are made.

Figure 2-28: Alaska Historic Oil Production



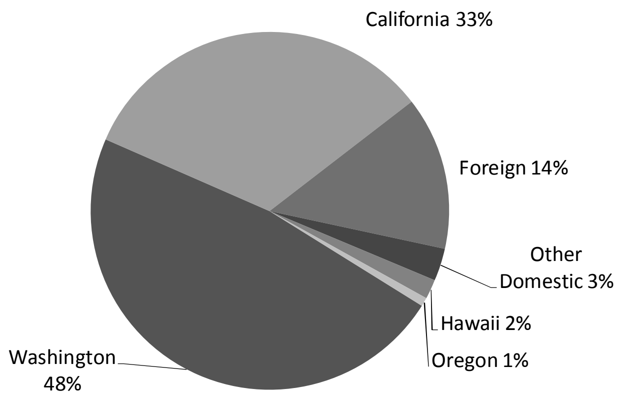
Source: Alaska Division of Oil and Gas

Approximately 97% of Alaska's oil is produced on the North Slope, with a small volume also produced in Cook Inlet. All of the North Slope oil is transported on the Trans-Alaska Pipeline. The pipeline requires a minimum amount of oil to continue functioning, and as North Slope production continues to decline, the risk of reaching this minimum increasing. Although there is some uncertainty around the minimum volume that is technically possible for the line to transport, this limit could be reached by 2026, according to the U.S. Energy Information Administration.

With declining production of crude oil (the largest sector of Alaska's economy), growth prospects are not strong. One mega-project that has been discussed and planned for decades is a new pipeline that would transport natural gas from the North Slope. The financial feasibility of this line is uncertain, however, and the prospects of it being constructed have been declining due to lower gas prices and to increasing domestic and world competition. In addition, the State of Alaska is one of the primary owners of the project, but low oil prices have created major budget problems for the State.

Washington is Alaska's primary waterborne trading partner. As shown in Figure 2-29, Washington accounted for nearly half of all waterborne cargo tonnage moving to and from Alaska from 2001 through 2014. California accounted for one-third, followed by foreign trade (14%), Hawaii (2%) and Oregon (1%). All other trading partners accounted for a total of 3% of Alaska waterborne trade.

Figure 2-29: Alaska Waterborne Trading Partners



Source: U.S. Army Corps of Engineers, 2001 through 2014

The largest share of waterborne tonnage shipped from Alaska is crude oil. Crude oil accounts for a large share of the tonnage shipped from Alaska to Washington, as well as most of the tonnage shipped from Alaska to California.

Oregon receives fertilizer from Alaska, as well as building products.

Fish is the other key product type shipped from Alaska to domestic destinations, and most of this fish moves through ports on Puget Sound. Fish is also shipped directly to foreign customers.

Coal is also shipped from Alaska to foreign destinations. Coal volumes vary widely from year to year, depending on foreign exchange rates, overseas demand, and other factors.

Waterborne cargo moving to Alaska includes essentially everything needed to live there, including food, consumer goods, building materials, and petroleum products. Most of these goods are shipped from Puget Sound.

Hawaii

Hawaii's gross domestic product grew from $53.4 billion in 2000 to $70.5 billion in 2014 (in real 2009 dollars) or at approximately 2.0% per year. This was higher than average U.S. GDP growth rate of 1.6% per year (from 2000 through 2015). The Hawaii Department of Business, Economic Development & Tourism (DBEDT) expects that real GDP will grow at approximately 2.3% per year through 2019.[5]

The two leading drivers of the Hawaiian economy are tourism (accounting for approximately 16.7% of Hawaii's GDP in 2014) and government (accounting for approximately 21.6% of Hawaii's GDP in 2015 [6]).

- In 2015, Hawaii had 8.6 million visitors, who stayed a total of 78 million days (9 days per visitor on average). Spending by visitors averaged approximately $1,800 per trip. DBEDT projects that visitation could increase by 1.9% per year through 2019, and at 0.9% per year through 2030.

[5] Source: Hawaii DBEDT Quarterly Statistical and Economic Report, Q2 2016

[6] Source: Bloomberg Government Study, Impact of Defense Spending: A State-by-State Analysis, 2011

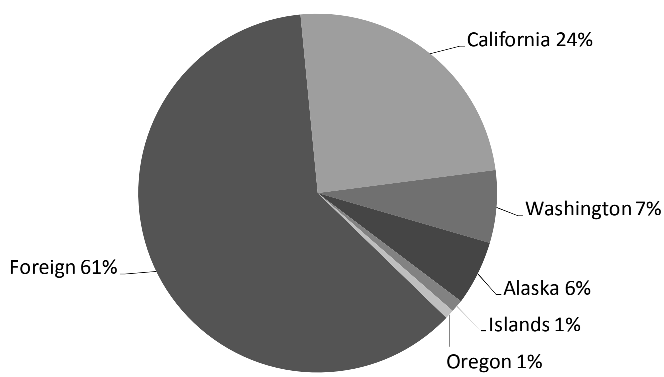
- The military is a key part of the economy of Hawaii; this includes the economic impact of active military and their families, as well as defense contracting, base operations, and capital expenditures. The largest military presence is centered in and near Joint Base Pearl Harbor–Hickam, where the Pacific operations of both the Navy and Air Force Pacific are headquartered. In 2014 there were 115,360 Hawaii residents associated with the active duty military, including 51,045 service members and 64,315 family members.[7]

Hawaii's population (1.43 million residents in 2015) grew at an average rate of 1.1% per year between 2000 and 2015. DBEDT estimates that the population could reach 1.66 million by 2035.[8]

The number of people employed in Hawaii grew at an average rate of 1.2% per year from 2000 through 2014. This rate was significantly higher than the U.S. average employment growth rate of 0.8% per year. DBEDT projects that the number of employed persons could pass 1 million in 2035. The unemployment rate in Hawaii has remained below 5.0% since 2013, down from a peak of 7.2% in 2009.

Hawaii's waterborne trade was relatively stable between 2001 and 2014, averaging approximately 13.2 million metric tons per year. This included 11.6 million metric tons of inbound cargo and 1.5 million metric tons of outbound cargo. As illustrated in Figure 2-30, the majority of Hawaii's off-island trade is with foreign countries (dominated by imports of crude petroleum, petroleum products, sand and gravel, and scrap metal et al.). California accounts for the next largest share (24%); this is primarily consumer products. Washington is the next largest trading partner (7%); this tonnage consists of consumer products and building products. Alaska (primarily crude oil) accounts for 6%, while and Oregon and non-Hawaiian Islands account for 1% each.[9]

Figure 2-30: Hawaiian Trade Partners (average tons from 2001 to 2014)



Source: U.S. Army Corps of Engineers State-to-State database

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[7] Source: Hawaii Databook, Table 10.11 Department of Defense Military Personnel and Dependents, data for 2014.

[8] Source: Data accessed from U.S. Bureau of Economic Analysis

[9] Source: U.S. Army Corps of Engineers State-to-State databases; includes inbound and outbound cargo, excludes trade between Hawaiian Islands.

Chapter 3
Marine Cargo Forecast

Introduction

This chapter provides the forecasts for waterborne cargo moving through deep draft marine terminals in Washington, as well as portions of Oregon. The forecasts include cargo moving through all public and private marine terminals in the region. These forecasts are also divided into four port sub-regions:

- Lower Columbia Washington,
- Lower Columbia Oregon,
- PSRC[10], and
- Other Puget Sound / Washington Coast.

The forecasts are organized by cargo handling type, including:

- Containers,
- Breakbulk,
- Neobulk,
- Dry bulk, and
- Liquid bulk.

Key Observations

- Containers
  - Ports in British Columba have been taking market share..
  - Direct East Coast service and Southern California ports also compete with PNW ports.
  - Transloading is increasing.
  - Ships are getting bigger, which impacts other parts of the transportation system.
- Breakbulk / Neobulk
  - Exports are projected to grow faster than imports.
  - Log Exports - demand spiked for a few years, due to China suddenly buying. China will continue to grow (more slowly), while Japan will decrease.
  - Log Imports - little change is projected under any scenario. Essentially all log imports are from Canada.
  - Auto Imports - under the reference case the PNW only reaches the peak volume of 2006-2007 in the outer years. Under the high forecast the historical peak is reached approximately halfway through the forecast period.
  - Auto exports are projected to grow strongly.

[10] PSRC is the Puget Sound Regional Council counties: King, Snohomish, Pierce, and Kitsap. It includes the Ports of Seattle, Tacoma, and Everett, as well as private facilities located in the region.

- Grain and oilseeds
  - The last fifteen years have seen strong growth; this is projected to continue under reference case, with even higher growth rates under the high forecast.
  - Significant export capacity has been added on the Columbia River, and the deepening of the navigation channel has attracted new grain export volumes.
- Other Dry Bulks
  - Imports - alumina has significantly decreased in importance. Most imports are now construction-related (i.e. gypsum, limestone, cement), in addition to fertilizers and chemicals. Future growth is tied closely to construction spending.
  - Exports - soda ash and potash account for most tonnage, all which currently moves through terminals on the Columbia River. Petroleum coke is steady, and is tied to refinery production. Other commodities include scrap metal and ores.
- Liquid Bulks
  - Crude oil accounts for the majority of tonnage. Waterborne volume is projected to be flat or to decrease slightly, unless crude-by-rail terminals are built.

Methodology

The forecasts were based on a variety of sources, depending on the handling group and commodities included. The initial basis for all of the projections was trade forecasts produced by IHS Markit. The IHS forecasts served as the “reference” cases for most commodities. Low case and high case forecasts were then developed using additional sources.

These forecasts are **unconstrained**, which means they assume that the infrastructure needed to handle the projected volumes will be available when needed. This includes capacity at marine terminals as well as on the rail system and other related infrastructure.

The **high case** for each handling type includes cargo volumes related to projects that are currently in the permitting process, such as the Millennium Bulk Terminal in Longview, the Northwest Innovation Works methanol plant in Kalama, and the Vancouver Energy terminal in Vancouver, among others. The **reference case** and **low case** growth projections do not include these volumes.

The Pacific Northwest was divided into four regions, and cargo projections were developed for each. These regions include:

- PSRC – this region includes marine terminals in King, Pierce, Snohomish, and Kitsap County, the counties included in the Puget Sound Regional Council, or PSRC.
- Puget Sound / Other Washington – this includes all ports and marine terminals on Puget Sound that are not in the PSRC region, as well as those on the Washington coast and in the Strait of Juan de Fuca.
- Lower Columbia Washington – this includes all marine terminals on the Washington side of the Columbia River, from Vancouver to the mouth of the river.
- Lower Columbia Oregon – this includes all marine terminals on the Oregon side of the Columbia River, from Portland to the mouth of the river, including those on the Willamette River.

Containers

The Pacific Northwest container trade is centered in Seattle and Tacoma. The Port of Seattle and Port of Tacoma recently merged their container operations under the Northwest Seaport Alliance (NWSA). The container terminals in Seattle are now referred to as the North Harbor, and the facilities in Tacoma are referred to as the South Harbor. In this document, forecasts for these facilities are included in the PSRC region.

Portland has also historically been a smaller player in the container trade, but lost most of its container service in 2015. Portland is working to secure a new container line. In addition, several other ports (such as Everett) handle relatively small numbers of containers

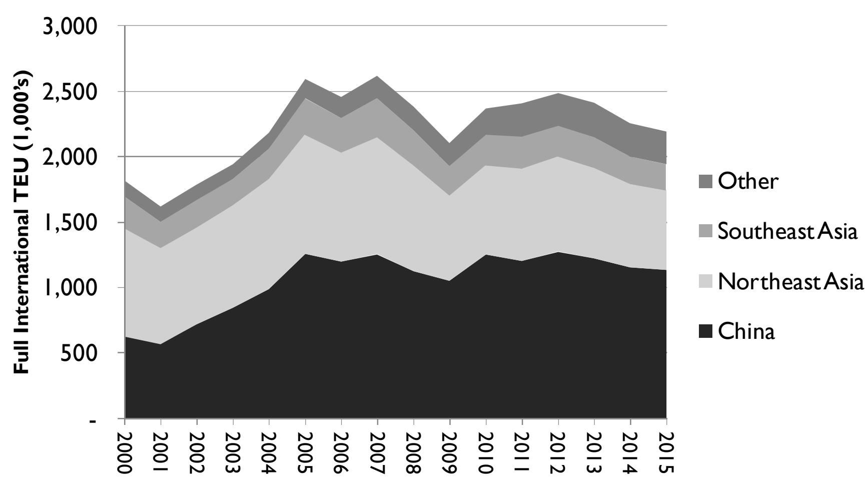
Container Trends and Forecast

Pacific Northwest container traffic increased sharply between 2001 and 2005, growing from 2.9 million TEU to nearly 4.1 million TEU (including full and empty imports, exports, and domestic containers). After remaining at the 4.1 million TEU level through 2006, volumes dropped sharply during the recession, falling to less than 3.3 million TEU in 2009. Although container volumes recovered somewhat in 2010, annual volumes were approximately 3.7 million TEU or less from 2010 through 2015.

International container traffic that moves through ports in the U.S. Pacific Northwest has long been dominated by trade with Asia. China, Other Northeast Asia, and Southeast Asia accounted for 93% of all full international containers in 2000 and 89% of full international containers in 2015 (see Figure 3-1).

The biggest change that occurred over this period was the increasing importance of China. The share of Pacific Northwest container trade accounted for by China grew from 34% in 2000 to 52% in 2015, while volume grew from approximately 630,000 TEU to 1.13 million TEU (full international containers). In contrast, Northeast Asia's share of container trade fell from to 45% to 28%, and volume dropped from 830,000 TEU to 610,000 TEU (full international containers). Southeast Asia's share also fell, from 13% to 9%, while volume dropped from 240,000 TEU to 201,000 (full international containers). All other regions accounted for 11% of international container traffic in 2015, which was an increase from the 7% share in 2000.

Figure 3-1: PNW International Container Trade Partners



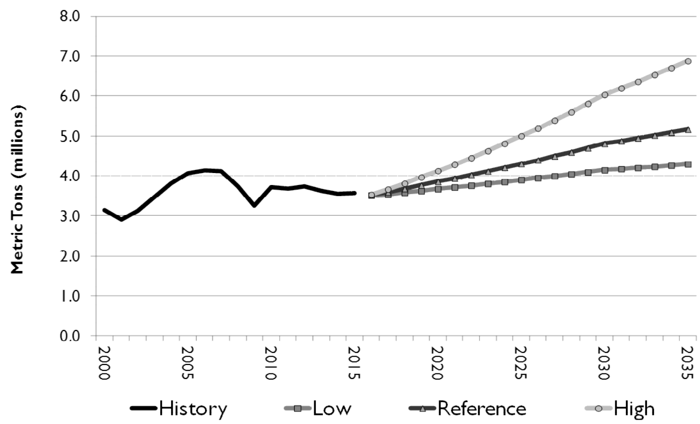
Between 2000 and 2015, container volume grew at an annual rate of 0.9%. The forecast growth rates range from 0.9% (low) to 3.3% (high). The reference growth rate is 1.9% per year (see Figure 3-2).

One key factor that will impact future growth is competition from British Columbia ports (as discussed below). The U.S. Pacific Northwest has lost a large portion of its intermodal traffic to ports in British Columbia over the past decade, and, if this trend continues, container traffic growth will tend toward the low rate.

On the other hand, the share of container traffic that is transloaded from ocean containers into domestic containers and trailers is increasing. While this trend is occurring at ports in the U.S. Pacific Northwest, customs regulations essentially prevent the transloading of U.S.-bound cargo that moves through ports in British Columbia.

Finally, slow economic growth is projected for both Alaska and Hawaii, which will limit growth in Pacific Northwest domestic container trade.

Figure 3-2: Pacific Northwest Container Forecast (Million TEU)



Source: BST Associates, IHS Markit

Import container traffic grew at an average annual rate of 2.3% between 2000 and 2015. The reference growth rate for 2015 through 2035 is slightly lower, at 2.1%. The low growth rate is projected to average 1.2% per year and the high rate 4.3% per year (see Table 3-1).

Export container traffic growth was slow between 2000 and 2015, averaging just 0.1% per year. Future growth is expected to be stronger, ranging between 1.4% per year (low) and 3.0% (high). The reference growth rate is 2.2% per year.

Combined, international container trade averaged 1.1% growth per year between 2000 and 2015. Future growth in international container trade is projected to range between 1.3% per year (low) and 3.7% (high), with a reference growth rate of 2.2%.

These projected growth rates are substantially lower than in past Marine Cargo Forecasts. The main reason for these lower rates is the success that British Columbia ports have had in capturing U.S.-bound intermodal traffic. The Fairview Terminal in Prince Rupert, which opened in 2007, has been able to offer shippers faster ocean transit times and lower rail rates for cargo moving to the U.S. Midwest. Also, cargo moving through ports in British Columbia is not subject to the Harbor Maintenance Tax while cargo moving the U.S. ports is subject to the tax, providing shippers with additional savings. This combination of factors has allowed British Columbia to capture a substantial share of cargo that would have moved through the U.S. Pacific Northwest.

Domestic container traffic includes cargo shipped to and from Alaska and Hawaii. Most cargo shipped by water to Alaska originates at ports on Puget Sound, primarily Seattle and Tacoma. The Pacific Northwest is also one of three main sources of cargo for Hawaii (along with Southern California and Northern California. Seattle and Tacoma are the center of the Pacific Northwest - Hawaii trade, but some of this traffic also moves through the Columbia River.

As described above, growth in domestic container traffic is projected to be relatively slow, due to slow economic growth in both Alaska and Hawaii. From 2000 through 2015, domestic container cargo grew at 0.1% per year, on average. Future growth is projected to range between -0.5% and 1.7%, with a reference growth rate of 0.6%.

The overwhelming majority of Pacific Northwest container traffic will continue to move through ports in the PSRC region, primarily Seattle and Tacoma. Most of the container traffic that had moved through Portland shifted to Seattle and Tacoma; if Portland is able to attract a new carrier some of this traffic could shift back to Portland, otherwise it will continue to move through Seattle and Tacoma. In addition, limited volumes of container traffic will likely continue to move through other ports in the Pacific Northwest.

Table 3-1: Container Trade by Type (Million TEU)

		History				Forecast				Compound Annual Growth Rate	
Region	Case	2000	2005	2010	2015	2020	2025	2030	2035	2000-2015	2015-2035
	Low					1.6	1.7	1.8	1.8		1.2%
Imports	Reference	1.0	1.6	1.6	1.5	1.7	1.9	2.1	2.2	2.3%	2.1%
	High					1.9	2.4	2.9	3.4		4.3%
	Low					1.3	1.5	1.6	1.8		1.4%
Exports	Reference	1.3	1.6	1.3	1.3	1.3	1.6	1.9	2.1	0.1%	2.2%
	High					1.4	1.7	2.1	2.4		3.0%
	Low					2.9	3.2	3.4	3.6		1.3%
Total International	Reference	2.4	3.2	2.9	2.8	3.1	3.5	4.0	4.3	1.1%	2.2%
	High					3.3	4.1	5.0	5.8		3.7%
	Low					0.7	0.7	0.7	0.7		-0.5%
Domestic	Reference	0.8	0.9	0.8	0.8	0.8	0.8	0.8	0.9	0.1%	0.6%
	High					0.8	0.9	1.0	1.1		1.7%
	Low					3.7	3.9	4.1	4.3		0.9%
Total	Reference	3.1	4.1	3.7	3.6	3.9	4.3	4.8	5.2	0.9%	1.9%
	High					4.1	5.0	6.0	6.9		3.3%

Source: BST Associates, IHS Markit

Key Issues for Container Traffic

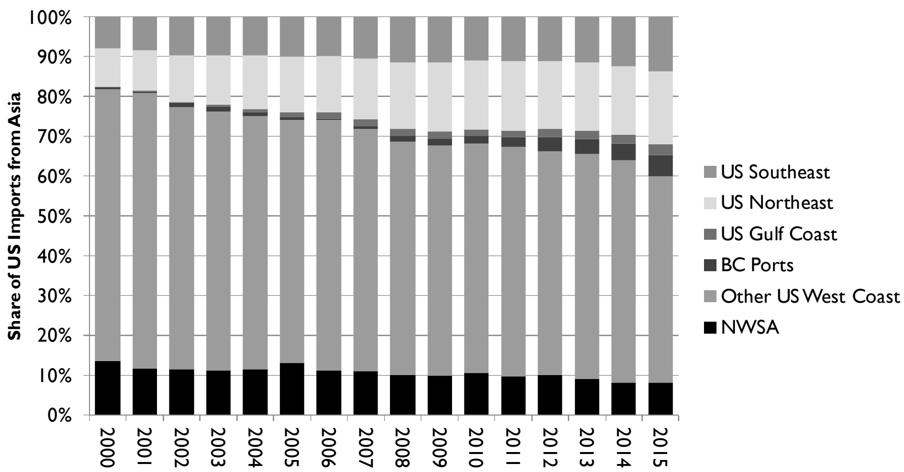
As described above, nearly all of the international container traffic that moves through the Pacific Northwest is moving from or to Asia. Ports in the Pacific Northwest face competition from several other port regions for cargo moving to and from inland points. West Coast ports handle the majority of containerized cargo that moves from Asia to the United States, but the U.S. West Coast market share has declined steadily since 2000, as ports on the East Coast, Gulf Coast, and British Columbia have attracted Asian cargo bound for inland U.S. destinations.

Between 2000 and 2015, the share of U.S.-Asia containerized imports that moved through U.S. West Coast ports declined from 82% to 60%. The share of Asian imports moving through the Northwest Seaport Alliance ports dropped from 14% in 2000 to 8% in 2015. The rest of the U.S. West Coast also saw a declining market share for Asian imports; from 2000 through 2015, U.S. West Coast market share declined from 68% in 2000 to 52% (see Figure 3-3).

As discussed above, ports in British Columbia (i.e. Prince Rupert and Vancouver) have taken a significant portion of the Asian import traffic bound for the U.S. In 2000, ports in British Columbia handled essentially no U.S.-bound container traffic, but by 2015 their share had grown to 5%.

The share of Asian import traffic moving through ports in the Northeast grew from 10% in 2000 to 18% in 2015, and the share moving through ports in the Southeast grew from 8% to 14% over the same period. Gulf Coast ports also gained market share, growing from 0% to 3%.

Figure 3-3: Share of Import Containers from Asia (Million TEU)



Source: PIERS data

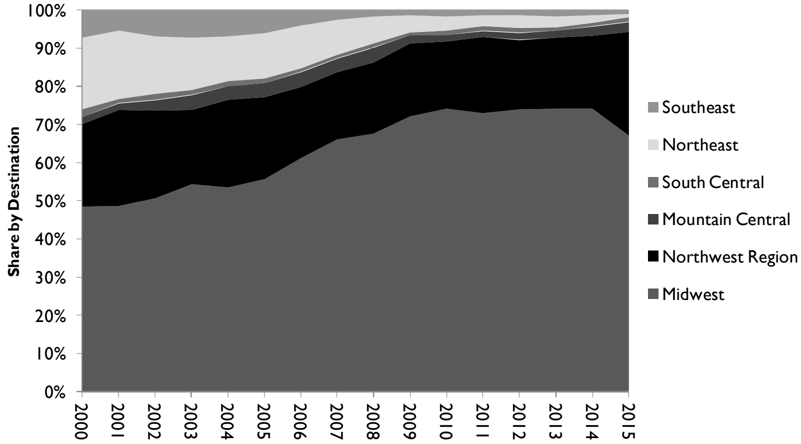
The Midwest has become increasingly important as a destination for containers imported through the Pacific Northwest, while other regions have become less important. The main reason for this shift is that importers have increasingly chosen to serve East Coast markets using all-water shipping routes via the Panama Canal, rather than shipping through West Coast ports.

Figure 3-4 illustrates trends in the shipment by rail of containers imported through the Pacific Northwest. Shipments to the Midwest accounted for 67% of these movements in 2015, up from 47% in 2000. At the same time, the share moving to the Northeast dropped from more than 18% in 2000 to 1% in 2015.

The share of import ocean containers shipped by rail from the Pacific Northwest to other Pacific Northwest destinations jumped in 2015, due to the loss of container service in Portland. Much of the container traffic that had moved through Portland shifted to Puget Sound ports, and a substantial share of these import containers were shipped by rail to Portland.

All other destinations (combined) accounted for 4% to 5% of import container traffic from 2009 through 2015, compared with 14% in 2000.

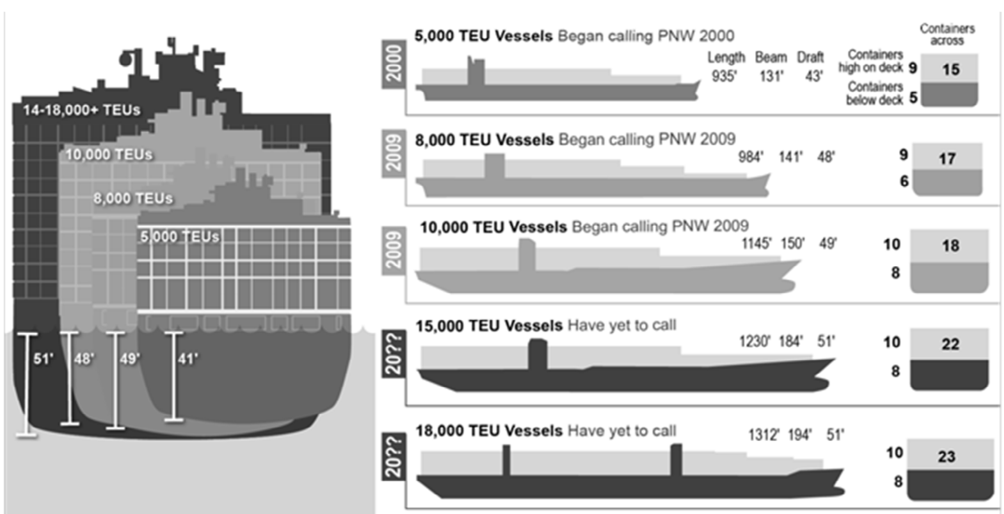
Figure 3-4: Pacific Northwest Originating Intermodal Traffic (Ocean Containers) by Destination



Source: Intermodal Association of North America (IANA) data

The size of container ships calling at container terminals in the Pacific Northwest has been increasing rapidly and is expected to continue to increase in the future. As shown in Figure 3-5, 5,000 TEU vessels began calling Pacific Northwest ports in 2000, followed by 8,000 TEU and 10,000 TEU vessels in 2009. The Benjamin Franklin, CMA-CGM's 18,000 TEU vessel, called at Terminal 18 on February 29, 2016. This vessel is 1,310 feet long and has a beam of 177 feet.

Figure 3-5: Evolution of Container Ships



Source: Mercator International[11]

The increasing size of container ships is a key factor that is negatively impacting Portland's ability to attract a new container carrier. As shown in Figure 3-5, the 8,000 to 10,000 TEU vessels that began calling the Pacific Northwest in 2009 have drafts of 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.

[11] Mercator International, *Seaport Alliance Strategic Business Plan*, May 16, 2015

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 will be 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.

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.

Breakbulk/Neobulk Cargo

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

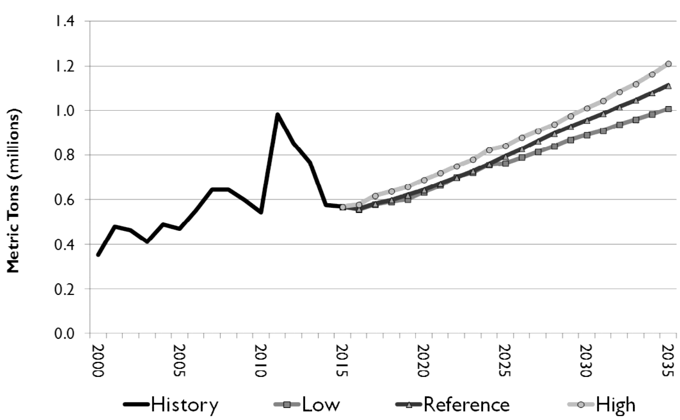
Breakbulk Exports

Breakbulk exports consist primarily of forest products, including lumber, pulp and paper. These grew from approximately 350,000 metric tons in 2000 to 600,000 metric tons in 2010, or at an average rate of 3.2% per year. In 2011 there was a surge of exports, consisting of forest products and machinery/equipment. The surge subsided in 2014, when breakbulk exports fell back to 600,000 metric tons (see Figure 3-6).

Pacific Northwest breakbulk export volumes are expected to increase from 2015 to 2035 as follows:

- Low case: reaching 1.0 million metric tons (2.9% per year growth),
- Reference case: reaching 1.1 million metric tons (3.4% per year growth),
- High case: reaching 1.2 million metric tons (3.9% per year growth).

Figure 3-6: Pacific Northwest Breakbulk Exports (1,000 Metric Tons)



Source: BST Associates, IHS Markit

Breakbulk Imports

Breakbulk imports are dominated by iron and steel, such as coil, bars, pipe, rail and other products. Most of these products are used by local/regional firms as inputs to manufacturing and construction. A small portion is also shipped by rail to the Midwest and beyond. The Lower Columbia River (on both sides of the river) and Central Puget Sound have extensive industry clusters of construction and manufacturing firms that use imported steel.

In addition to steel, other breakbulk imports include forest products and machinery/equipment.

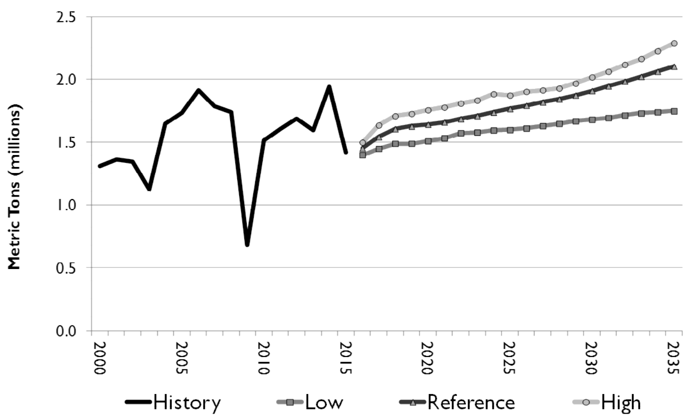
A strong U.S. dollar is expected to accelerate imports in the next few years. However, growth in imports of iron and steel will be tempered to some degree by import duties.

Breakbulk imports increased at an average annual rate of 0.5% between 2000 and 2015, growing from 1.3 million metric tons to 1.4 million metric tons. Volumes peaked in 2005 but then collapsed in 2009 as a result of the Great Recession. However, volumes rebounded in 2010, peaking in 2014 at nearly 1.9 million metric tons before declining to 1.4 million metric tons in 2015 (see Figure 3-7).

Pacific Northwest breakbulk import volumes are projected to increase to the following levels between 2015 and 2035:

- Low case: reaching 1.8 million metric tons (1.1% per year growth),
- Reference case: reaching 2.1 million metric tons (2.0% per year growth),
- High case: reaching 2.3 million metric tons (2.4% per year growth).

Figure 3-7: Pacific Northwest Breakbulk Imports (1,000 Metric Tons)



Source: BST Associates, IHS Markit

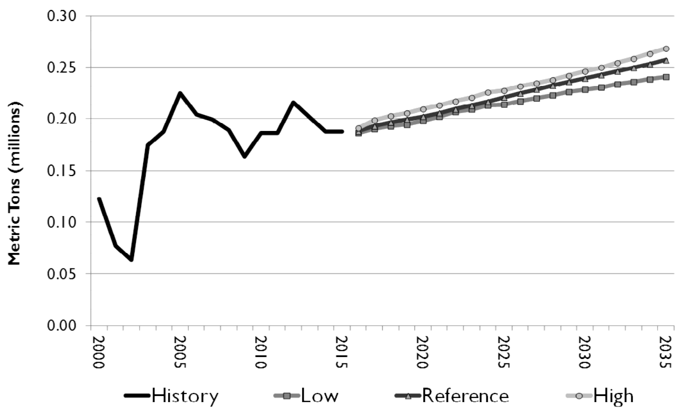
Domestic Coastwise Traffic

Coastwise breakbulk traffic consists mainly of shipments of forest products (lumber and other building products) to California, Alaska and Hawaii. Coastwise traffic increased from 120,000 metric tons in 2000 to 190,000 metric tons in 2015 (see Figure 3-8).

Volumes of coastwise breakbulk shipments are projected to increase to the following levels between 2015 and 2035:

- Low case: reaching 240,000 metric tons (1.3% per year growth),
- Reference case: reaching 260,000 metric tons (1.7% per year growth),
- High case: reaching 270,000 metric tons (1.9% per year growth).

Figure 3-8: Pacific Northwest Breakbulk Coastwise Shipments (1,000 Metric Tons)



Source: BST Associates, IHS Markit

Summary

As shown in Table 3-2, total breakbulk cargoes (including exports, imports and coastwise shipments) are projected to grow as follows from 2015 through 2035:

- Low case: reaching 3.0 million metric tons (1.6% per year growth),
- Reference case: reaching 3.5 million metric tons (2.4% per year growth),
- High case: reaching 3.8 million metric tons (2.8% per year growth).

