



WSDOT
Washington
State Freight
System Plan



2022

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A Freight Plan for Washington



A freight plan for Washington

Washington’s communities and businesses rely on a robust and interconnected freight transportation system to sustain life and commerce. The freight system is made up of thousands of miles of roads, railroads, waterways, and pipelines linking maritime ports, airports, and terminals statewide.

Because the freight transportation system performs a critical service of connecting every household and business to local and global markets, it is important to understand how it performs. This information is needed to help WSDOT continuously identify opportunities to improve the system and proactively plan for future challenges. The 2022 Washington State Freight System Plan (FSP) defines Washington’s freight transportation trends, issues, and needs to inform freight policy and guide investment decisions.

WSDOT is a significant freight transportation stakeholder: it operates and maintains 7,000 miles of roads, a ferry system, and a short line railroad system. WSDOT’s leadership in developing the FSP is critical for the future of freight in Washington. The FSP sets the vision for the future of the system and supports collaboration with public and private partners who also operate within Washington’s freight transportation system. These freight transportation partners include (but are not limited to) the federal government, cities and counties, port authorities, railroads, and pipeline companies.

A plan to support and improve the freight system in Washington

The 2022 Washington State FSP builds upon the 2017 Washington State FSP and provides new and up-to-date information needed by WSDOT and other statewide stakeholders to inform freight transportation policy and investment decisions over the next four years. This information includes insight into:

- How the freight transportation system serves Washington’s economy and communities.
- The impact of the freight system on community health and the environment.
- The transportation assets that make up the freight system.
- The performance of these freight transportation assets.
- Potential solutions and improvements to address freight transportation needs and issues.

WSDOT will use this 2022 Freight System Plan to assist in future transportation policy and program decisions.



Supporting resources: going beyond this plan

As you read the plan, look for boxes like this to find links to supporting materials or interactive features that provide more information from the development of the 2022 FSP.

- The [WSDOT Freight System Plan website](#) provides links to all materials referenced in the plan.
- An [online interactive StoryMap](#) shows how Washington supply chains work.
- An online interactive Freight Dashboard allows users to query and extract existing and forecasted freight commodity flow for Washington state at county and MPO/RTPO level.
- Callouts to plan appendices provide greater detail on topics discussed throughout the plan.

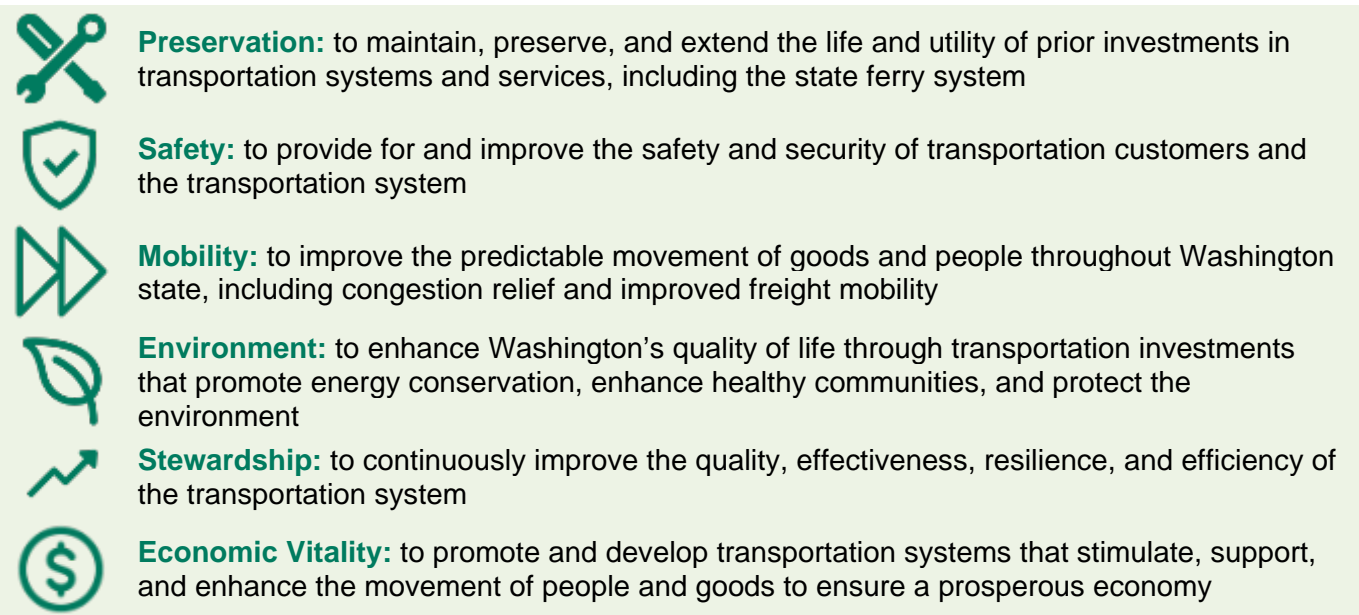
Connection with state and national policies and goals







Washington policies and goals

The *Washington Transportation Plan 2040 and Beyond* (WTP) establishes a broad vision for Washington’s transportation system:

Washington’s transportation system safely connects people and communities – fostering commerce and economic activity for all, operating seamlessly across boundaries, and providing travel options to achieve an environmentally and financially sound system.

In addition, the WTP lists six transportation policy goals established by the Washington state Legislature (listed below). Together, the vision and policy goals provide a unifying direction for WSDOT’s statewide portfolio of plans — including the FSP. WSDOT applied the six policy goals below as “lenses” to evaluate freight transportation needs and issues and to identify potential solutions for inclusion in this FSP.



-  **Preservation:** to maintain, preserve, and extend the life and utility of prior investments in transportation systems and services, including the state ferry system
-  **Safety:** to provide for and improve the safety and security of transportation customers and the transportation system
-  **Mobility:** to improve the predictable movement of goods and people throughout Washington state, including congestion relief and improved freight mobility
-  **Environment:** to enhance Washington’s quality of life through transportation investments that promote energy conservation, enhance healthy communities, and protect the environment
-  **Stewardship:** to continuously improve the quality, effectiveness, resilience, and efficiency of the transportation system
-  **Economic Vitality:** to promote and develop transportation systems that stimulate, support, and enhance the movement of people and goods to ensure a prosperous economy

In addition to supporting WTP goals and policies, the FSP also meets two key requirements for freight planning established in Washington law:

- 1. State Freight Plan Requirements** – Washington law requires that “*the state-interest component of the statewide multimodal transportation plan shall include a freight mobility plan which shall assess the transportation needs to ensure the safe, reliable, and efficient movement of goods within and through the state to ensure the state’s economic vitality.*” This FSP fulfills these requirements through its inventory of freight assets, identification of freight needs and issues, and development of potential strategies for improvements.
- 2. Marine Ports and Navigation Plan** – Washington law also requires that the state’s multimodal transportation plan shall include “*a state marine ports and navigation plan, which shall assess the transportation needs of Washington’s marine ports, including navigation, and identify transportation system improvements needed to support the international trade and economic development role of Washington’s marine ports.*” WSDOT completed a Marine Ports and Navigation Plan in 2017, and

the FSP complements this work by providing a port facility inventory, an assessment of current maritime needs and issues, and a set of potential strategies specific to maritime improvements.

The FSP is not WSDOT's only freight-relevant transportation plan. Because freight moves on multiple modes of transportation, freight considerations affect transportation safety, infrastructure condition, and mobility. In addition to alignment with the WTP, the FSP incorporates and aligns with findings and recommendations from other state transportation plans, such as the *Highway System Plan*, the *Safety Rest Area Strategic Plan*, the *Aviation System Plan*, and the *State Rail System Plan*. Another notable policy supported by the FSP is WSDOT's complete streets requirement, which requires projects over \$500,000 to undergo analysis of needs for all users. This requirement provides a renewed focus for identifying locations of potential conflicts between freight and other modes and the need for careful consideration of truck loading areas, deliveries, location of facilities, and congestion.¹

The FSP also aligns with broader guidance and requirements for statewide agencies. In particular, the FSP was developed in line with the *2021 Healthy Environment for All (HEAL) Act*,² which created a coordinated statewide approach to address potential disproportionate impacts on vulnerable and overburdened populations resulting from state agency actions.

Efforts to incorporate HEAL Act guidance in the FSP included consultations and outreach with groups representing vulnerable and overburdened populations, evaluation of the environmental impacts of freight on these populations, incorporation of environmental justice considerations in the project selection and prioritization processes, and the creation of potential strategies for engagement on environmental justice topics in the future.

The FSP also supports implementation of the Washington Department of Commerce's 2021 *State Energy Strategy*. The strategy recognizes that the transportation sector contributes the largest portion of carbon emissions, and that land use and road design affect freight costs. The strategy calls for improving the efficiency of the freight system by reducing bottlenecks, improving first and last mile connections, and where feasible, reducing freight miles of travel.

National policies, goals, and plan requirements

In addition to state-level requirements, the FSP also fulfills federal freight planning requirements. WSDOT must fulfill these federal requirements to access National Highway Freight Program (NHFP) funds for state and local freight projects. There are 20 specific federal requirements this plan fulfills:



An identification of **significant freight trends, needs, and issues** in Washington. The plan includes a summary of significant trends, needs, and issues on pages 48 through 65. Appendix F has a more-detailed inventory of trends, needs, and issues explored during the planning process and organized around the WTP transportation policy goal areas.



A description of the **freight policies, strategies, and performance measures** that will guide Washington's freight-related transportation investments. Pages 72 through 77 of this plan summarize how WSDOT currently guides its freight-related transportation investments and additional possible strategies for future implementation. Appendix E provides details on freight transportation performance measures and a performance evaluation. Appendix F provides further detail on potential strategies, and Appendix G contains Washington's Freight Investment Plan.



A listing of **critical, multimodal rural and urban freight corridors and facilities**. Pages 68 and 69 summarize the location of critical freight corridors in Washington. Appendix G provides further details about each of these corridors and the process that was used to designate the corridors. Appendix D provides a description of the interim National Multimodal Freight Network and WSDOT-proposed designation of additional multimodal freight facilities.

¹ Further information about the requirement is available in the Revised Code of Washington (Chapter 47.24).

² Further information about the HEAL Act is available from the Washington Legislature: <https://lawfilesexternal.wa.gov/biennium/2021-22/Pdf/Bills/Session%20Laws/Senate/5141-S2.SL.pdf?q=20220920105653>



A description of how the plan will improve Washington’s ability to **meet the *National Multimodal Freight Policy Goals and National Highway Freight Program Goals***. Appendix A provides a detailed description of the ways this plan improves WSDOT’s ability to meet national freight goals.



Consideration of **innovative technologies and operational strategies** that improve the safety and efficiency of freight movement. Pages 64 and 65 of this plan summarize the innovative technologies that were identified as most-relevant for Washington’s freight future. These technologies are explored in greater detail in Appendix F.



A description of improvements to **reduce or impede the deterioration of roads** expected to substantially deteriorate from heavy vehicle travel. Page 73 summarizes WSDOT’s approach to incorporating considerations of heavy truck traffic in pavement preservation decisions. Appendix E describes asset maintenance performance measure and how OS/OW vehicles deteriorate the condition of roadways, while Appendix F provides asset maintenance needs and issues and the investments that may be required to address deterioration. Appendix G also illustrates how roadway condition preservation considerations were incorporated into NHFP project scoring criteria.



An **inventory of facilities with freight mobility issues** in Washington and a description of the **strategies that Washington is employing to address mobility issues** on infrastructure owned or operated by WSDOT. The modal profiles on pages 24 through 43 summarize mobility issues with each mode, with a focus on truck-related bottlenecks on pages 26 and 27. Pages 73 through 77 highlight existing and potential strategies to address mobility issues. Greater detail on mobility issues and bottlenecks is available in Appendix E, and Appendix F has greater detail on potential strategies to address freight mobility issues.



Consideration of **significant congestion or delay caused by freight movement** and strategies to mitigate that congestion or delay. Page 55 summarizes Washington’s notable congestion and delay issues caused by freight movements, while page 73 summarizes WSDOT’s current work to mitigate freight-related congestion or delay. Appendix F provides further detail on congestion and delay caused by freight movements and projects being implemented to address these issues.



A **freight investment plan** that includes priority projects and descriptions of funding matches. Pages 68 and 69 of this plan provide a summary of NHFP funding allocated and matched by year, and Appendix G contains a detailed Freight Investment Plan, including a fiscally constrained list of priority freight projects for NHFP funding allocation.



A commercial motor vehicle **parking facility assessment**. Pages 28 through 31 of this plan summarize Washington’s truck parking issues and the locations where undesignated parking is most common. Further detail on the truck parking assessment is available in Appendix G.



A summary of the **most recent supply chain cargo flows** in Washington. Pages 22, and 48 through 52 provide state-level overviews of most-recent and forecasted supply chain cargo flows in Washington. Further detail on commodity flows is available in Appendix F.



An **inventory of commercial ports** in Washington. Pages 36 through 39 of the plan provide an overview of Washington’s maritime system, and Appendix D has a detailed inventory of commercial ports and maritime terminals.



Consideration of findings and **recommendations from WSDOT-member, multistate freight organizations**. WSDOT is not a member of a multistate freight organization as defined under section 70204 of federal law. However, Washington’s multistate collaboration efforts on freight-related topics are summarized on page 72.



The **impacts of e-commerce** on freight infrastructure in Washington. Pages 55 through 57 summarize the impacts of e-commerce on Washington’s freight system and emerging technologies related to e-commerce. Appendix F provides additional information on these.



Considerations of **military freight**. Page 23 has a summary of Washington’s strategic highway and railroad corridors, and Appendix D has additional detail on the location and routing of these corridors and Washington’s significant military installations.



Strategies and goals to decrease the severity of impacts of weather and natural disasters. Pages 57 through 59 describe the freight system impacts of weather and natural disasters, and pages 73 - 75 list ongoing work and potential strategies for future work on this topic. More-detailed information is available in Appendix F’s “Environment” and “Mobility” chapters.



Strategies and goals to decrease the impacts of freight movement on local air pollution, flooding and stormwater, and wildlife habitat. Pages 60 and 61 summarize freight impacts on flooding and wildlife habitat loss, while pages 61 through 63 summarize freight impacts on local air

pollution. Pages 73 through 75 summarize WSDOT and other Washington state government engagement on these topics. Appendix F has additional details on these topics.



A requirement that the state, in carrying out the activities under the state freight plan: **(1) enhance the reliability and redundancy of freight transportation or (2) incorporate the ability to rapidly restore access and reliability with respect to freight transportation.** Pages 57 through 59 describe some of the major threats to system resiliency. Pages 74 and 75 describe WSDOT's ongoing efforts to enhance reliability and redundancy. Appendix E provides further detail on mobility performance, while Appendix F has additional information on trends, needs, and issues that impact resiliency and reliability.



Relationship to long range plan, and fiscal constraint. The Washington State Freight System Plan is separate from the Washington Transportation Plan. However, the FSP supports WTP's six policy goal areas, and the WTP's goal areas were used as the framework for examining freight needs and issues and organizing potential strategies. Fiscal constraint is demonstrated in Appendix G's list of National Highway Freight Program projects.



Planning period. A state freight plan shall address an 8-year forecast period. This plan utilizes Freight Analysis Framework data with a forecast horizon of 2050, and trends, needs, issues, and potential strategies have been considered for both short-term and long-term perspectives exceeding an eight-year window.

In addition to meeting these requirements, this plan also illustrates how WSDOT will meet federal requirements to enhance the reliability or redundancy of freight transportation. The FSP also aligns with broader federal guidance on freight planning from the U.S. Department of Transportation's (USDOT) *National Multimodal Freight Policy Goals* and *National Highway Freight Program Goals*. Further information about these goals and how the 2022 FSP aligns is available in the Appendices.



Supporting resources: compliance with federal requirements

[Appendix A – Federal Conformance](#) summarizes how the FSP specifically addresses national policies and goals and how it fulfills federal freight plan requirements. This appendix also provides an overview of the FSP's alignment with the USDOT's *National Multimodal Freight Policy Goals* and *National Highway Freight Program Goals*.

[Appendix G – Freight Investment Plan](#) provides further information on how WSDOT is investing and matching the FY 2021-2025 NHFP funds made available to Washington.

A data-driven, collaboratively developed plan

A guiding principle for plan outreach was *equity*, ensuring that all Washingtonians – residents, businesses, public and private freight stakeholders, community-based organizations, and others – had an opportunity to provide feedback on plan development. Providing multiple ways to engage, ease of access to provide feedback, and high participation across diverse communities were key priorities for WSDOT.

Multiple types of evaluations and engagement were conducted to collect feedback on a range of freight-relevant topics, including the impacts that freight movement and pollution have on communities.



Prior and ongoing plans and studies: The vision and goals of previous WSDOT and federal plans as well as information from federal, state, and local transportation plans guided the FSP development.



Analysis of transportation data: Data collected by WSDOT, the Federal Highway Administration, and other state and federal agencies were used to evaluate infrastructure conditions, freight mobility, freight safety, and other factors. Examples of data sources include historic truck-involved crash data, travel time data, and bridge condition data.

These public data were supplemented by third-party-purchased data, including information on business development patterns and vehicle travel times.



Stakeholder consultations: Consultations were conducted with a variety of stakeholders. Internal consultations were conducted with various WSDOT offices to identify freight-relevant topics and materials. A broader series of external consultations were conducted with government agencies (such as port authorities and the Washington Department of Ecology, among others), major industry groups, and community groups representing diverse interests and communities across the state to identify freight-related needs and issues.



Online survey: WSDOT distributed an online survey in May 2022 to collect feedback from the general public and identify potential freight topics of relevance to the public for the draft plan. The survey received over 400 responses.