Table 3-2: Breakbulk Export, Import and Coastwise Shipment Forecasts (Million Metric Tons)

		History				Forecast				Compound Annual Growth Rate	
Direction	**Case**	**2000**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**2000-2015**	**2015-2035**
	Low					0.63	0.76	0.89	1.01		2.9%
Exports	Reference	0.35	0.47	0.54	0.57	0.64	0.79	0.96	1.11	3.2%	3.4%
	High					0.69	0.84	1.01	1.21		3.9%
	Low					1.51	1.60	1.68	1.75		1.1%
Imports	Reference	1.31	1.74	1.51	1.42	1.64	1.77	1.91	2.10	0.5%	2.0%
	High					1.76	1.87	2.02	2.29		2.4%
	Low					0.20	0.22	0.23	0.24		1.3%
Coastwise Shipments	Reference	0.12	0.22	0.19	0.19	0.20	0.22	0.24	0.26	2.9%	1.7%
	High					0.21	0.23	0.25	0.27		1.9%
	Low					2.34	2.58	2.80	3.00		1.6%
Total	Reference	1.78	2.43	2.24	2.17	2.49	2.78	3.11	3.48	1.3%	2.4%
	High					2.66	2.94	3.28	3.77		2.8%

Source: BST Associates, IHS Markit

Logs

Log Exports

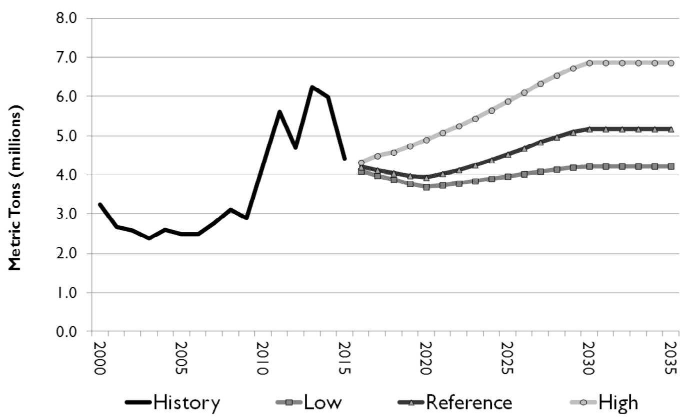
From 2000 to 2009, log exports remained relatively stable, ranging from 2.5 million metric tons to 3.0 million metric tons per year. There was rapid growth from 2010 to 2013/14, when log exports increased to 6.0 million tons, largely due to increased exports to China. However, exports fell in 2015 to 4.4 million tons (see Figure 3-9).

The forecast low and reference cases assume that Chinese demand continues to grow, but at a slower pace than in recent years; the high case assumes that demand from China increases. All growth scenarios assume that Japanese demand declines due to increasing domestic timber harvests in Japan.

Pacific Northwest log export volumes are projected to increase from 2015 to 2035 as follows:

- Low case: reaching 4.2 million metric tons (-0.2% per year growth),
- Reference case: reaching 5.2 million metric tons (0.8% per year growth),
- Low case: reaching 6.9 million metric tons (2.2% per year growth).

Figure 3-9: Pacific Northwest Log Exports (1,000 Metric Tons)



Source: BST Associates, IHS Markit

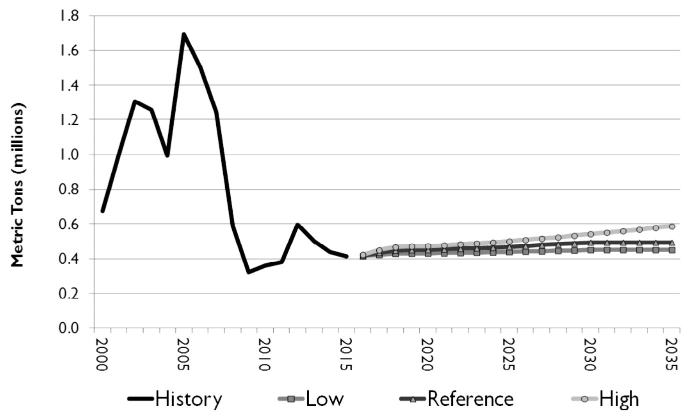
Log Imports

Some Pacific Northwest mills source logs from Canada, depending upon availability and price. Waterborne imports of logs grew steadily from 700,000 metric tons in 2000 to 1.7 million metric tons in 2005 as domestic sources dwindled. After 2005, import volumes began to decline, and ranged from 300,000 metric tons to 600,000 metric tons between 2008 and 2015 (see Figure 3-10)

Pacific Northwest log import volumes are expected to increase from 400,000 metric tons in 2015 to the following levels in 2035:

- Low case: 450,000 metric tons (0.5% per year growth),
- Reference case: 500,000 metric tons (0.9% per year growth),
- High case: 600,000 metric tons (1.8% per year growth).

Figure 3-10: Pacific Northwest Log Imports (1,000 Metric Tons)



Source: BST Associates, IHS Markit

Domestic Coastwise Traffic

Coastwise traffic is domestic waterborne traffic carried over the ocean, (e.g. Alaska to Puget Sound, or Columbia River to California). Coastwise log traffic steadily declined from approximately 400,000 metric tons per year from 2001 through 2004 to less than 50,000 metric tons in 2013, and to approximately 3,000 metric tons in 2014. Coastwise log traffic is not projected to grow significantly during the forecast period.

Internal traffic is vessel movements (origin and destination) which take place solely on inland waterways. An inland waterway is one that is geographically located within the boundaries of the contiguous 48 states or within the boundaries of the State of Alaska. Puget Sound is one such inland waterway, as is the Columbia/Snake River system. There is a substantial volume of internal movements of logs on Puget Sound, such as log shipments from the Olympic Peninsula to La Conner for distribution to local mills. However, this cargo forecast focuses on coastwise and international traffic and, as a result, internal shipments and receipts are not included.

Summary

Total log traffic grew from 4.2 million metric tons in 2000 to 4.8 million metric tons in 2015, or at an average annual rate of 1.0%. As shown in table 3-3, log traffic is projected to increase to the following levels in 2035:

- Low case: 4.7 million metric tons (-0.1% per year growth),
- Reference case: 5.7 million metric tons (0.8% per year growth),
- High case: 7.5 million metric tons (2.2% per year growth).

Table 3-3: Log Export and Import Forecasts (Million Metric Tons)

		History				Forecast				Compound Annual Growth Rate	
Region	**Case**	**2000**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**2000-2015**	**2015-2035**
	Low					3.7	4.0	4.2	4.2		-0.2%
Exports	Reference	3.2	2.5	4.2	4.4	3.9	4.5	5.2	5.2	2.1%	0.8%
	High					4.9	5.9	6.9	6.9		2.2%
	Low					0.4	0.4	0.5	0.5		0.5%
Imports	Reference	0.7	1.7	0.4	0.4	0.5	0.5	0.5	0.5	-3.2%	0.9%
	High					0.5	0.5	0.5	0.6		1.8%
	Low					4.1	4.4	4.7	4.7		-0.1%
Total	Reference	4.2	4.5	4.7	4.8	4.4	5.0	5.7	5.7	1.0%	0.8%
	High					5.4	6.4	7.5	7.5		2.2%

Source: BST Associates, IHS Markit
Note: total traffic includes coastwise traffic

Automobiles

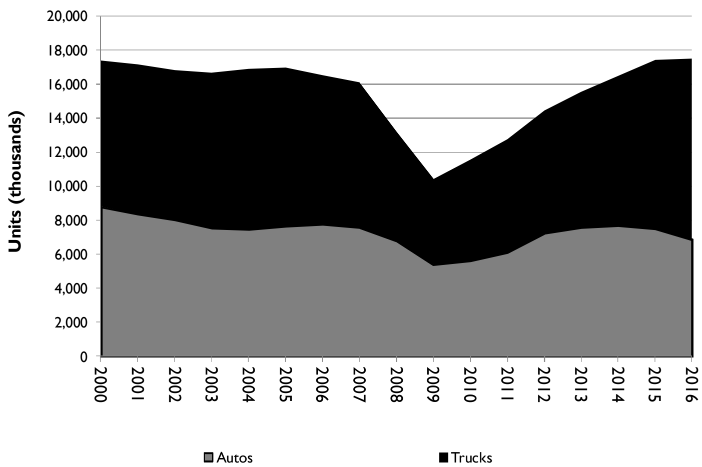
Pacific Northwest ports have long been major players in the automobile import trade, and in recent years have also begun to serve the export trade. The following sections provide an analysis of U.S. auto sales and production, as well as forecasts of Pacific Northwest auto imports and exports.

Imports

Sales of autos in the U.S. averaged 16 to 17 million units from 2000 to 2007, until the Great Recession drove sales to a low of 10.4 million units in 2009 (a drop of nearly 40%). Restructuring of the auto industry and gradual recovery of the economy led to a rebound in sales. Auto sales reached 16.5 million units in 2014, and exceeded 17 million units in both 2015 and 2016 (see Figure 3-11).

The type of vehicle sold in the U.S. has changed dramatically since 2000. In 2000, the market was evenly split between autos and trucks. Driven largely by low fuel prices, sales of trucks (including SUV's) surged during 2016, and now represent 61% of passenger vehicle sales in the U.S.

Figure 3-11: U.S. Auto Sales Trends (1,000 Units)



Source: U.S Bureau of Economic Analysis

In the U.S., the market share of foreign vehicles grew from approximately 17% in 2000 to a peak of 26% in 2009; for the past five years imports have leveled off at 21% to 22% of U.S. sales. A growing share of these vehicles is manufactured in Mexico, which has now surpassed Japan as the second largest exporter to the U.S. Canada remains the largest exporter to the U.S., with export volumes that have remained relatively stable.

IHS expects that the U.S. auto market is reaching maturity, with sales momentum slowed due to rising interest rates, as well as to the impact of legislated content (safety and environmental requirements) on prices. In addition, increased urbanization is reducing the need for vehicles. Other trends include electrification and hybrids, automated driving and shared mobility services.

Global light vehicle production is expected to grow at the following annual rates between 2015 and 2021:

- Chinese production – 4.0 % per year between 2015 and 2021,
- South Asian production – 6.4 % per year between 2015 and 2021,

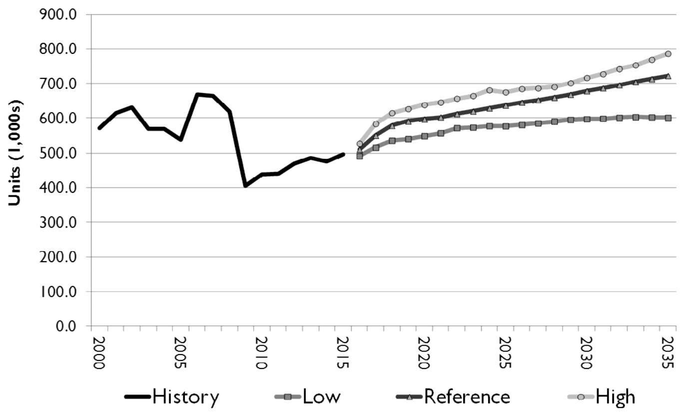
- EU production – 1.6 % per year between 2015 and 2021, and
- North American production – 1.1 % per year between 2015 and 2021.

Auto imports moving through Pacific Northwest ports ranged from 550,000 units to 650,000 units between 2000 and 2008. During the Great Recession, import volumes declined to 400,000 units in 2009, but grew back to approximately 500,000 units in 2015 (see Figure 3-12)

Between 2015 and 2035, Pacific Northwest auto import volumes are expected to increase from 500,000 units to:

- Low case: 601,000 units (1.0% per year growth),
- Reference case: 723,000 units (1.9% per year growth),
- High case: 756,000 units (2.3% per year growth).

Figure 3-12: Pacific Northwest Auto Imports (1,000 Units)



Source: BST Associates, IHS Markit

Exports

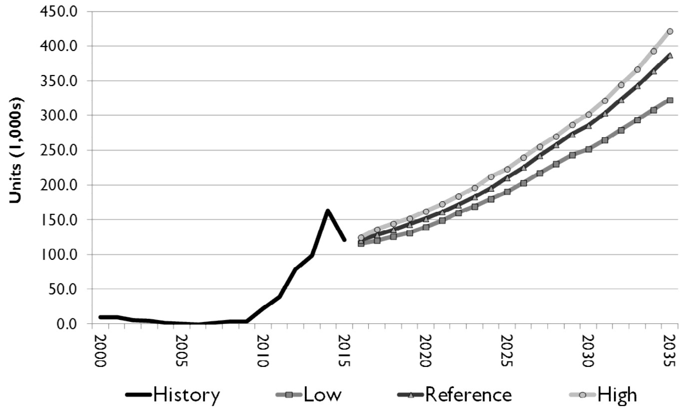
Exports of U.S. autos across all ports and border crossings increased rapidly between 2000 and 2015, growing at an annual rate of 11.4%. Emerging markets in China, India, Brazil, Eastern Europe and South Africa drove much of this growth.

Between 2000 and 2015, auto exports moving via Pacific Northwest ports increased at an annual rate of 23.0%, due mainly to shipments from Grays Harbor and Portland to China (see Figure 3-13).

Between 2015 and 2035, Pacific Northwest auto export volumes are expected to increase from 121,000 units to:

- Low case: 322,000 units (5.0% per year growth),
- Reference case: 387,000 units (6.0% per year growth),
- High case: 422,000 units (6.5% per year growth).

Figure 3-13: Pacific Northwest Auto Exports (1,000 Units)



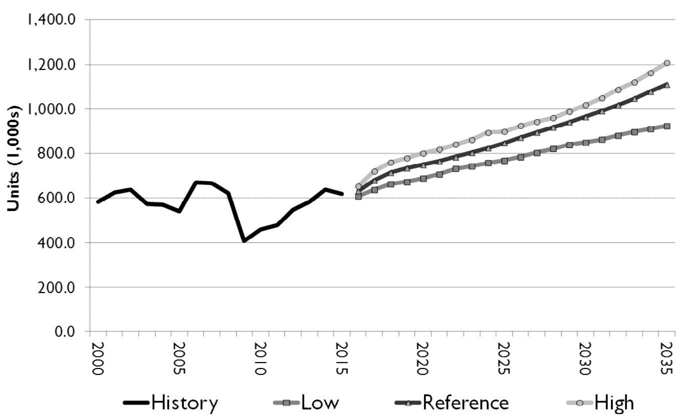
Source: BST Associates, IHS Markit

Summary

Pacific Northwest auto import and export volumes are expected to increase from 616,000 units in 2015 to the following volumes in 2035 as follows:

- Low case: 923,000 units (2.0% per year growth),
- Reference case: 1.1 million units (3.0% per year growth),
- High case: 1.2 million units (3.4% per year growth) (see Figure 3-14 and Table 3-4).

Figure 3-14: Pacific Northwest Auto Imports & Exports (1,000 Units)



Source: BST Associates, IHS Markit

Table 3-4: Pacific Northwest Waterborne Auto Forecast by Direction (1,000 Metric Tons and 1,000 Units)

		History				Forecast				Compound Annual Growth Rate	
Region	**Case**	**2000**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**2000-2015**	**2015-2035**
	Low					549	577	597	601		1.0%
Import units (1,000)	Reference	571	538	438	496	597	637	678	723	-0.9%	1.9%
	High					638	675	717	787		2.3%
	Low					813	855	885	890		1.0%
Imports (1,000 MT)	Reference	743	817	643	736	885	944	1,005	1,070	-0.1%	1.9%
	High					946	1,000	1,062	1,165		2.3%
	Low					139	191	251	322		5.0%
Exports (1,000)	Reference	11	1	23	121	152	210	285	387	17.6%	6.0%
	High					162	223	302	422		6.5%
	Low					292	398	524	669		5.0%
Exports (1,000 MT)	Reference	16	4	65	252	317	440	595	804	20.1%	6.0%
	High					339	466	628	876		6.4%
	Low					688	767	849	923		2.0%
Total (1,000 units)	Reference	582	539	461	616	748	847	964	1,110	0.4%	3.0%
	High					800	898	1,018	1,208		3.4%
	Low					1,105	1,253	1,409	1,560		2.3%
Total (1,000 MTs)	Reference	760	820	708	988	1,202	1,383	1,599	1,874	1.8%	3.3%
	High					1,286	1,466	1,690	2,041		3.7%

Source: BST Associates, IHS Markit

Summary of Breakbulk and Neobulk Cargoes by Region

Breakbulk and neobulk volumes are summarized by region in Table 3-5. The differential rates of growth are caused by the differences in product mix and direction of trade.

The Lower Columbia Oregon region has lost breakbulk cargo to Lower Columbia Washington and to Northern California; between 2000 and 2015 the region’s volume dropped from 1.24 million metric tons 1.05 million metric tons. This drop was partially offset by increased log exports from Astoria, and by coastwise shipments from Rainier, Oregon to Hawaii. Between 2015 and 2035, projected growth in breakbulk and neobulk cargo for the Lower Columbia Oregon region is:

- Low case: 1.4 million metric tons (1.3% per year growth),
- Reference case: 1.6 million metric tons (2.2% per year growth),
- High case: 1.9 million metric tons (3.0% per year growth).

The shift of breakbulk cargo from Lower Columbia Oregon contributed to growth in Lower Columbia Washington, where breakbulk/neobulk volumes rose from 2.5 million metric tons in 2000 to 3.9 million metric tons in 2015. Between 2015 and 2035, projected growth in breakbulk/neobulk volume in the Lower Columbia Washington is:

- Low case: 4.2 million metric tons (0.4% per year growth),
- Reference case: 5.1 million metric tons (1.3% per year growth),
- High case: 6.3 million metric tons (2.4% per year growth).

In the PSRC region, breakbulk/neobulk volumes saw little change over the past 15 years, with 1.57 million metric tons in 2000 and 1.60 million metric tons in 2015. Between 2015 and 2035, projected growth in breakbulk/neobulk volume in the PSRC region is:

- Low case: 2.1 million metric tons (1.3% per year growth),
- Reference case: 2.4 million metric tons (2.0% per year growth),
- High case: 2.8 million metric tons (2.8% per year growth).

Breakbulk/neobulk volumes moving through the Other Puget Sound / Washington Coast region were also essentially flat, with 1.45 million metric tons in 2000 and 1.42 million metric tons in 2015. Between 2015 and 2035, projected growth in breakbulk/neobulk volume in the Other Puget Sound / Washington Coast region is:

- Low case: 1.7 million metric tons (0.7% per year growth),
- Reference case: 2.0 million metric tons (1.6% per year growth),
- High case: 2.4 million metric tons (2.7% per year growth).

Table 3-5: Pacific Northwest Breakbulk/Neobulk Forecast by Region (1,000,000 Metric Tons)

		History				Forecast				Compound Annual Growth Rate	
Region	**Case**	**2000**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**2000-2015**	**2015-2035**
Lower Columbia Oregon	Low					1.06	1.17	1.28	1.36		1.3%
	Reference	1.24	1.63	1.40	1.05	1.14	1.30	1.48	1.63	-1.1%	2.2%
	High					1.28	1.47	1.68	1.88		3.0%
Lower Columbia Washington	Low					3.61	3.87	4.12	4.20		0.4%
	Reference	2.47	2.57	3.27	3.92	3.87	4.35	4.89	5.08	3.1%	1.3%
	High					4.55	5.25	5.98	6.25		2.4%
PSRC	Low					1.63	1.80	1.96	2.07		1.3%
	Reference	1.57	1.98	1.73	1.60	1.72	1.96	2.21	2.40	0.2%	2.0%
	High					1.91	2.20	2.51	2.76		2.8%
Other Puget Sound/ Washington Coast	Low					1.30	1.43	1.56	1.65		0.7%
	Reference	1.45	1.58	1.25	1.42	1.39	1.60	1.84	1.96	-0.1%	1.6%
	High					1.62	1.92	2.26	2.43		2.7%
Total	Low					7.60	8.26	8.92	9.27		0.7%
	Reference	6.73	7.75	7.65	7.99	8.12	9.21	10.42	11.07	1.2%	1.6%
	High					9.36	10.84	12.43	13.32		2.6%

Source: BST Associates, IHS Markit

Grain and Oilseeds

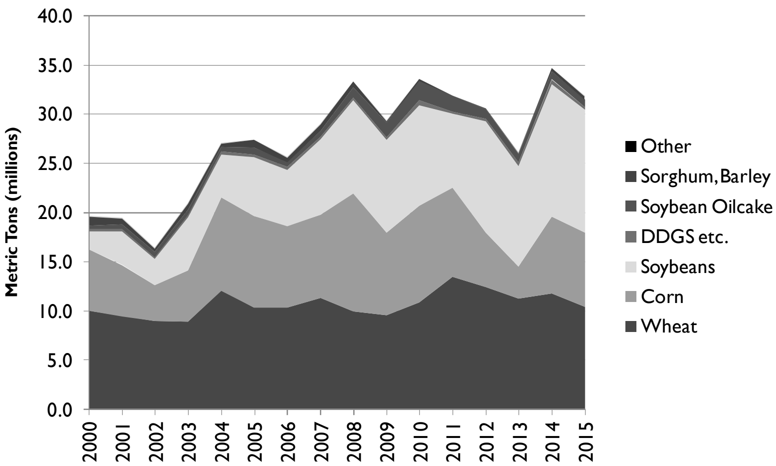
Overview

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 and DDGS[12].

Exports of grain and oilseeds through Pacific Northwest ports grew from less than 20 million metric tons in 2000 to nearly 35 million metric tons in 2015. Volumes 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 3-15)

Wheat, corn, and soybeans account for most of the grain and oilseed volume. Wheat volumes in 2015 were essentially the same as in 2000 (approximately 10.0 million metric tons), but ranged from a low of 9.0 million metric tons to a high of 13.4 million metric tons. Over the same period corn exports grew from 6.2 million to 7.6 million metric tons, and ranged from 3.2 million to 12.0 million metric tons. Soybeans grew from 1.8 million to 12.5 million metric tons, with growth occurring in most years. In fact, between 2010 and 2015 soybean exports dropped to less than 10.0 million metric tons in only one year (i.e. 7.6 million metric tons in 2011).

Figure 3-15: Pacific Northwest Grain and Oilseed Trends)



Source: BST Associates, WISERTrade

Wheat is primarily used for human consumption, as opposed to the coarse grains (corn, barley, sorghum), which are primarily used as animal feed. Demand for human food is less affected by changes in personal income than demand for animal feed, but currency exchange rates do have a strong impact on wheat sales. Competition for wheat exports is intense, particularly with Canada and Australia, among other countries.

In the Pacific Northwest, nearly all wheat and barley exports are handled through ports on the Columbia River. Much of the wheat exported through the Pacific Northwest is grown in the Great Plains, but the ports also handle substantial volumes of wheat grown in Eastern Washington,

[12] DDGS is distiller's dried grains with solubles, the nutrient rich co-product of ethanol production used as a feed ingredient.

Oregon, Idaho, Montana, and Utah. Export sales are critical to farmers in the Pacific Northwest, where 85% to 90% of Washington wheat and 90% of Oregon wheat is sold for export.

Competition is intense in the world coarse grain market, and Washington exporters vie for sales against Brazil, Argentina, and others. Washington ports also face competition from other U.S. port regions, specifically ports on the Gulf of Mexico.

Soybeans are used both for animal feed and for human consumption. The export markets are large and growing, particularly in China. As with other crops, there is strong international competition (mainly from Brazil and Argentina).

Completion of the Columbia River navigation channel deepening project has encouraged significant investments in capacity expansions at grain terminals on the river. These investments have increased annual export capacity from approximately 21 million metric tons to more than 37 million metric tons. These capacity improvements allowed the total volume of grain to jump to a new record of 25 million metric tons in 2014. Terminal improvement projects included:

- Portland - annual throughput capacity of the Columbia Grain 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 also increased by 2 million metric tons (from 4 to 6 million metric tons).
- 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.

One potential competitive threat to Pacific Northwest ports is future use of larger vessels at U.S. Gulf ports and at South American ports. New locks at the Panama Canal can handle vessels with maximum draft of 60 feet, and the Corps of Engineers is studying the potential to deepen the Mississippi River channel to 50 feet upstream to Baton Rouge. Depending on the origin of the grain (i.e. how far it is grown from the river system) the increased efficiency of the larger vessels could attract a larger share of the grain exports.

Another competitive threat is grain loaded into containers. Although the volume of this type of movement is still small relative to bulk shipments, it does provide shippers with additional options. Grain can be loaded into containers near the farming areas if empty containers are available, or it can be shipped by rail to the vicinity of container ports (such as Los Angeles / Long Beach), where empty containers are available for transloading.

Shifts in trade and consumption patterns have created opportunities for additional growth in grain and oilseed exports for Pacific Northwest ports. For example, the rising number of middle class households in China is expected to increase the demand for exports from the PNW. Changes in Canada’s system for sales and distribution of grain have also led to increasing volumes of Canadian grain exported through Columbia River ports.

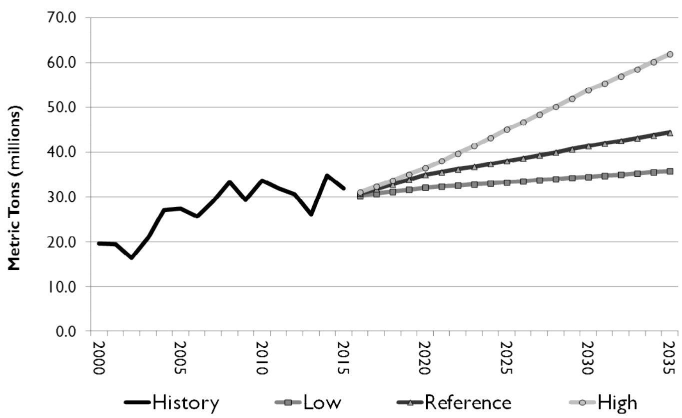
Changes in domestic consumption of corn may also create opportunity for increased exports. An estimated 40% of U.S. corn production is now used to make ethanol production, but demand for ethanol could decrease due to increasing U.S. production of oil, freeing more of the crop for export.

Forecast

Pacific Northwest grain exports grew at an average annual rate of 3.3% between 2000 and 2015. Future growth is projected to range from a low of 0.6% per year to a high of 3.4% per year, with a reference rate of 1.7% (see Figure 3-16)

Corn exports are forecast to grow strongly over the next twenty years, especially if less corn is used domestically in ethanol production. Wheat and soybean exports are also projected to continue growing.

Figure 3-16: Pacific Northwest Grain and Oilseed Forecast (1,000 Metric Tons)



Source: BST Associates, IHS Markit

Regional Forecast

Most of the growth over the past 15 years occurred in the Lower Columbia River Washington region, where volumes doubled. Total tonnage grew from 9.8 million to 19.9 million metric tons, or at an average annual rate of 4.9%, and the region accounted for nearly two-thirds of Pacific Northwest exports. As discussed above, significant new capacity was added to grain terminals in the region, and this investment appears to be paying off. Future growth is projected to range between 0.4% and 3.1% per year, with a reference rate of 2.3% (see Table 3-6).

Lower Columbia Oregon saw a drop in grain exports between 2000 and 2015, although 2015 was an outlier year. Future growth is projected to range between 1.2% and 3.9% per year, with a reference growth rate of 3.9%.

Between 2000 and 2015, grain exports through the PSRC region increased from 5.3 million to 7.0 million metric tons, or at an average annual rate of 1.9%. However, during that period the volume reached nearly 12 million metric tons in some years. Future growth is projected to range between 0.8% and 3.8% per year, with a reference growth rate of 2.0% per year.

Other Puget Sound / Washington Coast ports handled almost no grain exports in 2000, but handled 1.6 million metric tons in 2015. This jump is attributable to the construction of the new AGP export terminal in Aberdeen. Future growth is projected to range between -0.1% and 3.2% per year, with a reference rate of 0.7%.

Table 3-6: Grain Exports by Region (Million Metric Tons)

		History				Forecast				Compound Annual Growth Rate	
Region	Case	2000	2005	2010	2015	2020	2025	2030	2035	2000-2015	2015-2035
Lower Columbia Oregon	Low					4.2	4.3	4.3	4.4		1.2%
	Reference	4.5	5.2	6.1	3.4	4.5	4.8	5.1	5.3	-1.9%	2.3%
	High					4.6	5.6	6.5	7.3		3.9%
Lower Columbia Washington	Low					19.3	20.0	20.8	21.6		0.4%
	Reference	9.8	10.9	14.6	19.9	21.0	22.9	25.0	26.8	4.9%	1.5%
	High					21.9	27.1	32.2	36.9		3.1%
PSRC	Low					7.1	7.5	7.9	8.3		0.8%
	Reference	5.3	10.8	11.8	7.0	7.8	8.7	9.6	10.4	1.9%	2.0%
	High					8.2	10.4	12.6	14.7		3.8%
Other Puget Sound/ Washington Coast	Low					1.4	1.4	1.5	1.5		-0.1%
	Reference	0.1	0.5	1.0	1.6	1.5	1.6	1.7	1.8	24.0%	0.7%
	High					1.6	2.0	2.5	2.9		3.2%
Total	Low					32.1	33.2	34.4	35.8		0.6%
	Reference	19.6	27.4	33.6	31.9	34.9	38.0	41.3	44.3	3.3%	1.7%
	High					36.4	45.1	53.9	61.8		3.4%

Source: BST Associates

Dry Bulk Cargoes (Excluding Grain)

Overview

This section examines dry bulk cargo, excluding grains, oilseeds, and related products.

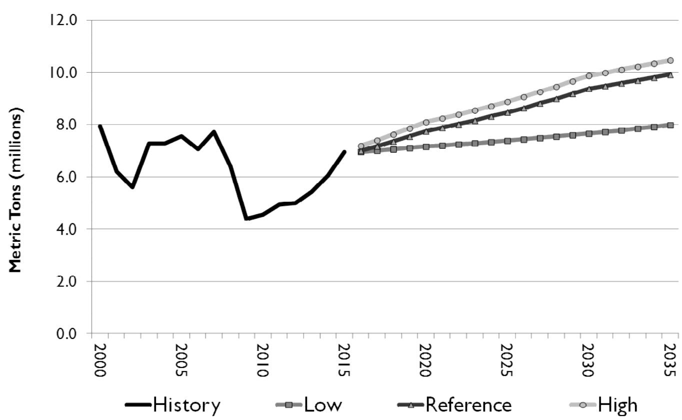
Imports

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.

Import tonnage of dry bulks fell from approximately 8.0 million metric tons in 2000 to 7.0 million metric tons in 2015, or a decline of 0.9% per year. Most of this decline occurred between 2007 and 2009, when import tonnage dropped to less than 4.4 million metric tons during the recession. After several years of slow growth imports have recovered strongly.

Future growth rates for import dry bulks are tied closely to projections of construction spending. The reference growth rate averages 1.8% per year from 2015 through 2035, the high growth rate averages 2.1%, and the low rate averages 0.7%. It should be noted that there will likely be one or more economic recessions over the forecast period, and during the oscillations of the economic cycle import volumes may deviate from these growth rates in any given year. Over the long run, however, these growth rates represent the projected annual average growth (see Figure 3-17)

Figure 3-17: Pacific Northwest Other Dry Bulk Imports Forecast (1,000 Metric Tons)



Source: BST Associates, IHS Markit

Exports

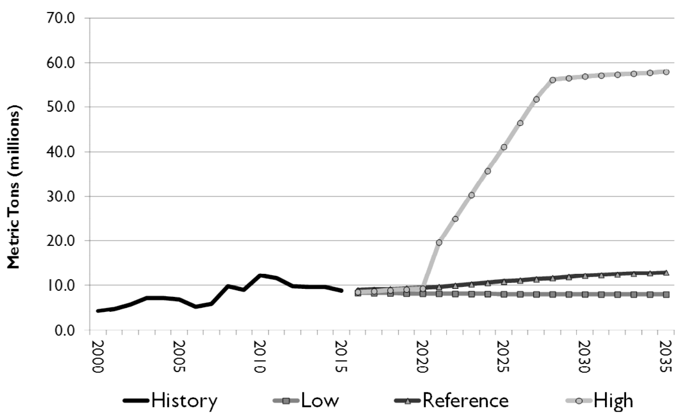
Dry bulk export commodities include minerals, scrap metal, petroleum coke, and hay pellets. Two minerals, potash and soda ash, account for more than two-thirds of dry bulk export tonnage. Soda ash mined in Wyoming has been exported through Portland for decades, while exports of potash (primarily from Saskatchewan) began in the mid-2000's. Other minerals, such as bentonite clay and sulfur, account for less than 4% of export dry bulk tonnage. Copper concentrates from Montana are exported via the Port of Vancouver.

Most of the remaining export dry bulk tonnage consists of petroleum coke and scrap metal. Petroleum coke is produced in steady volumes by the petroleum refineries on northern Puget Sound, and accounts for approximately 14% of export dry bulk tonnage. Scrap metal also accounts for 14% of export tonnage. Wood chips accounted for 14% of export tonnage in 2000, but dropped to just 2% of tonnage in 2015.

Between 2000 and 2015, dry bulk exports volumes grew at an annual rate of 5.0%. Much of this growth was due to the start-up of potash exports, which did not exist in 2000. Soda ash volumes also grew also over that time. From 2015 through 2035, the reference growth rate is projected to average 1.9% per year (see Figure 3-18)

The high case forecast growth rate is 10.2% per year; based on the assumption that coal will begin to be exported through the U.S. Pacific Northwest. The high case assumes that the Millennium Bulk Terminal in Longview is constructed and operates at maximum volume (i.e. 44 million metric tons per year.)

Figure 3-18: Pacific Northwest Other Dry Bulk Exports Forecast (1,000 Metric Tons)



Source: BST Associates, IHS Markit

Regional Forecast

More than half of dry bulk import tonnage moves through ports in the PSRC region. The region is home to a number of plants that manufacture construction materials, including cement plants, wallboard plants, and concrete batch plants. Key commodities include gypsum, limestone, sand and gravel, and scrap metal. Dry bulk imports moving through ports in the PSRC region are projected to grow from 3.9 million metric tons in 2015 to 6.3 million metric tons under the reference forecast, and to range between 5.0 million metric tons and 6.6 million metric tons. The rate of growth over twenty years is 2.5% per year under the reference forecast, 1.2% under the low forecast, and 2.7% under the high forecast (see Table 3-7).

Lower Columbia Oregon ports handle approximately one-quarter of import dry bulks. Growth was slow between 2000 and 2015, averaging 0.1% per year. From 2015 through 2035 the reference growth rate is 0.3%, with a low rate of -0.7% and a high rate of 0.7%. As with the PSRC region, the primary commodities are construction-related, including gypsum, limestone, and cement. Fertilizer accounts for most of the remaining tonnage.

Dry bulks import volumes are relatively limited in both the Lower Columbia Washington and Other Puget Sound / Washington Coast region, and the volumes of imports dropped in both regions between 2000 and 2015. For the Lower Columbia Washington ports the main source of the decline was alumina, which dropped sharply as smelters closed. Fertilizer and chemicals account for most of the tonnage now, and both saw increasing volumes between 2000 and 2015. For Other Puget Sound / Washington Coast ports, the main source of the declining tonnage was limestone and aggregates. Future growth for Lower Columbia Washington is projected to range between 1.1% and 2.6% per year, with a reference growth rate of 2.2%. Growth in Other Puget Sound / Washington Coast is projected to range between -0.2% and 0.7% per year, with a reference growth rate of 0.2%.

For the entire region, dry bulk imports are projected to grow at an average annual rate of 1.8% under the reference case, 0.7% under the low case and 2.1% under the high case.

Table 3-7: Dry Bulk Imports by Region (Million Metric Tons)

		History				Forecast				Compound Annual Growth Rate	
Region	**Case**	**2000**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**2000-2015**	**2015-2035**
Lower Columbia Oregon	Low					1.6	1.6	1.6	1.7		-0.7%
	Reference	1.9	2.1	1.2	1.9	1.7	1.8	1.9	2.0	0.1%	0.3%
	High					1.8	1.9	2.1	2.2		0.7%
Lower Columbia Washington	Low					0.9	0.9	0.9	0.9		1.1%
	Reference	0.9	0.6	0.8	0.7	0.9	1.0	1.1	1.1	-1.6%	2.2%
	High					1.0	1.0	1.1	1.2		2.6%
PSRC	Low					4.3	4.5	4.7	5.0		1.2%
	Reference	4.7	4.6	2.2	3.9	4.7	5.3	5.9	6.3	-1.2%	2.5%
	High					4.9	5.5	6.2	6.6		2.7%
Other Puget Sound/ Washington Coast	Low					0.4	0.4	0.4	0.4		-0.2%
	Reference	0.5	0.1	0.4	0.4	0.5	0.5	0.4	0.4	-0.8%	0.2%
	High					0.4	0.4	0.5	0.5		0.7%
Total	Low					7.2	7.4	7.7	8.0		0.7%
	Reference	8.0	7.5	4.6	7.0	7.7	8.5	9.4	9.9	-0.9%	1.8%
	High					8.1	8.9	9.9	10.5		2.1%

Source: BST Associates, IHS Markit

Most dry bulk exports move through the Lower Columbia region, especially the Lower Columbia Oregon. Combined, the Lower Columbia Oregon and Lower Columbia Washington regions accounted for 85% of dry bulk exports in 2015, and tonnage more than doubled between 2000 and 2015. Portland accounts for the largest share of these movements, due to the high volumes of potash and soda ash exports.

Export tonnage increased by an average of 5.8% per year in the Lower Columbia Oregon between 2000 and 2015. Future growth is projected to range between -0.3% and 2.3%, with a reference growth rate of 1.8% per year. In the Lower Columbia Washington region the projected low and reference growth rates are similar to those for Oregon. The high rate, however, is much higher, due to the inclusion of Millennium Bulk Terminal coal exports (see Table 3-8).

The PSRC region saw declining dry bulk exports between 2000 and 2015, due almost entirely to a fall in wood chip exports. Volumes dropped by an average of -2.9% per year between 2000 and 2015. With wood chips gone and not expected to return, the different commodity mix results in projected growth rates ranging between 0.2% and 5.0% per year, with a reference growth rate of 3.2% per year.

Other dry bulk exports doubled in volume through ports in the Other Puget Sound / Washington Coast region between 2000 and 2015, although the total volume handled is much smaller than through the Columbia River. Growth averaged 4.9% per year between 2000 and 2015, but is forecasted to slow between 2015 and 2035. Future growth is projected to range between -0.1% and 1.9%, with a reference growth rate of 1.4%.

For the region as a whole, the reference growth rate for dry bulk exports is 1.9% per year, the low rate is -0.2% and the high growth rate is 10.6%. The large jump between the reference and high growth rates is due to the inclusion of Millennium Bulk Terminal coal in the high forecast.

Table 3-8: Dry Bulk Exports by Region (Million Metric Tons)

		History				Forecast				Compound Annual Growth Rate	
Region	**Case**	**2000**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**2000-2015**	**2015-2035**
Lower Columbia Oregon	Low					4.4	4.3	4.3	4.3		-0.3%
	Reference	2.0	3.3	5.4	4.6	4.8	5.5	6.2	6.6	5.8%	1.8%
	High					5.0	5.9	6.7	7.2		2.3%
Lower Columbia Washington	Low					1.7	1.7	1.7	1.7		-0.2%
	Reference	1.1	1.5	1.5	1.8	1.9	2.2	2.4	2.5	3.1%	1.8%
	High					7.0	46.4	46.8	47.1		17.8%
PSRC	Low					0.6	0.6	0.6	0.6		0.2%
	Reference	0.9	1.2	1.2	0.6	0.7	0.8	1.0	1.0	-2.9%	3.2%
	High					0.7	1.0	1.3	1.5		5.0%
Other Puget Sound/ Washington Coast	Low					0.6	0.6	0.6	0.6		-0.1%
	Reference	0.3	0.1	0.2	0.6	0.6	0.7	0.7	0.8	4.9%	1.4%
	High					0.6	0.7	0.8	0.9		1.9%
Total	Low					7.3	7.2	7.1	7.1		-0.2%
	Reference	4.2	6.1	8.3	7.5	8.0	9.2	10.3	10.9	3.9%	1.9%
	High					13.3	54.0	55.7	56.6		10.6%

Source: BST Associates, IHS Markit

Liquid Bulks

Waterborne liquid bulk traffic in the Pacific Northwest is dominated by crude oil and refined petroleum products. A variety of other liquid commodities (e.g. animal fats, vegetable oils, chemicals, and fertilizers) are also handled, but in much smaller volumes.

Crude Oil

Five refineries on Puget Sound receive crude oil by water: two at Cherry Point near Ferndale, two at March Point near Anacortes, and a smaller facility in Tacoma. Puget Sound refineries have the capacity to process approximately 631,700 barrels of crude oil per day; incremental improvements to these facilities increased production capacity by an average of 0.6% per year between 1995 and 2015.[13] However, the amount of crude oil actually processed has remained relatively constant at approximately 560,000 barrels per day.[14] (See Table 3-9).

Table 3-9: Puget Sound Refinery Capacity (barrels per day)

Area	1995	2015	CAGR 1995-2015
Tacoma	44,300	40,700	-0.4%
Anacortes	236,500	265,000	0.6%
Ferndale	284,000	326,000	0.7%
Total	564,800	631,700	0.6%

Source: U.S. Energy Information Administration

As shown in Table 3-10, Washington refineries receive crude oil via seven different combinations of sources and modes of transportation.

Table 3-10: Puget Sound Crude Oil Sources and Routes

Source and Type of Crude	#	Route	Estimated Loading in 2015
Alaska (Alaska North Slope or (ANS))[10]	1	by tanker to the refineries	250,000 bbls/day or 45%, down from 90% in 2003 and expected to continue to decline.
Canadian crude from Alberta (heavy, medium and light)	2	by Trans Mountain Mainline Pipeline to Abbotsford, BC and then by Kinder Morgan's Puget Sound pipeline system to the refineries	140,000 bbls per day or 25% from 2011 to 2015, up from 10% in 2003
	3	by Trans Mountain Mainline Pipeline to the Westridge Terminal in Burnaby BC and then by barge to the refineries	
	4	by rail to refineries in Puget Sound	
Inland U.S., mostly Bakken (mainly light shale crude)	5	by rail to refineries in Puget Sound	140,000 bbls per day or 25%, up from 2% in 2011
	6	by rail to marine transload terminals and then by barge to Puget Sound	
Overseas imports from Latin America, the Middle East, and other global sources (a mix of heavy, medium and light)	7	by tanker to the refineries	30,000 bbls per day or 5%, down from 19% in 2011

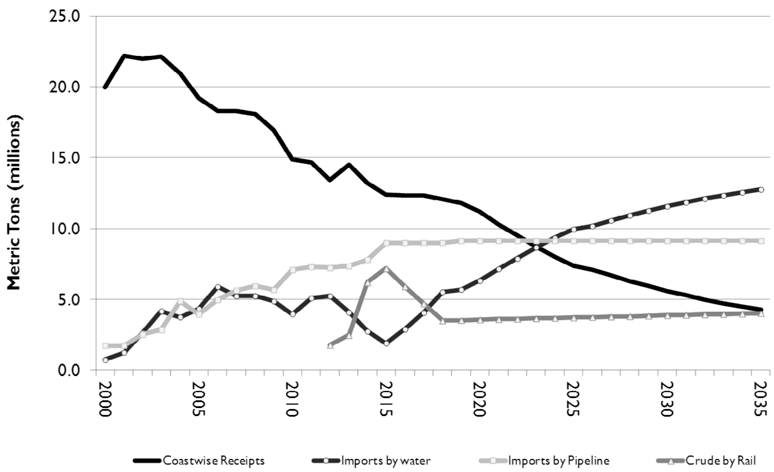
Source: Ian Goodman & Brigid Rowan

[13] Source: U.S. Energy Information Administration (EIA) refinery capacity reports.

[14] Source: Ian Goodman & Brigid Rowan, Technical Appendix to Expert Testimony on the Need for the Vancouver Energy Distribution Terminal: Market Analysis, May 13, 2016

Washington refineries have historically relied primarily on crude oil from Alaska, but as illustrated in Figure 3-19, crude oil receipts from Alaska peaked in 2003 and 2004, and have steadily declined since then. Forecasts by the Alaska State Department of Revenue and the U.S. Energy Information Administration (EIA) both project continued declines in crude oil production in Alaska. This continued decline in Alaskan crude oil is causing refineries to seek new sources and routes.

Figure 3-19: Pacific Northwest Crude Oil Receipts by Source: Reference Case (Million Metric Tons)



Source: BST Associates, IHS Markit

Canada is one alternative source of crude oil for the refineries. Canadian crude is received via pipeline, vessel (barge and tanker), and rail. The Trans Mountain Pipeline (owned by Kinder Morgan) connects oil fields in Alberta to the Westridge Terminal in Burnaby, B.C. An extension of this pipeline reaches the Washington refineries at Cherry Point and March Point. The Canadian Government recently granted Kinder Morgan a permit to expand the capacity of the Trans Mountain Pipeline from 300,000 barrels per day to 890,000 barrels per day[15]. Construction is expected to be completed by the end of 2019. However, the capacity of the extension to Washington refineries (approximately 180,000 barrels per day) will not be increased under this plan.

Canadian crude oil can also be shipped by water from the Westridge Terminal to Washington refineries, although the amount available depends on the level of demand for this same crude oil in Asia.

Canadian crude oil is also shipped by rail to Puget Sound refineries. In 2014 and 2015, regional receipts of crude by rail ("CBR") from Canada were an estimated at 3.4 million barrels per year.[16]

Domestic oil from the Lower 48 states is another alternative source of crude oil for the refineries. Most of this crude oil is originates in North Dakota (PADD 2[17]) and Utah (PADD 4), and is shipped to Washington by rail. The first CBR shipments to Washington were received in 2011, when approximately 250 carloads were received. The volume jumped to more than 80,000 carloads in 2015, including some receipts from Canada.

[15] There are 157 conditions that need to be met to construct the pipeline expansion.

[16] CBR volumes are based on data from EIA and the California Energy Commission.

[17] The United States is divided into five Petroleum Administration for Defense Districts, or PADDs

Most of the CBR was shipped directly to refineries in Washington, but a portion was also shipped by rail to a terminal on the Columbia River near Clatskanie, Oregon and then barged to Puget Sound. Shipments through this Oregon terminal peaked in 2014 at 9,151 railcars, and then fell to 1,345 railcars in 2015. This decline was due to completion of rail unloading facilities at four of the five Puget Sound refineries (The Shell refinery near Anacortes is the only refinery without a rail unloading facility. Shell was planning such a facility, but decided not to complete the environmental impact study for the project.)

Use of CBR by Washington refineries depends on the price and availability of oil. Inland U.S. oil is typically pegged to the West Texas Intermediate crude oil price and foreign oil is pegged to the Brent oil index. From 2011 to 2015, as the crude oil production rose in the U.S. (especially North Dakota), the price for domestic oil dropped. The difference in price between North Dakota oil and international oil was as much as $13 to $25 per barrel, driving up demand from the Washington refineries. Since 2015, however, the price differential has dropped significantly.

Availability of North Dakota oil will be impacted by pipeline construction. As new lines are completed that connect North Dakota oil fields to the existing pipeline system, more of the oil will be shipped by pipeline. For the most part these pipelines run to the Gulf Coast and East Coast; they do not connect to the West Coast. The shift to pipeline will not end CBR shipments to the Pacific Northwest, but the share of oil transported by rail to the refineries will decline.

The Washington refineries can also receive crude oil by tanker from foreign sources other than Canada. As noted above, these other foreign sources currently account for 5% of the supply, down from 19% in 2011.

Under the reference case, the modal split in 2035 is projected to be:

- Vessel from Alaska: 14%
- Pipeline from Canada: 30%
- Vessel from foreign sources (including Canada): 42%
- Rail: 13%

In addition to the rail unloading facilities at Washington refineries, a number of terminals have been proposed to transfer oil from rail to vessel.[18]. These include:

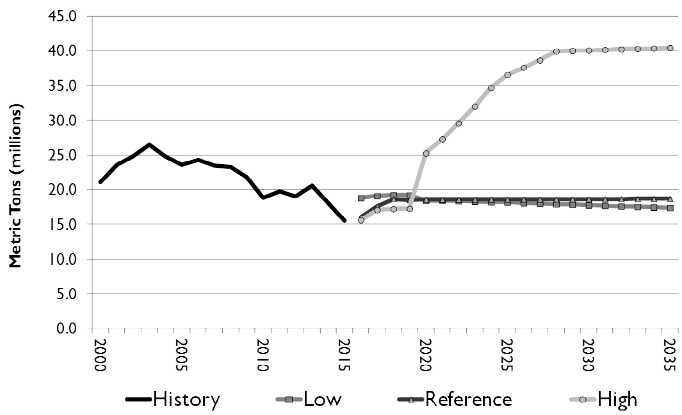
- Vancouver Energy Terminal (Port of Vancouver) – capacity of 360,000 barrels of crude oil per day, under review.
- Westway Terminal (Port of Grays Harbor) – 23,000 barrels of crude oil per day, under review.
- Global Partners (Port of St Helens at Port Westward) – capacity of 30,000 barrels of crude oil per day.
- Imperium Terminal (Port of Grays Harbor) – capacity of 14,000 barrels of crude oil per day.
- Arc Logistics (Portland) – capacity of 14,000 barrels of crude oil per day.
- NuStar Terminal (Port of Vancouver) – capacity of 41,000 barrels of crude oil per day.

[18] Included at the time of the forecasts.

These proposed rail-to-vessel terminals could supply domestic markets (notably California) as well as foreign markets, since export of U.S. crude oil was legalized in 2016. The high cast forecast includes these terminals, while the reference and low cases do not.

As shown in Figure 3-20, crude oil receipts are expected to remain relatively stable under the low and reference cases, with volumes averaging around 19 million metric tons per year through the end of the forecast period. The loss of Alaskan crude is fully offset by foreign sources arriving by water (barges and tankers). Under the high case scenario, crude oil used by refineries is projected to reach 21 million tons per year while crude oil moving through rail-to-vessel terminals is projected to reach the planned capacity of 25 million tons in 2025, and then to remain at that level through 2035.

Figure 3-20: Pacific Northwest Crude Oil Receipts and Shipments[19]
(Million Metric Tons)



Source: BST Associates, IHS Markit

Refined Petroleum Products

Puget Sound refineries supply 90% approximately of the refined petroleum products consumed in Washington and Oregon; the remaining 10% moves by pipeline from other states, primarily Utah and Montana. As shown in Table 3-11, the Seattle and Portland areas generate most of the demand for refined products, and account for 46% and 25%, respectively[20]. Other communities account for the remaining demand.

[19] Includes domestic and foreign sources of crude oil.

[20] U.S. Department of Homeland Security National Protection and Programs Directorate Office of Cyber and Infrastructure Analysis Columbia River Basin Petroleum and Refined-Product Supplies: Disruptions and Mitigations under Cascadia Subduction Zone Earthquake, Scenario, July 2016

Table 3-11: Average Refined Product Demand in Washington and Oregon

Demand Region	Barrels per Day (1,000's)	Percent of Market
Seattle	216.9	46%
Portland	117.88	25%
Eugene	47.15	10%
Moses Lake	9.43	2%
Kennewick-Richland	42.43	9%
Spokane	37.72	8%
Total	**471.51**	100%

Source: U.S. Department of Homeland Security

Washington and Oregon have a total of four pipelines that carry refined petroleum products. These include:

- Olympic Pipeline,
- Tesoro Pipeline,
- Yellowstone Pipeline, and
- Kinder Morgan Pipeline.

Of these, the Olympic Pipeline is the most important. This line runs from the refineries on Puget Sound as far south as Portland, and has distribution terminals located at Bayview (Mount Vernon), Seattle, Renton, Sea-Tac, Tacoma, Spanaway, Olympia, and Vancouver in Washington, as well as Linnton and Portland in Oregon. This line carries gasoline, diesel fuel and jet fuel, and has annual throughput capacity of approximately 4.6 billion gallons. This pipeline carries a relatively large share of the refined products shipped to the Portland area.

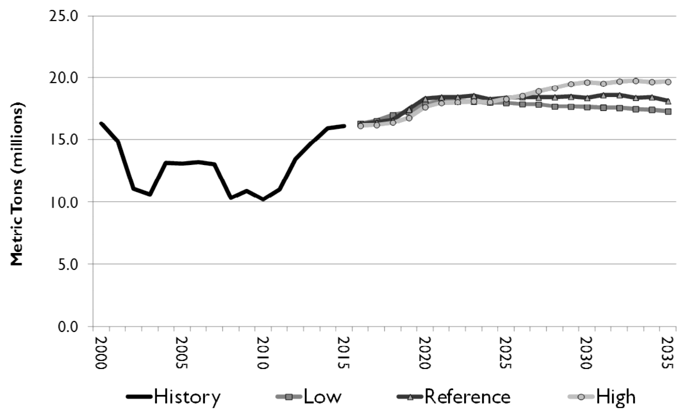
The Tesoro Pipeline runs from refineries near Salt Lake City to Pasco, with an extension from Pasco to Spokane. The Yellowstone Pipeline runs from Billings, Montana to Spokane and Moses Lake. The Kinder Morgan Pipeline runs from Portland to Eugene, and supplies virtually all of the gasoline used in the Willamette Valley.

Some of the petroleum products from the Puget Sound refineries are shipped by water to Alaska, California, and British Columbia, as well as to other domestic and foreign destinations. In 2000, 16.3 million metric tons of refined products was shipped or received by water. Volumes were higher in 2000 and 2001 while the Olympic Pipeline was out of service. After the pipeline was repaired the volume moving by water dropped to approximately 10 to 13 million metric tons for several years, but climbed back to 16 million metric tons again in 2015. The recent increase in volume was due to growth in shipments of refined products to British Columbia and other foreign destinations.

As shown in Figure 3-21, between 2015 and 2035, waterborne shipments and receipts of refined products are projected to grow to:

- Low case: 17.3 million metric tons (0.5% per year growth),
- Reference case: 18.1 million metric tons (0.8% per year growth),
- High case: 19.7 million metric tons (1.4% per year growth).

Figure 3-21: Pacific Northwest Refined Product Shipments & Receipts (Million Metric Tons)



Source: BST Associates, IHS Markit

Other Liquid Bulks

Other liquid bulks include animal fats, vegetable oils, chemicals, fertilizers, and methanol.

Animal fats and vegetable oils

Animal fats and vegetable oils are used as ingredients for animal feed, and as inputs to biodiesel production, among other uses. Shipments and receipts of animal fats and vegetable oils averaged less than 100,000 metric tons between 2000 and 2015, and ranged from a low of 19,600 metric tons in 2015 to a high of 123,000 metric tons in 2008. Projected growth of these products from 2015 through 2035 is:

- Low case: 22,000 metric tons (0.5% per year growth),
- Reference case: 38,000 metric tons (4.4% per year growth),
- High case: 53,000 metric tons (6.9% per year growth).

Chemicals and fertilizers

Chemicals and fertilizers include caustic soda and sodium hydroxide (used in the forest products industry), benzene and toluene (used in the chemical industry), and nitrogenous fertilizers (used in the agricultural industry), among others. Shipments and receipts of chemicals and fertilizers declined between 2000 and 2015, ranging from a low of 414,000 tons in 2012 and a high of 880,000 tons in 2002. Projected growth of these products from 2015 through 2035 is:

- Low case: 426,000 metric tons (-1.9% per year growth),
- Reference case: 850,000 metric tons (2.7% per year growth),
- High case: 1.3 million metric tons (5.5% per year growth).

Methanol

Methanol plants are proposed at the Port of Kalama and the Port of St. Helens. Methanol is a primary input to manufacturing plastics and other products, and demand is strong in Asia. Methanol is currently produced in China using crude oil and coal as feedstocks. The methanol manufactured at the Port of Kalama and Port of St. Helens would use natural gas as a feedstock, which is relatively clean when compared to oil and coal, and is relatively abundant in North America. 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). It is assumed that the plants would begin construction in 2018 and production in 2021 (at 1.8 million metric tons) and then ramp up to full production by 2024.

The methanol plants should have minimal impacts on road and rail infrastructure. The primary input, natural gas, is transported via pipeline. The finished product will be piped a short distance from the plant to the dock.

Summary of Liquid Bulks

Table 3-12 summarizes historical trends and projected growth rates for the different liquid bulk commodities.

Table 3-12: Pacific Northwest Waterborne Liquid Bulk Traffic by Category (Million Metric Tons)

		History				Forecast				Compound Annual Growth Rate	
Region	**Case**	**2000**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**2000-2015**	**2015-2035**
Crude Oil	Low	21.1	23.6	18.8	15.5	18.4	18.1	17.8	17.4		0.6%
	Reference	21.1	23.6	18.8	15.5	18.6	18.6	18.6	18.7	-2.0%	1.0%
	High	21.1	23.6	18.8	15.5	25.3	36.6	40.1	40.4		4.9%
Petroleum Products	Low	16.3	13.1	10.2	16.1	17.9	18.0	17.6	17.3		0.4%
	Reference	16.3	13.1	10.2	16.1	18.3	18.4	18.4	18.1	-0.1%	0.6%
	High	16.3	13.1	10.2	16.1	17.6	18.3	19.6	19.7		1.0%
Animal Fats & Vegetable Oils	Low	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0		0.6%
	Reference	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	-6.3%	3.3%
	High	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1		5.1%
Chemicals & Fertilizers	Low	0.7	0.7	0.6	0.6	0.3	0.4	0.4	0.4		-1.5%
	Reference	0.7	0.7	0.6	0.6	0.7	0.7	0.9	0.9	-1.8%	2.0%
	High	0.7	0.7	0.6	0.6	1.0	1.1	1.3	1.3		4.1%
Methanol	Low	-	-	-	-	-	-	-	-		NM
	Reference	-	-	-	-	-	-	-	-	NM	NM
	High	-	-	-	-	-	6.8	6.8	6.8		NM
Total	Low	38.1	37.5	29.7	32.1	36.6	36.5	35.8	35.1		0.4%
	Reference	38.1	37.5	29.7	32.1	37.6	37.8	37.9	37.7	-1.1%	0.8%
	High	38.1	37.5	29.7	32.1	43.9	62.9	67.9	68.3		3.8%

Source: BST Associates, IHS Markit

Regional Forecast

Regional splits for liquid bulk volumes are presented in Table 3-13.

The Lower Columbia Oregon region experienced a decline in liquid bulks between 2000 and 2015, with volumes dropping from 7.3 million metric tons in 2000 to 3.4 million metric tons in 2015. The volume in 2000 was much higher than in other years, due to the Olympic Pipeline being out of service and a shift from pipeline to vessel. This temporary shift ended after the pipeline was repaired and put back into services. Between 2015 and 2035, liquid bulk volumes in the Lower Columbia Oregon are projected to grow to:

- Low case: 3.0 million metric tons (-0.6% per year growth),

- Reference case: 3.9 million metric tons (0.8% per year growth),
- High case scenario (includes methanol at St Helens, and CBR at Portland and St Helens): reaching 8.0 million metric tons (4.4% per year growth).

Liquid bulk traffic in the Lower Columbia Washington region ranged between 250,000 metric tons and 650,000 metric tons from 2000 through 2015. Between 2015 and 2035, liquid bulk volumes in the Lower Columbia Washington are projected to grow to:

- Low case: 289,000 metric tons (-1.5% per year growth),
- Reference case: 570,000 metric tons (1.9% per year growth),
- High case (includes CBR at Vancouver and methanol at Kalama): 20.0 million metric tons (21.7% per year growth).

The PSRC region's liquid bulk traffic increased from 2.4 million metric tons in 2000 to 3.5 million metric tons in 2015, or at an average annual growth rate of 2.6%. Between 2015 and 2035, liquid bulk volume in the PSRC region is projected to grow to:

- Low case: 4.5 million metric tons (1.3% per year growth),
- Reference case: 4.6 million metric tons (1.5% per year growth),
- High case: 4.9 million metric tons (1.7% per year growth).

Liquid bulk volumes in the Other Puget Sound / Washington Coast region dropped from 28.2 million metric tons in 2000 to 24.9 million metric tons in 2015 due to falling crude oil receipts from Alaska. Between 2015 and 2035, liquid bulk volume in the Other Puget Sound / Washington Coast region is projected to increase to:

- Low case: 27.4 million metric tons (0.5% per year growth),
- Reference case: 28.6 million metric tons (0.7% per year growth),
- High case (includes CBR at Grays Harbor): 35.4 million metric tons (1.8% per year growth).

Table 3-13: Pacific Northwest Waterborne Liquid Bulk Traffic by Region (Million Metric Tons)

		History				Forecast				Compound Annual Growth Rate	
Region	**Case**	**2000**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**2000-2015**	**2015-2035**
Lower Columbia Oregon	Low	7.3	4.0	2.3	3.4	2.9	3.0	3.0	3.0		-0.6%
	Reference	7.3	4.0	2.3	3.4	3.5	3.6	3.8	3.9	-5.0%	0.8%
	High	7.3	4.0	2.3	3.4	5.8	7.7	7.9	8.0		4.4%
Lower Columbia Washington	Low	0.3	0.6	0.7	0.4	0.2	0.3	0.3	0.3		-1.5%
	Reference	0.3	0.6	0.7	0.4	0.5	0.5	0.6	0.6	1.3%	1.9%
	High	0.3	0.6	0.7	0.4	8.6	17.8	20.0	20.0		21.7%
PSRC	Low	2.4	3.2	3.2	3.5	4.5	4.5	4.5	4.5		1.3%
	Reference	2.4	3.2	3.2	3.5	4.6	4.6	4.6	4.6	2.6%	1.5%
	High	2.4	3.2	3.2	3.5	4.5	4.6	4.8	4.9		1.7%
Other Puget Sound/ Washington Coast	Low	28.2	29.7	23.5	24.9	29.0	28.7	28.1	27.4		0.5%
	Reference	28.2	29.7	23.5	24.9	29.1	29.0	29.0	28.6	-0.8%	0.7%
	High	28.2	29.7	23.5	24.9	28.6	32.7	35.1	35.4		1.8%
Total	Low	38.1	37.5	29.7	32.1	36.6	36.5	35.8	35.1		0.4%
	Reference	38.1	37.5	29.7	32.1	37.6	37.8	37.9	37.7	-1.1%	0.8%
	High	38.1	37.5	29.7	32.1	43.9	62.9	67.9	68.3		3.8%

Source: BST Associates, IHS Markit

Chapter 4
Inland Navigation System

Introduction

The Columbia/Snake River System is one of the most important waterway systems in the United States. It begins at the mouth of the Columbia River and extends 465 miles to Lewiston, Idaho, at the confluence of the Snake and Clearwater Rivers. The deep draft portion of the navigation system is 43 feet deep and 600 wide, and runs 105 miles from the mouth of the Columbia River to Portland and Vancouver. Other ports along the deep draft channel include Longview, Kalama, and Woodland in Washington, and Astoria and St. Helens in Oregon.

The inland navigation system extends 360 miles along the Columbia River from Vancouver to Pasco, and along the Snake River from Pasco to Lewiston, Idaho, and along the last several miles of the Clearwater River in Lewiston. The system includes four locks and dams on the Columbia River and four locks and dams on the Snake River. The system is maintained to a minimum depth of 14 feet.

The deep draft and shallow draft channels are both critical portions of the river transportation system. A large volume of the grain and other products exported through the deep draft ports is shipped by barge to the export terminals, while fertilizer and other commodities are imported by ship and then barged upriver.

Key Findings

- The inland navigation system is critical to the success of grain farmers in the Pacific Northwest, allowing them to compete on world markets. Barge grain volumes have held steady in recent years, averaging approximately 4 million metric tons per year.
- Loss of container service at Portland eliminated most barge movements of export containers. The cargo carried in these containers primarily included pulp and paper, hay, and lentils. Most this containerized cargo is now trucked to Seattle and Tacoma for export.
- Volumes of forest products (wood chips, logs, etc.) and aggregates (sand and gravel) have been steady, and are projected grow slowly.
- Volumes of municipal solid waste (i.e. garbage) have grown.
- Volumes of petroleum products dropped substantially between 2000 and 2015, due in part to closure of the Port of Wilma oil storage terminal.
- Loss of the inland navigation due to dam breaching would negatively impact roads and rail lines in the region.

Description of the Columbia-Snake River Navigation System

The deep draft portion of the Columbia River was maintained at an authorized depth of 40 feet for decades, beginning in the 1970's. In the late 1980's, several Columbia River ports joined together to request the Congress to direct the Corps of Engineers to study navigation in the river. The initial study began in 1989, and the record of decision authorizing a deepening of the channel to 43 feet was finally signed in 2004. Deepening began in 2006, and was completed in 2010.

Since the deepening was completed, public and private entities have invested more than $1 billion in improvements to marine terminals and other infrastructure in order to maximize the utilization of the improved system.[21]. These improvements have included:

- Construction of the first new grain terminal built in the U.S. in 25 years,
- Expansion of the largest export grain terminal on the West Coast of the U.S.,
- Construction of the first new grain barge on the Columbia River since 2011, and
- Purchase of the largest drydock in the U.S.

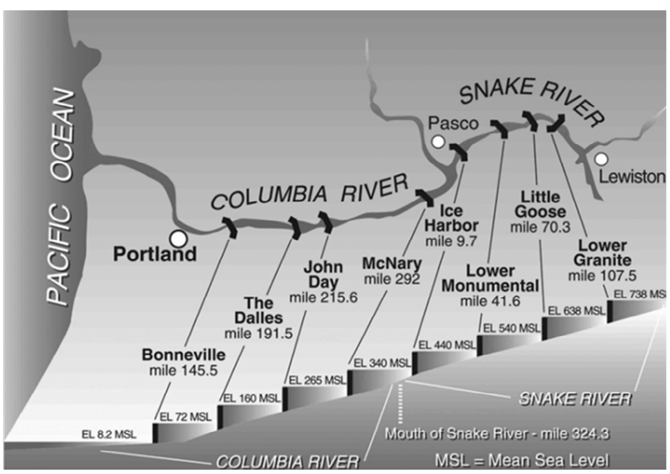
Several improvements are being considered for the system, including:

- Methanol plants at the Port of Kalama and the Port of St Helens,
- A crude oil terminal at the Port of Vancouver, and
- A coal terminal in Longview, among others.