Informational webinars and listening sessions: Through a series of informational webinars, each with specific government and stakeholder groups (Tribes, ports, truck drivers, environmental justice organizations, other groups, and the general public), WSDOT facilitated open-ended discussions about freight issues of importance to stakeholders. The webinars also educated stakeholders about the freight planning process and provided opportunities for stakeholders to ask questions and provide feedback to WSDOT.



Supporting resources: stakeholder outreach summary

Stakeholder engagement and feedback were critical inputs for the development of the FSP. [Appendix B – Outreach Summary](#) provides detailed information on the types of stakeholder outreach that WSDOT conducted for the FSP, including the types of groups WSDOT met with, major themes from outreach, and how outreach informed plan development.



**A System
that Sustains
Communities
and
Commerce**



A system that sustains communities and commerce

The movement of goods and cargo – such as consumer merchandise, agricultural crops, and manufactured products – is a foundational activity that enables nearly all forms of commerce. Trade and modern lifestyles would not be possible without efficient and affordable freight transportation options.

The freight transportation system is important because it moves almost everything that is bought, sold, and used in Washington.

The freight system is truly all-encompassing, carrying a wide range of goods including:



Everything grown and harvested in Washington, such as grain, apples, grapes, fish, dairy products, livestock, and timber



Everything made in Washington, such as lumber, gasoline, aircraft, ships, food products, beer, and chemical products



Everything bought, sold, and delivered in Washington, such as groceries, clothing, cars, medicine, toys, hardware, appliances, and office supplies

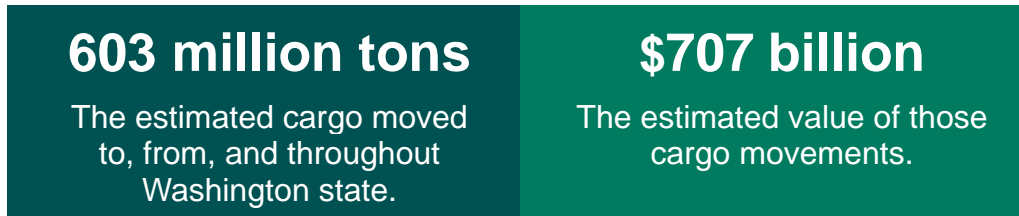
The state freight system is critical to several iconic Washington industries and products. These would struggle without a reliable, interconnected, and sophisticated freight transportation system supporting state economic supply chains. The freight system not only delivers goods such as those depicted below, but also the components and supplies necessary to grow and produce these goods.

Washington's freight system also plays the role of connector, facilitating the movement of goods, particularly in international trade lanes. Both ocean import and export cargoes cross Washington docks on their way between, for example, the Midwest and Asia. These goods also use the state's road and rail connections to connect to and from global markets. Shippers up and down the West Coast use border crossings with Canada to move goods between the U.S. and one of its key trading partners.



The importance of Washington's freight transportation system is illustrated by the incredible volume and value of goods it handles: 603 million tons of cargo worth \$707 billion in 2022.

Figure 1: Washington freight system’s tonnage handled and value, 2022

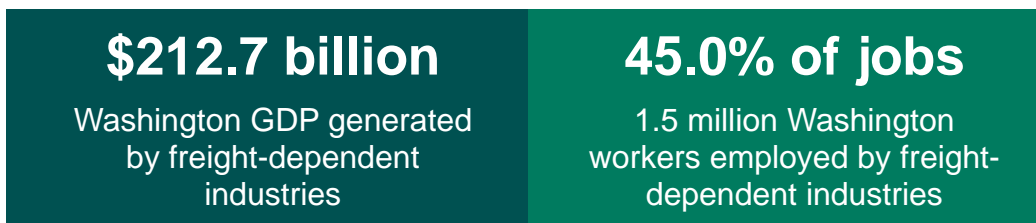


Source: CPCS analysis of FAF5.3 data, 2022.

This freight movement is made possible by Washington’s expansive multimodal transportation system of roads, railroads, ports and waterways, intermodal facilities, airports and air routes, pipelines, and logistics facilities. This transportation system plays a key role in supporting the state’s residents, communities, and companies by facilitating the physical movement of goods to, from, and throughout the state.

For example, businesses that rely on freight transportation to support their core operations (such as manufacturers, agricultural producers, wholesalers, and retail businesses) employ 45 percent of Washington’s workforce and generate \$212.7 billion of the state’s Gross Domestic Product (GDP), 35 percent of Washington’s total GDP.

Figure 2: Washington freight-dependent industries’ share of the state’s economy, 2019



Source: CPCS analysis of U.S. Bureau of Economic Analysis and U.S. Bureau of Labor Statistics data, 2022.

The freight transportation system is not something the average person thinks about on a regular basis. However, when things go wrong, it becomes readily apparent how freight movement, efficiency and safety are paramount to Washington’s quality of life and economic competitiveness.

This was made clear during the supply chain disruptions caused by the COVID-19 pandemic, which put the importance of the freight transportation system on full display. As shipping delays impacted companies across the state, nation, and world, the resulting impacts trickled down directly to average consumers who began to experience product shortages and rising costs on basic household staples.

However, a positive outcome resulted from the pandemic-induced supply challenges. Due to these disruptions, both government and private businesses are paying greater attention to the resiliency of the freight transportation system and looking for policies and investments that can help protect the freight system from major disruptions in the future.

Spotlight on Washington’s supply chains

While much of the freight transportation system’s infrastructure is owned and maintained by public agencies, such as WSDOT, cities, counties, or port authorities, private companies own components of freight infrastructure as well, such as warehouses, trucks, airplanes, and shipping fleets as well as most railroad lines and maritime shipping terminals. This means that the quantity of goods moved, the routing of those goods, and other logistical activities are primarily driven by the choices of private companies.

At the helm of most freight movement decisions are companies who arrange freight shipments to ensure goods move smoothly from start to finish. These firms may choose to use different modes of

transportation based on variables such as shipping costs and travel speeds. However, freight transportation demand is also determined by individuals and businesses that are directly consuming, producing, storing, transferring, selling, or carrying the goods. Together, the set of stakeholders, decisions, and operations that move freight from suppliers to consumers is referred to as the **supply chain**. Washington benefits from a robust and interconnected multimodal transportation system that supports numerous thriving supply chains.

Supply chains can be highly complex, with many decision-makers influencing how, where, and when freight travels through the system. These supply chains range from extraordinarily complex, such as global aerospace manufacturing (with many inputs and outputs), to relatively straightforward, like apple production (with relatively few inputs and outputs). However, regardless of complexity, each supply chain requires sophisticated freight movement operations and relies on the state's freight transportation system to support these operations.

To better understand the economic importance of the freight system, a series of supply chains were examined for major industries in Washington. The following section profiles three of Washington's freight-dependent industries known as the "three Ws" - wheat, wine, and wholesale/warehousing. The three Ws are only a few examples of the many activities that go on through the state's diverse and dynamic economy. The three Ws illustrate the dependency of major industries on the freight transportation system and highlight the types of stakeholders who influence freight transportation decisions. This supply chain examination provides useful context for understanding WSDOT's role in freight transportation and context for the following chapters of this plan.



Supporting resources

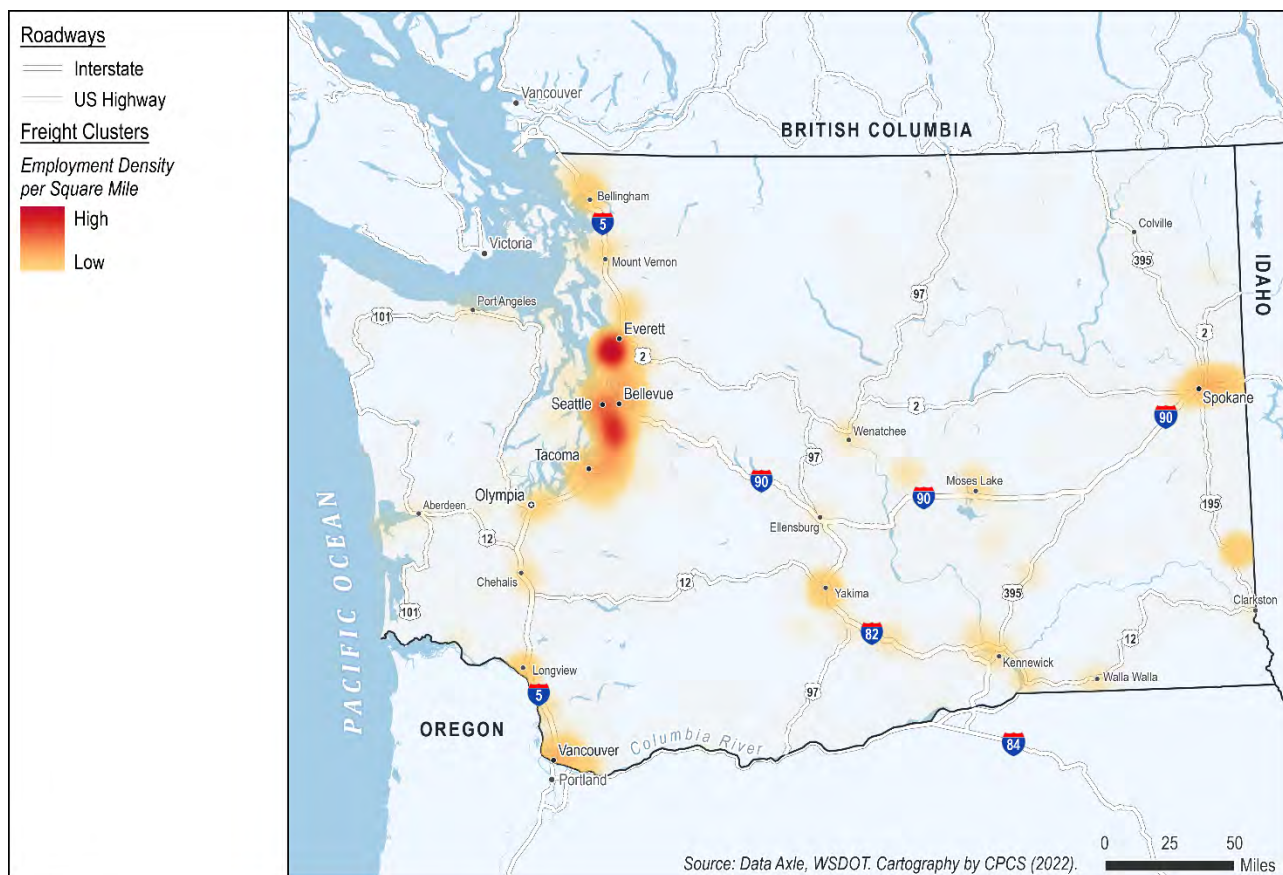
[Appendix C – Supply Chains](#) provides further information on the supply chains of different industries that serve Washington's freight system, including forestry, energy, and other manufacturing industries. Additional supply chain visualizations are also available through the [Freight System Plan interactive StoryMap](#).

Freight clusters

In order to understand supply chains, and the later discussions of Washington transportation assets, needs, and issues, it is helpful to understand where freight-related economic activity is most concentrated in Washington. One way to understand the state's freight system is by looking at freight clusters – areas of particularly dense freight-related business activity. Figure 3 illustrates Washington's major freight clusters based on the employment density of freight-related businesses, such as manufacturing, warehousing, retail, and agriculture, and illustrates the key geographic activity centers the multimodal freight system supports.

Major freight clusters are primarily located along the Interstate 5 (I-5) corridor with hotspots in the Puget Sound region from Tacoma to Everett. Other hotspots include Bellingham, Spokane, Moses Lake, Yakima, Kennewick, and the Portland-Vancouver metropolitan area.

Figure 3: Washington freight clusters

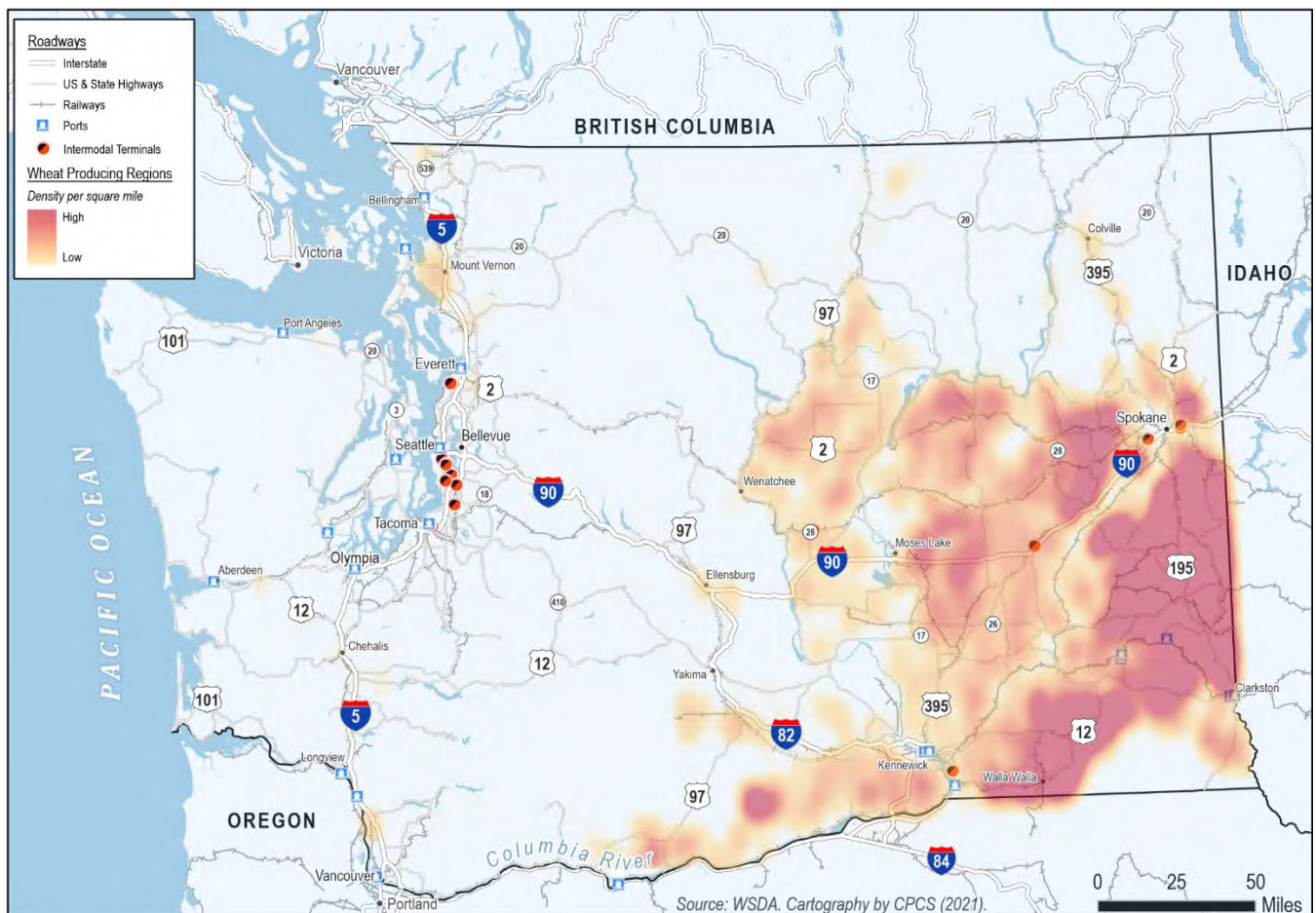


Wheat

Washington is the fourth-largest wheat-producing state in the nation and fourth-highest exporting state as well.³ Washington farmers mostly grow soft white wheat, which is used for baking food like crackers, cakes, and cookies.

Wheat supply chain: Wheat transport relies on a multimodal freight system. Wheat is mostly grown and harvested in the southeast part of the state. Trucks primarily transport wheat for distances less than 20 miles, far enough to reach a grain elevator where the wheat can be stored and then loaded onto trains or barges.⁴ From these grain elevators, wheat is primarily transported by railroad or barge for farther shipping. Barges running along the Columbia River system carry approximately 60 percent of Washington’s wheat to export elevators located along the lower Columbia River.⁵ Most wheat is then loaded onto cargo ships bound for international destinations. The top wheat export destinations from Washington are the Philippines, Japan, South Korea, and Taiwan.⁶

Figure 4: Washington grain production



³ 2020-2021 Washington Wheat Facts, Washington Grain Commission, 2021. https://wagrains.org/wp-content/uploads/2021/02/2020-21WheatFacts_4Web.pdf

⁴ Wheat Supply Chain Data Collection, Washington State Transportation Center, Jeremy Sage and Ken Casavant, February 2016. <https://www.wsdot.wa.gov/research/reports/fullreports/853.1.pdf>

⁵ 2020-2021 WSU Wheat & Barley Research Reports to the Washington Grain Commission, Washington State University (n.d.). <https://smallgrains.wsu.edu/additional-resources/research-progress-reports/>

⁶ U.S. State Export Data, 2019, U.S. Census Bureau Trade Data (n.d.). <https://www.census.gov/foreign-trade/statistics/state/index.html>

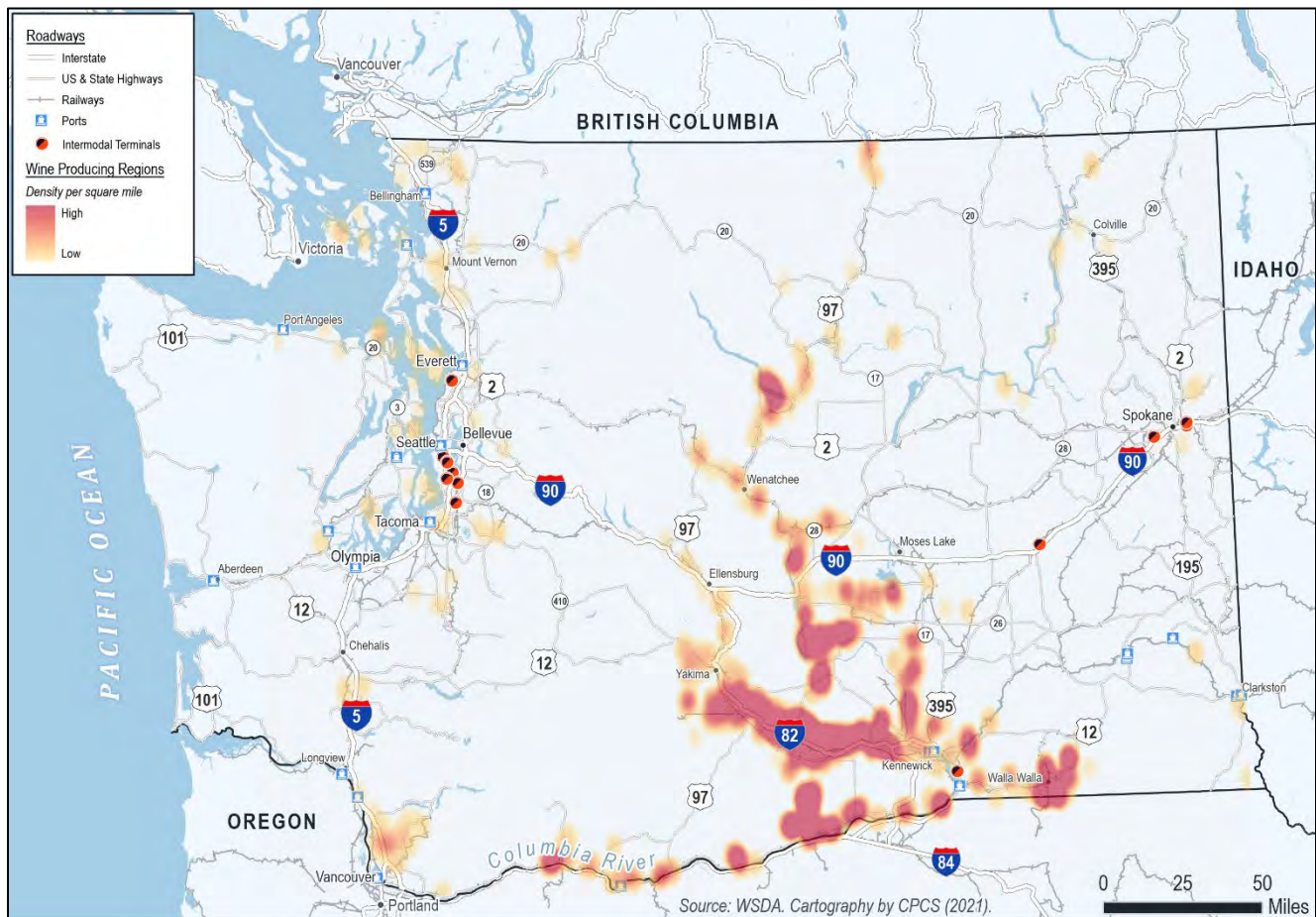
Wine production

There are more than 1,000 wineries and 400 grape growers in Washington, producing 80 different varieties and over 17 million cases of wine annually. Most red and white varieties include Cabernet Sauvignon (the most produced grape in Washington), Chardonnay, Riesling, and Merlot. Ninety percent of wineries are small-scale producers making less than 5,000 cases of wine per year.⁷

Wine supply chain: Nearly all of Washington’s wine grapes are grown in eastern Washington, while a smaller share is produced around Puget Sound. Large wineries handle much of the wine production process in-house, from growing grapes, to making wine, to bottling, and finally selling the wine. Smaller wine producers may source grapes from grape growers and handle some production in-house, such as grape crushing, fermenting, or blending, and rely on wine distributors for processing steps like bottling, labeling, packaging, storing, and distributing.

Refrigerated trucks and rail cars are used for distribution to the East Coast. Chateau Ste. Michelle, which accounts for 60 percent of all of Washington’s wine sales by volume, relies on refrigerated rail car service for transport between its main distribution center in Wallula and destinations across the Midwest and East Coast. Key inputs for wine, such as glass bottles, are typically sourced from outside the U.S., with 40 percent of wineries in the U.S. sourcing glass bottles from China.⁸

Figure 5: Washington wine producing regions



⁷ Fast Facts, Washington State Wine Commission, (n.d.). <https://www.washingtonwine.org/fast-facts/>

⁸ The weight of that wine bottle doesn't indicate quality, and it's hurting the planet, *The Washington Post*, November 4, 2021. <https://www.washingtonpost.com/food/2021/11/04/wine-bottle-carbon-footprint-cop26/>

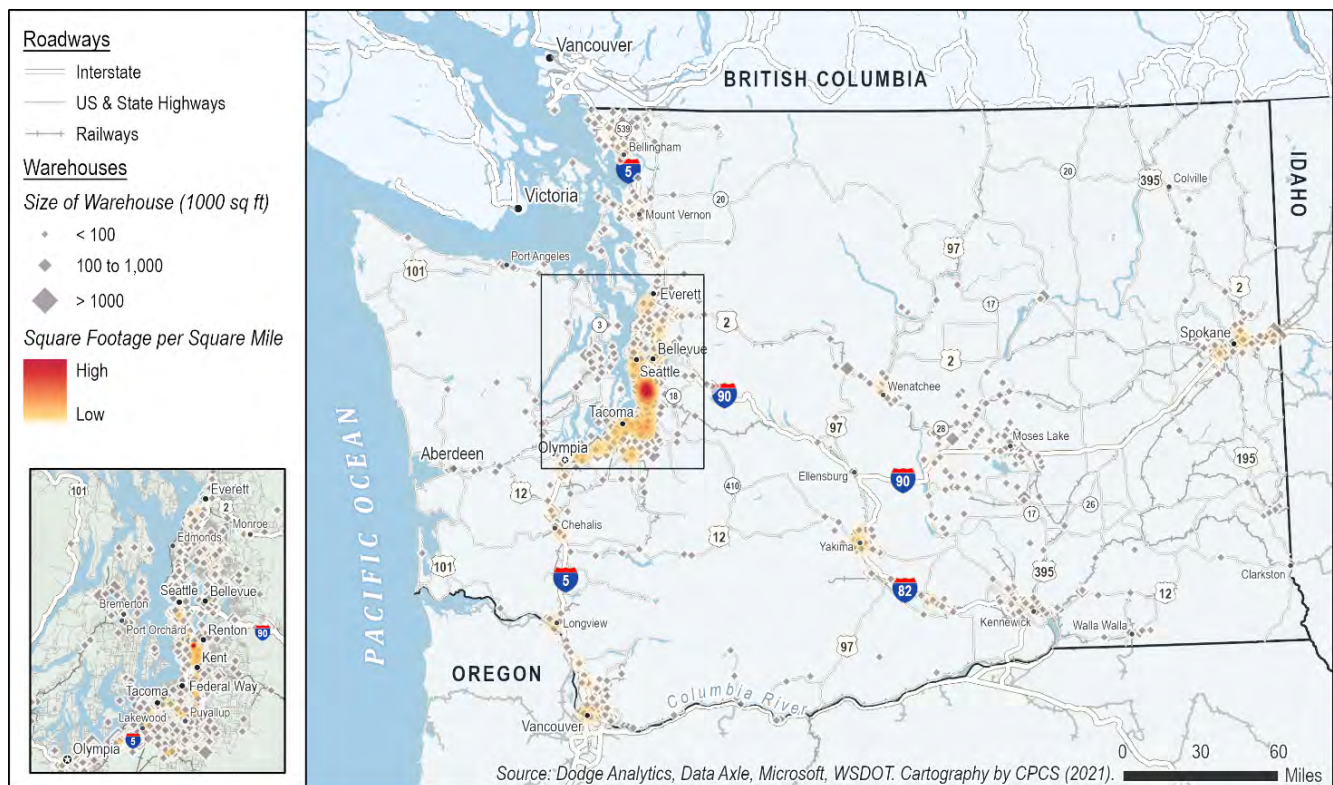
Wholesale, warehousing, and storage

Businesses such as manufacturers and retailers often lack the storage space or funds necessary to keep large amounts of materials on-site or “in-house.” This critical need for supply and storage services is met by wholesale, warehousing, and storage companies. Wholesalers support other businesses and consumers by supplying bulk goods, while warehousing and storage companies help other businesses store the materials they need to support their production or sales. The wholesale and warehouse/storage industry requires a large amount of space to accommodate variation in demand and supply chain performance.

This industry is concentrated in King and Pierce Counties, along the I-5 corridor, in Central Washington, and around Spokane. The increase in business storage needs within Washington has led to significant growth in warehousing and storage space over the last two decades. In Washington, this wholesale/warehouse/storage industry employs 150,000 people and pays \$12 billion annually in wages. The most notable employer in this field is Amazon, with more than 85,000 workers in the state.

Support for supply chains and consumer deliveries: Warehouses and distribution centers often receive and ship goods by truck and rail. Continued growth in demand and volume of e-commerce goods is a major trend for this industry. Additionally, the increased demand for next-day or same-day delivery has meant that businesses serving e-commerce clients have sought to expand their warehouse and distribution facilities into new areas of the state and develop new types of centers, such as extremely small distribution centers for local neighborhood deliveries and extremely large distribution centers to serve major population centers. The concentration of warehousing facilities primarily coincides with the freight clusters that anchor much of the system.

Figure 6: Washington wholesale, warehousing, and storage facilities



Summary of findings

Washington's freight system supports commerce and communities across the state and beyond. It supports 45 percent of Washington's jobs and 35 percent of the state's GDP across dozens of supply chains – from agriculture, fishing, and forestry to complex manufacturing such as the aerospace and defense sector. The state's economic vitality and quality of life for communities depend in large part on a well-maintained freight system that operates safely, efficiently, reliably, and sustainably. The next section describes each of the freight system's modes and system performance information.



A System that is Multimodal and Interconnected



A system that is multimodal and interconnected

This chapter provides an overview of Washington’s multimodal freight system and performance. Washington’s multimodal freight system includes the road network, railroads, maritime, air, and pipeline systems that convey supplies, groceries, crops, raw materials, parts and components, and other materials to residents and businesses. The system works remarkably well in many ways, but there are specific challenges that must be addressed through collaborative planning. These challenges include congestion, infrastructure conditions, safety, and environmental impacts.

Shippers and businesses in Washington benefit from a full suite of transportation modes. Figure 7 summarizes the size of Washington’s freight system, and Figure 8 on the following page illustrates how this multimodal system extends to every part of Washington.

Figure 7: The multimodal freight system in Washington

22,207	3,200	11	22	46,000	57
Centerline miles of truck corridors	Active railroad route miles	Deepwater marine ports	Airports providing cargo service	Pipeline system miles	Inland ports

Source: WSDOT, 2022; CPCS analysis of National Transportation Atlas data, 2022. WPPA Port Directory, 2022.

Washington’s interconnected freight system

Washington maintains an integrated, interconnected freight transportation system, which links modes of transportation together to connect Washington consumers and shippers with local, domestic, and international markets. For example, cherry farmers use trucks to transport their harvest to airports, where cherries are loaded into aircraft for delivery overseas. Washington manufacturers use a variety of modal combinations including truck-to-rail and ocean-to-rail combinations to move various supply chain input and output components and final products across the country and around the globe. The “fluid” movement of freight through transfer facilities, such as ports and truck-to-rail intermodal container terminals, are important considerations for these companies. Another benefit Washington’s interconnected system brings consumers and shippers is resiliency, providing alternative modes and routes to mitigate some supply chain disruptions.

The state’s freight system is also the backbone of Washington’s international trade activity. Perennially among the nation’s 10 largest exporters (8th in 2021), farmers and manufacturers alike rely on Washington’s wide range of modes (truck, rail, ocean, air) to move product from their facilities to global markets.

Freight’s relationship with other modes and users of transportation

Washington’s freight transportation system is interconnected, but it is also interrelated: since freight movement shares infrastructure with other vehicles, freight transportation needs and issues can also impact other transportation system users including passenger vehicles, transit, bicyclists, and pedestrians. For example, congestion caused by truck traffic can also impact other transportation users, and vice versa. This interrelationship between freight users and other users means that freight-benefitting improvements often have substantial benefits for other transportation users.

While Washington has an extensive freight system, the true range of freight transportation choices available to individual shippers is limited by the availability of access to each mode of transportation and the characteristics of the cargo that they are shipping. The shipping costs of each type of transportation mode are dependent on the types of cargo being shipped and the distance of shipping. The relative value of cargo also plays an important role in driving decisions about transportation modes. Shipping costs can make up a relatively large share of the overall cost of low-value-per-ton cargoes

such as minerals and agricultural products. By comparison, higher-value cargoes such as electronics and pharmaceuticals can “tolerate” a relatively higher transportation cost. Other significant shipping considerations that can influence a shipper’s choice of transportation mode include transportation speed and the reliability of a particular mode. For example, trucks are often the fastest ground mode of transportation and are typically relied on for higher-value goods. Trucks therefore often play a significant role in moving goods from port facilities to warehousing or distribution centers and onward to domestic railyards for transport.

Each mode of transportation has its own set of access, price, capacity, and speed characteristics. Together these diverse modes make up a “spectrum” of freight transportation options illustrated in Figure 9.

Each mode of freight transportation has cost and capacity advantages and disadvantages and is suited for specific types of cargo. The specialties of each mode also inform each mode’s unique relevance to specific industries and Washington’s economy and communities.

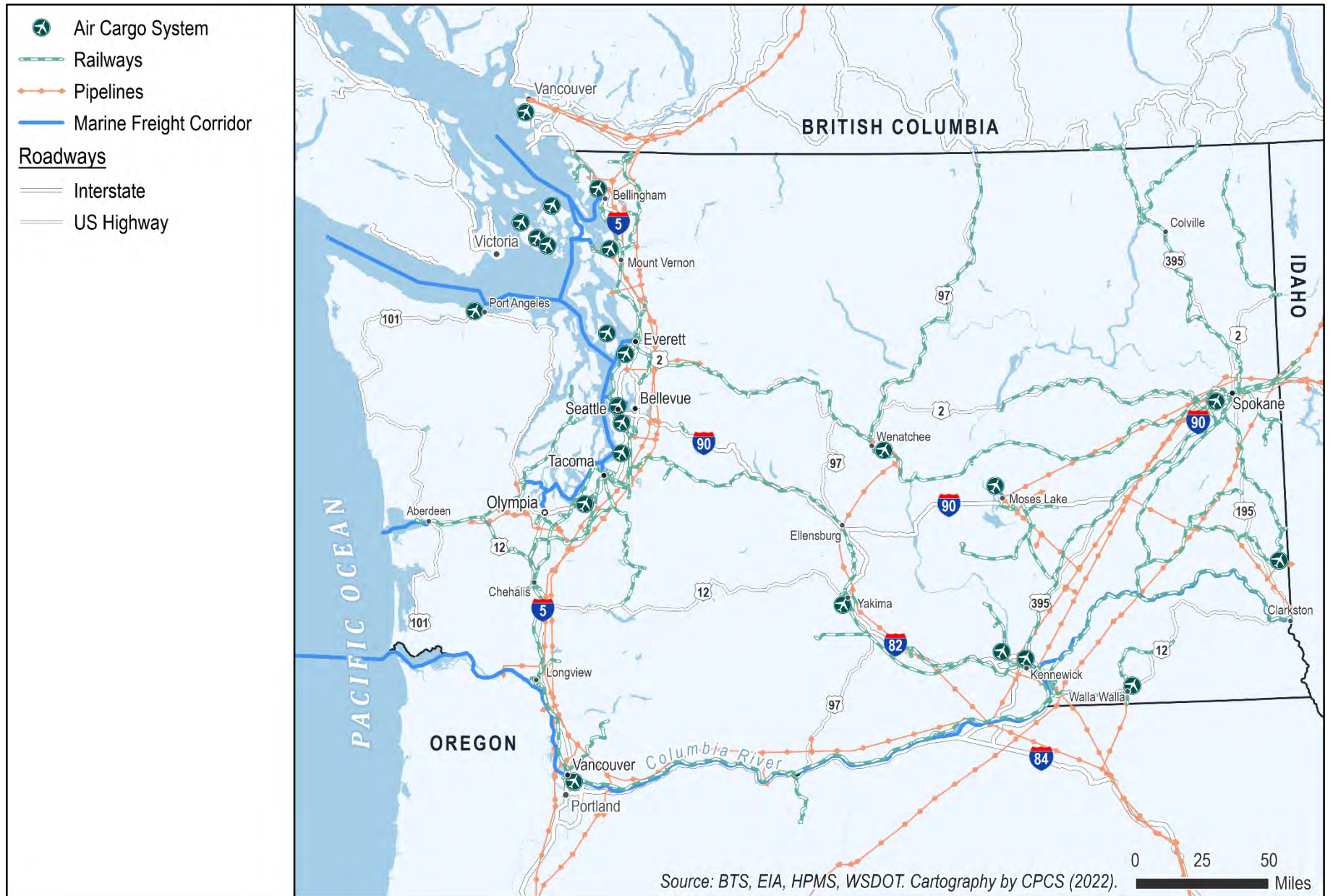
National Multimodal Freight Network

The FAST Act requires the USDOT to establish a National Multimodal Freight Network (NMFN) in the United States that identifies significant transportation assets for freight movement. The NMFN is intended to inform freight transportation planning and federal investments. USDOT published an interim NMFN and solicited public and stakeholder comments in 2016 and 2017. This interim network includes the following components:

- The National Highway Freight Network.
- The freight rail systems of the Class I railroads.
- Public ports with total foreign and domestic trade of more than 2 million short tons.
- The inland and intracoastal waterways of the United States, the Great Lakes, St. Lawrence Seaway, coastal, and open-ocean waterways.
- The top 50 airports with the highest annual landed weight and other strategic freight assets.