There are eight dams and navigational locks in the Columbia and Snake River that facilitate barge traffic movements. The Columbia River locks are located at the Bonneville, The Dalles, John Day and McNary Dams. The Snake River locks are located at Ice Harbor, Lower Monumental, Little Goose and Lower Granite Dams.

Most Washington inland ports are located in the McNary, Lower Granite, and Little Goose pools. Port facilities in Pasco and Walla Walla are located in the McNary pool, port facilities at Clarkston and Wilma are in the Lower Granite pool, and the port facilities at Almota and Central Ferry are located in the Little Goose pool.

Figure 4-1: Map of Columbia-Snake River Navigation System



Source: Pacific Northwest Waterways Association

All upriver locks have upper and lower miter sills (i.e., the chamber wall under water at each end of the lock channel) of 15 feet. The existence of these locks and authorized maintenance of the river pools at a 14-foot depth allows for low cost transportation of local and regionally produced commodities.

The river system has typically been managed to approximately 4 to 5 feet above minimum pool depending on the pool, in order to maintain a minimum 14-foot depth within the channel. However,

[21] Source: Impacts of Channel Deepening on the Columbia River, by ECONorthwest for the Pacific Northwest Waterways Association, June 2015.

the consideration of dam breaching or flow augmentation alternatives to enhance salmon revitalization efforts places these operating systems in jeopardy, because the locks would become "stranded" above lower than minimum required levels.

The barge system has evolved to take maximum advantage of the authorized minimum pool characteristics. "Jumbo" grain barges capable of carrying 3,600 tons of grain have become the mainstay of the wheat export fleet and are the largest vessels on the river system, drawing 13.5 feet. Container and other barges typically have a draft of 10 to 11 feet. Larger tugs typically push four barges and have a draft of 11 to 12 feet.

Access to the inland navigation system is a critical component of the success of the deep draft navigation system, and offers a low cost alternative to rail transportation. In addition to the transportation benefits, the dam system also provides irrigation, power generation, flood control, and recreational facilities.

Cargo Trends

Columbia River Inland Navigation Cargo Trends

Grain moving downstream continues to be the lifeblood of the barging system on the Columbia/Snake River System, accounting for 56%[22] of all commodity tonnage moving on the Columbia River section of the system (as measured at the Bonneville Lock and Dam). Approximately 90% of the wheat grown in Washington and Oregon is exported, and approximately 40% of all wheat shipped from Lower Columbia export terminals arrives by barge. The inland navigation system is a critical asset that allows regional grain shippers to compete in world markets.

Upbound movements of petroleum products are also key, accounting for an average of 20% of cargo movements at Bonneville. Other commodities, such as crude materials (logs and wood chips, among other products), and other products (chemicals and fertilizer, manufactured products and garbage) make up the remainder.

As shown in Figure 4-1 and Table 4-1, overall traffic growth on the Columbia River section of the Columbia/Snake River inland navigation system is projected to grow under all three scenarios. Between 2015 and 2035 the volume is projected to grow to:

- Low case: 6.63 million metric tons (0.2% per year growth),
- Reference case: 7.59 million metric tons (0.9% per year growth),
- High case: 8.84 million metric tons (1.7% per year growth).

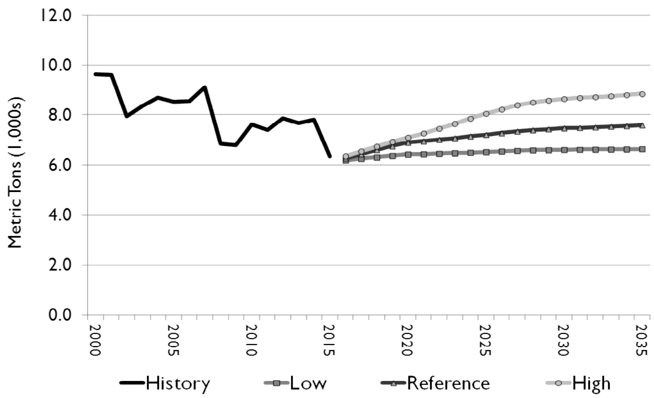
While the projected rates of growth are relatively low, they represent steady demand for barge transportation. Millions of tons of cargo is moved by barge, and includes some of the main commodities produced in the inland Northwest.

It should also be noted 2015 tonnage was relatively low (i.e. 3.4 million metric tons), due to low harvest volumes in 2015. Initial reports for 2016 indicate that grain volumes were closer to the recent average of 4.4 million metric tons.

Loss of the barge system would force existing cargo traffic onto the rail and road system. The impact on the road system would likely be substantial as traffic shifted from existing routes to new ones, especially if these new routes were not built for heavy truck traffic. The additional shipping could also cost local farmers a portion of their potential sales.

[22] Average value calculated for the period 2000 to 2015.

Figure 4-2: Columbia River Waterborne Traffic above Bonneville Lock (Million Metric Tons)



Source: BST Associates, U.S. Army Corp of Engineers, IHS Markit

Cargo Forecast by Commodity Group

Forecasts for major commodity groups are described in the following section. These forecasts are summarized in Table 4-1.

Food and farm products

The food and farm product category consists almost entirely of grain. Between 2000 and 2015, the volume of grain moving by barge on the river declined as new, high-capacity rail loading facilities came online in Montana and Washington. However, the volume of grain shipped by barge has stabilized in recent years at an average of approximately 4 million metric tons per year.

Wheat is the primary grain crop transported by barge. Harvested volumes can vary widely from year to year, but the long-term trend in the region (i.e. Washington, Oregon, and Idaho) is one of slow growth in wheat production. At the same time that production has increased, the acreage dedicated to wheat production has slowly declined, which shows that yield per acre has trended upward.

The reference case projects that barged volumes of grain will remain at approximately this level over the long run. Under the low case scenario, volumes in 2035 are projected to be 3.8 million metric tons, and under the high growth scenario 2035 volumes are projected to be 5.2 million metric tons.

Other food products (frozen potatoes, onions, peas and lentils) and farm products (hay and animal feeds) generally move in containers on barge, but the decline and subsequent loss of container service in Portland essentially eliminated this type of move. These products are now transported by truck, rail or truck-rail combination directly to the Northwest Seaport Alliance container terminals. As production of peas and lentils increases the volumes may reach the level where shipment via bulk ship (rather than containers) is feasible, which in turn could lead to additional traffic for the barge system. However, this opportunity was not included in this forecast.

Crude materials

Crude materials are primarily composed of wood chips, logs, other forest products and sand and gravel. Between 2000 and 2015, the annual volumes in this category ranged from 1.2 million metric tons to 1.5 million metric tons. The exception was 2009, when volumes dropped to 700,000 metric tons during the great recession.

By 2035, the volume of crude materials is projected to grow to between 1.4 million metric tons (low case) and 1.6 million metric tons (high case).

Petroleum products

Petroleum products shipped upriver to Pasco and Wilma represents the second largest cargo group transiting Bonneville Locks. These products include gasoline, residual fuel oil, and distillate fuels. Between 2005 and 2015 the volume of petroleum products declined significantly, due partially due to the closure in 2012 of a petroleum terminal at the Port of Wilma.

According to the U.S. Department of Homeland Security,[23] the Kennewick-Richland area has daily demand for approximately 42,430 barrels of refined petroleum products, representing 9% of the Washington and Oregon market. Many of the communities in this area are located along the inland navigation channel and have barge terminals capable of handling petroleum products. Petroleum products are shipped to the area by barge from terminals in Vancouver and Portland, as well as via pipeline (from Salt Lake City), truck, and rail.

Consumption of petroleum products is projected to decline on a per capita basis during the forecast period, resulting in a further decline in barged petroleum products. Volumes in 2035 are projected to range from 994,000 metric tons under the low case to 1.1 million metric tons under the high case, as compared to 1.2 million metric tons in 2015.

The market for petroleum products is extremely competitive, however, and the share shipped by barge could increase relative to that moved by pipeline. In addition, the U.S. Department of Homeland Security evaluated options to provide petroleum products in the event of a catastrophic earthquake affecting oil-related terminals in the Lower Columbia and Puget Sound. One of the options for responding to such an event would be to barge petroleum products down river from Pasco"[24] While neither of these potential changes was included in the forecast, they demonstrate how the barge system increases the robustness of the regional transportation system.

Other Cargoes

Other cargoes declined from 693,000 metric tons in 2000 to 475,000 metric tons in 2015. The mix of commodities in this catchall category has changed over the past fifteen years:

- Chemicals and fertilizers declined from 151,000 metric tons in 2000 to 57,000 metric tons in 2007, but grew back to 137,000 metric tons in 2015.
- Primary manufactured products (mainly pulp and paper products from upriver mills) were barged in containers to Portland, until Portland lost its container business. The volume of primary manufactured products moving by barge fell from 305,000 metric tons in 2000 to none in 2015.
- Equipment and machinery increased from 22,000 metric tons in 2000 to 51,000 in 2015. This includes products manufactured upriver (such as cranes manufactured by Lampson in Pasco) as well as products moving upriver for construction projects (such as power generation equipment and oil equipment, others).

[23] U.S. Department of Homeland Security, July 2016

[24] Ibid, page 21.

- Waste materials barged upriver to landfills increased from 213,000 metric tons in 2000 to 288,000 metric tons in 2015.

The loss of some manufactured products was partially offset by gains in others. Under the low case scenario, other cargoes are projected to decline to 422,000 metric tons by 2035. Under the reference case the volume is projected to grow to 672,000 metric tons, and under the high it is projected to grow to 866,000 metric tons.

As shown in Table 4-1, inland navigation traffic on the Columbia River dropped between 2000 and 2015, but is projected to grow, albeit slowly, from 2015 through 2035. There are several reasons for this:

- As discussed above, 2015 saw a relatively low grain harvest, which impacted the historical growth rate for food and farm products. As noted, however, it appears that grain volumes recovered in 2016, indicating that the volume of grain is not declining.
- The volume of crude materials dropped between 2000 and 2010, but grew slowly between 2010 and 2015. This slow growth is projected to continue.
- The volume of "Other" commodities also dropped between 2000 and 2010, but grew between 2010 and 2015. As with crude materials, this slow growth is projected to continue.
- The one major barge commodity projected to continue declining between 2015 and 2035 is petroleum products.

Table 4-1: Columbia River Waterborne Traffic by Category (1,000 Metric Tons)

		History				Forecast				Compound Annual Growth Rate	
Commodity Group	**Case**	**2000**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**2000-2015**	**2015-2035**
Petroleum Products	Low					1,047	1,020	1,006	994		-0.9%
	Reference	1,766	1,738	1,587	1,186	1,053	1,050	1,049	1,057	-2.6%	-0.6%
	High					1,091	1,099	1,090	1,122		-0.3%
Crude Materials	Low					1,284	1,312	1,350	1,391		0.4%
	Reference	1,358	1,593	1,222	1,282	1,324	1,382	1,462	1,552	-0.4%	1.0%
	High					1,332	1,403	1,501	1,612		1.2%
Food and Farm Products	Low					3,672	3,764	3,819	3,824		0.6%
	Reference	5,812	4,696	4,454	3,391	3,970	4,172	4,292	4,306	-3.5%	1.2%
	High					4,025	4,806	5,196	5,241		2.2%
Other	Low					414	418	425	422		-0.6%
	Reference	693	488	356	475	539	601	663	672	-2.5%	1.7%
	High					643	747	853	866		3.0%
Total	Low					6,417	6,514	6,600	6,631		0.2%
	Reference	9,629	8,515	7,618	6,334	6,887	7,205	7,467	7,587	-2.8%	0.9%
	High					7,091	8,055	8,640	8,841		1.7%

Source: BST Associates, IHS Markit

Snake River Cargo Trends

Grain accounts for 72%[25] of all commodity tonnage moving on the Snake River, as measured at the Ice Harbor Lock and Dam. Crude materials (logs and wood chips, among other products), and other products (chemicals and fertilizer, manufactured products and garbage) make up the remainder. Upbound movements of petroleum products ended in 2012.

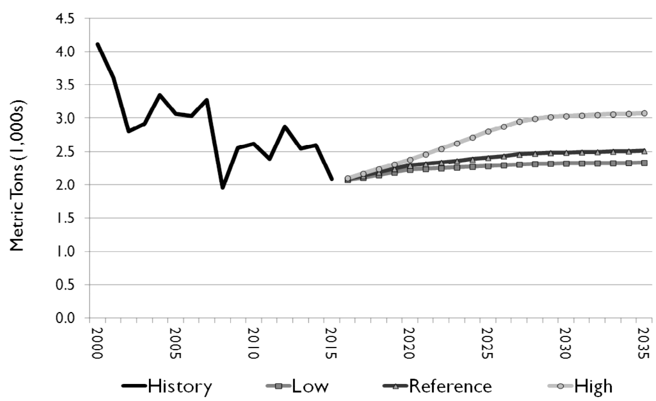
The volume of cargo moving through the Ice Harbor Locks accounts for approximately 34%[26] of the volume moving through Bonneville Locks. The same factors impacting Columbia River barge volumes also impact Snake River barge volumes, including a shift of some grain from barge to rail, and the loss of container service at Portland.

As discussed above, volumes in 2015 were lower than average, due in large part to a below-average grain harvest. As shown in Figure 4-3 and Table 4-2, barge traffic on the Snake River is projected grow from approximately 1.2 million metric tons in 2015 to:

- Low case: 2.3 million metric tons (0.6% per year growth),
- Reference case: 2.5 million metric tons (0.9% per year growth),
- High case: 3.1 million metric tons (2.0% per year growth).

As is the case for barge traffic on the Columbia River, while the projected rates of growth on the Snake River are relatively low, they represent steady demand for barge transportation. Under the reference case, traffic levels return to the average post-recession level (i.e. 2009 through 2015), and under the high case they grow beyond this level. Under the low case the volume does not return to the post-recession level.

Figure 4-3: Snake River Waterborne traffic above Ice Harbor Lock (Million Metric Tons)



Source: BST Associates, U.S. Army Corp of Engineers, IHS Markit

Cargo Forecast by Commodity Group

Food and farm products

The grain volume of 1.8 million metric tons in 2015 was lower than in prior years; volumes averaged approximately 2.3 million metric tons from 2010 through 2015. In 2035, the volume

[25] Average value calculated for the period 2000 to 2015.

[26] Average value calculated for the period 2010 to 2015

under the reference case is projected to remain at approximately 2.3 million metric tons. Volumes are projected to decline to 2.0 million metric tons under the low case, and to grow to 2.7 million metric tons under the high case.

Other food products and farm products (peas, lentils, hay and animal feeds) declined due to the loss of container service in Portland, since these commodities are shipped in containers. These commodities are not likely to return to barge in large volumes unless container service at Portland resumes.

Crude materials

The crude materials category includes wood chips, logs, other forest products, and sand and gravel. From 2000 through 2015, the volume of crude materials moving through the Ice Harbor Locks ranged between 130,000 metric tons and 370,000 metric. In 2015 they totaled 220,000 metric tons.

By 2035, the volume of crude materials is projected to grow to 239,000 metric tons under the low case and 294,000 metric tons under the high case.

Petroleum products

The petroleum distribution facility at the Port of Wilma historically handled most Snake River barge movements of petroleum products (e.g. gasoline, residual fuel oil, and distillate fuels), but that facility closed in 2012. The forecast assumes that shipments of petroleum products do not re-start.

Other Cargoes

The "Other Cargoes" category includes a mix of commodities, such as chemicals, fertilizers, primary manufactured products, equipment, and machinery. Because a large share of this cargo is containerized, loss of container service caused the volume of "Other Cargoes" to drop from 223,000 metric tons in 2000 to 18,000 metric tons in 2015. Changes to specific commodities included:

- Chemicals and fertilizers dropped from 37,000 metric tons in 2000 to 4,700 metric tons in 2008, but increased to 11,000 metric tons in 2015.
- Primary manufactured products (mostly pulp and paper products from upriver mills) disappeared completely in 2015.
- Equipment and machinery increased from 6,300 metric tons in 2000 to 7,200 in 2015. This category includes products manufactured upriver as well as project cargo shipped upriver for construction projects (e.g. power generation equipment and oil field equipment).

Barge volumes in this category account for a limited share of cargo moved on the Snake River, and are not projected to increase substantially by 2035. Under the low case, the volume is projected to decline further, while under the reference and high case scenarios, volumes are projected to grow slowly. Even under the high scenario (i.e. 3.5% average annual growth), the volume barged in 2035 is projected to be less than 17% of the volume moved in 2000.

As shown in Table 4-2, barge traffic on the Snake River dropped between 2000 and 2015, but is projected to grow, albeit slowly, from 2015 through 2035. The main reasons for this are:

- Grain now accounts for nearly 90% of barge tonnage on the Snake River, and grain volumes are projected to grow.
- The 2015 grain harvest was below average, which led to lower grain volumes in 2015.

- Most other commodities in the Food and Farm Products category are containerized, and barge container movements have essentially disappeared.

Table 4-2: Snake River Waterborne Traffic by Category (1,000 Metric Tons)

		History				Forecast				Compound Annual Growth Rate	
Commodity Group	**Case**	**2000**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**2000-2015**	**2015-2035**
	Low					-	-	-	-		NM
Petroleum Products	Reference	70	94	34	-	-	-	-	-	-100.0%	NM
	High					-	-	-	-		NM
	Low					220	225	232	239		0.4%
Crude Materials	Reference	370	286	202	220	234	244	259	275	-3.4%	1.1%
	High					243	256	273	294		1.5%
	Low					1,999	2,049	2,079	2,082		0.6%
Food and Farm Products	Reference	3,441	2,642	2,338	1,846	2,039	2,143	2,205	2,212	-4.1%	0.9%
	High					2,108	2,517	2,722	2,745		2.0%
	Low					9	10	11	11		-2.4%
Other	Reference	223	35	40	18	18	20	23	23	-15.4%	1.2%
	High					28	31	35	36		3.5%
	Low					2,228	2,284	2,321	2,332		0.6%
Total	Reference	4,105	3,057	2,613	2,084	2,292	2,407	2,486	2,509	-4.4%	0.9%
	High					2,379	2,803	3,030	3,075		2.0%

Source: BST Associates, IHS Markit

River Barging As an Integrated System

The Columbia/Snake River inland navigation system is part of a larger integrated and interdependent system. This larger system includes farmers and manufacturers, barge carriers, ocean shipping lines, deep-draft marine terminals, railroads, and trucks. Each of these plays an important role in the functioning of the entire system.

Wheat and barley farmers in the Pacific Northwest have a number of upriver terminals in Idaho, Oregon or Washington through which they can ship their grain. The routing choice depends on the needs of the buyer, the location of the farm field, membership in a famer's co-op, relative inland freight costs, and various other competitive factors.

Some grain is also trucked to these upriver terminals from as far away Montana, the Dakotas and even as far away as Minnesota. Typically, these long-distance moves are a backhaul cargo, with the front haul comprising shipment of forest products and vegetables from Walla Walla, the Tri-Cities or Lewiston to the Midwest.

One example of how the system is interdependent is the impact that loss of container service at Portland had on the barge carriers. Barges were used to move containers down river to Portland, where they were loaded onto container ships for export. Without container service at Portland, these containers are now trucked to Seattle and Tacoma, rather than moving by barge.

Cargo movements by barge on the Columbia and Snake rivers must be analyzed within the context of a total "transportation system" that involves three important elements.

- Combined domestic and import/export barge movements. A typical barge tow includes one towboat pushing four barges, each of which may carry different commodities. Some of these commodities move in international trade (imports and exports), and some move in domestic trade (shipments that are purely of an intrastate or interstate nature).

- Combined barge activity from Oregon, Washington and Idaho. There are no commodity groups that involve movements of either import/export cargo or domestic cargo solely between upriver Washington ports and deepwater Washington ports on the Lower Columbia River. Rather, every cargo category is characterized by products that:
  - are produced in more than one state,
  - are shipped through upriver ports in more than one state, and
  - move through deepwater ports in both Oregon and Washington.

  For example, wheat is grown in Idaho, Washington and Oregon, is loaded onto barge at upriver terminal in all three states, and is exported through deepwater terminals in both Washington and Oregon.
- Barge terminals in one state serve customers in many states. For example, cargo moving through terminals in Wilma and Clarkston (in Washington) may originate in Washington, Idaho, or other states.

On a single round trip, a towboat may transport barges carrying a variety of cargoes to and from upriver ports in Washington, Oregon and Idaho. With this type of integrated operation, both the frequency of service and the rates charged depend on the combined total of all products moving, whether in international or domestic trade. While grain is the most important commodity moved, no individual commodity by itself determines either the frequency of barge service or the rates charged.

Impacts of Dam Breaching

Proposals to breach the dams on the lower Snake River could have a serious and negative impact on barge transportation on the Columbia River. While the goal of dam breaching is to enhance the survival of various endangered fish species, the impact on the fish is uncertain. What is certain is that dam breaching would negatively impact shippers, with higher transportation costs and lower levels of service.

Transportation System Impacts

The current Snake River barge system is very efficient for moving cargo. The barge system provides shippers with an alternative to shipping by rail, imposes price competition on the railroads, and supplies sufficient capacity to absorb substantial fluctuations in grain shipments, especially during peak export months and years.

The major components of the existing barge transportation system include:

- Barge terminals and river elevators,
- Access roads to the barge terminals and river elevators,
- Navigation channel,
- Barge fleet, and
- Export elevators.

If the Snake River dams were breached, much of the grain (and other commodities) that is now barged on the Snake River could be expected to shift to barge terminals in the McNary pool (between Pasco and Umatilla). Elimination of barge transportation on the lower Snake River would cause grain to be moved farther by truck, and would result in a less efficient system.

All parts of the regional transportation system would be impacted by dam breaching. The mainline rail system, shortline rail system, and state and county roads would all see an increase in volumes. Without additional investment in the road and rail system this could lead to capacity constraints.

The shortline railroads in the region do not necessarily have the capacity to handle greatly increased volumes. These shortlines typically generate enough revenue to only cover operating costs, and not enough to pay for capacity improvements. In order to transport substantially more grain, they may require grants or other public assistance to help pay for capacity expansion. Without expanded rail capacity, Washington farmers might face higher shipping costs, making Washington grain less competitive on world markets.

Grain elevators served by rail may also require substantial capital improvements if they are to handle the grain that now moves by barge. One of the main issues at rail-served elevators is the capacity of their rail tracks. When many of these elevators were built it was common to include enough track to handle three cars. However, in order to get the best rates from railroads, elevators must now be able to accommodate a minimum of 25 or 26 cars. As with improvements to the shortline system, grant funding or other financial assistance may be needed to pay for these upgrades. In addition, many of the existing rail-served elevators have seen little use in years, and the condition of their equipment is unknown.

The highway system will also face increased costs, due to shifting transportation patterns. Roads that were not designed and constructed to handle large volumes of truck traffic can be expected to face increased maintenance and reconstruction costs. It is unlikely that state and local governments would be able to quickly respond if the dams were breached.

Rate Impacts

Competition between barge and rail prevents either from charging monopoly rates for their service. Breaching the Snake River dams, however, would decrease competition and would likely lead to higher rates.

According to the National Corn Growers Association, “it has been demonstrated numerous times that areas throughout the country that do not have access to barge transportation have higher rail rates.” The Tennessee Valley Authority examined the effect of barge transportation on rail rates on the upper Mississippi River, and concluded that “the continued availability of water transport appears to have a significant impact on the pricing behavior of other surface transportation modes - at least when these modes are reasonably close to the river. In particular, there is a large body of economic literature, which suggests that available barge transportation effectively constrains railroad pricing for the transportation of commodities that are appropriately moved by barge. These barge-constrained rail prices have come to be called ‘water-compelled’ rates.”

Since Washington farmers sell into world markets, they have little ability to raise their selling price to recover additional transportation costs.

Chapter 5
Modal Shares and Corridors

Introduction

Waterborne shipments and receipts in Washington are dependent on a comprehensive array of land-side transportation modes. These land-side modes, including truck, rail, and pipeline, as well as barge transportation, move cargo to and from marine terminals.

This chapter describes the modes of transportation used to move each commodity group to and from marine terminals. While this chapter looks at each mode separately, all of the modes function as parts of an integrated system. Air cargo is not included in this analysis, because the volume of marine cargo that is also moved by air is very small.

The land transportation network continues to serve as the lifeline that links industrial plants, farms and forests with cities and ports, and connects products with both local and distant markets. A large percentage of the Washington State economy is inextricably linked, either directly or indirectly, to offshore domestic commerce and international trade. As a result, the efficient performance of the highway, rail and waterways systems are of critical importance for moving freight to and from the ports.

Key Findings

- Waterborne cargo depends on a well-functioning inland transportation system.
- All inland modes are important, including road, rail, pipeline, and inland navigation.
- The inland mode of transportation varies by commodity group.
- Rail baseline volumes are projected to grow steadily, but have the possibility to increase substantially (due mainly to the ultimate fate of proposed coal and crude oil terminals).

Table 5-1: Summary of Transportation Modes

	Waterborne Shipments				Waterborne Receipts			
Commodity	Truck	Rail	Pipeline	Barge	Truck	Rail	Pipeline	Barge
Containers	✓	✓			✓	✓		
Autos		✓			✓	✓		
Logs	✓			✓				
Crude oil		✓				✓	✓	
Other liquid bulk			✓	✓	✓			
Breakbulk	✓	✓			✓	✓		
Grain		✓		✓				
Other dry bulk	✓	✓		✓	✓	✓		✓

Existing Cargo Throughput

As shown in Table 5-2, foreign waterborne traffic (i.e. imports and exports) increased by nearly 50% between 2000 and 2014, (the last year available), growing from 61.6 million metric tons to 90.3 million metric tons. Most of the growth was due to increasing exports, which grew by 24.9 million metric tons; imports grew by 3.8 million metric tons during the same period.

Domestic coastwise traffic dropped by approximately one-third between 2000 and 2014, falling from 41.3 million metric tons to 26.6 million metric tons. (Coastwise traffic includes waterborne movements that enter or leave the internal waters of Puget Sound, as well as movements into and out of the Columbia River system. It mainly includes traffic moving to and from Hawaii, Alaska, and California, but also includes some intra-Northwest moves.) Most of the drop in coastwise traffic was due to declining receipts of crude oil from Alaska. Coastwise receipts fell from 28.9 million metric tons to 16.2 million metric tons, while coastwise shipments dropped from 12.4 million to 10.4 million metric tons

Internal waterborne traffic includes movements of cargo entirely within the internal waters of Puget Sound or the Columbia River system. Only internal shipments (and not receipts) are presented in Table 5-2, in order to avoid double-counting. Internal shipments fell from 20.6 million to 13.3 million metric tons between 2000 and 2014. Declining log and woodchip movements account for a portion of the drop, but the biggest drop was in movements of liquid bulks. It should be noted that both internal and coastwise shipments of liquid bulks were unusually high in 2000 and 2001, due to a temporary shift of petroleum products out of the damaged Olympic Pipeline and onto vessels.

Table 5-2: Waterborne Commerce in Washington (including Lower Columbia Oregon) (Million Metric Tons)

	Foreign			Domestic Coastwise			Internal
Case	Shipping	Receiving	Total	Shipping	Receiving	Total	Shipments
2000	39.3	22.3	61.6	12.4	28.9	41.3	20.6
2001	39.3	19.3	58.6	11.2	29.7	41.0	16.5
2002	37.2	21.9	59.0	8.8	28.0	36.8	15.0
2003	40.7	23.5	64.2	9.3	27.0	36.3	15.0
2004	49.0	26.4	75.4	10.5	26.9	37.3	16.2
2005	49.2	31.1	80.4	10.0	26.4	36.3	15.9
2006	48.7	33.3	82.0	10.4	24.3	34.7	14.7
2007	54.2	31.5	85.7	10.1	24.5	34.6	15.6
2008	59.2	28.2	87.4	8.4	22.5	30.9	13.2
2009	52.7	21.7	74.4	7.9	21.3	29.2	10.5
2010	60.0	24.3	84.3	8.0	19.1	27.0	11.1
2011	62.0	26.2	88.2	7.6	18.4	26.0	11.8
2012	60.3	27.0	87.3	8.7	17.3	26.0	12.7
2013	56.2	25.7	81.9	9.4	17.8	27.1	13.5
2014	64.2	26.1	90.3	10.4	16.2	26.6	13.3
CAGR 2000-2014	3.6%	1.1%	2.8%	-1.3%	-4.0%	-3.1%	-3.1%

Source: BST Associates, using data from the U.S. Army Corps of Engineers

Domestic traffic primarily includes coastwise trade with Alaska, Hawaii and Southern California, but also includes internal traffic (such as grain barged down the Snake and Columbia Rivers), and local traffic[27] (i.e., traffic within a single harbor).

[27] Please note that local traffic is not included in the remaining sections of this report.

Modal Distribution of Freight

Imports through Washington ports move to their final destination and exports arrive at marine terminals through several modes of transport including rail, truck, barge/raft or direct movement into a plant (or distribution facility) for consumption.

- Rail transport is the preferred mode for large volumes of cargo moving at least 500 miles, such as containers imported from China and destined for Chicago. Rail is also efficient for moving large volumes of heavier cargo on shorter routes, such as petroleum coke movements from Ferndale to Longview, or alumina shipments from Longview to Wenatchee.
- Truck transport is more likely for cargoes moving within the state or region.
- Barge transport is used on the inland navigation system on the Columbia and Snake Rivers, and accounts for a substantial portion of the grain exported via ports on the Lower Columbia River. Barge transport also connects Puget Sound ports with shippers on the Olympic Peninsula and in British Columbia; logs are frequently barged or rafted from one port to another for export or for use in local mills.
- Commodities may be transferred directly from vessel into a plant. For example, imports of limestone, gypsum, salt and other like products often move directly into a manufacturing plant for processing into cement, sheetrock, chemicals or other products.

The following analysis of modal distribution focuses on the first movement of a commodity after offloading from a vessel (for inbound cargo), or on the last mode of transport prior to loading on a vessel (for outbound cargo). For commodities offloaded directly into waterfront plants for manufacturing, it is not feasible to track the final destinations of the manufactured products. For example, imports of gypsum can be traced to a manufacturing plant, but the final destination of the wallboard made from the gypsum cannot be tracked using available databases. This is also true for commodities that are moved through a central distribution facility and later are transported to market.

Modal Split by Handling Group

Containers

Containers have different modal splits, depending on whether they are imports, exports, or domestic moves. In 2015, an estimated 75% of containerized imports moved by rail, either in ocean containers or transloaded into domestic containers. Ocean containers on rail accounted for 49% of imports, transloaded containers accounted for 27%, and local distribution by truck accounted for 24%. Under the reference case and the low case the truck share is projected to grow to 34% by 2035, while under the high case it is projected to grow to 29%. Under all three cases the share of ocean containers loaded directly to rail continues to decrease, while the share of transloaded containers grows.

It is critical to note that only a portion of the import containers shipped by rail are loaded directly onto rail at marine terminals. For the remainder, trucks are used to dray the containers from port terminals to railroad intermodal yards or transload facilities. In Seattle, especially, this means that port container traffic must use city streets to reach container yards.

Export containers are more likely to move by truck than by rail; in 2015 approximately 25% of export containers arrived by rail and 75% by truck. These shares are not projected to change substantially between 2015 and 2035.

Domestic waterborne containers move to and from the port terminals almost entirely by truck.

Combining imports, exports, and domestic moves, approximately 40% of containers move by rail and 60% by truck.

Automobiles

Approximately 20% of the automobiles imported through the Pacific Northwest remain in the region and are distributed by truck. The remaining 80% is shipped inland by rail.

Export automobiles are essentially 100% moved by rail.

Crude Oil

All waterborne inbound crude oil (foreign imports and coastwise receipts) moves directly into refineries for processing. Most of the refineries are also able to receive crude oil by pipeline from Canada, and in the past five years they have also begun to receive oil by rail. Over the next 20 years, waterborne receipts will likely continue to account for most of the crude oil processed by the refineries, although as production in Alaska declines it will be replaced by foreign oil.

Alaska's share of refinery inputs dropped from 90% in 2003 to 45% in 2015, and is projected to decline to just 14% in 2035. The share of refinery inputs received by water from other foreign sources dropped from 19% in 2011 to 5% in 2015, due mainly to advent of crude receipts by rail. However, as new pipelines absorb much of the domestic crude oil that currently moves by rail, foreign waterborne receipts will grow in importance for Washington refineries; by 2035 they are expected to account for 42% of refinery inputs. Receipts by rail are projected to account for 12% to 13% of refinery inputs in 2035. The pipeline from Canada currently accounts for the remaining 30% of refinery inputs, and this is projected to continue through 2035.