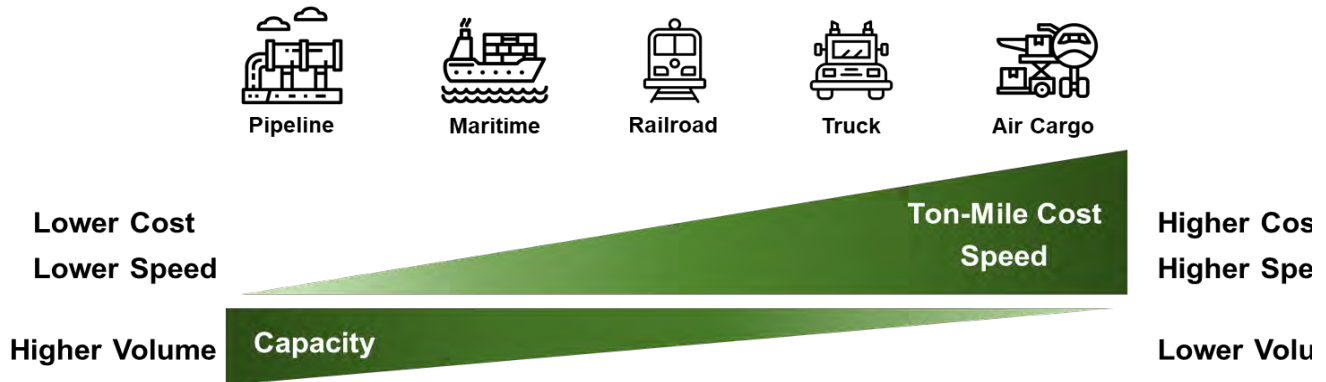
WSDOT proposed additional designations of multimodal freight corridors and facilities for addition to the interim NMFN to USDOT during the public comment period. More information about this designation can be found in Appendix D – Washington’s Freight Transportation System.

Figure 8: Washington's multimodal freight system



Each mode of freight transportation has advantages and disadvantages and is suited for specific types of cargo based on costs and capacity.

Figure 9: The freight transportation modal “spectrum”



Why doesn't more freight move by rail?

Many Washingtonians have asked “*Why doesn't more freight move by rail?*” The simple answer is that, for many trips, trucks are the most cost-effective way to move freight, especially for distances under 500 miles. Typically, to utilize rail service, connections to railroads must be made by truck, so when shipping distances are short, it makes more sense and is more cost-effective to simply keep cargo moving on a truck.

- **Pipelines** carry large quantities of select commodities (such as a liquid or a gas) over long distances. In general, pipelines offer the most economical method of moving bulk liquid and gas cargo to refineries as well as consumption and trading centers. Washington pipelines carry a variety of products including crude oil, gasoline, diesel, and jet fuel, among others.
- **Maritime** freight transportation is critical to Washington’s international and domestic trade. This mode is best suited for the movement of large volumes of cargo in bulk (i.e., grain, oil, chemicals, and aggregates) as well as intermodal containers and oversized/overweight freight. Intermodal containers are large, standardized shipping containers that can be transferred between ships, trains, and trucks without unloading cargo. Higher-value manufactured goods can also be suitable candidates for maritime transportation when fast service is not needed. Maritime freight also offers significantly lower carbon and pollution emissions per ton-mile of cargo transported compared to heavy-duty trucks.
- **Railroads** typically move high tonnage cargo over medium to long distances. Both lower-value bulky goods (i.e., grain, aggregates, forest products, and oil) as well as higher-value goods (often carried in intermodal containers) are carried by rail, depending on the desired shipping time and access to rail facilities.
- **Trucks** offer lower capacity and higher costs for transporting goods compared to maritime and rail modes. However, because rail to road connections can be found at almost every major rail facility, trucking provides the first/last mile connection between shippers and other modes. Trucks are typically used for carrying moderate- and higher-value goods over relatively long distances in relatively shorter periods. They are also used to carry lower-value goods for shorter distances.
- **Air cargo** enables the fast movement of high-value and time-sensitive goods over long distances. Using air cargo is the most expensive modal choice when comparing modes based on per ton-mile carrying costs.

Modal trade-off examples – the food industry

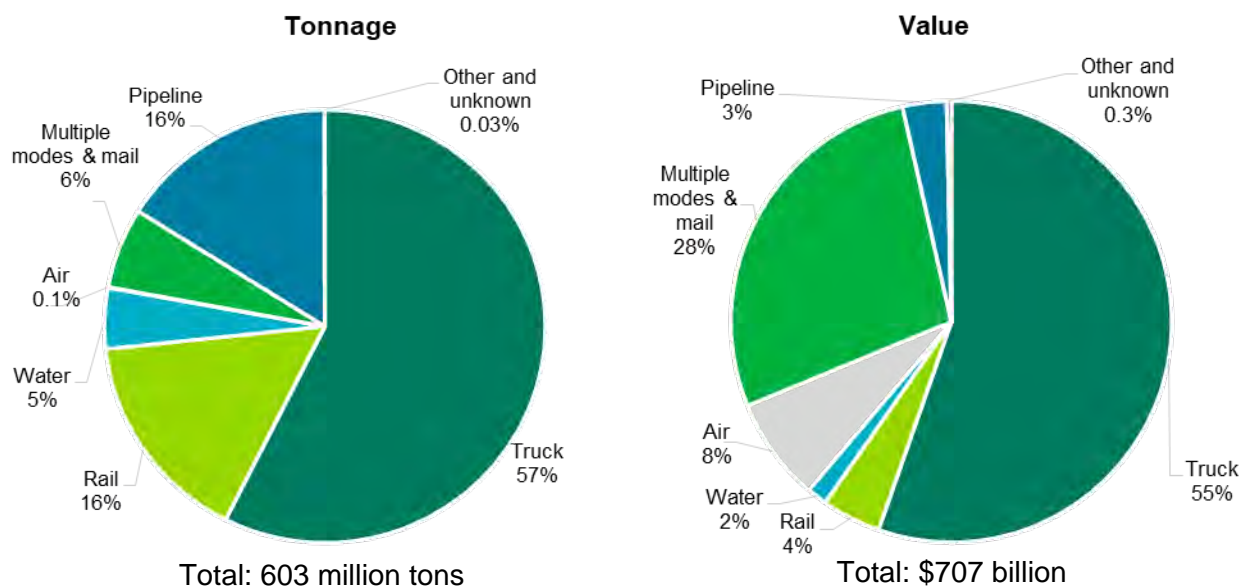
The food production industry provides an example of modal trade-offs: some types of fresh fish have a relatively high value per ton, and therefore can be exported or sent elsewhere in the United States via air cargo. By comparison, most of Washington’s wheat production has a relatively low value per ton, and much is shipped out of the state via water transportation, which has a high carrying capacity and relatively low shipping cost.

How Washington’s freight system is used

The extensive highway network reaches all corners of the state and can handle a wide range of cargo, making trucking the most used form of freight transportation in Washington.

Across Washington’s extensive multimodal freight system, truck transportation is the most frequently used mode. Figure 10 illustrates the overall breakdown of the tonnage and value of cargo carried by each mode of transportation in Washington in 2022.

Figure 10: Total freight tonnage and value carried by mode, 2022



Source: CPCS analysis of FAF5.3 data, 2022.

Note: Does not include commodities without a defined mode, which makes up 0.3 percent by tonnage and 0.1 percent by value. Note: Mode refers to the domestic movement of goods within the U.S., for both domestic and international goods.

- Trucks carry over half of the commodities moving in Washington, making up 57 percent by tonnage and 55 percent by value (compared to national freight movements, for which trucks carry 64 percent by tonnage and 72 percent by value).
- Pipeline, water, and rail also move high-tonnage goods, whereas “multiple modes and mail” (which includes intermodal container and trailer-on-railcar shipments) along with air transportation move high-value goods to and from Washington. This difference between modes reflects the fact that air transportation and intermodal transportation are often used to support movement of higher-value consumer products, while pipeline and rail often move relatively lower-value, but heavier commodities.
- Trucks are particularly important for domestic freight transportation. The modal share of truck movements is higher for domestic goods movement, and trucks carry 65 percent of domestic goods by tonnage and 62 percent by value.

- Trucks carry relatively less tonnage for international freight transportation, as imports and exports rely heavily not only on trucks but other modes as well. The share of import and export freight tonnage handled by rail is 33 percent, while pipelines handle 21 percent of international tonnage, and multiple modes and mail carry 8 percent of import and export tonnage. Trucks also play a key role in first/last mile goods movement to/from international cargo terminals such as ports and airports.
- Washington's well-connected and competitive maritime network is well known for its role in moving goods internationally. It plays an even bigger role serving domestic shipments. About 86 percent of the state's waterborne freight activities by volume and 79 percent by value are domestic. Sand, aggregate, grain, and wood chips are some of the primary commodities moving along the state's waterways and navigation channels. Ports along the Salish Sea serve as hubs for moving freight by water to both Alaska and Hawaii as well.
- While air cargo, relative to the other modes, carries very little in terms of the state's total tonnage, it is a primary mode for higher value and time sensitive freight. When looking at the value of the state's freight shipments, air cargo plays a crucial role, ranking third behind only truck and rail.



Supporting resources: military freight

Washington has significant military facilities, and the reliable operation of the freight transportation system is important to the operation of these facilities and national security overall. In addition to the Ports of Tacoma and Everett playing roles in the National Port Readiness Network supporting military freight movement, two surface transportation networks that are critical for military freight have been identified:

The **Strategic Highway Network (STRAHNET)** is a system of public highways designated by the Department of Defense (DOD) and Federal Highway Administration (FHWA) to accommodate the emergency transportation of military personnel and equipment in times of peace and war and provides connection to military installations and ports. Washington's STRAHNET includes the entire length of I-5, I-90, and I-82 in the state and sections of US 101, SR 8, and US 12 west of Olympia and between Aberdeen and Knapton (a total of 835 miles with over 103 miles connector routes). Both I-82 and I-5 connect with I-84 along the Columbia River in Oregon. I-84 is also part of the STRAHNET system providing access to military installations and the defense system in Washington and California through the I-5 corridor. This system is continually changing, and in early 2022, WSDOT coordinated with the Surface Deployment and Distribution Command, Port of Everett, City of Everett, and FHWA to make modification to STRAHNET designation within the City of Everett. This modification improved military access and mobility by adding a new STRAHNET connector for accessing Port of Everett, a newly designated Department of Defense Strategic Seaport.

The **Strategic Rail Corridor Network (STRACNET)** provides rail access to military installations across the U.S. Washington's STRACNET encompasses the BNSF's route running from Spokane to Everett and Seattle and the railroad's Seattle subdivision between Seattle and Vancouver (a total of 586 miles with over 266 miles of connector lines). UP's line running along the Columbia River in Oregon is also part of the STRACNET system, connecting with Washington's STRACNET lines at Hinkle and Portland, Oregon.

Further information on these two networks and considerations of military freight movement can be found in [Appendix D – Freight System](#).

Washington's road network

Washington's road network provides direct links between nearly all freight origins and destinations, while also enabling connections to other modes within the freight network. Figure 12 shows Washington's extensive road network. As shown, key corridors in Washington (fully listed in Appendix D) include I-5 running north-south from Canada to Mexico and Interstate 90 (I-90) running east-west from the Pacific to Atlantic Coast. Additionally, Interstate 84 (I-84) runs along Oregon's northern border with Washington, with several bridges across the Columbia River connecting I-84 to State Route 14 (SR 14) along Washington's southern border. These corridors support domestic and international trade movements, as they connect Washington's northern and western borders to dozens of other states, cities, and countries.

Figure 11: Logging truck in aberdeen



Source: WSDOT, 2022.

Figure 12: Washington's highway freight system



Figure 13: Washington road network inventory

22,207 Centerline miles of truck corridors	343.5 million Tons of freight moved by truck in Washington in 2022	\$391 billion Value of freight moved by truck in Washington in 2022
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Source: WSDOT, 2022; CPCS analysis of FAF5.3 data, 2022.

Asset condition: Heavy vehicle operations can significantly deteriorate the condition of roadways, as a vehicle’s impact on a road surface increases exponentially as vehicle weight increases, and trucks cause more damage than passenger vehicles. At the same time, poor condition roadways can also impede efficient freight movement, and rough roads can damage cargo.

As of 2021, 93 percent of the state highway pavements and 93 percent of the WSDOT-owned bridges were in fair or better condition. Maintaining or preserving pavement in good or fair condition is critical because it saves seven to sixteen times the cost of rehabilitation or reconstruction than when pavements are in worse condition. Corridors with more oversized/overweight truck movements deteriorate more quickly, such as the I-5 corridor between Seattle and Portland, the I-90 corridor between Seattle and Ellensburg, and I-90 between Ritzville and the state’s border with Idaho.

Mobility: Reliability of the highway system keeps operational costs down and allows shippers to easily predict when their goods will arrive. Reliability can be measured in many ways, but a common method is Truck Travel Time Reliability (TTTR) Index. TTTR, a federal measure used by planners to assess the reliability of truck travel times, is the ratio of travel times during congestion compared to travel times when traffic is light. A TTTR Index of 1.5 means that travel times during congested periods are 50 percent longer compared to when traffic is traveling in free-flow speeds. Figure 14 illustrates how Washington’s statewide TTTR values fluctuate from year to year, but the system has consistently performed better than the performance targets set by WSDOT.

Figure 14: Washington’s statewide TTTR Index on interstates and targets

2017	2019	2020	2021	2-year Target	4-year Target
1.63	1.54	1.43	1.49	1.7	1.75

Source: CPCS analysis of NPMRDS data, 2022; FHWA State Biennial Reports, 2018 & 2020.

Over the past four years Washington’s truck travel times have exceeded WSDOT’s established goals.

Combining TTTR Index with a measure of average delay times results in a combined index that highlights segments on the roadway network on which the trucks experience a significant breakdown in traffic flow due to both expected and unexpected delays. This measure is used to identify the top segments that experience truck congestion, known as truck bottlenecks. Figure 15 shows how truck bottlenecks are mostly concentrated in urban areas, along high-volume highway corridors, and near major freight facilities. Delay hotspots include I-5 through Seattle and Tacoma and I-405 through Bellevue.

Safety: Despite the best efforts of WSDOT and its safety partners, such as the Washington State Patrol, truck-related fatalities and serious injuries are trending upwards in 2021 as more people resume travel. However, the five-year average rate of truck-involved crashes has declined. Over 40,000 truck-involved crashes occurred in Washington between 2016-2021, primarily along high-volume corridors, such as I-5, I-405, and I-90, particularly in King, Pierce, and Snohomish Counties. These crashes led to fatalities and injuries, as shown in Figure 16. About 77 percent of the truck-involved crashes that happened in Washington between 2016 and 2021 were property damage only (PDO), leading to no casualties but causing monetary costs to society. Road safety and congestion were among the most common topics of interest WSDOT heard from stakeholders and communities through engagement conducted during the development of the FSP.

Figure 15: Washington's truck bottleneck locations

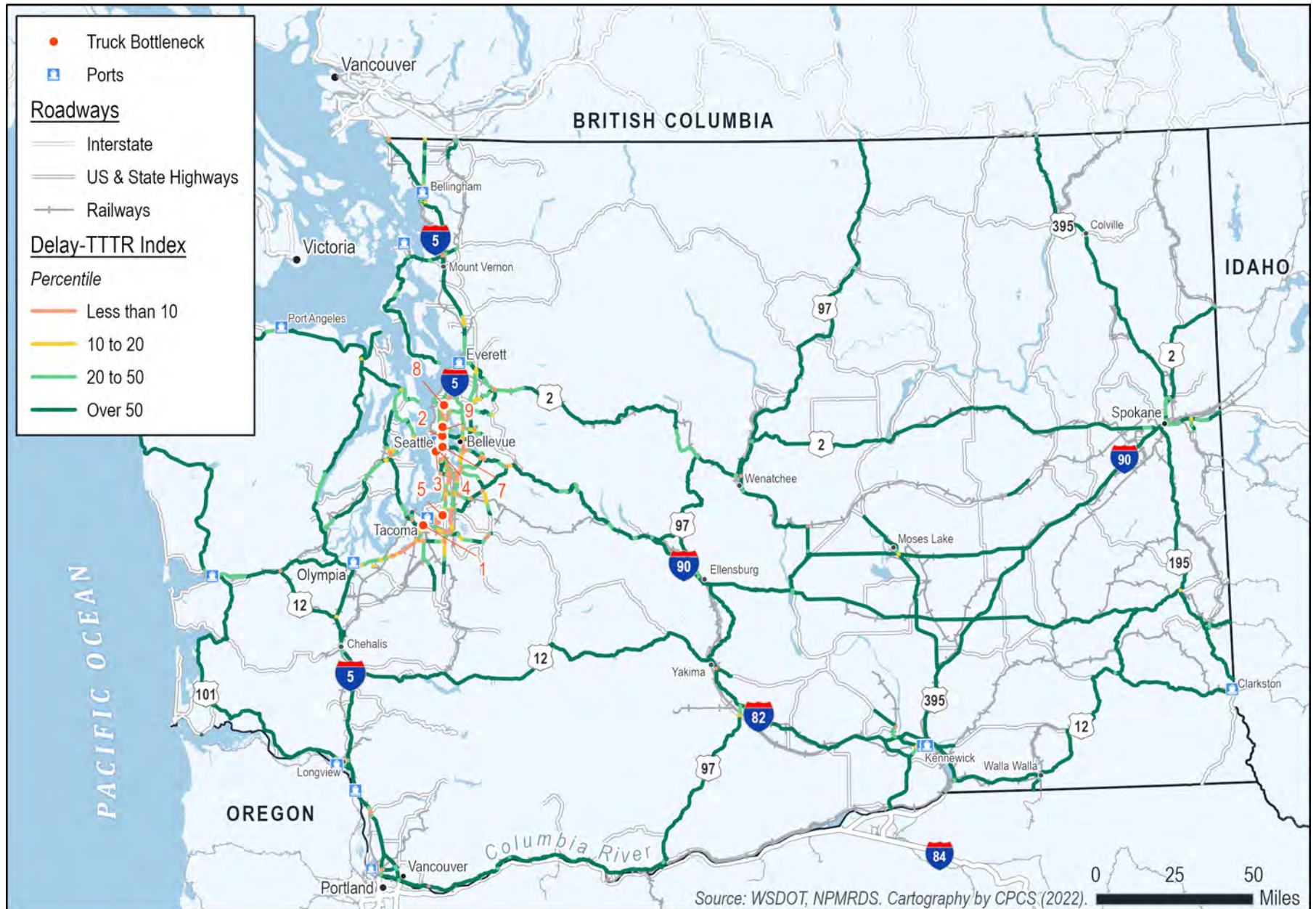
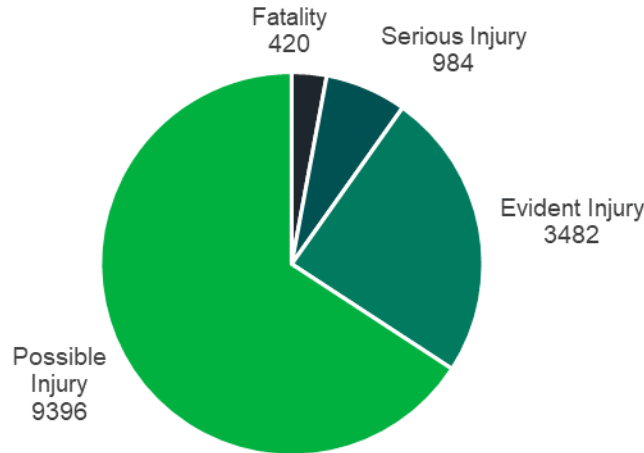


Figure 16: Truck-involved casualties in Washington, 2016-2021



Source: CPCS analysis of WSDOT crash data, 2022.

Washington’s state highway safety plan (Target Zero 2019) provides details on the primary truck crash factors and at-fault parties in the truck-involved crashes. Heavy truck drivers were at fault in about 27 percent of the truck-involved crashes. Meanwhile, passenger vehicle and motorcycle drivers were at fault in over 60 percent, and pedestrians and cyclists were at fault in the remaining 13 percent of the truck-involved crashes.

In those crashes where pedestrians and cyclists were at fault, the primary crash factor was the failure to yield the right-of-way. This highlights the incompatibility of these modes with truck movements, particularly in locations where sidewalks and bike paths are sparse and pedestrians and cyclists have to compete with roadway modes.

Road and trucking needs and issues: feedback from public outreach

In addition to the mobility, condition, and safety topics noted above, other trucking-related needs and issues were commonly mentioned during the FSP’s public engagement process. For example:

- **A shortage of truck drivers** was the top-ranked freight transportation issue noted among over 380 respondents from an FSP online survey and was frequently mentioned in many consultations and outreach meetings. WSDOT also conducted a truck driver listening session to learn more about drivers’ needs.
- **Traffic congestion** was the third-highest ranked issue among survey respondents and was a concern in areas around major urban freight facilities, similar to the findings of the mobility assessment above. Difficulty predicting travel times and scheduling at the ports were identified as challenges to producers who need to export goods, sometimes resulting in lost sales.

Truck parking

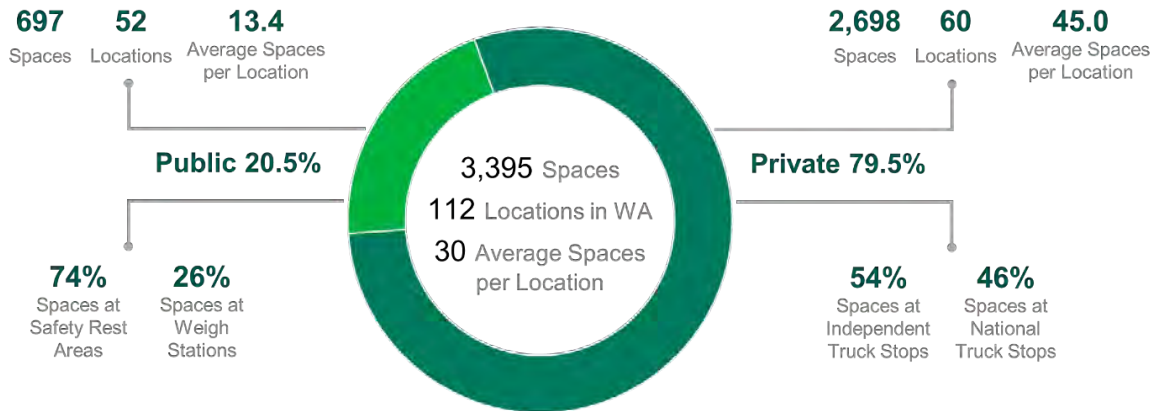
Behind the wheel of each truck is a driver with basic safety, rest, and amenity needs.

Truck drivers require parking facilities to wait for shipper/receiver appointments (staging); access basic amenities such as restrooms, food, and fuel; and meet federal hours-of-service (HOS) requirements. As part of the 2022 FSP development, WSDOT conducted a state truck parking assessment (which included an undesignated truck parking survey)⁹ to review truck traffic volumes and the capability of public and private sectors to provide truck parking facilities, identify areas with shortages of adequate truck parking, and understand the underlying causes for the shortages.

⁹ Undesignated truck parking refers to trucks parked in unmarked locations. See text box on page 25 for full discussion of the importance of understanding and monitoring undesignated truck parking.

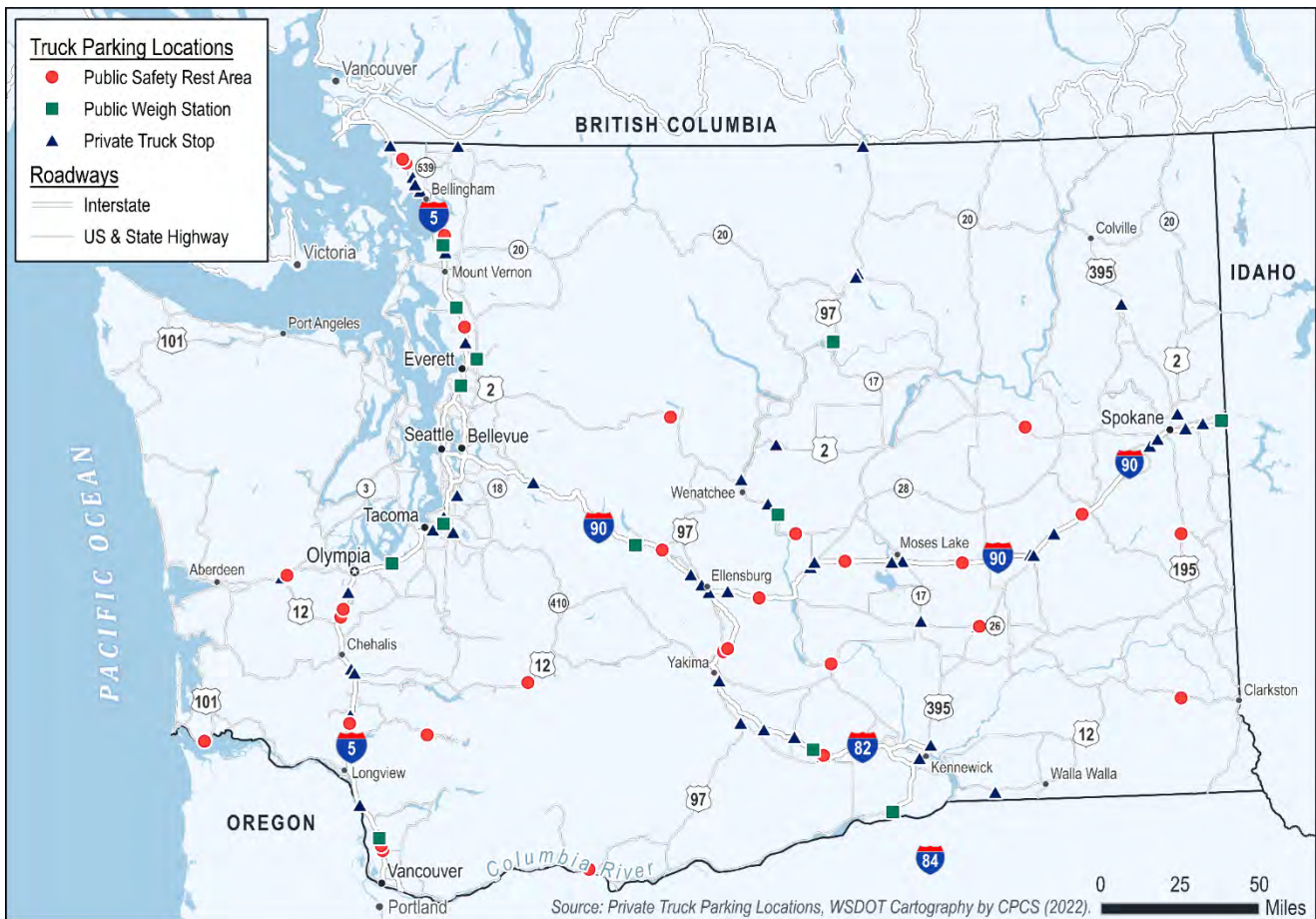
In Washington, 112 formal truck parking locations statewide provide nearly 3,400 truck parking spaces (Figure 17). Truck parking locations are typically found along or near interstates – namely I-5, I-90, and I-82 – due to their high truck volumes (Figure 18).

Figure 17: Truck parking spaces in Washington



Source: CPCS analysis, 2022.

Figure 18: Public and private truck parking locations in Washington



However, truck drivers cite difficulties finding safe and adequate truck parking in Washington, especially for short-term staging and overnight parking. Among respondents that participated in the 2016 Washington State Truck Parking Study survey, 60 percent indicated taking an hour or longer to find

overnight truck parking.¹⁰ Issues related to truck parking were also raised frequently during stakeholder and community engagement for this plan.

In 2021, truck drivers ranked truck parking as a top issue in the trucking industry.^{11,12}

When truck drivers are unable to access available truck parking, adverse economic, safety, infrastructure, and quality of life impacts result. At times, drivers may be forced to park in undesignated locations. Furthermore, a lack of truck parking means that truck vehicles miles traveled (VMT) may increase as drivers search for available parking spots.

What is undesignated truck parking?

Undesignated truck parking refers to trucks parked in unmarked locations and serves as an observable indicator of inadequate truck parking. Truck drivers park in undesignated locations when they need to fulfill federally mandated HOS requirements, stage for pick-up/delivery, or access basic amenities, but cannot find safe and adequate designated truck parking.

Examining the location and duration of undesignated stops provides insight into the underlying causes of undesignated parking. Undesignated parking occurrences that exceed 7 hours in duration – often along key freight corridors and near safety rest areas – indicate drivers stopped to fulfill their federally mandated 10-hour HOS breaks. Meanwhile, drivers stopped in undesignated locations in urban areas and on last-mile roads for short periods of time indicates a need for staging near freight facilities.

In Washington, undesignated truck parking is concentrated in urban areas and along key corridors, notably in the Puget Sound region, along I-5, I-90, and I-82, and near state borders (Figure 19). Along and near the state's key freight corridors, trucks park at undesignated locations at rest areas and weigh stations, along the roadway and on/off ramp shoulders, and on nearby last-mile roads. In urban areas, undesignated parking typically occurs on last-mile roads near freight generators.

Truck parking capacity will become increasingly strained as the demand for truck transportation increases faster than the supply of safe and adequate truck parking. WSDOT has an opportunity to use the findings of this data-driven assessment, in combination with other recently completed (2021 Washington State Truck Parking Workshop, 2021 Joint Transportation Committee (JTC) Truck Parking Action Plan, 2021 I-5 Fort Lewis Weigh Station Study, 2019 Strategic Highway Safety Plan: Target Zero, 2016 Washington State Truck Parking Study), ongoing (Truck Parking Information Management System pilot, Safety Rest Area Plan), and future (e.g., evaluate utilization of the state's existing truck parking facilities) truck parking efforts, to better understand truck parking issues and focus truck parking activities in the state.

Washington JTC Truck Parking Action Plan, 2021

The JTC Truck Parking Action Plan builds on previous truck parking work to identify recommended actions to advance truck parking in the state, including:

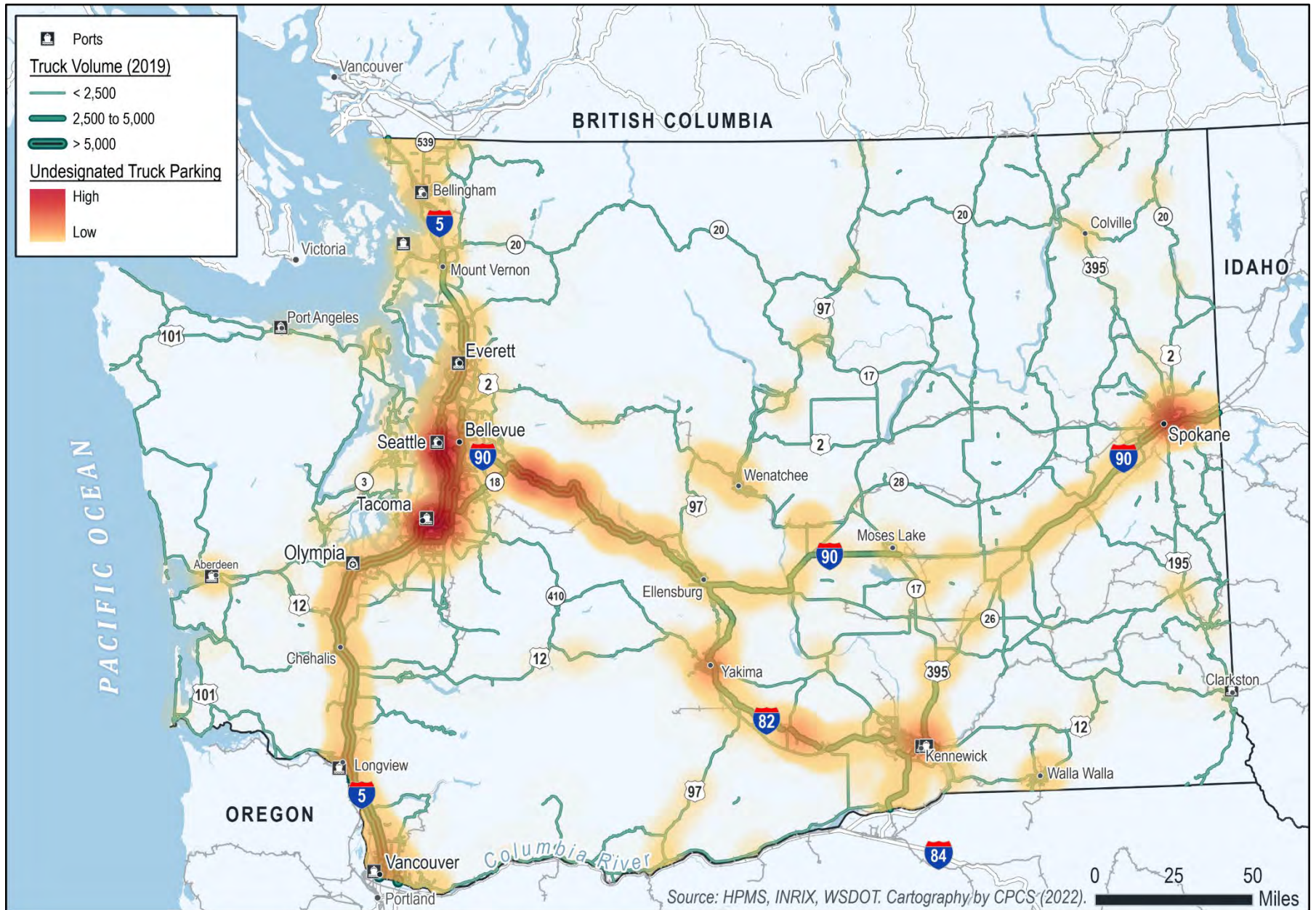
- Develop more publicly owned truck parking in high demand areas
- Better utilize existing parking in urban areas
- Encourage shippers and receivers to provide parking and basic amenities
- Develop truck parking information systems
- Secure federal funding for next-gen truck parking
- Better utilize existing infrastructure along mountain passes
- Maintain momentum

¹⁰ Washington State Truck Parking Study, Washington State Department of Transportation, December 2016.

¹¹ Truck parking was tied with driver compensation as the top-ranking trucking industry issue.

¹² Critical Issues in the Trucking Industry – 2021, American Transportation Research Institute, October 2021.
<https://truckingresearch.org/wp-content/uploads/2021/10/ATRI-Top-Industry-Issues-2021.pdf>

Figure 19: Undesignated truck parking heat map



Washington’s railroad network

Rail is an integral part of Washington’s multimodal freight transportation system, offering an environmentally and economically efficient goods movement option to support the statewide economy. Using a system standardized by the federal Surface Transportation Board (STB), freight railroads are commonly categorized into one of three classifications by their operating revenue. The state’s freight rail system consists of two Class I railroads (major railroads serving large areas of the United States) and 27 Class III railroads (also referred to as short lines) operating on over 3,200 miles of track across the state.