Shipments of crude oil by water from Pacific Northwest ports occurred in very limited quantities prior to the Bakken oil boom and the crude by rail revolution. Over the past few years, however, a number of terminals in the Pacific Northwest have been constructed or re-purposed to ship crude oil outbound. These terminals have been used to move U.S.-produced oil to U.S. refineries in California and Washington, but in the future they may be used to export crude oil to foreign destinations.

All of the oil now shipped outbound by water from the Pacific Northwest arrives at the marine terminals by rail, and this will likely still be the case in the future. With a number of new oil shipping terminals now in the permitting phase, the biggest unknown factor is how much more oil will arrive by rail for shipment by water. The largest of these proposed terminals is the Vancouver Energy project in Vancouver, Washington; smaller terminals have been proposed for Grays Harbor and elsewhere. Under the high growth forecast scenario these new terminals could increase rail receipts from 7.4 million metric tons in 2014 to 30.1 million metric tons in 2030.

The uncertainty over these crude oil shipping terminals is one of the two main areas of uncertainty in the 2017 Marine Cargo Forecast (the other is coal).

Other Liquid Bulks

Most of the petroleum products manufactured at Washington refineries moves by pipeline (approximately 47%) or water (approximately 42%). Of the remainder, approximately 10% moves by truck and the remainder by rail. These modal shares are projected to remain relatively stable through 2035.

Most liquid fertilizer is imported, and approximately 13% of this is shipped to inland river or coastal destinations by barge. The remainder moves by truck or rail.

Other liquid bulk products move by truck or rail, or directly into plants.

Logs

Logs are primarily moved by truck, with a small share transported by barge or raft. Trucks account for an estimated 95% of logs, and barge/raft the remaining 5%.

Breakbulk

Breakbulk cargo is moved by truck and rail. Trucks account for an estimated 70% of breakbulk cargo and rail 30%.

Grain

Grain exports move to shipping terminals by rail or by barge. In total, approximately 89% of grain exports moved by rail in 2015, and 11% moved by barge.

All of the grain exported through the PSRC region and the Other Puget Sound/Washington Coast region is moved by rail, while grain exported through the Columbia River moves by rail or barge.

Wheat is the most dependent on barge transportation, and the barge system on the Columbia/Snake River System is critical to the wheat farmers in the Pacific Northwest. Essentially all wheat exports move through terminals on the Lower Columbia River, and none through Puget Sound or coastal ports. As discussed in Chapter 3, barge grain volumes (primarily wheat) on the have averaged approximately 4 million tons (average over the period 2005 to 2015), and are projected to range from 3.8 million to 5.2 million metric tons in 2035.

In 2035, 100% of the grain moving through the PSRC region and the Other Puget Sound/Washington Coast region will continue to move by rail. On the Lower Columbia River, rail currently accounts for 85% of exports and barge 15%; these shares are projected to remain relatively constant through 2035. Because export terminals on the Oregon side of the river mainly handled wheat, the barge share of total exports is higher than on the Washington side of the river. Oregon exports are approximately 61% rail and 39% barge currently, and over time the rail share is projected to grow to approximately 65%. On the Washington Columbia River the inland split is currently 89% rail and 11% barge, which is projected to remain relatively constant.

Dry Bulk Imports

Dry bulk imports are moved inland by rail, barge, and truck, but most moves directly into manufacturing plants. For example:

- Gypsum moves directly into wallboard plants
- Limestone moves directly into cement manufacturing plants

Aluminum ore moves directly into the aluminum smelter in Ferndale (in the Other Puget Sound / Washington Coast region), and by rail to the Wenatchee smelter. However, the Wenatchee smelter may be permanently closing, in which case 100% of aluminum ore would move directly in the plant in Ferndale.

Portland cement moves directly into concrete batch plants, and is also moved to inland batch plants by truck and by rail.

Aggregates and sands also move directly into concrete batch plants, or are shipped to inland destinations by truck or rail.

Scrap steel and steel slag moves directly into steel mills, or is trucked to mills.

Dry bulk fertilizer is transported inland by barge, rail and truck.

Dry Bulk Exports

Dry bulk commodities exported through Pacific Northwest ports move almost entirely by rail. The two largest commodities, in terms of tonnage, are potash and soda ash. Potash is shipped by rail from Saskatchewan to ports on the Columbia River, and soda ash is shipped by rail from Wyoming, also to the Columbia River. Together, these two commodities account for two-thirds of dry bulk exports.

Petroleum coke accounts for approximately 14% dry bulk exports, and moves by rail and by truck. This product is manufactured at oil refineries on northern Puget Sound, and then moved to Anacortes by truck or to Longview by rail. Approximately 70% is moved by rail and 30% by truck.

Scrap also accounted for 14% of dry bulk exports in 2015; it moves by truck, rail and barge.

Other commodities that move in relatively small volumes include bentonite clay (rail) and wood chips (barge).

Overall, rail accounts for approximately 90% of dry bulk exports, while barge and truck each account for 5% or less.

The major question hanging over future dry bulk modal splits is what happens with coal exports. Coal is not currently exported through terminals in Washington or Oregon. Coal is included in the high forecast, however, and this forecast assumes that the Millennium Bulk Terminal in Longview is constructed and operates at full capacity (44 million metric tons per year). All of the coal would move by rail. To provide a sense of the scale of the potential coal exports, total dry bulk exports are currently approximately 7.5 million metric tons per year, while current grain exports are 32 million metric tons.

Chapter 6
Rail System Capacity

Introduction and Background

MainLine Management Inc. (MLM) was retained by BST Associates (BST) to assist in the preparation of the 2017 Marine Cargo Forecast Update and Rail Capacity Study. MLM and BST have previously jointly completed similar studies in 2004, 2009 and 2011.

The following chapter presents a summarized version of the rail capacity analysis. A more detailed version is presented in a separate document as *Appendix A*.

The current analysis differs from previous ones in the use of a rail simulation model. The previous studies used a "static analysis" of each line segment and corridor, rather than a rail simulation model. For the current analysis, a computer model of the mainline rail system in Washington State was created, using the Rail Traffic Controller (RTC) simulation software. RTC is the standard analysis program used by all Class I railroads in North America to analyze rail operations and capacity under various operating protocols, train volumes and infrastructure design. To a large extent, the mainline system in Washington is essentially the BNSF Railway (BNSF) network.

The rail capacity analysis included five scenarios, beginning with current conditions (in 2016), and continuing in five-year increments from 2020 through 2035. For the 2020 through 2030 analyses, MLM added capacity improvements to the simulated rail system as needed, in order to maintain traffic movement. The 2035 results were based on a static analysis, rather than a model simulation. The five cases analyzed were:

1. Base case of current operations and infrastructure (early 2016).
2. Growth case of train volumes at 2020 with infrastructure and capacity improvements as identified.
3. Growth case of train volumes at 2025 with infrastructure and capacity improvements as identified.
4. Growth case of train volumes at 2030 with infrastructure and capacity improvements as identified.
5. Growth case of train volumes at 2035 with infrastructure and capacity improvements as identified.

All train types were modeled, including international cargo, domestic cargo, and passenger trains. International train volumes were based on the Marine Cargo Forecast results, described in previous chapters. Domestic train volumes were based on current conditions and anticipated growth factors. Passenger train volumes were based on existing conditions and planned additions, including new passenger train service from WSDOT the will begin in fall of 2017. Passenger train volumes do not include any additional trains that may be added through Sound Transit 3.

BST Associates developed three growth scenarios (i.e. reference case, low case, and high case) for each cargo type. MLM used the reference growth case for the 2020 simulation, and the high case for the 2025, 2030, and 2035 analyses. The high case was used in the 2025 – 2035 analyses in order to understand the potential impact on rail capacity of large increases in rail traffic. The high cases also include the rail traffic that would be generated by several planned new marine terminals, including coal export facilities and crude oil transfer facilities.

The following chapter describes the methodologies and findings from each of the cases studied. A more detailed version of the rail capacity analysis is provided in *Appendix A*; this appendix provides a more complete discussion of the analyses performed and the results.

MLM does not represent that the capacity improvements and/or operational adjustments it introduced into the various simulation cases are requirements that BNSF would likely employ as growth in train volumes occurs. MLM introduced infrastructure and operational enhancements in a manner that it believes is reasonable given the significant growth in train volumes that were tested. The modifications were included to satisfy the ability of the model to successfully complete specific simulations with performance results that reasonably compared to previous case results.

MLM believes that BNSF, as it has done in the past, will invest in infrastructure improvements and make operational adjustments as demand requires and that best fits their strategies. The improvements that BNSF might make may be different than those MLM introduced into the model over the course of the simulation analyses. BNSF reviewed the draft analysis, and elected to not endorse or refute the results.

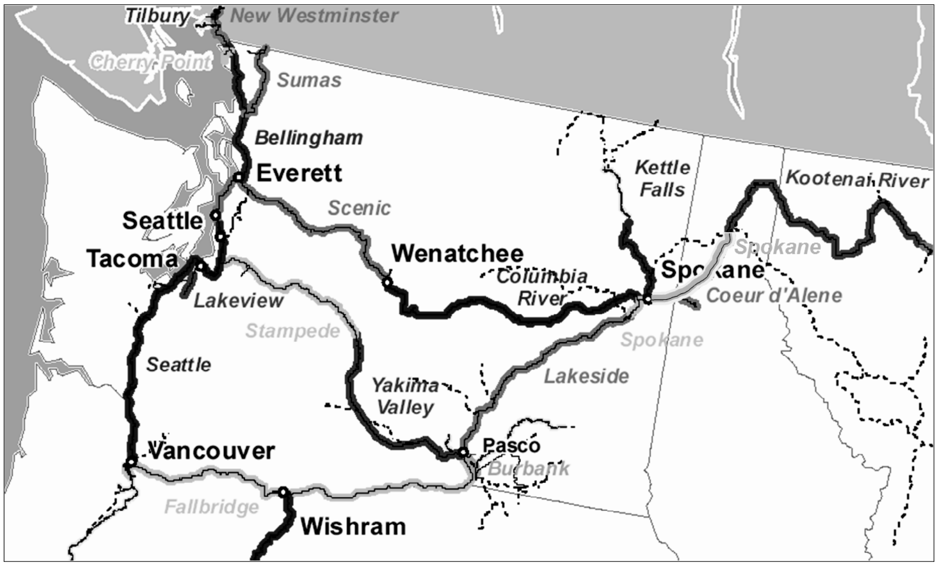
Key Findings

- The mainline system in the Pacific Northwest does not currently experience significant delays.
- As projected rail traffic grows, capacity on the region's rail system can likely be maintained through a combination of infrastructure improvements (such as additional track) and operating procedures.
- In order to accommodate high-case traffic growth in the out years, the height of the Stampede Pass Tunnel will likely need to be increased to allow for double-stack traffic and auto carriers.
- In order to accommodate high-case traffic growth in the out years, the Sandpoint (Lake Pend Oreille) and Pasco (Columbia River) bridges will likely need to be expanded two tracks
- Terminals are more likely to experience delays than are mainline track segments. (Modeling terminal operations was not part of scope of work for this project, and may require further research).

Model Network and Route Description

This section provides a description of the rail network used in the rail capacity analysis. Figure 5-1 below displays BNSF's rail network in the Pacific Northwest, with subdivision names and key stations included for reference. The subdivision names are used below when describing the results of the rail capacity analysis.

Figure 6-1: BNSF Pacific Northwest Mainline Rail Network



Source: BNSF

Sandpoint Junction to Spokane

This section of railroad is part of the Spokane Subdivision. The line between Spokane and Sandpoint, Idaho, experiences high levels of traffic because it handles a large share of BNSF traffic moving between the Pacific Northwest and the Midwest (e.g. Chicago) and the Southeast (e.g. Memphis). In addition to BNSF trains, the Montana Rail Link (MRL) main line connects to the BNSF main line at Sandpoint Junction. BNSF dispatches the route between Sandpoint and Spokane.

Spokane to Pasco

Just west of Spokane (at Latah Junction) the BNSF main line splits into two routes. The southern route is the BNSF Lakeside Subdivision, which runs between Spokane and Pasco. The northern route is the Columbia River Subdivision which runs between Spokane and Wenatchee. The Lakeside Subdivision is heavily utilized by manifest trains, unit bulk trains, intermodal/container trains moving to and from Portland, and two daily Amtrak trains.

Pasco to Vancouver

The BNSF Fallbridge Subdivision runs between Pasco and Vancouver, WA, following the north bank of the Columbia River. In order to handle an increased number of heavy unit trains (such as grain and oil trains), BNSF has begun to operate loaded unit trains westbound on the Fallbridge Subdivision, while sending the eastbound empty trains via other routes. The Fallbridge Subdivision also handles two daily Amtrak trains that run between Portland and Spokane, as well as all BNSF trains moving between the Pacific Northwest and California. The California trains use the Fallbridge Subdivision as far as Wishram, where the trains turn south and run towards California.

Vancouver to Seattle

The BNSF Seattle Subdivision runs between Vancouver and Seattle. From Vancouver to Tacoma, Union Pacific (UP) trains operate over the BNSF line via trackage rights, and the Seattle

Subdivision also hosts multiple Amtrak movements. BNSF controls train movements on the Subdivision. Between Tacoma and Seattle, UP exits the BNSF trackage and runs on its own route to Black River Junction, approximately 10 miles south of Seattle. BNSF and UP share trackage between Black River and Argo, where UP exits to their own yard. BNSF also hosts Sound Transit commuter rail operations between Tacoma and Seattle.

Seattle to Everett

The BNSF Scenic Subdivision runs along Puget Sound from Seattle to Everett. In addition to BNSF traffic, this subdivision hosts multiple Amtrak trains and weekday Sound Transit commuter trains. Most of this subdivision includes multiple main tracks, but there are two very short single track sections.

Everett to Canadian Border

The Bellingham Subdivision runs between Everett and the Canadian border at Blaine. This subdivision is a single track railroad with sidings. All BNSF unit trains that move to or from Canadian locations use this line, as well as manifest trains that handle local Vancouver BC traffic and traffic interchanged with Canadian railroads. Two pairs of round trip Seattle-Vancouver Amtrak trains also use the line.

The Sumas Subdivision provides an alternate route for BNSF Canadian traffic. The Sumas Subdivision diverges from the Bellingham Subdivision at Burlington, WA. This line handles one train per day in each direction, as well as handling local on line traffic and interchange traffic from Canadian Pacific at Sumas.

Everett to Wenatchee, Wenatchee to Spokane

The BNSF Scenic Subdivision runs from Seattle through Everett, and then runs east-west between Everett and Wenatchee. The BNSF Columbia River Subdivision runs between Wenatchee and Latah Junction, near Spokane.

The Scenic Subdivision features relatively steep 2.2% grades on both sides of Stevens Pass, and an eight-mile tunnel at the summit. These heavy grades restrict the operation of loaded unit trains over the route.

Auburn to Ellensburg, Ellensburg to Pasco

The Stampede Subdivision runs between Auburn and Ellensburg, and the Yakima Valley Subdivision runs between Ellensburg and SP&S Junction, near Pasco. BNSF operates the combined Stampede and Yakima Valley Subdivisions as an eastbound directional railroad. Currently there are no through trains that run from Pasco to Auburn.

The Stampede Subdivision features a 2.2% grade on both sides of Stampede Pass, and a two-mile tunnel at the summit of the pass. The tunnel is not tall enough to allow double-stacked containers and some other types of freight cars, so the route is currently restricted to lower-profile cars.

Methodology

Model Simulation

To meet the goals of the study, computer model simulation was utilized to determine the impact of existing and projected future rail operations within BNSF's Pacific Northwest rail network. Model simulation is an important tool in providing data for analytical studies in complex rail environments. All simulations were performed with the Rail Traffic Controller (RTC) model. RTC is used by all Class 1 railways in North America and has been accepted as the primary tool utilized in rail simulation analysis.

Analyses Performed

The RTC model creates a large amount of data as it performs the simulations. This data is analyzed to determine where conflicts occur, or how operations change as infrastructure or rail traffic levels are modified.

Delay Analysis

MLM utilized the data to develop two major analysis applications involving delay. The RTC model defines delay as time that a train must wait because the route it needs to take is unavailable.

The first analysis MLM performed was to estimate minutes of delay for each 10 train miles operated (referred to as "D/10"), within each network segment. The D/10 measurement allows comparison between cases that have differing number of trains and track configurations.

The second type of analysis performed was to locate delays that exceeded 30 minutes (referred to as "D>30"). Based upon MLM's experience with railroad operations, there are always going to be some delays in a railway network. However, some delays indicate problem areas, which is why D>30 delays are evaluated.

MLM ran each scenario over a three day period. The results of the D/10 and D>30 models were averaged over all three analysis days of the simulations.

With the data that RTC collects for each train movement, average velocity over a designated line segment can be calculated. This can be done for all freight operations on a line segment, or it can be broken down by train type.

Train Volumes

The model creates an output file that records every train that passes through every node of the network. MLM has developed an analysis that allows any specific node to be queried to find out all the trains that pass through the node, what time the train arrived and departed the node, and how fast the train was operating at the node.

This information was used to develop train volumes at locations through the PNW rail network. On many line segments, this involved analyzing multiple locations because of junctions or major industries, which alter the train counts from one location to the next. The train counts were recorded so that volume changes could be compared with delay results. Train volumes for each scenario are shown in Table 5-1 at the end of this memo.

Grade Crossing Analysis

MLM was also asked to supply model results to the team completing a separate analysis of grade crossing conflicts. The Road-Rail Conflict Study is being conducted by a team led by The

Transpo Group, under contract to the Joint Transportation Committee (JTC) of the Washington State Legislature.

The Transpo team provided MLM with a list of grade crossing locations for which data was required. MLM analyzed how often and for how long these grade crossings were occupied by rail movements. To do this, nodes were included in the model network that represented the location of the various crossings being studied. The model records when the head end of a train enters each node and when the rear end of that train departs the node.

All nodes associated with the specified crossings were analyzed to develop this information for the simulations; in some cases, this meant two or more nodes had to be analyzed for a single crossing because multiple tracks ran through the crossing. In the Base Case analysis, there were approximately 190 nodes that were analyzed to include all the crossings that were provided for analysis.

Analysis Segments

In this study, analysis was performed by subdivision. For each simulation, an analysis of delay and grade crossing occupancy was made for eleven segments on the network. A list of the specific locations is contained in *Appendix A*.

Data Sources

Data from BNSF was not available for use in the rail simulation analysis, so MLM used other sources, including data from previous analyses, to create a rail operating plan for the current analysis. One of the sources used to create the operating plan was 2012 data from BNSF's signal system provided to MLM for an earlier analysis.

The second source that MLM utilized was a list of all active trains on BNSF's rail system for one day in November 2013 and then another list for one day in February 2016. The lists included every active train symbol running on BNSF's northern corridor on those days.

Another source that was used in previous analyses was a monitoring website called ATCS Monitor. ATCS stands for Advanced Train Control System, which is a method used by railroads to dispatch and monitor their train operations. ATCS Monitor was developed by radio enthusiasts who determined that the signals sent between dispatching centers and wayside signals could be captured and decoded to understand how a rail line was being dispatched. While ATCS Monitor data was not available for the current study, ATCS Monitor data from earlier studies was extremely helpful in determining timing of trains, as well as developing estimated schedules.

Schedule Development

After the ATCS Monitor data had been recorded and analyzed, patterns were documented for traffic along line segments. MLM understands that the train identifications may not be exact; however they create a very good representation of the traffic that moves over each line segment.

Train departure times were estimated based on BNSF documents from Portland/Vancouver, and observed ATCS Monitor departures from Seattle/Tacoma, Pasco and Spokane. Once manifest and intermodal trains had been assigned, the unit trains were added to the appropriate sections based on the operating plan.

Results and Analysis of Scenarios

The following sections of this report briefly describe the results and the capacity analysis of the simulations.

Train Volume Growth and Track Improvements

Train Volume Growth

This section reviews how growth was calculated for various commodities for the simulations. Growth for international containers, domestic intermodal, vehicles, manifest, grain, oil, and coal were calculated using various methodologies. As noted above, all train types were modeled, including international cargo, domestic cargo, and passenger trains. International train volumes were based on the Marine Cargo Forecast results, described in previous chapters. Domestic train volumes were based on current conditions and anticipated growth factors. Passenger train volumes were based on existing conditions and planned additions.

A detailed discussion on train volume growth methodologies is contained in *Appendix A*.

Track Improvements by Simulation

Track improvements were added to the model in all of the simulations, based on areas of congestion that were observed after analyzing the simulation outputs. Track improvements that were included in the Base P5 Case were in addition to the track configuration used in the Base Case. A list of the improvements included in the Base P5 case (2020) can be found in *Appendix A*. Similarly, a list of improvements included in the Base P10 (2025) and the Base P15 (2030) simulation cases is contained in *Appendix A*.

Segment Results and Analysis

The following sections of the report briefly address the capacity findings from each of the simulations. A brief summary of the findings and MLM's conclusions starts each simulation's Results and Analysis section.

Base Case Analysis Results

Base Case Conclusions

The Base Case conditions indicate that BNSF does not currently have capacity issues on most of line segments in the PNW. Between terminals, trains ran efficiently for the most part. The terminals in the PNW appear to be a larger concern for rail capacity in the PNW.

It should be noted that the scope of the project did not include detailed simulation of operations within the terminals, so delays that were found in the Base Case are likely an understatement of actual delays occurring at terminals in actual operations.

Grade Crossing Occupancy Analysis

A grade crossing analysis was performed for each simulation case, the results of which are included in a separate spreadsheet.

A list of all trains that operated through the crossings was also provided by line segment. The simulation day, train identification number, train length and train type were provided in the list, along with the entrance, clearing and total occupancy times.

Line Segment Capacity Observations

The following section briefly reviews the capacity observations by line segment (and by terminal where it is integral to the operation) for the Base Case.

Spokane Subdivision

The Spokane Subdivision (Sandpoint to Irvin) operated **well below** estimated sustainable capacity, with a D/10 calculation of 1.6 minutes of delay per 10 miles operated. Hauser Terminal also operated **well below** estimated sustainable capacity, at 6.2 minutes of delay per 10 miles. Hauser operations were simplified (in the simulation) and likely do not represent the full range of potential delays that can occur in a major terminal. Freight train velocity on the Spokane Subdivision was 32.3 miles per hour on average.

Spokane Terminal and Lakeside Subdivision

Spokane Terminal (Irvin to Latah Junction, Latah Junction to Lakeside Junction, Lakeside Junction to Sunset Junction) operated **well below** estimated sustainable capacity, at 4.3 minutes of delay per 10 miles operated.

The Lakeside Subdivision (Lakeside Junction to Glade) also operated **well below** estimated sustainable capacity, with 2.5 minutes of delay per 10 miles operated. The new segments of second main track that BNSF installed in 2014/2015 alleviated locations that experienced notable delays in previous analyses. Average velocity for freight traffic on the route was 30.9 mph.

Pasco Terminal and Fallbridge Subdivision

Pasco Terminal (Glade to SP&S Junction) operated **within** estimated sustainable capacity, with 11.7 minutes of delay per 10 miles operated. Pasco is a major classification yard for BNSF, which means many trains terminate and originate at the terminal. At the same time, a very high percentage of empty unit trains and all loaded unit trains passed through the terminal.

The Fallbridge Subdivision (SP&S Junction to McLoughlin) operated **well below** estimated sustainable capacity, with 3.9 minutes of delay per 10 miles operated. However, the subdivision had the highest number of delays exceeding 30 minutes (23.7/day). Single track meets and overtakes were the main contributor to the delays. Velocity also showed that the subdivision operated relatively efficiently, with freight traffic operating at an average of 30.3 mph.

Vancouver Terminal

In past analyses, Vancouver Terminal (McLoughlin to Portland, Columbia River Bridge to Felida) operated approaching or at estimated sustainable capacity. In the current analysis, Vancouver Terminal operated **well below** estimated sustainable capacity, with 9.3 minutes of delay per 10 miles operated. There were three major changes that facilitated this improvement: “east bypass” route, an additional single track connection between the Seattle and Fallbridge subdivisions, and the new connection to the Port of Vancouver.

Seattle Subdivision

The Seattle Subdivision (Felida to Nelson Bennett) operated **well below** estimated sustainable capacity, with 0.9 minutes of delay per 10 miles. Areas of minor congestion occurred around Kalama and Longview, where trains diverge to large industrial facilities. Average freight train velocity for the subdivision was 32.2 mph, indicating the subdivision operated efficiently throughout the analysis.

Seattle Tacoma (SeaTac) Terminal

The SeaTac Terminal (Nelson Bennett Tunnel to MP 8, Scenic Sub) operated **well below** estimated sustainable capacity, with 5.3 minutes of delay per 10 miles operated. While the overall number is very good, there were times when the terminal became congested. Sound Transit Commuter operations between Everett and King Street Station and King Street Station and Tacoma/Lakewood caused much of the congestion.

Scenic Subdivision (West)

The Scenic Subdivision extends between Seattle (MP 0) and Wenatchee. However, for purposes of this analysis, it was divided into west and east segments. The Scenic Subdivision West extended from MP 8 to MP 28 (MP 8 to Mukilteo). It operated **well below** estimated sustainable capacity, with 1.5 minutes of delay per 10 miles operated.

A portion of the Scenic Subdivision was included in the SeaTac Terminal analysis segment. Most of the freight trains that experienced delays because of Sound Transit commuter trains were delayed in the SeaTac portion of the subdivision.

Bellingham Subdivision and Everett Terminal

Everett Terminal (MP 28 Scenic Subdivision to Bridge 38, Bridge 38 to PA Junction, Everett Junction to PA Junction) operated **within** estimated sustainable capacity, at 19.3 minutes of delay per 10 miles operated. The Everett passenger station, shared by Sound Transit and Amtrak, is located on a single track segment of the Scenic Subdivision between Everett Junction and PA Junction. When these trains were operating, freight trains could not leave Delta Yard without delaying the passenger trains. Additionally, limited capacity on the Bellingham Subdivision led to yard delays.

The Bellingham Subdivision operated **within** estimated sustainable capacity, at 6.8 minutes of delay per 10 miles operated. This was the highest D/10 statistic for any of the line segments that were studied. Amtrak trains also delayed trains along the Bellingham Sub, as did single track meets of opposing freight trains. The average freight velocity on the Bellingham Subdivision was 20.7 mph. This is notably lower than the velocities on other subdivisions.

Scenic Subdivision (East) and Columbia River Subdivision

The Scenic Subdivision East (PA Junction to Wenatchee) and the Columbia River Subdivision (Wenatchee to Latah Junction) were included in the analysis; however the simulation was not as detailed as other segments of the railroad. This was done to expedite each simulation at the request of the client.

The Scenic Subdivision East operated **within** estimated sustainable capacity, at 6.4 minutes of delay per 10 miles operated, while the Columbia River Subdivision operated **well below** estimated sustainable capacity, at 1.7 minutes of delay per 10 miles operated. Scenic Subdivision trains averaged a velocity of 20.5 mph, reflecting the slow track speed and delay issues attendant with the grades, curves and the Cascade Tunnel. Average velocity of trains on the Columbia River Subdivision was 36.5 mph, reflecting how efficiently the subdivision operated under the traffic levels that were included in the analysis.

Stampede Subdivision and Yakima Valley Subdivision

The Stampede Subdivision (Auburn to Ellensburg) and the Yakima Valley Subdivision (Ellensburg to SP&S Junction) both operated **well below** estimated sustainable capacity, at 1.0 minutes of delay per 10 miles operated. Similar to the Scenic (east) and Columbia River Subs, the

Stampede and Yakima Valley Subs were not simulated with the same level of detail as other subdivisions. Again, this was done at the client's request to expedite the analyses. The Stampede and Yakima Valley Subs operated most trains in an eastbound direction. The average velocity of trains using these subdivisions was 30 mph.

Base Case Plus 5 Years (Base P5) Analysis Results

Base P5 Conclusions

Based on the results of the simulations through Base P5 (2020), MLM believes BNSF has sufficient line segment capacity to accommodate the growth projected for five years. This projection excludes coal trains serving the proposed Millennium Bulk Terminal in Longview and oil trains serving the proposed Vancouver Energy terminal in Vancouver.

In the opinion of MLM, the greatest concern for rail capacity in the PNW in this time frame is BNSF's terminals, especially Hauser, Pasco, and Everett. Additionally, there are intermittent constraints in the Seattle/Tacoma terminal. Detailed terminal operations, however, were not within the scope of the WPPA 2017 study analysis.

As mentioned, the Base P5 simulation did not include large unit train growth projects such as Millennium coal trains and Vancouver Energy oil trains. These projects were included in the Base P10 and Base P15 simulations, however, and the results are noted in descriptions of those simulations.

There were similar impacts between freight and passenger trains between Seattle and Tacoma as in the Base Case.

Base P5 Grade Crossing Occupancy Analysis and Train Volumes

Additional grade crossing information related to the Base P5 simulation has been included in spreadsheet. This is in addition to the Base Case spreadsheet that describes grade crossing occupancies for that simulation. Train volumes are shown in Table 5-1 below.

Base P5 Line Segment Capacity Observations

Spokane Subdivision

The Spokane Subdivision operated **well below** estimated sustainable capacity, at 1.9 minutes of delay per 10 miles operated (1.6 minutes of delay in the Base Case). Infrastructure improvements mitigated the growth in traffic on the line segment. Hauser Terminal also operated **well below** estimated sustainable capacity, at 4.4 minutes of delay per 10 miles (6.2 minutes of delay in the Base Case). Simplified terminal operations (in the model) likely understated the actual amount of delay. Freight train velocity on the Spokane Subdivision was 32.0 miles per hour on average (32.3 mph in Base Case).

Spokane Terminal and Lakeside Subdivision

Spokane Terminal also operated **well below** estimated sustainable capacity, at 3.8 minutes of delay per 10 miles operated (4.3 minutes in Base Case).

The Lakeside Subdivision also operated **well below** estimated sustainable capacity, with 3.3 minutes of delay per 10 miles operated (2.5 minutes in Base Case). Train volume growth was responsible for the increase in delay. Average velocity for freight traffic on the route was 29.5 mph (30.9 mph in Base Case).

Pasco Terminal and Fallbridge Subdivision

Pasco Terminal operated **within** estimated sustainable capacity, with 14.8 minutes of delay per 10 miles operated (11.7 minutes in Base Case). Congestion caused by growth around the single track Columbia River Bridge impacted Pasco's delay minutes.

The Fallbridge Subdivision operated **well below** estimated sustainable capacity, with 3.5 minutes of delay per 10 miles operated (3.9 minutes in the Base Case). Rerouting eastbound traffic from the Fallbridge Subdivision to the Stampede Subdivision accounted for the improvement in delay. Velocity also showed that the subdivision operated relatively efficiently, with freight traffic operating at an average of 31.3 mph (30.3 mph in Base Case).

Vancouver Terminal

Vancouver Terminal operated **well below** estimated sustainable capacity, with 7.5 minutes of delay per 10 miles operated (9.3 minutes in Base Case). Some new infrastructure on the Seattle Subdivision north of the terminal assisted with the improved delay.

Seattle Subdivision

The Seattle Subdivision operated **well below** estimated sustainable capacity, with 1.5 minutes of delay per 10 miles (0.9 minutes in Base Case). The two main tracks over the entire length of the subdivision minimized delays. Most of the delays exceeding 30 minutes continued to occur between Longview and Kalama, where large numbers of trains enter or leave the main line. One other location that experienced repetitive delay was at Nisqually Junction, where the BNSF Seattle Subdivision and the new Amtrak route between Tacoma and Nisqually (i.e. Point Defiance Bypass) converge. Average freight train velocity for the subdivision was 32.2 mph (32.2 mph in Base Case), indicating that the subdivision continued to operate efficiently.

Seattle Tacoma (SeaTac) Terminal

The SeaTac Terminal operated **well below** estimated sustainable capacity, with 6.7 minutes of delay per 10 miles operated (5.3 minutes in Base Case). Passenger operations were once again a contributor to the delays. As discussed in the Base Case analysis, Sound Transit Commuter operations between Everett and King Street Station and King Street Station and Tacoma/Lakewood caused much of the congestion.

Scenic Subdivision West

The Scenic Subdivision West operated **well below** estimated sustainable capacity, with 1.3 minutes of delay per 10 miles operated (1.5 minutes in Base Case). No improvements were included in the Base P5 case in this segment.

Bellingham Subdivision and Everett Terminal

Everett Terminal operated **within** estimated sustainable capacity, at 19.5 minutes of delay per 10 miles operated (19.3 minutes in Base Case). This number remained very close to the boundary between **within** and **at or approaching** estimated sustainable capacity (>20 minutes of delay per 10 miles). As in the Base Case, passenger operations on single track were responsible for many of the delays. A short single track section at Mukilteo also caused delays that led to this Base P5 analysis result.

The Bellingham Subdivision operated **well below** estimated sustainable capacity, at 3.8 minutes of delay per 10 miles operated (6.8 minutes in Base Case). Train mix and reroutes of traffic through the terminal were responsible for the improvement. The average freight velocity on the Bellingham Subdivision was 23.6 mph (20.7 mph in Base Case).