Figure 22 illustrates the extent of the railroad network. BNSF and Union Pacific (UP) are the Class I rail operators in Washington, serving over 1,400 miles and 500 miles of track, respectively. In addition, the UP has the trackage right to operate on BNSF-owned tracks between Vancouver and Seattle. Short lines in the state operate about 1,300 miles of track.

In addition to carrying freight, rail lines in certain corridors are used for passenger rail service. Both Amtrak (long-distance) and Sound Transit (commuter service) services use tracks owned by BNSF to move passengers by rail in Washington.

Figure 20: Train carrying airplane fuselage



Source: BERK Consulting

Figure 21: Washington freight rail inventory



Source: WSDOT, 2022; CPCS analysis of FAF5.3 data, 2022.

Palouse river and coulee city rail system

While most railroads are privately owned and operated, some states, including Washington, own some rail lines that are important to the state’s economy and which provide public benefits. The Palouse River and Coulee City Rail System (PCC) is owned by WSDOT and provides a valuable connection that helps farmers ship their products out of eastern Washington. The PCC is the longest short line railroad in Washington and serves Adams, Grant, Lincoln, Spokane, and Whitman Counties. WSDOT oversees this system and has leased operating rights to private railroad companies who operate each of the three branches of the system. The PCC Rail Authority, a four-county inter-governmental entity, is responsible for the business and economic development aspects of the service.

Freight context: The freight rail system in Washington serves both domestic and international commodity flows, particularly for the agricultural and energy industries. The top commodities carried by rail include cereal grains and other agricultural products shipped to ports for export, as well as crude petroleum shipped to refineries across the state. Both industries rely heavily on rail for efficient and cost-effective movement of cargo, primarily originating from the Midwest. In addition to supporting domestic movements, rail provides important connections to Canadian freight facilities. Figure 23 illustrates the major commodities moved by rail in Washington.

Figure 22: Washington's freight rail system

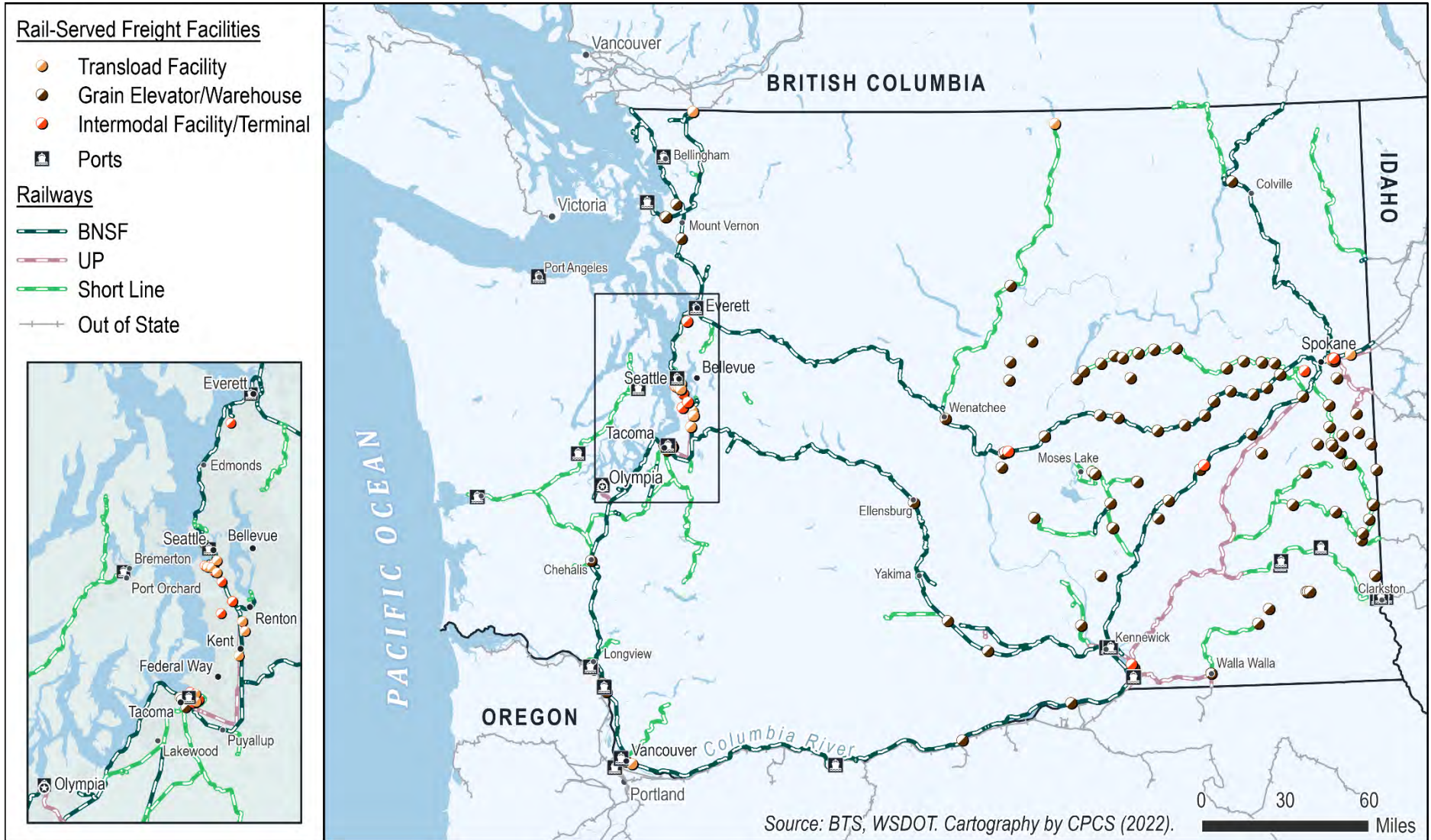
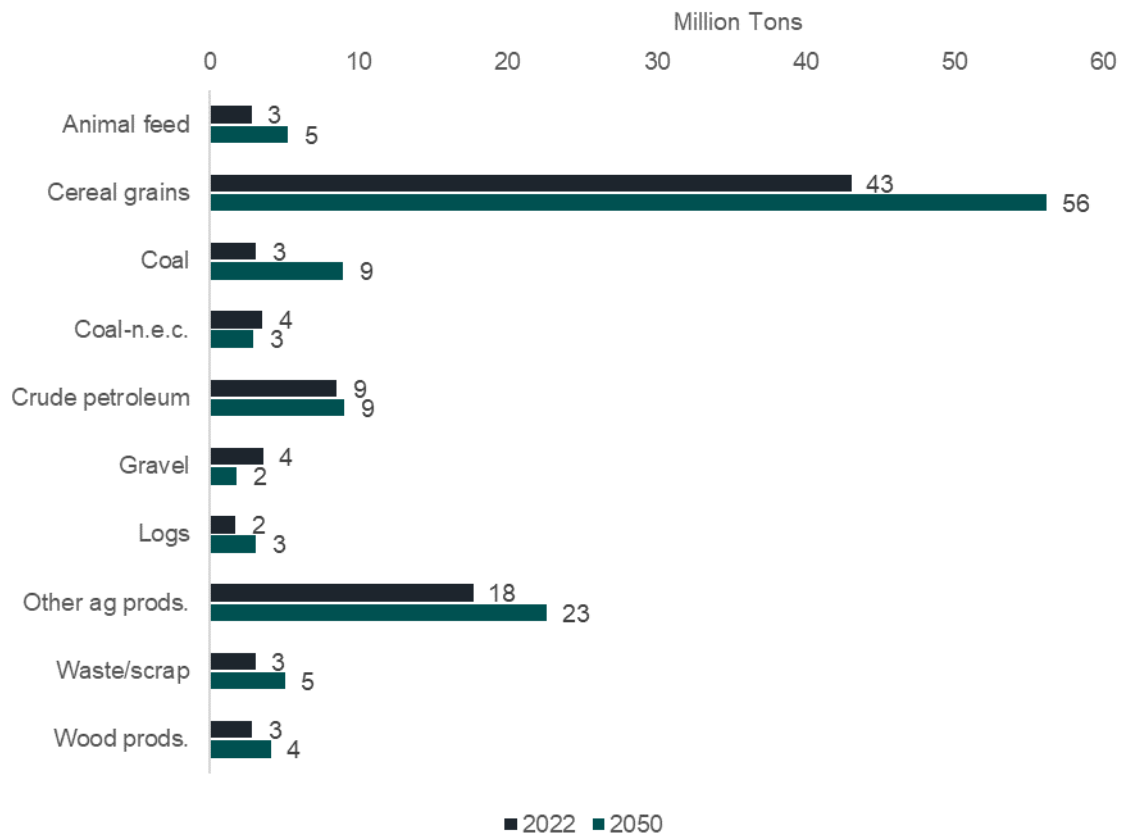


Figure 23: Commodities carried by rail in Washington



Source: CPCS analysis of FAF5.3 data, 2022.

Washington Grain Train

The Washington Grain Train program managed by WSDOT supports greater reliability and efficiency in the movement of grain products to domestic and international markets. The program moves Washington-grown products while preserving short line railroads. It also supports multimodal freight options to improve economic vitality and development.

The Grain Train program includes 116 railcars for shipping wheat and barley within the state, primarily on the state-owned Palouse River Coulee City Railroad (PCC) rail system in eastern Washington. WSDOT owns 98 of the cars and the Port of Walla Walla owns 18. The cars are mainly used to move grain from small elevators to shuttle elevators on the same railroad.

Figure 24: Grain Train hopper car



Source: WSDOT

Mobility: Rail volumes are expected to grow, especially on BNSF’s lines from Tacoma to Vancouver and Vancouver to Spokane and UP’s line between Spokane and Hinkle, Oregon. While the Class I railroads in the state will likely address key capacity issues on their rail lines, increased yard and terminal demand and increasing Class I railroad train lengths can affect first/last mile rail mobility.

Asset condition: One of the most pressing issues facing Washington’s freight rail system is the ability to handle the industry’s standard railcar sizes and speeds. The two Class I railroads (BNSF and UP) can handle the standard 286,000-pound railcars on mainlines in the state and can be operated at 25 mph or above. However, short lines in the state do not all equally perform at these levels. Based on a 2019 survey, 55 percent of short line mileage is capable of handling 286,000-pound rail cars, and 61 percent can operate at 25 mph or above. This discrepancy in speed and capacity is important because it limits the potential throughput and modal cost-competitiveness of short lines: if shippers cannot obtain competitive service on short lines, they may choose to use truck shipping or locate their facilities elsewhere.

Safety: Trespassing on private railroad property is illegal and the leading cause of rail-related fatalities in the country. In Washington, 314 trespassing incidents occurred between 2012 and 2021, 181 of which led to fatalities. Trespassing incidents in the state have steadily increased since 2012, primarily in urban locations of King, Pierce, and Snohomish Counties.

Collisions between trains and vehicles at grade crossings are the second leading cause of rail-related fatalities across the U.S. Between 2012 and 2021, about 364 highway-rail grade crossing incidents occurred in Washington (including 53 incidents with Amtrak trains), leading to 54 deaths and 104 injuries. Nearly 80 percent of the incidents were at public highway-rail crossings, and the rest were at privately-owned crossings that are not located on the public road network.

Railroad crossings that are blocked by slowly moving, extremely long, or stopped trains are also a concern across the state, especially as freight and passenger traffic increases on both roadways and rail lines. Blocked rail crossings can create safety risks to local communities by temporarily increasing emergency response times.

An increase in train lengths following the implementation of precision scheduled railroading (PSR) operating practices on Class I railroads is a safety and mobility concern for communities living near at-grade crossings in Washington. In particular, at-grade crossings on UP and BNSF lines southwest of Spokane experience the highest frequency of blockages.

Washington transportation security considerations

WSDOT has multiple partners at the state and federal level who are tasked with ensuring safety and security. Notably, the federal Department of Homeland Security has a significant transportation safety mandate and is responsible for aviation security as well as railroad security mission elements. Freight-related security topics of interest in Washington include:

- The security of border crossings, ports, and coastlines and prevention of movement of illicit materials.
- Ensuring the safety of railroad lines that handle large volumes of hazardous material, such as oil.
- Security of major transportation assets and terminals, such as bridges, tunnels, ports, and airports.

Washington’s maritime network

Washington’s maritime network supports the state’s role as a key international trade gateway for the U.S., connecting global and North American markets. The state’s maritime network is shown in Figure 27 and consists of three subsystems: (1) the Salish Sea (an inland sea consisting of Puget Sound as well as several other bodies of water like the Strait of Juan de Fuca and the Strait of Georgia); (2) the Columbia-Snake River System (a 465-mile inland waterway system consisting of the Columbia River and Snake River); and (3) the U.S. Pacific Coast.

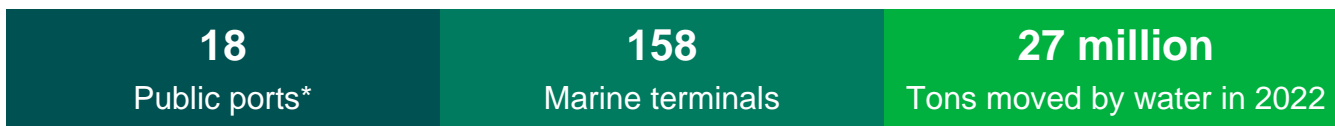
All three elements of this system include publicly owned ports, which consist of one or more marine terminals handling varying types of cargo. The maritime system also includes many privately owned terminals dedicated to supporting operations for individual companies or specific types of cargo.

Figure 25: Barge on the Columbia River



Source: iStock, 2022.

Figure 26: Washington maritime inventory



* Of the 74 total public port authorities recognized by WPPA, only 18 have freight-related maritime assets: either cargo or shipbuilding facilities.

Source: CPCS analysis of USACE Master Docks and Waterborne Commerce data, Google Earth, Google Maps, and National Transportation Atlas data, 2022.

Freight Context: Over 27 million tons of freight is carried by the state’s maritime system annually, primarily serving agricultural, energy, and manufacturing industries. This means Washington’s maritime network is well-connected and an important complement to road and rail shipping for bulk commodities. Maritime shipping also plays a key role in supporting overseas exports and imports of a variety of cargo types, from grain to consumer goods, to petroleum, to transportation equipment. In fact, in 2020 nearly 110 million tons of cargo moving through the state freight network moved across the state’s docks at one point.

Washington ranks fifth in the U.S. in terms of overall maritime volumes, only behind Texas, Louisiana, California, and New Jersey. Demonstrating the importance of Washington’s role as an export gateway, the state handles the third largest volume of waterborne exports (by weight) in the country.¹³

The state’s maritime ports handle a wide range of goods moving to and from the Pacific Northwest and the nation. Grain from the upper Midwest flows through export elevators in Washington. Consumer goods moving to the interior of the U.S. are handled at Washington container ports. The state’s refineries ship oil products by ocean vessel to Oregon, California, and Hawaii. Washington is also a critical marine freight hub for Alaska, linking Alaska to the national freight network. As an example, ocean barges transport rail cars between Alaska and Seattle, providing a needed connection between the national rail system and Alaska shippers.

While travel times by barge take longer than rail or truck, it provides a lower cost option that is very efficient. According to the Pacific Northwest Waterways Association, one tow (a towboat plus four barges) can move the same amount of freight as one freight train and 538 trucks.

¹³ Waterborne tonnage for principal U.S. ports and all 50 states and U.S. territories; Waterborne tonnages for domestic, foreign, imports, exports and intra-state waterborne traffic, U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center, 2020. <https://usace.contentdm.oclc.org/digital/collection/p16021coll2/id/7447>

Figure 27: Washington's maritime transportation corridors





Supporting resources: Washington port inventory

Washington is home to 158 maritime terminals that facilitate the movement of goods, with 72 terminals on the Columbia-Snake River, five terminals on the Pacific Ocean, and 81 terminals on the Salish Sea. These terminals are also supplemented by public port authorities that support economic development in Washington. There are 73 port authorities in Washington, and 18 of these port authorities have maritime assets for cargo handling or shipbuilding.

Further information on this port inventory is available in [Appendix D –Freight System](#).

Mobility: Road congestion is a common challenge at Washington’s maritime ports. Near the largest ports, heavily congested local road networks can hinder truck access between terminals and the regional highway network. Also, railroad grade road crossings near many maritime ports delay truck and vehicle traffic. On the water side, managing maritime terminal capacity is also critical as volumes grow. Adequate waterway and berth depth and terminal and support yard projects are critical to the efficiency and capacity of maritime cargo operations.

Columbia-Snake River system

This 465-mile-long inland river system connects ports between Ilwaco and Clarkston with the Pacific Ocean. The system provides shippers with a low-cost, efficient, and reliable method of transporting their goods to regional, national, and global markets. The river system is a particularly important link in the grain supply chain. There are 27 grain elevators on the upper Columbia and Snake Rivers. Grain destined for export markets is delivered by barge to export elevators at deep water ports on the Columbia River – then transported via outbound ocean-vessels to markets overseas. This makes the river system the largest wheat export gateway in the U.S. The Snake River alone handles 10 percent of U.S. wheat exports. Commercial navigation on the Snake River is made possible by a series of locks and dams. Dams maintain the water level required for navigation while locks allow for passage around the dams. In addition to supporting transportation, the lock and dam system on the river support energy generation, agricultural production, tourism and recreation, and local economic development.

There have been extensive studies of the impact the series of four locks and dams on the lower Snake River have on the environment, particularly fish wildlife habitats on the Snake River as well as on native Tribes in the Pacific Northwest. Because of this impact, Governor Jay Inslee and Senator Patty Murray are leading work to determine if and how the benefits of the Snake River system can be replaced if the lower Snake River dams were removed and the river restored to a free-flowing condition. In June 2022, the Governor and Senator Murray released a draft of the study (***Lower Snake River Dams: Benefit Replacement Draft Report***) that identifies the needs, potential solutions, and cost estimates for mitigating the loss of benefits the lower Snake River dams provide.

Should dam breaching move forward, barge navigation between the Tri Cities and the Clarkston/Lewiston area would no longer be possible. For freight transportation, a loss of barge navigation would result in an increase in the use of both rail and truck alternatives. This mode shift will impact on road and rail infrastructure in southern Washington. According to the draft report, the increase in shipper transportation costs and how much growth both rail and truck experience depend on 1) how great the disparity is between future truck and rail rates and 2) a given shipper’s location in the region.

The draft study identifies several potential infrastructure improvement needs in the event of dam removal. This includes upgrading rail infrastructure; improving storage, loading, and unloading facilities; and enhancing and maintaining local and state roads. These improvements include track and bridge upgrades to handle heavier cars, extending the short-line system to Tri Cities, new and expanded grain storage facilities, upgraded road capacity, and increased road and bridge maintenance, among others. In addition to infrastructure, the draft report highlights the need for economic mitigation, such as off-setting higher transportation costs and compensating for economic loss, where other mitigation measures are not possible.

Although this draft report identifies mitigation needs, potential strategies, and a range of costs, a more thorough transportation impact analysis is needed to understand more clearly what the infrastructure need is and what that infrastructure will cost.

Asset conditions: Some of Washington's maritime assets and facilities have recently undergone major renovations that improved overall maritime system capacity, mobility, and reliability. In 2018 and 2020, the Lake Washington Ship Canal Locks project replaced a 100-year-old large lock gate and filled culvert valves.^{14,15} Improvements were also recently made to locks and jetties on the Columbia River. Recent and upcoming port investments include:

- The Northwest Seaport Alliance Terminal 5 Modernization Project to accommodate larger container vessels.
- The Port of Longview Berth 4 redevelopment and expansion at Barlow Point to add capacity to its internal rail system.
- The Port of Bellingham Shipping Terminal revitalization, including dredging and pier straightening investments, which will allow a greater range of vessels to access the Bellingham Shipping Terminal.
- Port of Grays Harbor East Terminal 4 redevelopment and expansion to increase terminal cargo space by 50 percent.

Ocean Shipping Reform Act

A significant concern for Washington freight stakeholders who rely on ocean shipping has been slow service and expensive fees being charged by ocean carriers in the wake of COVID-19-related transportation and market disruptions.

In 2022, U.S. Congress passed the *Ocean Shipping Reform Act*, which requires the Federal Maritime Commission (FMC) to investigate complaints about charges imposed by ocean carriers. The act also gives FMC the ability to order refunds for charges determined to be "unreasonable." Other changes resulting from the *Ocean Shipping Reform Act* include prohibiting carriers and terminals from refusing cargo space or resorting to other "unfair or unjustly discriminatory methods" against shippers.

¹⁴ Ballard Locks awarded \$10.5m to replace 100-year-old large lock gates *My Ballard*, September 13, 2018. <https://www.myballard.com/2018/09/13/ballard-locks-awarded-10-5m-to-replace-100-year-old-large-lock-gates/>

¹⁵ Large chamber at Chittenden Locks in Ballard closes for upgrades, *King 5*, February 12, 2020. <https://www.king5.com/article/news/local/seattle/hiram-chittenden-ballard-locks-seattle-renovations/281-586095fc-0e22-4efa-90ef-37ebbe6a03b6>

Washington’s air cargo network

Washington has 22 airports that provide air cargo services. The state’s four major cargo airports are Seattle-Tacoma International Airport (SEA), King County International Airport-Boeing Field (BFI), Spokane International Airport (GEG), and Paine Field Airport (PAE). Figure 30 shows the state’s airports by cargo volume. In addition to airports located in the state, Portland International Airport in Oregon and Vancouver International Airport in British Columbia are also important air cargo service hubs for Washington businesses.

Figure 28: Washington’s air cargo inventory



Source: CPCS analysis of FAF5.3 data, 2022. *Note: these numbers are derived from FHWA FAF 5.3 data source and only capture the domestic air shipment and the domestic portion of international air shipments to or from Washington state. These may differ from the air cargo volume reported by individual airports in WA, which account for both domestic and international shipments moved through their air cargo facilities regardless of state origin or destination.

Freight context: Air cargo is crucial to Washington’s economy due to its speed and reliability. Key state economic sectors, such as agriculture, aerospace manufacturing, and seafood rely on fast transportation to ensure valuable and perishable goods reach domestic and international markets safely and on time. Moreover, the rise of e-commerce has increased the importance and demand for air cargo. Today’s consumers demand two-day or even same-day deliveries, which are often made possible by air cargo. The importance of air cargo’s high speed and reliability is reflected in freight statistics. The air network handled less than 1 percent of Washington’s cargo tonnage, but over 8 percent of cargo by value.

Mobility: Expected growth in air cargo volumes in the future means that Washington’s airports need to prepare for increased volumes by constructing new air cargo warehouses and aircraft parking. Specifically, SEA, GEG, and BFI all have significant capacity constraints based on the *2018 JTC Statewide Air Cargo Study*. SEA, GEG, and BFI all share a deficit of truck parking as well.

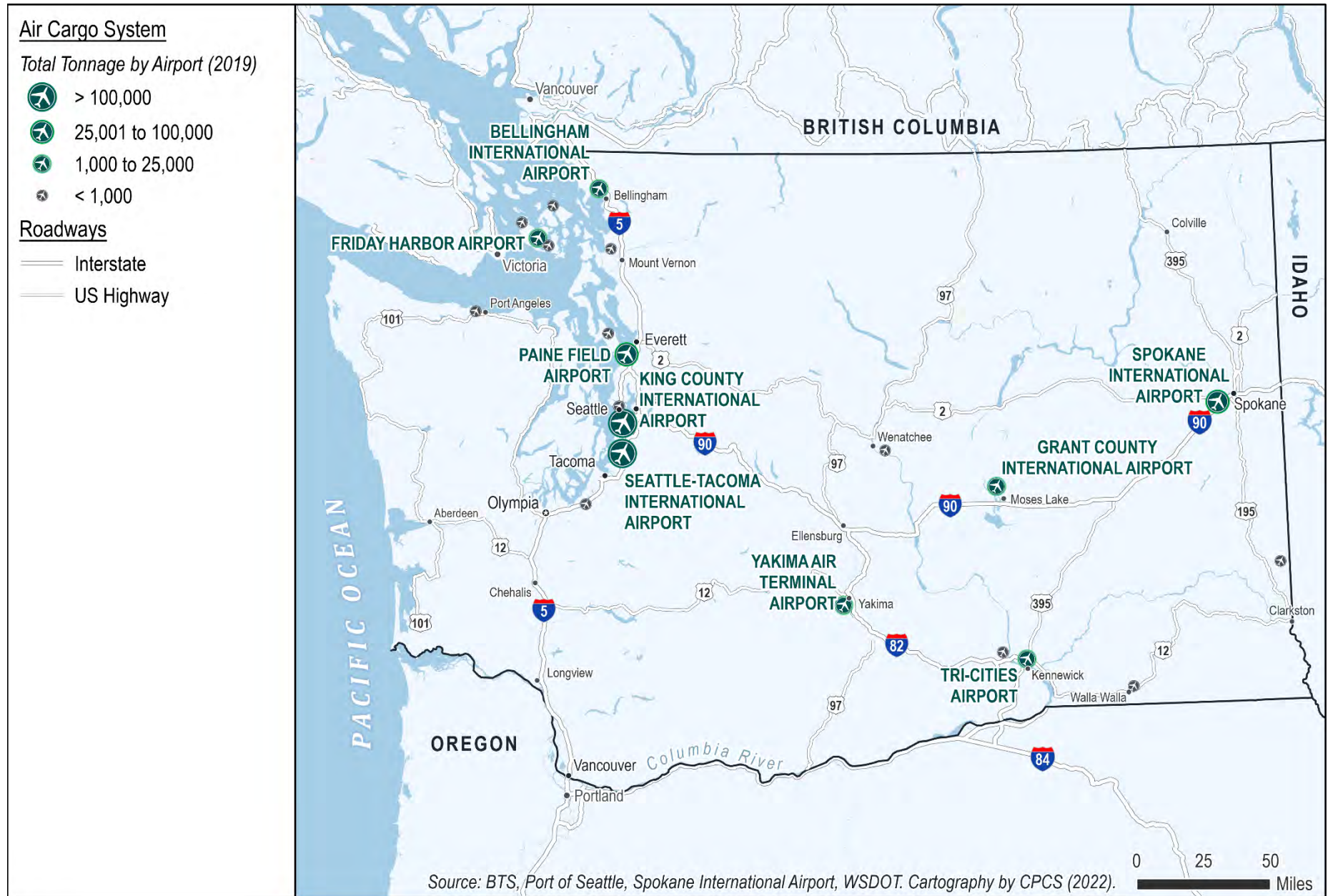
Asset conditions: Most of the runways in the top ten cargo airports (by volume) in Washington are in good or excellent condition. BFI and Tri-Cities Airport have two runways that are in fair condition. The only runway that is in poor condition is at Yakima Air Terminal/McAllister Field.

Figure 29: Seattle-Tacoma Airport air cargo facilities and highway connections



Source: Google Maps.

Figure 30: Washington's air cargo system



Washington’s pipeline network

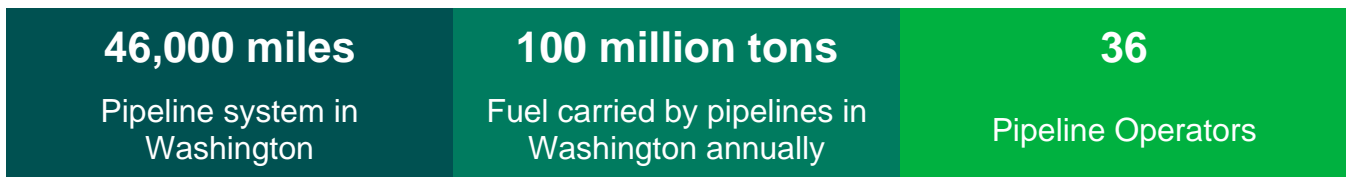
Washington consumes twice the amount of energy it produces, meaning the state is a net energy importer – primarily through pipelines.

Washington’s pipeline system is over 46,000 miles long and carries natural gas, crude oil, and petroleum products across 30 of the state’s 39 counties. Most crude oil comes from Alaska by ship, the Bakken in North Dakota by rail, or Canada Oil Sands by pipeline. Nearly 100 million tons of fuel is carried by pipelines in Washington annually, worth over \$22.8 billion. The largest pipelines in Washington are:

- **BP’s Olympic Pipeline:** The longest in the state. The pipeline carries gasoline, diesel, and jet fuel originating at four refineries in Whatcom and Skagit counties. The fuels are delivered to locations including Seattle-Tacoma Airport, Renton, Tacoma, Vancouver, and Portland (Oregon).¹⁶
- **Williams Companies’ Northwest Pipeline:** Operates in 24 of Washington’s 39 counties.¹⁷ The operator’s 3,900 miles of transmission pipeline carries 3.8 million dekatherms of natural gas,¹⁸ per day, between the states of Washington, Oregon, Idaho, Wyoming, Utah, and Colorado.¹⁹
- **Cascade Natural Gas Corporation:** Operates in 17 of Washington’s 39 counties.²⁰ Headquartered in Kennewick, Cascade’s pipeline serves over 294,000 customers.²¹

Washington also has the nation’s fifth-largest refining capacity. The state’s five refineries convert significant amounts of crude oil into consumer products like gasoline and jet fuel. BP’s Cherry Point refinery in Blaine is the largest in Washington, capable of processing about 242,000 barrels of crude oil every day. It is the only refinery in the Pacific Northwest that can produce diesel from biomass feedstocks and is the largest supplier of jet fuel to international airports in Seattle, Portland, and British Columbia.

Figure 31: Washington pipeline network inventory



Source: CPCS analysis of PHMSA data and Freight Analysis Framework data. 2022.

Mobility: The volume of oil movement by pipeline in Washington has been slowly rising over the last decade, from just over six billion gallons in 2010 to over eight billion in 2019. Oil volumes fell to 7.5 billion gallons in 2020 as the pandemic developed. Meanwhile, crude oil volumes have remained stable. In 2020, almost 72 million barrels, or over three billion gallons, of crude oil moved by pipeline in the state. Unlike natural gas pipelines, oil and petroleum pipelines in western and eastern Washington do not connect. This restricts the pipeline system from moving fuel east to west, a gap that the rail

¹⁶ Our pipelines, BP, (n.d.). https://www.bp.com/en_us/united-states/home/products-and-services/pipelines/our-pipelines.html#accordion_olympic

¹⁷ Pipeline Operators by County, Washington Utilities and Transportation Commission, (n.d.). <https://www.utc.wa.gov/pipeline-operators-county>

¹⁸ A dekatherm (Dth) is a unit to measure the heating value of a certain volume of natural gas. One Dth is equal to a million thermal units. <https://www.definitions.net/definition/DEKATHERM>

¹⁹ Northwest Pipeline, Williams Companies, (n.d.). <https://www.williams.com/pipeline/northwest-pipeline/>

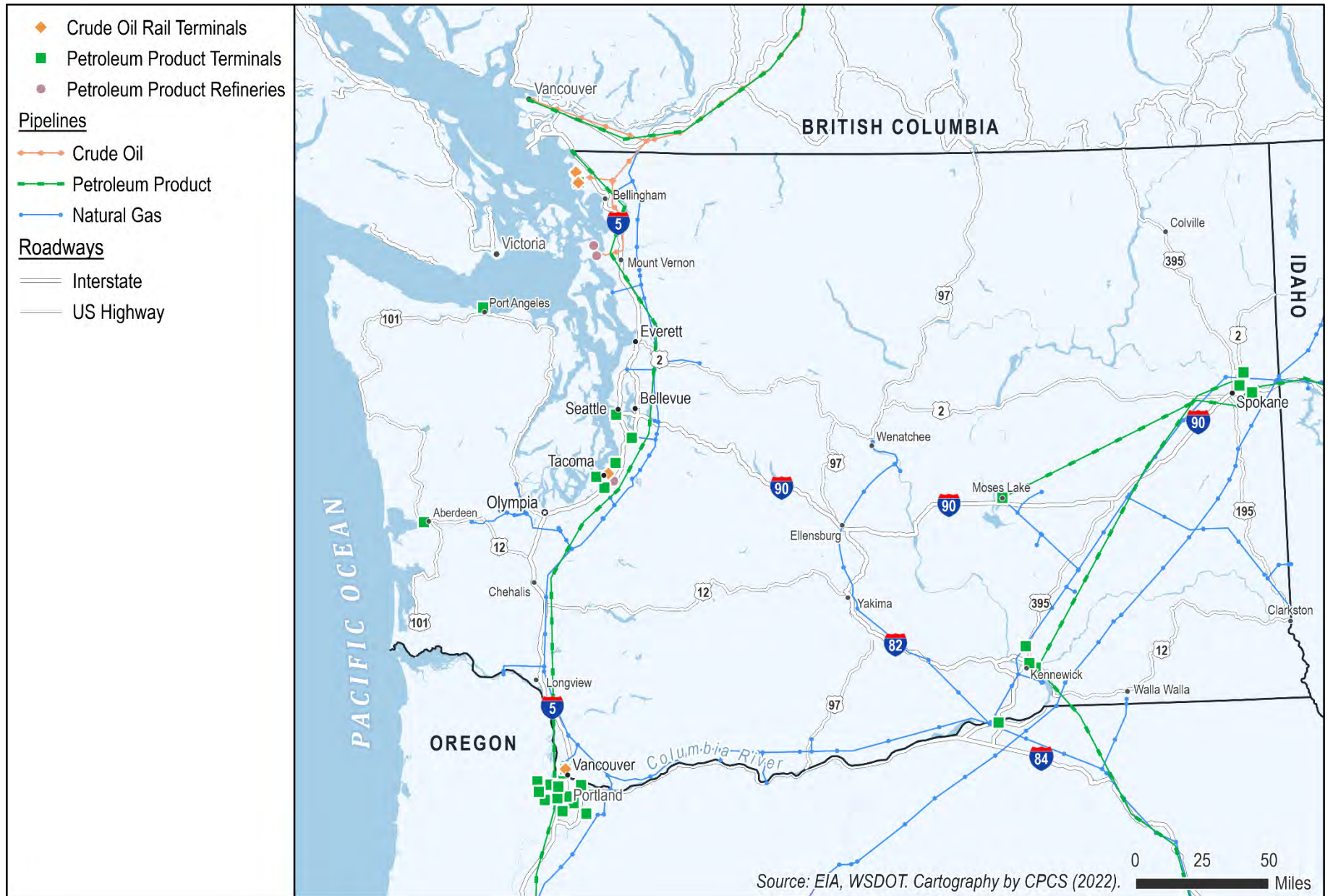
²⁰ Pipeline Operators by County, Washington Utilities and Transportation Commission, (n.d.). <https://www.utc.wa.gov/pipeline-operators-county>

²¹ About Us, Cascade Natural Gas Corporation, (n.d.). <https://www.cngc.com/in-the-community/about-us/>

system tends to fill. This lack of east-west connection also means there is limited resiliency in the transportation system's movement of oil and petroleum between eastern and western Washington.