Scenic Subdivision (East) and Columbia River Subdivision

The Scenic Subdivision East operated **within** estimated sustainable capacity, at 4.3 minutes of delay per 10 miles operated (6.4 minutes in Base Case), while the Columbia River Subdivision operated **well below** estimated sustainable capacity, at 1.6 minutes of delay per 10 miles operated (1.7 minutes in Base Case). Velocity for trains on the Scenic Subdivision averaged 22.0 mph (20.5 mph in the Base Case), while velocity for trains on the Columbia River Subdivision averaged 36.7 mph (36.5 mph in Base Case).

Stampede Subdivision and Yakima Valley Subdivision

The Stampede Subdivision and the Yakima Valley Subdivision both operated **well below** estimated sustainable capacity, at 0.5 minutes of delay per 10 miles operated. Since most of the trains operated in an easterly direction, there were minimal meets that caused delays. The average velocity of trains using these subdivisions was 30.7 mph (30.0 mph in the Base Case).

Base Case Plus 10 Years (Base P10) Analysis Results

Base P10 Conclusions

The Base P10 simulation showed that the projected growth trains over the 10 year time frame will create congestion if no line segment infrastructure improvements are constructed. However, with infrastructure improvements (such as those added in the simulation), each of the major line segments operated efficiently. MLM placed improvements at locations where the simulation indicated they were needed; BNSF will perform their own analyses and may make improvements in locations that are different from MLM's. However, MLM is confident that BNSF will address the capacity issues as they arise when the traffic actually materializes.

Base P10 Train Volumes and Grade Crossing Occupancy Analysis

There was a notable increase in train volumes on certain line segments in the Base P10 (2025) simulation compared to the Base P5 simulation totals. These major increases represent the inclusion of growth as projected in the Marine Cargo Forecast, as well as growth associated with large unit train projects such as Millennium Bulk Terminal coal trains and Vancouver Energy oil trains. For each loaded train that was added for those projects, there was a corresponding empty train that had to be added as well. Some of the line segments, such as the Lakeside and Spokane Subdivisions, handled both the loaded and empty movements. Other line segments, such as the Fallbridge or Stampede/Yakima Valley Subdivisions, only handled either the loaded or the empty movement, but not both. Train volumes are shown by line segment in Table 5-1 below.

Additional grade crossing information related to the Base P10 simulation has been included in spreadsheet.

Base P10 Line Segment Capacity Observations

The following section briefly reviews the capacity observations by line segment (and by terminal where it is integral to the operation) for the Base P10 simulation.

Spokane Subdivision

The Spokane Subdivision operated **well below** estimated sustainable capacity, at 1.4 minutes of delay per 10 miles operated (1.6 in the Base Case, 1.9 in Base P5). Additional infrastructure that completed the second main track across the entire subdivision (except for the Sandpoint Bridge) accounted for the improvement even with increased train volumes. Hauser Terminal also operated **well below** estimated sustainable capacity, at 4.5 minutes of delay per 10 miles (6.2 in the Base Case, 4.4 in Base P5), although again, MLM suspects the delays are understated because of simplified terminal operations (in the model). Freight train velocity on the Spokane Subdivision was 32.9 miles per hour on average (32.3 mph in Base Case, 32.0 in Base P5).

Spokane Terminal and Lakeside Subdivision

Spokane Terminal also operated **well below** estimated sustainable capacity, at 5.2 minutes of delay per 10 miles operated (4.3 in Base Case, 3.8 in Base P5). Trains accessing multiple junctions within the terminal accounted for most of the increased delay.

The Lakeside Subdivision also operated **well below** estimated sustainable capacity, with 3.9 minutes of delay per 10 miles operated (2.5 in Base Case, 3.3 in Base P5). This subdivision experienced growth of 20 trains per day, and only the inclusion of large additional sections of second main track kept delay at the levels that were developed. Average velocity for freight traffic on the route was 28.1 mph (30.9 in Base Case, 29.5 in Base P5).

Pasco Terminal and Fallbridge Subdivision

Pasco Terminal operated **within** estimated sustainable capacity, with 16.4 minutes of delay per 10 miles operated (11.7 in Base Case, 14.8 in Base P5). The Columbia River Bridge at Pasco remained a concern in the Base P10 simulation. BNSF routing protocol will likely have all westbound loaded unit trains running from Pasco to Vancouver via the Fallbridge Subdivision, and most or all eastbound unit empties returning to Pasco via the Yakima Valley Subdivision. These two subdivisions converge at SP&S Junction, which is just west of the Columbia River Bridge. Therefore, all projected unit train growth, whether it is coal, oil or grain, will cross this bridge twice; once when loaded, and then again when empty.

The Fallbridge Subdivision operated **well below** estimated sustainable capacity, with 3.7 minutes of delay per 10 miles operated (3.9 in the Base Case, 3.5 in Base P5). Some capacity improvements and additional rerouting of eastbound traffic to the Stampede Subdivision contributed to this result. A slight decrease in velocity also reflected the increased train movements, with freight traffic operating at an average of 30.6 mph (30.3 in Base Case, 31.3 in Base P5).

Vancouver Terminal

Vancouver Terminal operated **within** estimated sustainable capacity, with 11.4 minutes of delay per 10 miles operated (9.3 in Base Case, 7.5 in Base P5). The increase in delay minutes reflects the impact of additional train movements through the terminal.

Seattle Subdivision

The Seattle Subdivision operated **well below** estimated sustainable capacity, with 0.8 minutes of delay per 10 miles (0.9 in Base Case, 1.5 in Base P5). The two main tracks over the entire length of the subdivision again minimized delays. There were very few delays that exceeded 30 minutes on the Seattle Subdivision during the Base P10 simulation. Where they did occur was generally in the vicinity of Kalama and Longview. Average velocity for freight train on the subdivision was 30.0 mph (32.2 in Base Case, 32.2 in Base P5).

Seattle Tacoma (SeaTac) Terminal

The SeaTac Terminal operated **well below** estimated sustainable capacity, with 6.1 minutes of delay per 10 miles operated (5.3 in Base Case, 6.7 in Base P5). As has been observed in all the previous simulations, passenger operations were once again a major contributor to the delays.

Scenic Subdivision (West)

The Scenic Subdivision West operated **well below** estimated sustainable capacity, with 3.9 minutes of delay per 10 miles operated (1.5 in Base Case, 1.3 in Base P5). Increased growth train volumes accounted for the increase in the delay statistic.

Bellingham Subdivision and Everett Terminal

Everett Terminal operated **within** estimated sustainable capacity, at 15.4 minutes of delay per 10 miles operated (19.3 in Base Case, 19.5 in Base P5). The improvement was because some trains were rerouted through the west side of the terminal rather than passing through or stopping in Delta Yard.

The Bellingham Subdivision operated **within** estimated sustainable capacity, at 4.6 minutes of delay per 10 miles operated (6.8 in Base Case, 3.8 in Base P5). Infrastructure improvements and rerouting trains through Everett were responsible for the delay improvement. The average freight velocity on the Bellingham Subdivision was 23.1 mph (20.7 in Base Case, 23.6 in Base P5).

Scenic Subdivision (East) and Columbia River Subdivision

The Scenic Subdivision East operated **within** estimated sustainable capacity, at 6.3 minutes of delay per 10 miles operated (6.4 in Base Case, 4.3 in Base P5), while the Columbia River Subdivision operated **well below** estimated sustainable capacity, at 1.7 minutes of delay per 10 miles operated (1.7 in Base Case, 1.6 in Base P5). Scenic Subdivision trains averaged a velocity of 20.4 mph (20.5 in the Base Case, 22.0 in Base P5), and Columbia River Subdivision trains averaged velocity of 35.8 mph (36.5 in Base Case, 36.7 in Base P5).

Stampede Subdivision and Yakima Valley Subdivision

The Stampede Subdivision and the Yakima Valley Subdivision both operated **well below** estimated sustainable capacity, at 1.8 minutes of delay per 10 miles operated (1.0 in Base Case, 0.5 in Base P5). Even with a large increase in train volumes, the directional nature of the route allowed trains to move with minimal delay. Most of the delays accumulated near SP&S Junction (near Pasco) for trains waiting to move through Pasco Yard. The average velocity of trains using these subdivisions was 28.7 mph (30.0 in the Base Case, 30.7 in Base P5).

Base Case Plus 15 Years (Base P15) Analysis Results

Base P15 Conclusions

Traffic growth associated with the Base P15 simulation was significant. In order to mitigate congestion on the PNW rail network caused by the new trains, MLM was forced to add infrastructure and operating modifications to the model. Major modifications were made to the Lakeside and Fallbridge Subdivisions, as well as improvements to the signal system and increased tunnel height on the Stampede and Yakima Valley Subdivisions. Beyond the physical improvements, operating changes were also required to maintain a fluid railroad network at the projected train volumes.

The largest of these operating changes was the rerouting of trains to the Stampede/Yakima Valley Subdivisions. In previous simulations, only empty unit trains used this route to return to Pasco and then east. In the Base P15 simulation, MLM had to assume that manifest trains destined for Pasco and Spokane from Everett, Seattle and Tacoma would use the route, in addition to empty unit trains. Also, some intermodal trains from Portland and Tacoma were rerouted via the Stampede/Yakima Valley Subdivisions to Pasco prior to proceeding east.

Many of the Everett, Seattle and Tacoma manifest trains that previously had moved to Pasco via the Seattle and Fallbridge Subs were reassigned to the Stampede Pass to minimize the amount of eastbound traffic using the Fallbridge route.

MLM made the assumption that, should the projected high-case train volumes materialize, BNSF would increase the height of the Stampede Pass tunnels to allow international and domestic double-stack trains to operate via that route. Clearance for that type of traffic would also allow manifest trains containing auto carriers to operate via the route. With infrastructure improvements and the operational modifications, MLM believes BNSF will have enough line segment capacity to accommodate traffic into the 2030 time frame.

The operating modifications that rerouted many of the trains are discussed in *Appendix A*. Train volumes by line segment are shown in Table 5-1 below. Additional grade crossing information related to the Base P15 simulation has been included in the spreadsheet.

Base P15 Line Segment Capacity Observations

The following section of the memo briefly reviews the capacity observations by line segment and terminal for the Base P15 simulation.

Spokane Subdivision

The Spokane Subdivision operated **well below** estimated sustainable capacity, at 2.8 minutes of delay per 10 miles operated (1.6 BC, 1.9 P5, 1.4 P10). No additional infrastructure was added in the P15 simulation. Additional train counts over the route were responsible for the delay increase. Hauser Terminal also operated **well below** estimated sustainable capacity, at 7.5 minutes of delay per 10 miles (6.2 BC, 4.4 P5, 4.5 P10), although it is likely these numbers are understated. Freight train velocity on the Spokane Subdivision was 29.8 miles per hour on average (32.3 mph BC, 32.0 P5, 32.9 P10).

Spokane Terminal and Lakeside Subdivision

Spokane Terminal also operated **well below** estimated sustainable capacity, at 4.4 minutes of delay per 10 miles operated (4.3 BC, 3.8 P5, 5.2 P10). The model included a new connection between UP and BNSF lines near Cheney, which improved traffic flows even under the train volume increases in the P15 simulation.

The Lakeside Subdivision also operated **well below** estimated sustainable capacity, with 0.4 minutes of delay per 10 miles operated (2.5 BC, 3.3 P5, 3.9 P10). Completing the addition of a second main track across the subdivision was responsible for the improvement in train delay. Average velocity for freight traffic on the route was 36.1 mph (30.9 BC, 29.5 P5, 28.1 P10).

Pasco Terminal and Fallbridge Sub.

Pasco Terminal operated **above** estimated sustainable capacity, with 26.2 minutes of delay per 10 miles operated (11.7 BC, 14.8 P5, 16.4 P10). This is a notable increase from the P10 delay statistics; MLM is concerned that, at this level of delay, it is likely that the terminal would not be capable of operating for long periods without experiencing delays that potentially could affect all movements through Pasco. The single track bridge over the Columbia River and the coal spraying track were mainly responsible for the delay increase.

The Fallbridge Subdivision (SP&S Junction to McLoughlin) operated **well below** estimated sustainable capacity, with 2.3 minutes of delay per 10 miles operated (3.9 BC, 3.5 P5, 3.7 P10). The average velocity of trains between Vancouver and Pasco improved due to reducing the number of eastbound trains on the subdivision. The only eastbound trains left on the subdivision were Amtrak and trains moving to/from the south at Wishram. Freight traffic operated at an average of 33.2 mph (30.3 BC, 31.3 P5, 30.6 P10), which was notably higher than previous cases.

Vancouver Terminal

Vancouver Terminal operated **within** estimated sustainable capacity, with 12.5 minutes of delay per 10 miles operated (9.3 BC, 7.5 P5, 11.4 P10). The increase in delay minutes reflects the impact of the additional loaded coal and grain trains that had to move through the terminal between the Fallbridge and Seattle Subdivisions, and additional UP grain and intermodal trains that passed through the terminal.

Seattle Subdivision

The Seattle Subdivision operated **well below** estimated sustainable capacity, with 1.1 minutes of delay per 10 miles (0.9 BC, 1.5 P5, 0.8 P10). Average freight train velocity for the subdivision was 27.7 mph (32.2 BC, 32.2 P5, 30.0 P10). The decrease in velocity reflects the increased unit traffic that was added to the route, which generally runs at a reduced velocity compared to manifest or intermodal operations.

Seattle Tacoma (SeaTac) Terminal

The SeaTac Terminal operated **well below** estimated sustainable capacity, with 7.9 minutes of delay per 10 miles operated (5.3 BC, 6.7 P5, 6.1 P10). Delays associated with passenger trains between Seattle and TR Junction in Tacoma continued to contribute to terminal freight congestion.

Scenic Subdivision (West)

The Scenic Subdivision West operated **well below** estimated sustainable capacity, with 2.7 minutes of delay per 10 miles operated (1.5 BC, 1.3 P5, 3.9 P10).

Bellingham Subdivision and Everett Terminal

Everett Terminal operated **approaching or at** estimated sustainable capacity, at 22.0 minutes of delay per 10 miles operated (19.3 BC, 19.5 P5, 15.4 P10). Passenger trains continued to create terminal delays, as did restricted capacity on the Bellingham Subdivision and on the Scenic Subdivision (East). Trains were frequently held in the yard until capacity north or east of the terminal became available.

The Bellingham Subdivision operated **within** estimated sustainable capacity, at 5.6 minutes of delay per 10 miles operated (6.8 BC, 3.8 P5, 4.6 P10). Additional traffic to/from British Columbia contributed to the increase in delay on the subdivision and within Everett Terminal. The average freight velocity on the Bellingham Subdivision was 22.4 mph (20.7 BC, 23.6 P5, 23.1 P10).

Scenic Subdivision (East) and Columbia River Subdivision

The Scenic Subdivision East operated **within** estimated sustainable capacity, at 5.0 minutes of delay per 10 miles operated (6.4 BC, 4.3 P5, 6.3 P10), while the Columbia River Subdivision operated **well below** estimated sustainable capacity, at 2.0 minutes of delay per 10 miles operated (1.7 BC, 1.6 P5, 1.7 P10). Trains on the Scenic Subdivision averaged velocity of 21.3 mph (20.5 BC, 22.0 P5, 20.4 P10), and trains on the Columbia River Subdivision averaged 35.6 mph (36.5 BC, 36.7 P5, 35.8 P10).

Stampede Subdivision and Yakima Valley Subdivision

The Stampede Subdivision and the Yakima Valley Subdivision both operated **well below** estimated sustainable capacity, at 1.8 minutes of delay per 10 miles operated (1.0 BC, 0.5 P5, 1.8 P10). An upgraded signal system was added to the subdivision to accommodate the projected number of trains. Congestion near SP&S junction continued to be the main cause of delay on the subdivision. The average velocity of trains using these subdivisions was 28.6 mph (30.0 BC, 30.7 P5, 28.7 P10).

Base P20 (2035) Static Analysis

In addition to the four simulation analyses discussed above, MLM utilized the 'High' growth projection developed by in the Marine Cargo Forecast to estimate train volumes in 2035, over the various segments of the network previously described. Since a model simulation analysis was not performed for the segments, MLM did not attempt to identify potential capacity improvements that might be necessary to accommodate train volume growth. A general discussion of the impacts that the train volume growth contained in the 2035 Static Analysis is contained in *Appendix A*.

Also, since a model simulation analysis was not performed for the P20 analysis, specific road/rail crossing conflict information was not developed.

The table below recaps the estimated train volumes for all the simulation cases and the 2035 Static Analysis.

Table 6-1: Three Day Average Train Volume Summary, Through Base P20

			Trains per Day				
Location	Subdivision	Milepost	Base Case	Base P5 (2020)	Base P10 (2025)	Base P15 (2030)	Base P20 (2035)
E. Spokane	Spokane	63	66	69	93	111	119
Lind	Lakeside	91	42	46	66	88	93
Plymouth	Fallbridge	190	38	38	47	51	54
McLoughlin	Fallbridge	14	42	42	52	58	61
Ridgefield	Seattle	122	59	64	79	93	100
Vader	Seattle	77	51	56	71	85	91
East Olympia	Seattle	35	46	52	66	81	87
SeaTac Terminal (Puyallup)		~32X	60	66	82	95	99
SeaTac Terminal (Spokane Street)		~2X	68	79	85	90	94
SeaTac Terminal (Broad Street)		~2	53	58	65	70	74
Mukilteo	Scenic	28	42	47	53	59	62
Marysville	Bellingham	38	26	25	28	31	31
Bow	Bellingham	79	20	20	22	25	25
Border	Bellingham	117	15	16	17	20	20
Monroe	Scenic	1770	23	23	28	26	28
Harrington	Columbia River	1527	24	23	28	25	27
Ravensdale	Stampede	91	6	9	20	40	42
Yakima	Yakima Valley	90	8	11	23	41	43

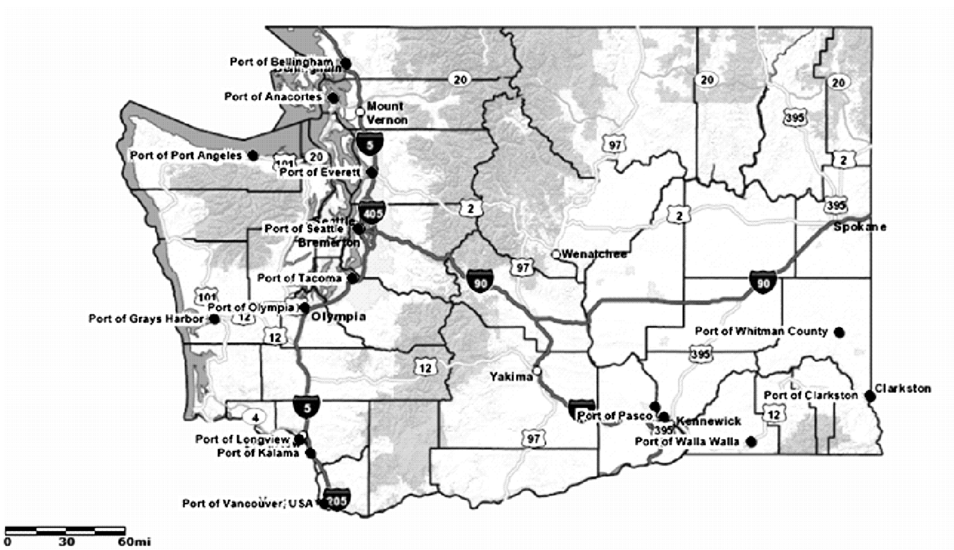
Source: Mainline Management

Chapter 7
Port Infrastructure and Access

Introduction and Background

A summary of each of the 16 participating ports was prepared to enhance this year's Marine Cargo Forecast and to get a better understanding of current and future infrastructure needs. To accomplish this, the 16 partner Ports were interviewed and the findings were summarized into a Port Profile for each of the participating Ports. This detailed summary of each of the 16 ports can be found in *Appendix B*:

Figure 7-1: Participating Ports



It should be noted that although this sample of ports represents both large and small, urban and rural ports, the ports self-selected to participate in this study by providing funding for the 2017 Marine Cargo Forecast.

The participating ports included:

- Anacortes
- Bellingham
- Benton
- Clarkston
- Everett
- Grays Harbor
- Kalama
- Longview
- Olympia
- Pasco
- Port Angeles

- Seattle (Northwest Seaport Alliance)
- Tacoma (Northwest Seaport Alliance)
- Vancouver, USA
- Walla Walla
- Whitman County

Initial Findings

- In general, the ports are trying to grow their traditional lines of business, versus expand into new areas.
- Containers, bulk and breakbulk remain the areas of concentration.
- There are local access/ congestion issues that will require infrastructure improvements to meet future growth.
- There are many port or port related projects that lack full funding to implement the project

Port Summaries

Each Port summary has been tailored to local characteristics. The individual port summaries collected the following information:

- A short overview of the Port
- Description of existing facilities – public and private
- Description of future facilities – public and private
- Description of cargo
    - Opportunities
    - Threats
    - Modal share
- Overview of port access
    - Current projects
    - Future projects
- Discussion of other issues
- Description of access
    - Truck
    - Rail
    - Barge
    - Pipeline
- Future cargo activities
- List of new terminals
- Identification of access challenges/ projects
- Other challenges/ issues
- Maps
        - Location and Access

The intent of the summaries is to (1) provide a current overview of the current public and private port facilities, (2) to identify future port projects, and (3) to identify port access projects and issues.

For example, Bellingham harbor has an array of public and private terminals.

Table 7-1: Example of Public and Private Terminal Summary for the Bellingham Harbor

Public/ Private	Terminal Name	Owner	Operator	City/ Area	Purpose
Public	Bellingham Shipping Terminal	Port of Bellingham	Port of Bellingham	Bellingham	General cargo, logs, bulks
Private	BP Cherry Point Refinery north dock	British Petroleum	British Petroleum	Cherry Point	Crude oil unloading
Private	BP Cherry Point Refinery south dock	British Petroleum	British Petroleum	Cherry Point	Petroleum product loading
Private	Gateway Pacific	SSA	SSA	Cherry Point	Exports of coal, mineral bulks, grain
Private	Intalco Company Aluminum Wharf	Intalco	Intalco	Cherry Point	Alumina receipts
Private	Conoco Phillips Ferndale Refinery	Conoco Phillips	Conoco Phillips	Cherry Point	Crude oil receipts and petroleum product shipments
Private	Bellingham Cold Storage	Bellingham Cold Storage	Bellingham Cold Storage	Bellingham	Fish/seafood

Example of a Port Summary – Grays Harbor

Overview

The Port of Grays Harbor is Washington's only deep-water port on the Pacific Coast. Centrally located between Seattle and Portland, the Port has highway access via the four-lane highway from Interstate 5 and rail service provided by Puget Sound & Pacific with connections to Burlington Northern Santa Fe and Union Pacific. The continuous rail loop throughout the marine terminal complex is designed to handle and store unit-trains as well as smaller sets of rail cars. Specializing in heavy-lift, roll-on/roll-off, autos, wheeled vehicles, project cargoes, liquid bulks and bulk cargoes; the Port of Grays Harbor efficiently handles a multitude of diverse cargoes from breakbulk and agricultural products to liquid bulk. Located within Foreign Trade Zone 173 are over 110,000 square feet of covered, secured on-dock warehouse space and adjacent paved cargo yard dockside available for short and long term storage.

Table 7-2: Existing Terminals – Grays Harbor

Terminal Name	Owner	Operator	City/ Area	Purpose
Terminal 1	Port of Grays Harbor	REG Grays Harbor and Westway Terminal	Hoquiam	Liquid bulk
Terminal 2	Port of Grays Harbor	AGP	Aberdeen	Grain and grain products
Terminal 3	Port of Grays Harbor	Willis Enterprises	Hoquiam	Wood chips
Terminal 4	Port of Grays Harbor	PLS, Pasha	Aberdeen	Autos, Ro-ro, logs, general cargo
Sierra Pacific Marine Terminal	Sierra Pacific	Sierra Pacific Ind.	Aberdeen	Lumber, logs and wood chips
Terminal 1	Port of Grays Harbor	REG Grays Harbor and Westway Terminal	Hoquiam	Liquid bulk
Terminal 2	Port of Grays Harbor	AGP	Aberdeen	Grain and grain products

Rail Service

Rail Service is available through both BNSF and UPRR, via Genesee & Wyoming's Puget Sound and Pacific Railroad. The Port of Grays Harbor’s marine terminal rail system features more than 50,000 ft. of rail. This provides two continuous loop tracks serving terminals 1, 2 and 4 and the cargo storage facilities. Utilizing this unique state-of-the-art rail infrastructure, unit trains can be continuously loaded or unloaded at AGP storage silos or Pasha Automotive Services processing center.

Highway Access

Interstate 5 via Hwy 101 and US 12

Barge Facilities

Terminal 3 wood chip loading facility and Sierra Pacific for logs, lumber and wood chip loading.

Table 7-3: Future Terminals – Grays Harbor

Terminal Name	Owner	Operator	City/ Area	Purpose
Terminal 1	Port of Grays Harbor	Westway Terminals	Hoquiam	Liquid bulk – crude oil storage
Terminal 3	Port of Grays Harbor		Hoquiam	Existing pier with adjacent uplands (150 acres) planned for dry bulk storage and vessel loading. Site needs rail realignment to allow for unit train receiving and handling. Dry bulk storage facility and ship loader to facilitate the transfer of dry bulk from unit trains to storage and then delivery to vessel. New rail alignment is needed to mitigate impact of unit train traffic on local freight service roads.

Future cargo opportunities

- New Cargo types include: Inbound automotive, liquid bulks and dry bulks
- Anticipate a gradual recovery from 2014 peak with average 8% year over year growth.
- It is anticipated that the new cargo will follow the current modal splits: 75% rail and 25% truck

Existing Access Routes

- Truck – US101, US12 and SR8
- Rail – BNSF 80%, UP 20%
- Barge – Columbia River and Puget Sound
- Pipeline – N/A

Access Issues

- Truck – US12 in East Aberdeen
- Rail – BNSF Junction (Centralia)
- Barge – N/A
- Pipeline – N/A

Access Projects

Current Access Projects include:

- East Aberdeen Mobility Project
  - The freight community is actively seeking funding for Pre design study. Once completed PE, ROW and Construction funds will be sought.
  - Strategic Partners – WSDOT, City of Aberdeen, PSAP railroad, Port of Grays Harbor, Grays Harbor Council of Governments and Grays Harbor County.
  - Co-lead/ project sponsor – City of Aberdeen
  - Current funding gap – $500,000 for pre-engineering study.
  - Total estimated project cost – $22 million

- Past Federal Funding – Alternatives Analysis was funded through STP. No other federal grants initiated to date.
- Key reports/studies that document access project: East Aberdeen Mobility Project Preferred Alternative Selection Report. Project also documented in the Southwest Washington RTPO Regional Transportation Plan and WSDOT 2014 Freight Mobility Plan.
- Project is at the local level and will be integrated into the RTPO TIP as funds become available.
- Project will be integrated into the STIP when federal funds are secured.

Other Issues

No other critical issues were identified

Table 7-4: Grays Harbor Historical Cargo Statistics (metric tons)

Year	Metric Tons
2011	1,233,845
2012	1,850,465
2013	2,384,242
2014	2,628,515
2015	2,203,943

Figure 7-2: Location of Port Facilities – Grays Harbor

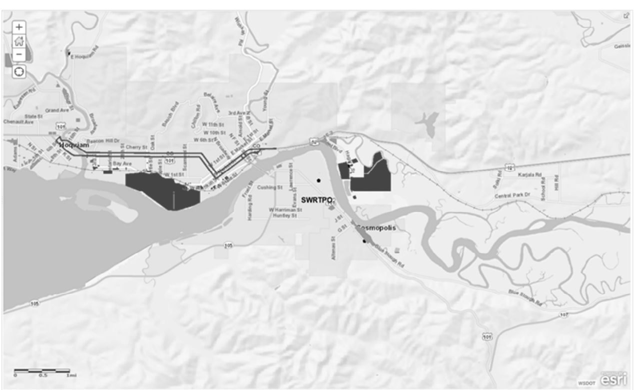
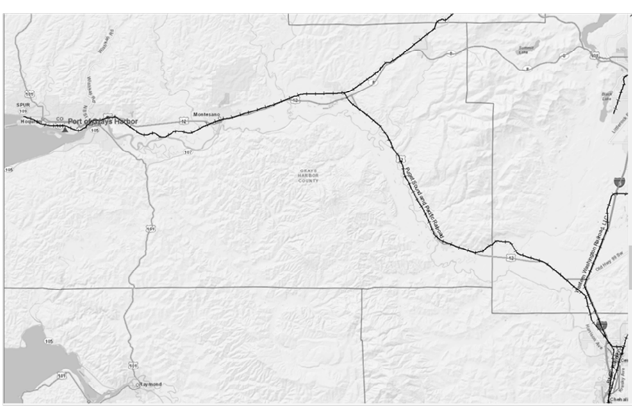


Figure 7-3: Location of Rail Lines – Grays Harbor



Themes Gathered from Interviews

Based upon the interviews the following themes emerged:

Cargo facilities

The ports in Washington state are actively preparing for the future. This includes planning for modernization of aging terminals and facilities, converting aging facilities for use in new lines of businesses, building brand new facilities, and expanding existing facilities to meet anticipated cargo growth.

Port Road and Rail Access- (First and Last Mile issues)

Road and Rail access issues can be segmented into three main categories

- Road access to port facilities through urbanized areas
- Road access to new facilities through rural areas
- Road / rail grade crossing conflicts

Adequate, well maintained road access is important to all of Washington's ports. Without uncongested road access, the port cannot meet customer and community expectations as economic engines for their communities. Most of the sixteen ports interviewed reported that they work in concert with their local jurisdictions to ensure the first and last mile roadways are adequate to meet the needs of their supply chains. Challenges occur when local land use plans or patterns encroach near the ports. This is especially noticeable where the same access routes are used by both local and port traffic. This can be further exacerbated in smaller urbanized areas such as Clarkston and Grays Harbor where retail and port traffic share the same routes. In larger cities like Seattle, the expansive needs of a larger city with its diverse population and businesses provide additional stresses on access and mobility issues.

The development of new facilities put additional pressures on mobility and access. Notable examples include the greenfield developments at Barlow Point in Longview and Kalama Methanol Manufacturing and Exporting Facility (KMMEF) in Kalama. Each of these projects has unique access challenges because of their additional traffic demands on local roads. In some cases, local roads have the capacity to meet future needs. In other cases, such as Barlow Point, new intersections may have to be built and current intersection expanded. Furthermore, capacity of the roads may need to be expanded with additional turning lanes to improve the flow of traffic as growth occurs.

Road and rail grade crossings continue to be an area of conflict within and near ports. Multiple studies are currently underway to help communities and states prioritize crossing improvements. In Washington State the Joint Transportation Committee (JTC) completed a Road-Rail Conflict Study called *The Prioritization of Prominent Road-Rail Conflicts in Washington State*. This project developed a systems-based approach for prioritizing and addressing at-grade crossing impacts and needs on a statewide basis. The 2017 Legislature has directed the Freight Mobility Strategic Investment Board to update the Road-Rail Conflict study using data from the 2017 Marine Cargo Forecast.

A second study is being conducted by the Transportation Research Board (TRB) of the National Science Academies, NHRCP 25-50: *Prioritization Procedure for Proposed Road-Rail*

Grade Separation Projects along Specific Rail Corridors[28]. The TRB study is developing a comprehensive set of criteria that balance economic and social benefits and costs. The goal is to provide a model that can be used by local jurisdictions to prioritize grade crossing separation project investments along a rail corridor.

First and Last mile rail issues were less apparent in the responses to the interviews than expected. This may be due to recent investments by railroads, both mainline and short-lines, that have greatly improved rail access to the ports. Interestingly, large rail projects that have traditionally appeared on rail project lists such as Bullfrog Junction in Tacoma, the Bi-directional running through the Columbia Gorge, the crowning of Stampede Pass were not mentioned as needs by the ports. This may be due to the way the information was gathered for this forecast. Port participants may have interpreted the questions about access to be literally “at the Port gates”.

Dredging

Dredging is an issue for Ports throughout the state. Dredging is necessary on an on-going basis to maintain authorized water depth in navigation channels, connecting channels, and marine terminal berths. In some cases, dredging is also needed to deepen channels and marine terminals to handle larger vessels.

Dredging is paid for by different entities, depending upon where it is performed. Dredging is a federal responsibility when it comes to the operation and maintenance of federal navigation channels, which are significant components of the supply chain in the Pacific Northwest. Deepening projects are considered an improvement, and thus are cost-shared by the federal government with local sponsors. Dredging alongside marine terminal berths and in marinas is the sole responsibility of the local port.

Funding for continued maintenance dredging is a concern for most ports throughout the region, while funding and permitting for deepening projects is more localized. For example, several ports in the Puget Sound need to deepen access channels and marine terminal berths in order to accommodate the next generation of container ships. On the Lower Columbia River, water depth alongside marine terminals is matched to the depth of the deepened navigation channel, so maintenance of the existing channel is a continuing concern.

Examples of Project Types

Modernization of Aging Facilities

Container facilities preparing for “Big ships”

Northwest Seaport Alliance - Seattle Harbor Terminal 5

The NWSA is planning to modernize the 172-acre Terminal 5 to make it ready for mega ships. This includes upgrading the power, dock and berth “understructure to allow a future operator to acquire and install super-post -Panamax cranes on this modernized terminal. This is the last terminal in the north harbor upgrading in order to install the super-post- Panamax cranes. The upgrade is part of the Alliance’s long-term growth strategy to move 3.5 million TEU’s annually through the north harbor.

[28] http://leg.wa.gov/JTC/Pages/Road-Rail-Study.aspx

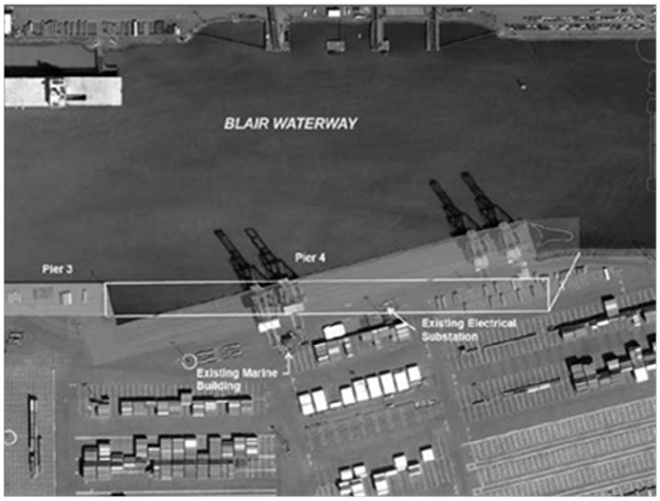
Figure 7-4: Aerial View of Terminal 5

Northwest Seaport Alliance - Tacoma Harbor Terminal 4 Modernization

Terminal 4, part of the Husky Container Terminal, has become outdated in the face of modern containerized ship building trends. With wharfs constructed at odd alignments and cranes unable to handle increasingly larger ships, Terminal 4 needs improvements. The Port began phased improvements of the container terminal by upgrading the adjacent Terminal 3 in 2014. The second phase involves the removal of contaminated sediment under the Terminal 4 Pier; construction is currently underway. The final phase, for which the Port is seeking federal funds, would reconstruct the Terminal 4 pier, aligning it with the neighboring Pier 3 to create one contiguous 2,960-foot-long pier structure capable of simultaneously berthing two ultra-large container ships. The new pier structure will also be designed to accommodate modern 24-container wide, 100-guage cranes needed to work larger vessels.

The planned $113 million upgrades to Terminal 4 will allow the Husky Container Terminal to increase the size of ships it can handle. Today, the terminal can serve ships that carry 6,500 Twenty Foot Equivalent Unit (TEU) containers. After the improvements, the terminal will be able to handle 18,000 TEU vessels with the new cranes, increasing cargo throughput capacity across the pier from about 767,000 TEUs annually to an estimated 1.3 million TEUs. It is the increased throughput that will create the demand for new family wage jobs in the region. This project will be completed in 2018.

Figure 7-5: Aerial View of Terminal 4



Port of Everett - South Terminal Intermodal Modernization

The Port of Everett's South Terminal Intermodal Modernization project will redevelop their south terminal to meet current and future multi-modal freight shipping needs of the region and nation.

This project allows the Port to efficiently and safely serve larger vessels that are currently being chartered by eight shipping lines, in particular Panamax class ships carrying containerized aerospace cargo. Notably, the Port of Everett serves as an extension of the aerospace manufacturing process, and plays a critical role in the just-in-time-delivery schedule. It transports **all** of the oversized parts for the 747, 767 (military and commercial), 777, K-C46 Tanker and soon to be 777X airplane programs. It also serves as a backup facility for the 787 Dreamliner program.

Figure 7-6: Aerial View of the Port of Everett

This project is necessary for the Port to meet the heavier containers being used to transport the airplane parts for the new Boeing 777X program and other breakbulk export cargoes that utilize port facilities. The wharf strengthening is needed for the intermodal transfer of goods from ship to shore, and the rail infrastructure is needed to stage the cargo for transport to the inland states without creating congestion on the BNSF mainline to the Midwest. This project has been fully funded and will begin construction in the fall of 2017.

Modernization of Non-Container facilities

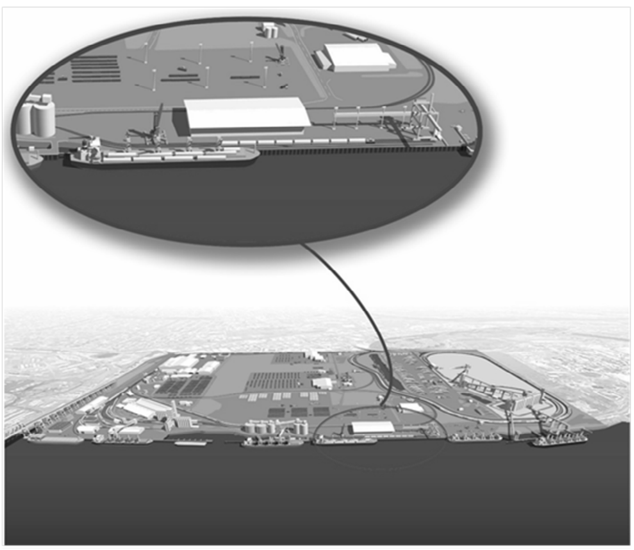
Ports reinvest in infrastructure to remain competitive

Port of Longview – Multi-Cargo Modernization

The Port of Longview's $31.4 million Multi-Cargo Modernization project will reinvigorate two general cargo docks into a premiere west coast heavy-lift and bulk cargo handling facility. This project is vital to strengthening local infrastructure that moves cargo in support of international trade for the benefit of our local, regional and national economies.

The project will rehabilitate and modernize 1,500 lineal feet of Berth 6 & 7 bulk and breakbulk cargo facilities to optimize increased cargo handling omni-dock operations. The terminal improvements include installation of a dual wastewater and stormwater collection system, strengthening decking and piling to withstand dual pick, breakbulk heavy loads, upgrading on-dock rail systems, and deepening the berths to take advantage of the recently deepened federal navigation channel.

Figure 7-7: Port of Longview Modernization



Conversion of Aging Facilities to New Lines of Business

Ports increase economic vitality through new opportunities

Port of Port Angeles - Marine Trades Industrial Park

The Marine Trades Industrial Park or (MTIP) includes existing businesses west of Cedar Street and south of Marine Drive and the former K-Ply site, all located along the industrial portion of the Port Angeles waterfront. Currently the Port is in Phase 1 of the master planning process to identify projected land and infrastructure needs to accommodate projected growth based on interviews with owners of existing key businesses and Port staff. The master plan developed as part of Phase 1 of the master planning effort will identify alternatives for future development of the entire Marine Trades Area (MTA). The MTA is an approximately 77-acre area along the Port Angeles waterfront that includes Terminals 1 and 3. The boundary includes the "K-Ply Site", an 18-acre parcel at the east end of the MTA that was recently the site of a soil contamination cleanup project. Cleanup was completed in late spring of 2016, and the site is now ready for development as the Marine Trades Industrial Park (MTIP).

The MTA includes several existing businesses, including Westport Marine, Platypus Marine, Vigor Industrial, and a few smaller businesses that are either marine-related or general commercial in nature. These businesses have communicated to the Port that one of their top priorities is the development of a new boat wash down facility that will enhance their existing operations and attract new business to the Port. Currently, the Port is studying this requested improvement.

First and Last Mile Access Challenges

Road access to port facilities through urbanized areas

Northwest Seaport Alliance - Seattle Harbor Terminal 5 Access Improvements

One example of road access challenges is truck access to the modernized NWSA North Harbor Terminal 5. In the redevelopment of T-5 to a modern terminal that can handle up to 18,000 TEU ships, the port realizes that the current road access to T-5 must be improved. In their Environmental Impact Study, three alternatives were evaluated:

- Alt 1- no action 647K TEUs / yr.- 70% trucked off dock
- Alt 2 -1.3 M TEUs / yr. -50% trucked off dock 650K TEUs
- Alt 3 -1.7 M TEUs /yr. – 50% trucked off dock 850K TEUs

The port is studying proposed mitigation options for anticipated increases in truck traffic to and from the terminal. Alternatives include the closure of the Terminal 5 leg of the 5-legged intersection and upgrading signals to rail yards on Lower Spokane St & East Marginal Way.

More on the project can be found at http://www.portseattle.org/Environmental/Environmental-Documents/SEPA-NEPA/Pages/default.aspx

Port of Clarkston – Access Improvements

In smaller urbanized areas, such as Clarkston, ports continue to have road access issues. The Port of Clarkston identified three road access challenges to get trucks to and from their terminals:

- Highway 12 Bridge into Idaho is a major chokepoint for freight (AP1)
- Congestion North (at 4 way stop) at 5th St and Fair St. This is the intersection in front of Walmart and Costco. (AP2)
- 5th and Bridge Street- at this intersection there are continuous conflicts between transit buses and truck traffic traveling to the ports terminals.
- 6th St. in Clarkston is a challenge for log trucks (AP4)

All four access points are outside of the port’s ownership, so the port must rely on local and state agencies to prioritize these projects and fund solutions.

Road Access to New Port Facilities through Rural Areas

Port of Kalama – Access Improvements

- Kalama Methanol Manufacturing and Exporting Facility (KMMEF)

Rural areas have many of the same challenges as urban areas. In the Port of Kalama, the development of the Kalama Methanol Manufacturing and Exporting Facility (KMMEF) has prompted the port to evaluate road access issues near the site. They are examining access issues for both the construction, and post construction periods.

Road Access and Modal Conflicts

Port of Grays Harbor – East Aberdeen Mobility Project

In Aberdeen, traffic congestion caused by Port of Grays Harbor rail traffic closes off access to a main retail hub for up to 30 minutes, multiple times per day. The community and the port are jointly working on solutions to this access challenge. Known as The East Aberdeen Mobility Project (formerly Wishkah Mall Access), one identified solution is the construction of a grade separation over the PSAP railroad tracks to allow separation of rail and road.

Future Modal Conflicts

Port Longview – Barlow Point

The Port of Longview is in the final planning process for the development of 280 acres of greenfield properties along the Columbia River. Initial master plans show that road and rail investments will need to be made to ensure good road and rail access to the property. The final design of these access improvements will be dependent on the final customer and their respective use of the property.

Port Infrastructure Project List for 16 Participating Ports

The development of the list of port related projects began with the interviews of the 16 participating ports during the summer of 2016. This effort was integrated with the FMSIB / WSDOT effort to prepare a prioritized project list required under FAST Act for distribution of the National Highway Freight Program formula money.

Due to the specific planning processes identified in FAST ACT, Cities, counties, and ports were to coordinate with MPOs and RTPOs before submitting projects to the 2016 list. This is a new, and different process for many Washington ports. Although, some of the ports are very active in their local transportation planning organizations, many are not. Thus, not all port projects were included in the lists that were submitted to WSDOT from their respective planning organizations.

To help with this change in the planning process, the consultant team provided guidance to each port on how to get their projects into the WAFAC list. Most were successful; however, for a variety of reasons, some projects failed to get onto the WAFAC list.

There is continuous work underway to better communicate the process, and ensure that the process continues to evolve and improve over time. The project list included in this study (*Appendix B*) is a combination of (a) projects that ports self-submitted,(b) port related projects that are on the WAFAC list and (c) projects submitted by parties other than ports (e.g. local governmental agencies ,cities and counties). It is the intent of this study to be as inclusive as possible when identifying projects that are important to ports that participated in this study.

Table 7-5: Summary of Port Infrastructure Projects

Port	Road	Rail	New Terminal Facilities	Terminal Modernization	Terminal Infrastructure	Dock	Dredging	Bus. Park Infrastructure	Buildings	Prop. Purchases	ITS	Grade Separations	Studies - Feasibility	Studies - Road/ Rail	Summary
Anacortes							1								1
Bellingham							1								1
Benton		1													1
Clarkston	2														2
Everett	1			3											4
Grays Harbor			2									1			3
Kalama	4		1			1	2	2	1	1					12
Longview	3	2	1	3											9
Multi -Col River Ports							1								1
NWSA	3	5			1		2				1				12
Olympia		1					1						1		3
Pasco		1							1			1			3
Port Angeles	1		1		1				1				3		7
Seattle	16	1									2	2			21
Tacoma	7	1									1	1		1	11
Vancouver	3	1			1							1			6
Walla Walla	1														1
WPPA - Statewide														1	1
Total Projects	41	13	5	6	3	1	8	2	3	1	4	6	4	2	99

Funding Challenges

Most of the project on the Port Infrastructure Project list lack full funding. There are always many more project needs than available dollars. As has been the case for many years, there are many more good projects that need funding than funds available. To try to focus federal investments into projects that align with Federal and State priorities, the Fixing America's Surface Transportation (FAST) Act, passed in December 2015, provides a structured project identification process. It is recommended that ports become educated on the process, and actively engage as soon as possible.

At the federal level, progress has been made through the enactment of the FAST Act to provide states and local officials with guidance on federal funding priorities. This includes the planning requirements as detailed above regarding State Freight Plans and state Freight Advisory Committees. The result of the FAST Act is that the key criteria for accessing Federal funds is that projects align with state and federal priorities, not just a local priority. This may put additional pressure on smaller ports and communities that have traditionally had a hard time competing at the national level. There are two avenues to federal funding under the National Highway Freight Program: formula money allocated to the state and then assigned to projects within the state and FASTLANE discretionary grants.

National Highway Freight Formula Program Eligibility

The FAST Act established the National Highway Freight Program, which provides states with formula funding to be used for projects on the National Highway Freight Network. Washington State expects to receive about $20 million per year from 2016 to 2020. Funds apportioned to the State for the national highway freight program may be obligated to carry out one or more of the following:

i. Development phase activities, including planning, feasibility analysis, revenue forecasting, environmental review, preliminary engineering and design work, and other preconstruction activities.
ii. Construction, reconstruction, rehabilitation, acquisition of real property (including land relating to the project and improvements to land), construction contingencies, acquisition of equipment, and operational improvements directly relating to improving system performance.
iii. Intelligent transportation systems and other technology to improve the flow of freight, including intelligent freight transportation systems.
iv. Efforts to reduce the environmental impacts of freight movement.
v. Environmental and community mitigation for freight movement.
vi. Railway-highway grade separation.
vii. Geometric improvements to interchanges and ramps.
viii. Truck-only lanes.
ix. Climbing and runaway truck lanes.
x. Adding or widening of shoulders.
xi. Truck parking facilities eligible for funding under section 1401 of MAP-21 (23 U.S. Code §137).
xii. Real-time traffic, truck parking, roadway condition, and multimodal transportation information systems.
xiii. Electronic screening and credentialing systems for vehicles, including weigh-in-motion truck inspection technologies.
xiv. Traffic signal optimization, including synchronized and adaptive signals.
xv. Work zone management and information systems.
xvi. Highway ramp metering.
xvii. Electronic cargo and border security technologies that improve truck freight movement.
xviii. Intelligent transportation systems that would increase truck freight efficiencies inside the boundaries of intermodal facilities.
xix. Additional road capacity to address highway freight bottlenecks.
xx. Physical separation of passenger vehicles from commercial motor freight.
xxi. Enhancement of the resiliency of critical highway infrastructure, including highway infrastructure that supports national energy security, to improve the flow of freight.
xxii. A highway or bridge project, other than a project described in clauses (i) through (xxi), to improve the flow of freight on the National Highway Freight Network.

xxiii. Any other surface transportation project to improve the flow of freight into and out of a facility, including projects (i) within the boundaries of public or private freight rail or water facilities (including ports); and (ii) that provide surface transportation infrastructure necessary to facilitate direct intermodal interchange, transfer, and access into or out of the facility.

National Highway Freight Program Project Screening

Projects published on this list are required to meet the following screening requirements:

- **Network Screening**: Projects are required to be located on the National Highway Freight Network, which is currently in development (the Primary Highway Freight System and remainder of Interstate system have been established; Critical Urban and Rural Freight Corridors are to be designated by September). A state may obligate apportioned funds for projects on any component of the National Highway Freight Network. Projects that do not meet these requirements will not advance to the next screening for consideration.
- **Regional Screening**: Projects are required to be supported by the regional transportation planning organization. If a project is not in a current regional plan, a letter from the metropolitan or regional planning organization must be submitted with the project. Tribal projects may be submitted directly to WSDOT; regional coordination is encouraged. Projects that do not meet these requirements will not advance to the next screening for consideration.
- **Scheduling Screening**: Projects are required to identify the scheduled year that funding is expected to be used. The program is funded through FY2020 under the FAST Act, and projects must be scheduled no later than June 30, 2020, to become eligible for funding. For construction projects, this is the year for construction. If projects are not ready for construction, the scheduled year for development phase activities should be provided. Projects scheduled beyond June 30, 2020 will be considered long-range investments without identified federal funding.
- **Funding Screening**: Projects are required to demonstrate fiscal constraint and quantify the gap in current funding. Fund sources and commitments must be identified and documented as part of the submission. Updated project costs were to be provided in state FY2017 dollars. Projects that did not meet these requirements were not considered.

National Highway Freight Program Project Prioritization

The prioritized project list was delivered to the legislature for funding consideration. Submitted projects were prioritized based on readiness. WAFAC categorized projects eligible to use formula funding, based on three tiers.

- Tier 1 will be composed of screened projects that are scheduled July 2016 to June 2018.
- Tier 2 will be composed of screened projects that are scheduled July 2018 to June 2020.
- Tier 3 will be composed of screened projects that are scheduled July 2020 to June 2035.

Specifically, federal funding available under FASTLANE discretionary grants must align with the following requirements:

Nationally Significant Freight & Highway Projects Program Requirements

The FAST Act also established the Nationally Significant Freight & Highway Projects Program, administered as the INFRA (Infrastructure for Rebuilding America) grant program. Eligible project costs include:

1) development phase activities, including planning, feasibility analysis, revenue forecasting, environmental review, preliminary engineering and design work, and other preconstruction activities; and
2) construction, reconstruction, rehabilitation, acquisition of real property (including land related to the project and improvements to the land), environmental mitigation, construction contingencies, acquisition of equipment, and operational improvements directly related to improving system performance.

The US Secretary of Transportation may select a project for funding under this section only if the Secretary determines that:

1) the project will generate national or regional economic, mobility, or safety benefits;
2) the project will be cost effective;
3) the project will contribute to the accomplishment of one or more of the national goals described under section 150 of Title 23, United States Code;
4) the project is based on the results of preliminary engineering;
5) with respect to related non-Federal financial commitments:
    - one or more stable and dependable sources of funding and financing are available to construct, maintain, and operate the project; and
    - contingency amounts are available to cover unanticipated cost increases;
6) the project cannot be easily and efficiently completed without other Federal funding or
7) financial assistance available to the project sponsor; and
8) the project is reasonably expected to begin construction not later than 18 months after thedate of obligation of funds for the project.

Nationally Significant Freight & Highway Projects Program Screening

Projects published on this freight grant list will need to meet the following criteria:

Network Screening: Eligible projects include the following only:

- Highway freight projects on the National Highway Freight Network;
- Highway or bridge projects carried on the National Highway System;
- Railway-highway grade crossing or grade separation projects; or
- Freight intermodal or rail projects.

Regional Screening: Projects are required to be supported by the regional transportation planning organization. If a project is not in a current regional plan, a letter from the metropolitan or regional planning organization must be submitted with the project. Tribal projects may be submitted directly to WSDOT; regional coordination is encouraged.

Funding Screening: Projects must be reasonably expected to begin construction not later than 18 months after the date of obligation of funding. The estimated end date of the final Notice of

Funding Opportunity for the INFRA grant program has a projected latest date of spring 2020; the program is funded at approximately $900 million per year.

Minimum project costs for large projects is $100 million; the funding gap is required to be at least $25 million. For small projects, less than $100 million, the funding gap is required to be at least $5 million.

Projects are required to demonstrate availability of sufficient funds (Federal, state, local, and private), less the grant request, to cover at least 40 percent of total project costs (INFRA grants may be used for up to 60 percent of the future eligible project costs, and total federal assistance may be up to 80 percent of project costs). Fund sources and commitments must be identified and documented as part of the submission. Updated project costs should be provided in state FY2017 dollars.

Summary

As detailed in the Port Infrastructure Project list, ports in Washington have a multitude of investment needs. Finding funding for these investments will continue to be a challenge because local port and communities do not have the resources to fully self-fund these improvements. With the need to find outside funding for port projects, it has become mandatory that ports actively participate in their local and regional planning organizations and planning processes. The FAST Act requires listing of projects in these broad-based regional and state planning activities to be eligible for new federal funding.

Prior to the FAST Act, Washington ports could independently do their planning under the Washington State Growth Management Act. With the enactment of FAST Act at the federal level, it is no longer a choice to participate in regional transportation planning efforts if a port is interested in pursuing federal funding for a port or port-related project in the future.

Table 7-6: Summary of Port Infrastructure Projects

Proj #	Port Priority	WSDOT No.	Project Name	Location Description	Latitude / Longitude	Brief Description	Improve Type	Port District	Project Owner	Submitting Authority	Ref.	PE Year	ROW Year	Const. Year	Project Cost / Funding Gap	% Gap
1	high		Pier 2 Export Initiative	Anacortes	48.521944 / 122.612778	The Port's primary bulk cargo facility, Pier 2 will require dredging to deepen its draft from -36.5' MLLW to -45 MLLW to accommodate larger, Panamax sized vessels and retain shipping and family-wage jobs. This project will complete the following five items: 1. Relocation of the facility's manufacturing and storage structure 2. Purchase and operation of a new mobile bulk shiploader 3. Repairs to the Pier's bulkhead wall 4. Relocation/reinstallation of the existing breasting dolphins 5. Berth deepening to allow larger ships to berth at the Pier and leave fully loaded	Dredging/ Terminal Infrastructure	Anacortes	Port of Anacortes	Port of Anacortes		2017	N/A	2017-2018	$11,801,200 / $6,767,305	57%
2			Squalicum Waterway Maintenance Dredging	Bellingham		The USACE has not performed maintenance dredging in the Squalicum Waterway since 2004, and heavy sedimentation has since caused a navigation hazard which threatens continued use of the waterway by commercial vessels loading and off-loading cargo. Commercial vessels have recently grounded in the Squalicum Waterway and the Puget Sound Pilots Association has warned about this navigation hazard. Cargo vessels operating in the Squalicum Waterway are currently limited by tidal restrictions. The need for maintenance dredging grows increasingly urgent to protect the over 2,000 jobs and hundreds of millions of dollars in gross annual revenue which rely on a maintained federal navigation channel.	Dredging	Bellingham	US Army Corp of Engineers/ Port of Bellingham	Port of Bellingham		2017	N/A	2018-2019	/ $750,000	
3	1		Richland Inland Port	Richland		The City of Richland and the Port of Benton have commissioned a joint Rail Master Plan to assess the feasibility of an inland container port. The Richland Inland Port will provide a transportation option to Eastern Washington agricultural exporters that face long dray operations to reach ports in Seattle and Tacoma. This project includes rail and road improvements and will have multiple phases. The rail serves both class I railroads.	Rail	Benton	Port of Benton & City of Richland	Port of Benton	-	2018 Phase 1 Tie replacement , Phase 2 Rail upgrades, Phase 3 Track resurfacing	N/A	2018 Phase 1 Tie replacement, 2018 Phase 2 Rail upgrades, 2019 Phase 3 Track resurfacing	$2.9m (phase 1), Rail upgrade taking rail from 90# to 136# $4.8m (phase 2), Track resurfacing $705k (phase 3) / $000,000	100%

Proj #	Port Priority	WSDOT No.	Project Name	Location Description	Latitude / Longitude	Brief Description	Improve Type	Port District	Project Owner	Submitting Authority	Ref.	PE Year	ROW Year	Const. Year	Project Cost / Funding Gap	% Gap
4	1	68	Bridge and 2nd Street Intersection	Intersection of Bridge Street, 2nd Street, and Diagonal Street	46.420297 / -177.042639	Road widening and realignment of the 5-point intersection; adding lanes to reduce congestion	Road	Clarkston	City of Clarkston	Lewis Clark Valley MPO	LCVMPO Long Range Transportation Plan	2020	2021	2022	$916,000 / $732,800	80%
5	2	73	Southway Bridge	Fleshman Way from the abutment of the bridge to the midpoint of the bridge.	46.396805 / -117.043785	Design and Reconstruction of the Southway Bridge; mill through asphalt pavement, membrane, and reconstruct delaminated localized areas of the deck surface, followed by a Polymer Concrete (PPC) overlay	Road	Clarkston	Asotin County, City of Clarkston, City of Lewiston, Nez Perce County	Lewis Clark Valley MPO	LCVMPO Long Range Transportation Plan	2020		2021	$2,113,350 / $1,690,680	80%
6		25	South Terminal Modernization Project II	Everett, Washington	47.975418 / -122.25645	Strengthen the remaining 560 feet of the South Terminal, install 700 feet of crane rail to support two 100-ft gauge gantry cranes, and construct a double rail siding to support the cargo operations.	Terminal Modernization	Everett	Port of Everett	PSRC		July 2016-July 2017	N/A	2017-2018	$50,100,000 / $000	0%
7		56	South Terminal Modernization Project Yard and Wharf Improvements	Everett, Washington	47.98513 / -122.216745	The Port of Everett is modernizing its seaport to meet 21st century shipping needs. This project would invest in utilities, expansion of on-dock rail, and a new fender system to support an expanded South Terminal.	Terminal Modernization	Everett	Port of Everett	PSRC		July 2016-December 2020	N/A	2021	$30,200,000 / $30,200,000	100%
8		34	EMVD/ SR 529 Interchange Improvements	East Marine View Dr. (SR 529 off-ramp to SR 529 on ramp)	48.011328 / -122.090388	Correct the height restriction with East Marine View Drive	Terminal Modernization	Everett	City of Everett	PSRC	Letter	2018	2019	2019	$2,246,000 / $1,980,000	88%
9		72	West Marine View Drive (Highway 529) Bulkhead Rebuild	Everett, Washington	47.981997 / -122.215143	Rebuild aging bulkhead that is supporting the Southbound lanes of SR529 (West Marine View Dr.), which accesses both Naval Station Everett and the Port of Everett.	Road	Everett	Port of Everett	PSRC		60% design in 2016	N/A	TBD	$1,700,000 / $1,700,000	100%
10	1		Terminal 1- Port of Grays Harbor	Hoquiam	46.966756 / -123.856341	Liquid bulk – Terminal 1 operates as a barge and bulk liquid terminal. Adjacent property is available for development.	New Terminal Facility	Grays Harbor	Port of Grays Harbor							

Proj #	Port Priority	WSDOT No.	Project Name	Location Description	Latitude / Longitude	Brief Description	Improve Type	Port District	Project Owner	Submitting Authority	Ref.	PE Year	ROW Year	Const. Year	Project Cost / Funding Gap	% Gap
11	2		Terminal 3- Port of Grays Harbor	Hoquiam	46.970163 / -123.912272	Existing pier with adjacent uplands (150 acres) planned for dry bulk storage and vessel loading. Site needs rail realignment to allow for unit train receiving and handling. Dry bulk storage facility and ship loader to facilitate the transfer of dry bulk from unit trains to storage and then delivery to vessel. New rail alignment is needed to mitigate impact of unit train traffic on local freight service roads.	New Terminal Facility	Grays Harbor	Port of Grays Harbor							
12	3	67	East Aberdeen Mobility Project (formerly-Wishkah Mall Access)	US 12 (E. Wishkah St.), Fleet St to S Harbor St.	46.977217 / -123.809013	Grade separation, access control, pedestrian safety improvements	Grade Separation	Grays Harbor	City of Aberdeen WSDOT	SWRTPO	http://www.cwcog.org/documents/2040RTPFINALck11-4-15.pdf	2018			$30,000,000 / $30,000,000	100%
13		23	Kalama Methanol Manufacturing and Exporting Facility (KMMEF) - Dock	The Port would construct the proposed export dock at approximately River Mile (RM) 72 of the Columbia River Navigation Channel.	46.045522 / -122.876473	The new export dock is designed to accommodate both the existing fleet and future generations of methanol carriers. The dock would generally be 530 feet long and 36 feet wide and would be designed to accommodate vessels ranging in size from 45,000 deadweight tonnage (DWT) to 127,000 DWT, measuring from 600 to 900 feet in length, and 106 to 152 feet in width. The dock would consist of a transition platform, trestle, and turning platform. From the access trestle, the berth face of the dock would extend approximately 530 feet downstream, and would consist of an approximately 100- by 54-foot transition platform, a 370- by 36-foot berth trestle, and a 104- by 112-foot turning platform.	Dock	Kalama	Port of Kalama	SWRTPO				2017-2019	$21,500,000 / $10,750,000	50%
14		7	Improvements to Tradewinds and East Wind Roads required to support the development of the Kalama Methanol Manufacturing and Exporting Facility	Local roads accessing the facility off Tradewinds Road at I-5 exit 32	46.047835 / -122.864165	Improvement to local roads to include: Road "A" will be a new, 680-foot long road that will provide access to Air Liquide, an existing Port tenant, and to the Port's wastewater treatment plant. The new road will also provide emergency response access to the methanol plant. Road "A" is needed because the existing access road will be taken out of service to accommodate the new methanol plant footprint. Road "B" will be a 3,100-foot long improvement to an existing gravel road that today is not capable of handling general road or bike traffic.	Road	Kalama	Port of Kalama	SWRTPO				2017-2019	$1,200,000 / $700,000	58%

Proj #	Port Priority	WSDOT No.	Project Name	Location Description	Latitude / Longitude	Brief Description	Improve Type	Port District	Project Owner	Submitting Authority	Ref.	PE Year	ROW Year	Const. Year	Project Cost / Funding Gap	% Gap
15		70	Oak Street Overpass Modification	Access / Egress to I-5 Exit 30 Overpass	46.018465 / -122.849933	Access / Egress to Overpass	Road	Kalama	Port of Kalama	SWRTPO		2019	2020	2021	$1,000,000 / $1,000,000	100%
16		10	Spencer Creek Business Park- Pre-loading Site	Spencer Creek Business Park - I-5 exit 32	46.043838 / -122.851913	Pre-loading required for building construction	Business Park Infrastructure	Kalama	Port of Kalama	SWRTPO				2016-2017	$1,400,000 / $1,400,000	100%
17		26	Spencer Creek Business Park - Installation of floating Light Industrial Dock, in support larger freight movement	Spencer Creek Business Park - I-5 exit 32	46.044144 / -122.848279	Installation of floating light industrial dock, in support larger freight movement	Business Park Infrastructure	Kalama	Port of Kalama	SWRTPO				2017-2021	$20,000,000 / $20,000,000	100%
18		46	Spencer Creek Business Park - Road and Utility Improvements to the Business Park	Spencer Creek Business Park - I-5 exit 32	46.04409 / -122.846211	Utilities and Roads	Road	Kalama	Port of Kalama	SWRTPO				2018-2019	$12,000,000 / $12,000,000	100%
19		18	Spencer Creek Business Park- Enhance Surface Streets	Access to light industrial businesses east of I-5 exit 32	46.043838 / -122.851913	Surface Street Enhancements	Road	Kalama	Port of Kalama	SWRTPO				2017	$5,000,000 / $5,000,000	100%
20		13	Property Purchases	Port of Kalama - Central Port	46.026112 / -122859868	Waterfront Industrial Property (Central Port)	Property Purchases	Kalama	Port of Kalama	SWRTPO				2017-2021	$3,000,000 / $3,000,000	100%
21		14	Deep Water Terminal Berth Dredging	Columbia River in Kalama	45.98508 / -122.836151	Dredge deep water berth to maintain access for grain terminal export	Dredging	Kalama	Port of Kalama	SWRTPO				2017-2021	$3,750,000 / $3,750,000	100%

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22		8	Dredge Spoils Disposal Sites	Lower Columbia River-Portland to Astoria	46.049147 / -122.873901	Property purchase	Dredging	Kalama	Port of Kalama	SWRTPO				2017-2021	$1,000,000 / $1,000,000	100%
23		21	Kalama River Industrial Park - Building Construction	Kalama River Industrial Park	46.034114 / -122.868274	Light Industrial building construction	Buildings	Kalama	Port of Kalama	SWRTPO				2017	$8,000,000 / $8,000,000	100%
24			Kalama Methanol Manufacturing and Exporting Facility (KMMEF) - Infrastructure Improvements	Tradewinds Road at I-5 exit 32		Construction of a Fire Loop to support fire suppression at the facility as well as adding security infrastructure. The project will also add a well and make storm water system enhancements. This is a phased project.	Terminal Infrastructure	Kalama	Port of Kalama	SWRTPO				2017-2019	$23,000,000 / $23,000,000	100%
25	1	59	Port of Longview Industrial Rail Corridor (IRC) Expansion Project	Expansion of existing industrial rail corridor into the Port. Rail is south/southwest of SR432. From approximately Lat 46.109996/ Long -122.904654 to Lat 46.110770/Long -122.935767	46.11077 / -122.935767	The Project consist of expansion of its existing industrial rail corridor by adding one to two additional through tracks into the Port with up to four sidings to accommodate current and future growth and market demand. The running tracks will be approximately 9,500-ft and the sidings up to 7,500-ft.	Rail	Longview	Port of Longview	CWCOG		2016	2017	2018	$35,000,000 / $30,000,000	86%
26	2	110	Barlow Point Terminal Development	Barlow Point Property located adjacent to SR 432 at approximately Lat 46.14983/Long -123.02504	46.14983 / -123.02504	Port terminal development on 285+ acres. Site is considered a "green field" development; no previous development has occurred. Project would include dock structures, utility backbone, roadways, storm water systems, etc. on the site to support 1 to 3 future private terminal developments.	New Terminal Facility	Longview	Port of Longview	CWCOG		2017		2021	$227,000,000 / $227,000,000	100%
27	3	61	Barlow Point Terminal Railway Entry Development	Rail development from the end of the BNSF line adjacent to SR432 at approximately: Lat 46.146479/Long -123.002307	46.146479 / -123.002307	New rail infrastructure development from the terminus of the BNSF Reynolds Lead into the Barlow Point property; to include two inbound and two outbound tracks. Project is to provide rail backbone to the property for future private terminal development.	Rail	Longview	Port of Longview	CWCOG		2016	2018	2019	$43,000,000 / $43,000,000	100%
28	4	38	Barlow Point Terminal Entry Road Development	On SR432 at approximately: Lat 46.148879/Long 123.011405	46.148879 / -123.011405	Develop Barlow Point terminal entrance off of SR432. Project is to provide safe entrance/exit for future private terminal development.	Road	Longview	Port of Longview	CWCOG		2016	2018	2019	$4,000,000 / $4,000,000	100%

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29		43	Industrial Way / Oregon Way Intersection Project	Project is located on State Route (SR) 432, a designated National Highway System (NHS) route.		Project is located at the intersection of Industrial Way (State Route (SR) 432) and SR 433, a critical connection of two Highways of Statewide Significance that support significant passenger and freight truck movement. Intersection is currently operating close to Level of Service (LOS) E and is projected to fail (LOS F) in 2040.	Road	Longview	Cowlitz County	CWCOG	2016-2019 RTIP/STIP	2016	2018	2020	$95,000,000 / $7,559,304	8%
30		40	SR 432 Corridor Improvements - Phase II	The project is located on SR 432 between MP 7.04, California Way and SR 432 Intersection, and MP 7.62, SR 432 off-ramp; and on SR 411 at MP 0.03, SR 432 on-ramp.	46.115836 / -122.931154	This project will relieve congestion, increase capacity, and improve safety on the SR 432 Corridor at two locations: SR 432 / SR 411 interchange off-ramp and on-ramp; and SR 432 / California Way intersection. This corridor is critical to the economic vitality of the region and the state, providing access to intermodal businesses and the Port of Longview. The SR 432/ SR 411 interchange improvements will increase capacity and safety by constructing a second left turn lane from the westbound SR 432 off-ramp to SR 411/3rd Avenue, and improve efficiency and increase safety for eastbound traffic by realigning the eastbound on-ramp to SR 432. Improvements to the SR 432 / California Way intersection will eliminate closely spaced, offset intersections by realigning California Way to create a single four-legged intersection at SR 432 / Industrial Way / California Way. Eliminating the offset will result in more efficient signal operation and turning movements, reducing travel time and congestion. Realignment of California Way will require right-of-way acquisition of 4 parcels and relocation of three existing businesses. Two existing railroad crossings will be widened to accommodate the new alignment.	Road	Longview	City of Longview	CWCOG: Longview-Kelso-Rainier MPO	http://industrialoregonway.org/wp-content/uploads/2015/08/SR_432_FINAL%20Concept%20Development%20Report_Combined.pdf	2017	2017	2020	$9,500,000 / $5,320,000	56%
31		53	Berth 4 Terminal Redevelopment Project (including rail infrastructure support)	Berth 4 at Port proper south/southwest of SR432 at approximately Lat 46.105980/Long -122.952933	46.10598 / -122.952933	Redevelopment of the Berth 4 facilities into a leased terminal. Project development will be in coordination with private development. Project may include storage, dock construction, and rail infrastructure improvements.	Terminal Modernization	Longview	Port of Longview	CWCOG		2018		2019	$20,000,000 / $20,000,000	100%
32		54	Bridgeview Terminal (Berth 1/2) Project	Berth1/2 at Port proper south/southwest of SR 432; immediately upstream of SR433 at approximately Lat 46.1071/Long -122.95624	46.1071 / -122.95624	Redevelopment of the Berth 1 and Berth 2 facilities into one leased terminal. Project development will be in coordination with private development. Project may include storage, dock construction, and rail infrastructure improvements.	Terminal Modernization	Longview	Port of Longview	CWCOG		2017		2018	$20,000,000 / $20,000,000	100%

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33		45	Port of Longview Multi-Cargo Modernization Project (Berth 6/7)	Berth 6/7 within the Port of Longview Proper (i.e South of SR 433 Bridge) Lat 46.0625/Long - 122.5726	46.10598 / - 122.5726	Project will rehabilitate and modernize 1500 lineal feet of Berth 6 & 7 bulk and breakbulk cargo facilities to optimize increased cargo handling omni-dock operations. The terminal improvements include installation of a dual wastewater and storm water collection system, strengthening decking and piling to withstand dual pick, breakbulk heavy loads, upgrading on-dock rail systems, and deepening the berths to take advantage of the recently deepened federal navigation channel.	Terminal Modernization	Longview	Port of Longview	CWCOG		2017		2018	$31,400,000 / $10,000,000	32%
34		65	Dredge Material Management Plan	The Columbia River deep draft federal navigation channel (FNC) is 43 feet deep and generally 600 feet wide, from the Mouth of Columbia River, River Mile (RM) 3 to Vancouver, WA, RM 105.5.		The scope of this project is to complete a management plan of sufficient detail to ensure unimpeded maintenance of the 43-foot Columbia River federal navigation channel for the next 20 years. Other federal and non-federal dredging within the related geographic area will be considered to the extent that placement from these sources affects placement capacity for the 43-foot channel. The Sponsor Ports in Washington on the Columbia River (Port of Longview, Port of Kalama, Port of Woodland, and Port of Vancouver) are responsible for aiding the USACE in this process, conducting a joint SEPA/NEPA evaluation, as well as securing dredge material placement sites (easements and property) within the 20-year Plan's timeframe.	Dredging	Longview, Kalama, Vancouver	USACE/Washington State Sponsor Ports; and Oregon Sponsor Port, Port of Portland.	CWCOG & SWRTPO			2019	2019	$50,000,000 / $50,000,000	100%
35	1	20	Blair Hylebos Rail Improvements	Port of Tacoma MIC, Blair Hylebos Peninsula	47.261478 / - 122.372383	Track improvements specific to future dry bulk export terminal requirements and connection to arrival/departure track infrastructure and direct mainline infrastructure.	Rail	NWSA	Northwest Seaport Alliance	PSRC	Letter of Support	2016	2017	2017	$7,000,000 / $3,000,000	43%
36	high		Gateway Project - SR 509/167	King & Pierce Counties		Construction of new four lane alignment on SR 167 between SR 509 in Tacoma and SR 161 in Puyallup. This project will also widen SR 509 between SR 516 and 28th/24th Ave. South and add toll lanes.	Road	NWSA	WSDOT	PSRC				2020	$1,463,000,000 / $130,000,000	9%
37	high	66	Terminal 5 Improvements	Terminal 5 is located in the Duwamish MIC, north of the West Seattle Bridge on the west side of the west Duwamish Waterway, and just east of Harbor Avenue in West Seattle.	47.577535 / - 122.36572	The completed project will upgrade the terminal's dock and power supply to accommodate larger cranes, additional refrigerated container storage and future shorepower, and increase the depth of the berth to accommodate larger ships. The grant requested portion of this project includes truck gate, ITS and intersection improvements in the S. Spokane St/East Marginal Way/Hanford corridor, container movement and power supply improvements to facilitate truck access and minimize traffic impacts.	Terminal Modernization	NWSA	Northwest Seaport Alliance	PSRC	Letter of Support	2017-18		2019	$275,000,000 / $100,000,000	36%

Proj #	Port Priority	WSDOT No.	Project Name	Location Description	Latitude / Longitude	Brief Description	Improve Type	Port District	Project Owner	Submitting Authority	Ref.	PE Year	ROW Year	Const. Year	Project Cost / Funding Gap	% Gap
38	high	58	Arrival/Departure Tracks	Port of Tacoma MIC	47.250659 / -122.370225	In order to increase cargo velocity through terminals, it is necessary to arrive and depart longer trains of 8,000' intact. This project would extend a number of SR-509 rail corridor tracks 1,300' east, construct a new rail bridge across Wapato Creek, and relocate utilities. This phase provides two track connections from existing support yard to future Bulk Export facility and connects the easterly end of the existing Pierce County Terminal Intermodal Yard to the SR-509 corridor arrival and departure tracks.	Rail	NWSA	Northwest Seaport Alliance	PSRC	Letter of Support	2018-2019			$45,000,000 / $30,000,000	67%
39		15	Terminal 5 Access Improvements	Terminal 5 is located in the Duwamish MIC, north of the West Seattle Bridge on the west side of the west Duwamish Waterway, and just east of Harbor Avenue in West Seattle.	47.572539 / -122.360767	The project includes truck gate, ITS and intersection improvements in the S. Spokane St/East Marginal Way/Hanford corridor to facilitate truck access and minimize traffic impacts.	Road	NWSA	Northwest Seaport Alliance	PSRC	Letter of Support, may include components of RCP 5350, 5348	2017	2017	2018	$5,000,000 / $4,000,000	80%
40		24	Duwamish Rail Corridor Project	Seattle, Duwamish MIC, existing rail lines on the south side of Spokane Street from Terminals 5 and 18 through the south end of Argo Yard	47.570799 / -122.34887	Create improved direct rail access from the Port marine terminals T-5 and T-18 to UP and BNSF mainlines	Rail	NWSA	Northwest Seaport Alliance	PSRC	Letter of Support	2019-2020			$16,000,000 / $16,000,000	100%
41	high	60	T-5 Rail Improvements	Terminal 5 is located in the Duwamish MIC, north of the West Seattle Bridge on the west side of the west Duwamish Waterway, and just east of Harbor Avenue in West Seattle.	47.575302 / -122.369349	Intermodal Yard and Rail Enhancements	Rail	NWSA	Northwest Seaport Alliance	PSRC	Letter of Support	2018-2019			$40,000,000 / $40,000,000	100%
42		17	Terminal 18 Truck Access Improvements	Terminal 18 is located in the Duwamish MIC, north of S. Spokane St on the east side of Harbor Island in Seattle	47.571808 / -122.347902	This project will reconfigure the southern edge of the NWSA's Terminal 18, and adjacent public right-of-way, to relocate the terminal truck entrance's security check and optical character recognition equipment. It will increase the capacity of the security check and eliminate truck queues on public streets.	Road	NWSA	Northwest Seaport Alliance	PSRC	Letter of Support	2017		2018	$5,000,000 / $5,000,000	100%

Proj #	Port Priority	WSDOT No.	Project Name	Location Description	Latitude / Longitude	Brief Description	Improve Type	Port District	Project Owner	Submitting Authority	Ref.	PE Year	ROW Year	Const. Year	Project Cost / Funding Gap	% Gap
43		12	Port Community Technology System	NWSA facilities, Seattle Duwamish MICs	47.593262 / -122.340519	Implement an electronic platform that allows for the secure exchange of information between the NWSA and private, as well as public, sector stakeholders to improve the efficiency of the NWSA-related supply chain. This will cover NWSA terminals, trucks, rail and waterways; and their interactions with each other.	ITS	NWSA	Northwest Seaport Alliance	PSRC	Letter of Support	2016	NA	2017-18	$10,000,000 / $3,000,000	30%
44		62	North Intermodal Yard Alignment	Port of Tacoma MIC, General Central Peninsula	47.266808 / -122.409118	Align North and South Intermodal Yards	Rail	NWSA	Northwest Seaport Alliance	PSRC	Letter of Support	2019-2020		2020	$50,000,000 / $45,000,000	90%
45	medium		Seattle Dredging	Seattle			Dredging	NWSA	NWSA	NWSA		2018-2021		2022	$72,000,000 / $72,000,000	100%
46			Tacoma Dredging	Tacoma			Dredging	NWSA	NWSA	NWSA		2023-2024		2025-2026	N/A / N/A	100%
47			Port of Olympia Master Plan	Olympia		The port of Olympia will undertake a Master Planning effort that seeks to identify facility and asset improvements designed to retain and increase marine terminal business opportunities in the future. Wharf strengthening, dock reconstruction and terminal optimization among other improvements will be reviewed and prioritized.	Study	Olympia	Port of Olympia	Port of Olympia		2018				
48			Maintenance Dredging - Turning Basin	Olympia		Work with the ACOE to perform maintenance dredging to achieve Congressionally-mandated 30 foot channel depth.	Dredging	Olympia	Port of Olympia	Port of Olympia						
49				Olympia			Rail	Olympia								
50	1	31	Big Pasco Intermodal Rail Reconstruction	Big Pasco Industrial Park, Pasco, WA Tracks 416, 420, 419, and 452	46.215356 / -119.062015	Reconstruct 12,300 LF of WWII Port-owned rail actively used for intermodal transloading	Rail	Pasco	Port of Pasco	Benton/Franklin MPO	Letter of Support	2017	Complete	2018	$1,700,000 / $1,300,000	76%
51	2		New Port Industrial Park	Big Pasco Industrial Park, Pasco, WA	46.210064 / -119.076622	Land purchase and infrastructure for new Potential food processing/ cold storage/ logistics park	Buildings	Pasco	Port of Pasco							
52	3		BNSF grade xing at SR 397 and A st	SR 397 South of "A" Street	46.132509 / -119.043607	Replace grade crossing with grade separation to improve safety and freight mobility into BNSF unit train yard and the Port of Pasco intermodal facility	Grade Separation	Pasco	Port of Pasco							
53			Terminal 1 Warehouse reconstructions	Port Angeles		Warehouse reconstruction/ modernization	Buildings	Port Angeles	Port of Port Angeles							

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54			Barge Facility	Port Angeles		Feasibility study will compare transportation costs of barging versus trucking or air. Project anticipates enhancement of existing sheet pile bulkhead to support a barge loading facility.	Feasibility study for New Terminal Facility	Port Angeles	Port of Port Angeles							
55			Terminal 3 Expansion	Port Angeles	48.125216 / -123.44065	Expansion of the Port's main cargo pier to allow larger vessels to call including oil tankers, cruise ships and log vessels.	Feasibility study for New Terminal Facility	Port Angeles	Port of Port Angeles							
56			Terminal 7 Redevelopment	Port Angeles	48.128438 / -123.45915	Redevelopment of aging timber pier to support vessel berthing and cargo handling.	Feasibility Study for Terminal Modernization	Port Angeles	Port of Port Angeles							
57			Marine Trades Industrial Park	Port Angeles		Upland development and surface transportation improvements to support ship building and repair at an 18 acre waterfront industrial property. This project will also include nearby property acquisition to provide new supply and support services to maximize water dependent uses.	New Terminal Facility	Port Angeles	Port of Port Angeles							
58			New Road Accessing T3 (Marine Dr to T3)	Port Angeles	48.123988 / -123.446411	Improved road access to Terminal 3	Road	Port Angeles	Port of Port Angeles							
59			Waterfront Stormwater Improvement Project	Port Angeles		Installation of new stormwater conveyance and treatment infrastructure to allow for continuation of industrial activity along the waterfront.	Terminal Infrastructure	Port Angeles	Port of Port Angeles							
60	1	91	Terminal 91 Uplands Access	TBD betw Dravus & Halladay Sts, east of Thorndyke, along 20th and/or 21st Aves W.	47.642041 / -122.382638	Rehabilitation of existing avenues to support industrial land uses in the T-91 Uplands	Road	Seattle	POS/City of Seattle	PSRC	Letter of Support	2020		2021	$10,000,000 / $10,000,000	100%
61	high	52	S Lander St Grade Separation	Duwamish Manufacturing Industrial Center, 1st Ave S - 4th Ave S	47.579828 / -122.332047	Construct a grade separation to replace an at-grade crossing over active BNSF railroad tracks	Grade Separation	Seattle	City of Seattle	PSRC	T2040 ID: #5254	2017	N/A	2018	$140,000,000 / $000	0%
62	medium	76	4th Ave S ITS Implementation	Duwamish Manufacturing Industrial Center, SR 519 / Edgar Martinez Dr S - S Lander St	47.589548 / -122.329063	Provide adaptive traffic signalization for optimized freight operations	ITS	Seattle	City of Seattle	PSRC	Letter of Support	2019	N/A	2020	$2,500,000 / $2,500,000	100%

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63	high	84	S Atlantic St / SR 519 / Edgar Martinez Dr S Corridor ITS Implementation	Alaskan Way to 4th Ave S	47.59241 / -122.333508	Provide adaptive signal control for optimized freight operations following Alaskan Way Viaduct Replacement project	ITS	Seattle	City of Seattle	PSRC	Letter of Support	2020	N/A	2020	$5,000,000 / $5,000,000	100%
64	high	32	S Hanford Railroad Crossing Rehabilitation	Duwamish Manufacturing Industrial Center, E Marginal Way - Colorado Ave S	47.573772 / -122.36657	Reinforce active rail crossings with concrete grade crossing systems	Rail	Seattle	City of Seattle	PSRC	Letter of Support	2019	N/A	2019	$2,000,000 / $1,800,000	90%
65	high	83	W Emerson St Freight Safety Improvements	Ballard Interbay Manufacturing Industrial Center, 15th Ave W - 19th Ave W	47.653951 / -122.378065	Redesign and construct interchange improvements to reduce modal conflicts	Road	Seattle	City of Seattle	PSRC	Letter of Support	2019	2021	2024	$4,800,000 / $4,800,000	100%
66	high	79	Ballard Bridge Seismic Improvements	Ballard Interbay Manufacturing Industrial Center, NW 50th St - W Emerson St / W Nickerson St	47.659377 / -122.376014	Ensure seismic resiliency for existing structure on regionally significant freight route facility	Road	Seattle	City of Seattle	PSRC	Letter of Support	2019	N/A	2020	$8,800,000 / $3,500,000	40%
67	high	90	E Marginal Way / S Hanford Street Intersection Improvements	E Marginal Way / S Hanford Street Intersection	47.575582 / -122.340025	Upgrade the signal, lengthen the northbound right-turn lane, improve the railroad crossing pavement, and evaluate the need for railroad crossing gates. The project also includes rebuilding the intersection and its approaches to Heavy Haul route requirements	Road	Seattle	City of Seattle	PSRC	Letter of Support	2017	N/A	2020	$8,600,000 / $8,600,000	100%
68	high	105	E Marginal Way Reconstruction and Safety Enhancements	Duwamish Manufacturing Industrial Center, S Atlantic St - Diagonal Way S	47.56232 / -122.339277	Reconstruct to heavy haul standards, add advanced traffic management systems, and incorporate separated bicycle and pedestrian facilities while maintaining freight efficiency	Road	Seattle	City of Seattle	PSRC	Letter of Support	2017	2018	2020	$60,000,000 / $55,000,000	92%
69	high	9	Nickerson St Reconstruction	Ballard Interbay Manufacturing Industrial Center, 15th Ave W - 13th Ave W	47.655159 / -122.374777	Replace damaged/failing concrete panels for maritime industry access route	Road	Seattle	City of Seattle	PSRC	Letter of Support	2017	N/A	2017	$12,500,000 / $1,400,000	11%
70	medium	29	6th Ave S / Industrial Way Intersection Reconstruction	Duwamish Manufacturing Industrial Center, 6th Ave S & S Industrial Way	47.566147 / -122.325575	Replace damaged/failing concrete panels and enhance intersection design	Road	Seattle	City of Seattle	PSRC	Letter of Support	2018	N/A	2018	$1,000,000 / $800,000	80%

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71	medium	71	Duwamish Local Freight Access Improvements	S Holden St / 5th Ave S / S Kenyon St / 8th Ave S	47.534132 / -122.328123	Reconstruct roadway with drainage, curb, sidewalks and landscaping. Coincides with Seattle Public Utilities drainage substation project	Road	Seattle	City of Seattle	PSRC	Letter of Support	2017	2018	2020	$1,300,000 / $1,300,000	100%
72	medium	27	Lower Spokane St Freight-Only Lanes Pilot	Chelan Ave - Airport Way S	47.571414 / -122.328033	Pilot project to design, implement, and evaluate freight-only lanes on the corridor	Road	Seattle	City of Seattle	PSRC	Letter of Support	2019	N/A	2019	$450,000 / $300,000	67%
73	medium	80	S Atlantic St Reconstruction	Duwamish Manufacturing Industrial Center, Alaskan Way S - 1st Ave S	47.590324 / -122.335671	Replace damaged/failing concrete panels	Road	Seattle	City of Seattle	PSRC	Letter of Support	2025	N/A	2025	$3,700,000 / $3,700,000	100%
74	high	30	SR 519 / Edgar Martinez Dr S Freight Operations Improvements	Duwamish Manufacturing Industrial Center, 1st Ave S - 4th Ave S	47.590401 / -122.334137	Reconstruct intersections for optimized freight operations	Road	Seattle	City of Seattle	PSRC	Letter of Support	2019	N/A	2019	$900,000 / $900,000	100%
75	medium	108	SODO Rail Corridor Grade Separation	BNSF RR Crossings in SODO	47.58498 / -122.337431	Improve access to manufacturing and industrial center and Port of Seattle facilities. May include non-motorized grade separation to increase safety and reduce modal conflicts	Grade Separation	Seattle	City of Seattle	PSRC	T2040 ID: 5252	2025	2027	2030	$145,000,000 / $145,000,000	100%
76	long term	103	1st Ave S Viaduct Replacement	Duwamish Manufacturing Industrial Center, Class I mainline and UP Argo Yard	47.564231 / -122.32944	Replace viaduct structure spanning Class I railroad and UP Argo Yard at the end of its useful life, increasing vertical clearance and optimizing yard operations	Road	Seattle	City of Seattle	PSRC	Letter of Support	2020	N/A	2030	$55,000,000 / $55,000,000	100%
77	long term	104	4th Ave S Viaduct Replacement	Duwamish Manufacturing Industrial Center, Class I mainline and UP Argo Yard	47.560835 / -122.32944	Replace viaduct structure spanning Class I railroad and UP Argo Yard at the end of its useful life, increasing vertical clearance and optimizing yard operations	Road	Seattle	City of Seattle	PSRC	Letter of Support	2020	N/A	2030	$55,000,000 / $55,000,000	100%
78	long term	113	Ballard Bridge Replacement	Ballard Interbay Manufacturing Industrial Center, NW 50th St - W Emerson St / W Nickerson St	47.658598 / -122.376146	Replace structure to increase capacity and improve access	Road	Seattle	City of Seattle	PSRC	Letter of Support	2020	2030	2035	$520,000,000 / $518,000,000	100%
79	long term	85	E Marginal Ave S / 8th Ave S / S Myrtle St Intersection Improvements	E Marginal Ave S / 8th Ave S / S Myrtle St Intersection	47.539425 / -122.322549	Improve intersection geometry, revise signalization, upgrade drainage, rehabilitate pavement at railroad tracks, and install streetscaping	Road	Seattle	City of Seattle	PSRC	Letter of Support	2019	N/A	2020	$5,600,000 / $5,100,000	91%

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80	long term	95	W Galer St Interchange Ramp	Ballard Interbay Manufacturing Industrial Center, Alaskan Way W - Magnolia Bridge	47.633218 / -122.378848	Construct additional ramp to improve access over BNSF mainline tracks and storage yard	Road	Seattle	City of Seattle	PSRC	Letter of Support	2025	2027	2030	$23,000,000 / $23,000,000	100%
61	high	52	S Lander St Grade Separation	Duwamish Manufacturing Industrial Center, 1st Ave S - 4th Ave S	47.579828 / -122.332047	Construct a grade separation to replace an at-grade crossing over active BNSF railroad tracks	Grade Separation	Seattle	City of Seattle	PSRC	T2040 ID: #5254	2017	N/A	2018	$140,000,000 / $000	0%
62	medium	76	4th Ave S ITS Implementation	Duwamish Manufacturing Industrial Center, SR 519 / Edgar Martinez Dr S - S Lander St	47.589548 / -122.329063	Provide adaptive traffic signalization for optimized freight operations	ITS	Seattle	City of Seattle	PSRC	Letter of Support	2019	N/A	2020	$2,500,000 / $2,500,000	100%
63	high	84	S Atlantic St / SR 519 / Edgar Martinez Dr S Corridor ITS Implementation	Alaskan Way to 4th Ave S	47.59241 / -122.333508	Provide adaptive signal control for optimized freight operations following Alaskan Way Viaduct Replacement project	ITS	Seattle	City of Seattle	PSRC	Letter of Support	2020	N/A	2020	$5,000,000 / $5,000,000	100%
64	high	32	S Hanford Railroad Crossing Rehabilitation	Duwamish Manufacturing Industrial Center, E Marginal Way - Colorado Ave S	47.573772 / -122.36657	Reinforce active rail crossings with concrete grade crossing systems	Rail	Seattle	City of Seattle	PSRC	Letter of Support	2019	N/A	2019	$2,000,000 / $1,800,000	90%
65	high	83	W Emerson St Freight Safety Improvements	Ballard Interbay Manufacturing Industrial Center, 15th Ave W - 19th Ave W	47.653951 / -122.378065	Redesign and construct interchange improvements to reduce modal conflicts	Road	Seattle	City of Seattle	PSRC	Letter of Support	2019	2021	2024	$4,800,000 / $4,800,000	100%
81		37	Tideflats Area ITS backbone	Generally corresponding to the Regionally-designated Port of Tacoma Manufacturing and Industrial Center.	47.251308 / -122.425811	ITS improvements consistent with near-term ITS improvements identified in the 2016 Tacoma Tideflats Emergency Response Plan	ITS	Tacoma	City of Tacoma	City of Tacoma	Exempt	2017	2018	2019	$3,700,000 / $3,700,000	100%
82	medium	75	8th St E/54th Ave E Intersection Improvements	8th St E/54th Ave E Intersection	47.249967 / -122.356776	Add westbound left turn lane and reconstruct eastbound approach to a 3-lane roadway.	Road	Tacoma	City of Fife	PSRC	PSRC Project 4639	2017	2018	2020	$2,880,000 / $2,000,000	69%

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83	high	63	I-5 and 54th Ave E Interchange Improvement Project	I-5/54th Ave E I-5 Interchange and nearby streets	47.240773 / -122.357048	Rebuild I-5 Interchange and nearby intersections.	Road	Tacoma	City of Fife	PSRC	PSRC Project 4639	2017	2018	2020	$53,000,000 / $50,000,000	94%
84	medium	11	Pacific Highway E/54th Ave E Intersection Improvements	Pacific Highway E/54th Ave E intersection	47.243097 / -122.356966	Construct a 2nd westbound left-lane turn lane, new signal poles, illumination and other intersection improvements.	Road	Tacoma	City of Fife	PSRC	PSRC Project 4639	2015	2015	2017	$2,800,000 / $2,000,000	71%
85	high	89	Portland Avenue	Portland Avenue from I-5 to Lincoln	47.244413 / -122.412105	Upgrade Pavement, rehabilitate bridge deck, install signal at SR-509 ramp terminal	Road	Tacoma	City of Tacoma	City of Tacoma	Exempt	2018	2019	2020	$8,200,000 / $8,100,000	99%
86	high	55	POT Road Interchange Modification - Phase III	Northbound ramps at I-5/POT Road Interchange and new 34th Avenue E bridge	47.241122 / -122.385694	New 34th Avenue E bridge over I-5, reconstruct northbound I-5 exit and entrance ramp connectors with POT Road, 20th St E improvements, and two new signal installations (Phase 3).	Road	Tacoma	City of Fife	PSRC	PSRC Project 4639	2009	2014	2019	$27,500,000 / $21,000,000	76%
87	high	109	Puyallup Bridge Rehabilitation (F16C, F16D, F16E)	Puyallup Avenue/Ells Street, beginning in vicinity of Portland Avenue/bridge segment F16C, to vicinity of Milwaukee Way/bridge segment F16E	47.240997 / -122.400308	Bridge Replacement. Note the Puyallup River Bridge is made of 6 segments. This project includes segments F16C, D, E and F16.	Road	Tacoma	City of Tacoma	City of Tacoma	State Freight Mobility Plan Reference Project 230	2019	2020	2021	$150,000,000 / $150,000,000	100%
88	high	47	Taylor Way Rehabilitation	Taylor Way from the Fife/Tacoma City border to E. 11th St./Alexander Ave.	47.266156 / -122.375527	Reconstruct roadway to heavy haul standards, remove/upgrade rail crossings, widen SR509/Taylor Way intersection, install fiber/ITS/ signal improvements, new sidewalks, lighting/curb ramps, channelization	Road	Tacoma	City of Tacoma	City of Tacoma	Exempt	2017	2018	2019	$21,385,540 / $13,473,740	63%
89	high	3	Tideflats Area Transportation Study Update	Generally corresponding to the Regionally-designated Port of Tacoma Manufacturing and Industrial Center.	47.255174 / -122.426859	Building on prior planning studies such as the Tideflats Area Transportation Study and the Tideflats Area ITS Architecture Plan, develop a prioritized list of capital investments.	Road / Rail Study	Tacoma	City of Tacoma	City of Tacoma	Exempt			2017	$400,000 / $400,000	100%
90			Puyallup River Rail Bridge	BNSF Crossing of Puyallup River	47.2442 / -122.4067											
91			54th /Fife - Allow UP to expand yard	Fife, WA			Grade Separation	Tacoma	City of Fife							

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92			Terminal 5 – On-Terminal Grade separation	Vancouver	45.647921 / -122.726243	Grade separation over rail to provide unimpeded truck access to the terminal over the rail	Grade Separation	Vancouver	Port of Vancouver, USA							
93			NW 32nd Avenue Industrial Corridor	Vancouver		Port access is improved through the creation of a north-south arterial extension, replacement for the Fruit Valley Road/BNSF railroad bridge and capacity improvements at Fruit Valley Road and 78th Street.	Road	Vancouver	Port of Vancouver, USA							
94			Terminal 5 West	Vancouver	45.650504 / -122.7295	– The port is seeking to develop its Terminal 5 west site for a future tenant. Development includes filling T-5 west to bring it above the floodplain so that it is useable as a marine industrial site	New Terminal Facility	Vancouver	Port of Vancouver, USA							
95			SR-501 Widening	Vancouver		Widening of SR-501 from two to four lanes from where Mill Plain and 4th Plain meet west to the flushing channel are important to the port. As freight volumes at the Port of Vancouver increase, and in order to speed development of Columbia Gateway, widening this critical freight route in necessary to support both the growth of freight traffic as well as providing critical safety improvements in the corridor.	Road	Vancouver	WSDOT							
96			Port of Vancouver USA North Wye Connection	Vancouver	45.650726 / -122.729898		Rail	Vancouver	Port of Vancouver, USA							
97	high		I-5 Columbia River Bridge	Vancouver/Portland, OR		The I5 Columbia River Bridge project is a bridge reconstruction project that would link the states of Washington and Oregon. The project proposes to replace the existing two highway spans on Interstate 5 (I-5) across the Columbia River with two new spans, along with new interchanges on both the Oregon and Washington sides of the river. The project focuses on a five mile segment of the I-5 corridor, beginning at State Route 500 in northern Vancouver and extending to just north of Columbia Boulevard in north Portland. The project's stated intent is to improve safety, reduce traffic congestion, increase mobility of motorists, freight traffic, and to mitigate seismic risks.	Road	Vancouver	WSDOT/ODOT						$3,300,000,000 / $000	

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98	1		US 12/ Wallula to Frenchtown - Build new highway	US 12, MP 304.17 - 328.16	46.064442 / -118.276654	Build new highway. This project will construct the next section of a four-lane, limited access divided highway on US 12 from Nine Mile Hill to Frenchtown vicinity to reduce the risk of collisions and improve economic vitality.	Road	Walla Walla	WSDOT		Walla Walla Valley Sub-Regional Transportation Planning Organization			2019	$384,807,000 / $216,000,000	56%
99			Washington State Freight Optimization Strategy	N/A		By employing dynamic modeling tools and by leveraging both private and public sector supply chain data sets Washington State will develop a Statewide Freight Transportation Network Optimization Strategy that will ensure infrastructure investments are meeting performance objectives such as increased economic vitality and reduced transportation costs.	Study	WPPA - Statewide	Multi-Jurisdictional	WPPA					$750,000 / $750,000	100%