Safety: Between 2011 and 2020 four pipeline safety incidents occurred in Washington, leading to three injuries. The average number of incidents per mile of pipeline system in the state is about 60 percent less than the national average, indicating a relatively safer pipeline system. This is likely the result of significant investments in spill prevention and spill response equipment. During the same period, two major hazmat spill incidents (over 100 gallons) occurred in Washington. Pipeline spill incidents are relevant to safety analysis but are typically considered an environmental issue and are monitored by Washington Department of Ecology. Pipeline security evaluation measures focus on operation and site-specific safety issues (e.g., access control systems, lighting, intrusion detection systems) and are regulated by the Transportation Security Administration (TSA).

Figure 32: Washington's pipeline system



Summary of findings

Washington’s freight system is extensive, complex, and interconnected – from the constantly in-demand truck network to the Class I and short line railroads, to the maritime network and its three subsystems, to the air cargo network with its 22 airports, to the vast pipeline network. Together, these systems move supplies, groceries, raw materials, parts and components, and many other critical products to residents and businesses. Collaborative planning is needed to ensure the system remains safe, competitive, reliable, and well-maintained over time.



Supporting resources

Further detail on specific assets of Washington’s freight transportation system and the performance of the freight system can be found in the following items:

- [Appendix D Freight System](#)
- [Appendix E System Performance](#)



A System Facing a Changing World



A system facing a changing world

This chapter provides an overview of significant freight system trends, needs, and issues with respect to the state. While the system functions relatively well (except for some chronically congested segments), both short-term disruptions and longer-term trends and issues can cause a breakdown in system performance. Performance breakdowns can occur as a result of ongoing, expected, and resource-constrained challenges, such as recurring congestion, maintenance issues, and climate change, but can also occur as a result of unexpected challenges, such as a pandemic, floods, and major collisions.

This section summarizes forecasts for increasing freight volumes and introduces the potential for disruptions in four topic areas:



Economic shocks such as trade agreements, freight workforce labor shortages, continued growth and supply chain disruptions, and e-commerce.



Climate change-related trends, such as increased frequency and severity of wildfires, storms, and sea level rise



New technologies such as autonomous vehicles and new fuels



Freight transportation's impact on the environment such as CO2 emissions and impacts on wildlife habitat

Winter 2022 flooding and freight disruptions

Severe weather is an example of a major challenge facing Washington's transportation system. In January 2022, swelling rivers, mudslides, and torrential rain inundated sections of I-5 while snow, avalanche concerns, and poor visibility closed mountain passes in the Cascades, cutting off Puget Sound from the rest of the state.²² While the state was able to restore road access within a few hours, this event reminded many Washingtonians of the 2007 I-5 flooding that lasted four days, cost \$47 million in economic losses, and stranded hundreds of truck drivers and commuters.²³

Figure 33: I-5 Flooding in Chehalis



Source: WSDOT, 2022.

²² I-5 reopens after flooding closed 20-mile stretch in Chehalis for several hours, *The Seattle Times*, Christine Clarridge and David Kroman, January 7, 2022. <https://www.seattletimes.com/seattle-news/weather/20-mile-stretch-of-i-5-closed-in-chehalis-due-to-flooding/>

²³ Travel Costs Associated with Flood Closures of State Highways Near Centralia/Chehalis, Washington, Mark E Hallenbeck, Anne Goodchild, and Jerome Drescher, 2014. <https://trid.trb.org/view/1331203>



Supporting resources

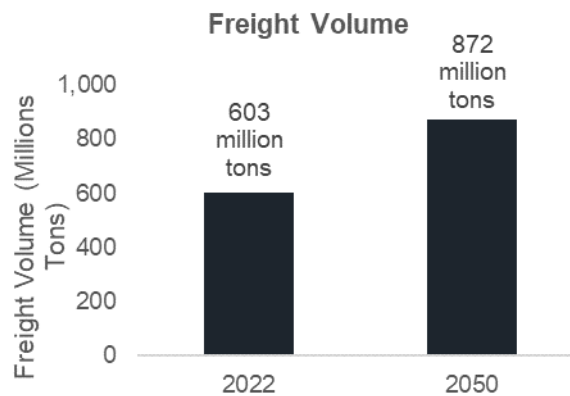
[Appendix F – Needs, Issues, and Potential Improvements](#) provides more information about the different trends and factors studied as part of development of the 2022 FSP that may impact the Washington freight transportation system in the future.

Changing freight volume

Washington’s population and economy are expected to continue growing, and this growth will be accompanied by increasingly large volumes of freight moving to, from, and within the state.

The following figures illustrate the projected change in state freight tonnage (Figure 34), modal share (Figure 35), and commodity growth (Figure 36) between 2022 and 2050 according to FHWA’s Freight Analysis Framework (FAF).

Figure 34: Freight forecast*



Source: CPCS analysis of FAF5.3 data, 2022.

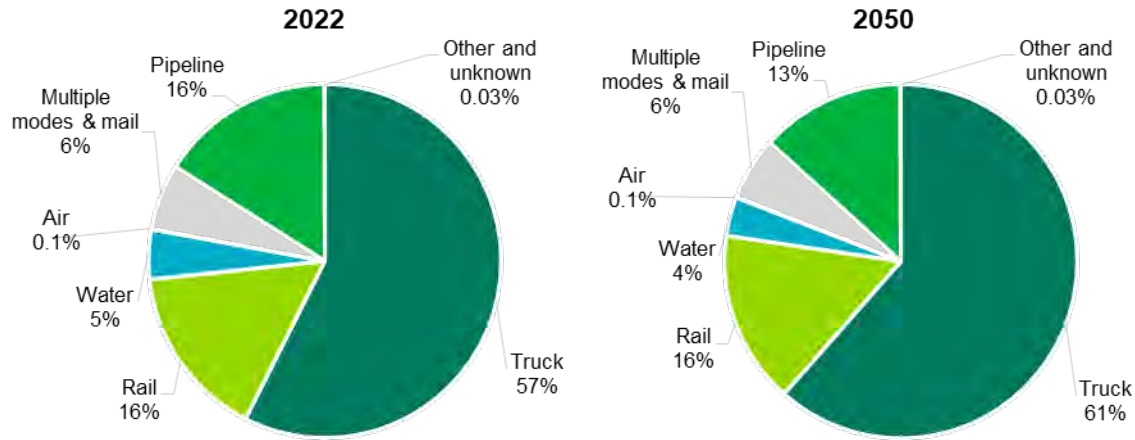
Between 2022 and 2050, freight movements in Washington are forecast to increase 45 percent, from 603 million tons of cargo to 872 million tons. For reference, U.S. tonnage is expected to increase 44 percent, from 19,975 million tons of cargo to 28,904 million tons between 2022 to 2050. Freight volumes are expected to grow over time, and many factors impact where, how, and what freight will travel on the system in the future.²⁴

Increasing freight volumes are likely to further exacerbate many of the challenges the state freight system currently faces. Forecasted truck vehicle miles traveled on the various interstates are expected to increase by 67 percent from 2022 to 2050.

Together, Figure 35 and Figure 36 display how the modal distribution of freight tonnage is expected to change over the next 30 years. Specifically, air cargo has the largest change in tonnage between 2022 and 2050 (104 percent), but it is growing from the smallest base in 2022, resulting in a very small percentage increase in modal share (0.05 percent in 2022 to 0.07 percent in 2050). The growth in truck tonnage in both absolute and percentage terms results in an increase in modal share for trucks in 2050. Despite growth in tonnage, the modal share of freight tonnage transported by rail and multiple modes and mail are relatively unchanged from 2022 to 2050. Similarly, the pipeline system and maritime are projected to grow at a slower rate (pipeline growth 20 percent and maritime growth 13 percent), relative to other modes, resulting in decreased market share.

²⁴ CPCS Analysis of FHWA Freight Analysis Framework Version 5, measuring Washington total freight movements in 2022 and 2050 including Washington cargo origins, destinations, and within movements across all modes.

Figure 35: Freight modal share by weight



Source: CPCS analysis of FAF5.3 data, 2022.

Figure 36: Change in tonnage, by mode

Mode	2022 Tons (thousands)	2050 Tons (thousands)	Percent Change
Air	310	633	104%
Truck	345,778	535,760	55%
Rail	95,637	137,575	44%
Multiple modes & mail	36,202	50,176	39%
Pipeline	96,526	115,481	20%
Water	27,349	30,983	13%
Other and unknown	1,677	1,440	-14%
Total	603,480	872,047	45%

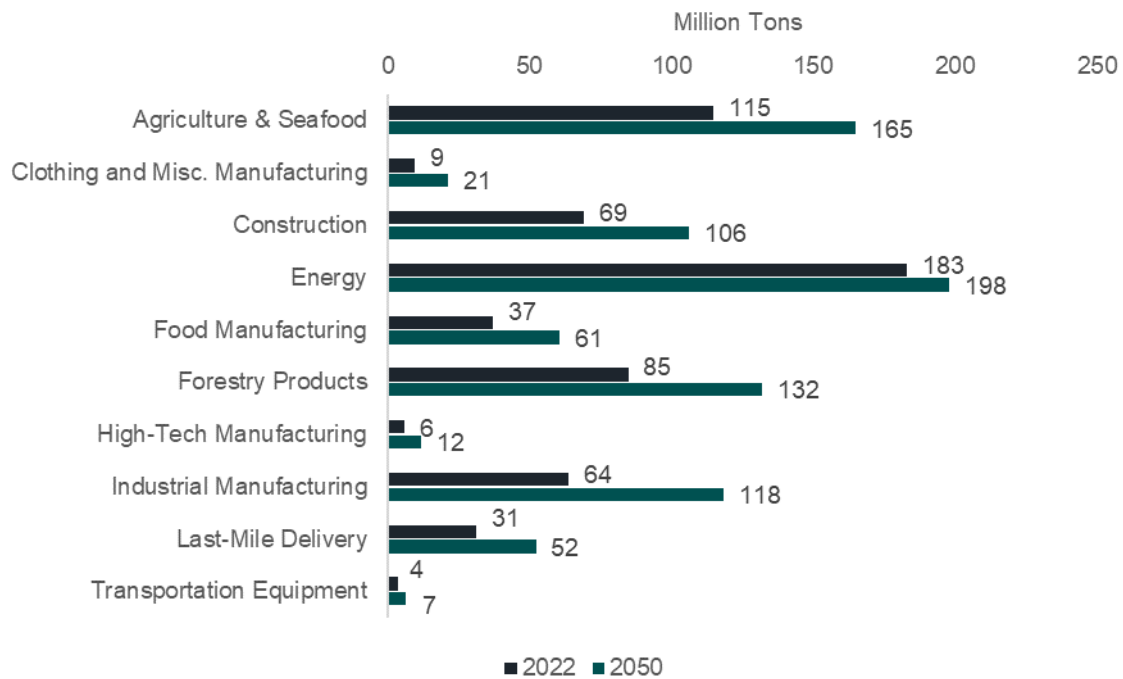
Source: CPCS analysis of FAF5.3 data, 2022

Note: FAF data focuses on shipment origins and destinations, regardless of transportation facilities used. Further, this data, used here for modal share and tonnage analysis, represents modes used for all domestic shipments and the domestic portion of international shipments; it does not include the foreign mode used for the international move.

The importance of containerized ocean shipments to and from Washington ports

Waterborne trade statistics typically detail the various maritime shipment types, such as bulk, breakbulk, autos, project cargo, and containers. Containerization is a more efficient, faster, and economical way to ship certain types of products by ocean. Containerized shipments are how agricultural exports (aside from grains) usually move on the maritime system. Import containers are largely filled with consumer goods, which are lighter weight. Viewing containers only by weight can understate the importance and value of these shipments. As consumer demand and the need for imported components for manufacturing grow, the growth in container volumes will likely increase faster than the overall tonnage of maritime cargo. Container shipments are also typically higher in value and can be more time-sensitive than cargoes moving by other types of maritime shipping. Forecasting maritime growth by weight can sometimes underrepresent the growth in containerized shipments and related demand for landside freight transportation.

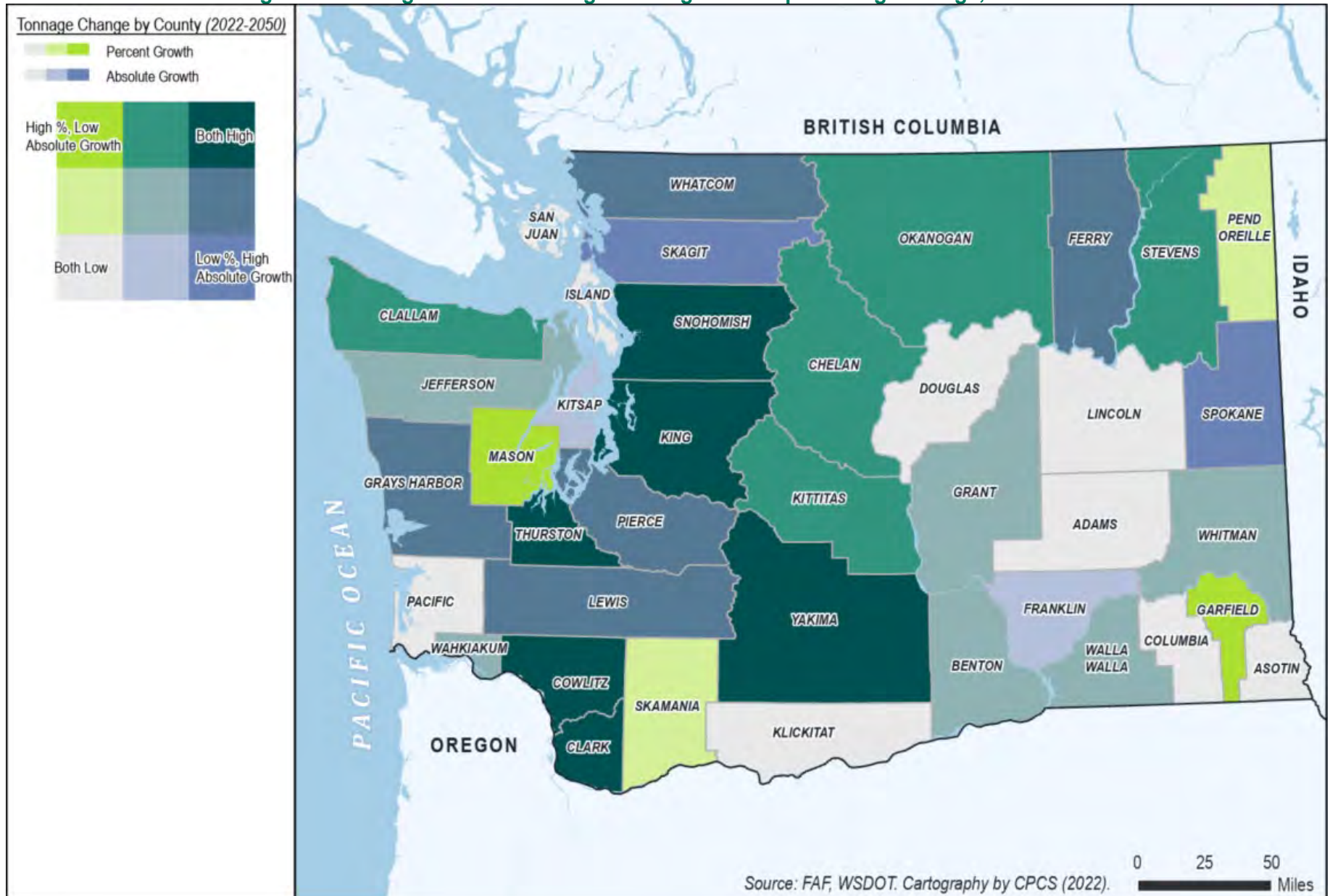
Figure 37: Growth in top commodities, 2022-2050



Source: CPCS analysis of FAF5.3 data, 2022.

Figure 38 displays the percent change in freight tonnage between 2022 and 2050 by county. Freight tonnage is expected to grow fastest on a percentage basis in Okanogan, Snohomish, King, Mason, Stevens, and Garfield Counties. In-line with Figure 37, the driver of growth in freight tonnage is attributable to agriculture and seafood, forestry products, industrial manufacturing, and construction. Figure 39 displays a map that shows the change in tonnage from 2022 to 2050 in both absolute and percent terms. Displaying both percent growth and absolute change in freight tonnage provides additional context to interpret the percent change in tonnage between 2022 and 2050. For example, King County has both a high growth rate (64 percent) and growth in the tons (92.4 million tons) originating or destined for the county. Conversely, Garfield County has a high growth rate (72 percent), but a much smaller growth in tons (1.4 million tons).

Figure 39: Change in absolute freight tonnage versus percentage change, 2022-2050



Source: CPCS disaggregation of FAF 5.3 Data Note: Pipeline tonnage is not assigned to counties in the FAF disaggregation, due to data limitations. Therefore, pipeline flows are not included in the calculation of change in tonnage.

Impact of economic shocks

Changes to the state's economic conditions impact what, where, when, and how goods move on the freight system.

Demand for freight transportation is an *induced demand* – it occurs in response to other activities and actions in the market, such as firms' choices to produce goods, and consumers' choices to purchase them. Therefore, the demand for freight transportation and characteristics of this demand (such as choices of specific transportation modes or routings) are heavily influenced by other events in the broader state, national, and global economy. Some of the long-standing economic trends impacting the freight system include international trade agreements, truck driver shortages, growth in warehousing and distribution, and e-commerce impacts. The COVID-19 pandemic also created or worsened short-term supply chain challenges in Washington and beyond.

International trade agreements: In March 2020, the United States-Mexico-Canada Agreement (USMCA) was ratified. The agreement is expected to strengthen north-south trade ties for Washington and may increase truck volumes at the border crossings between Washington and British Columbia. At the same time, the U.S.-China trading relationship has been challenging for agricultural producers. It is also not clear what the long-term impact of the U.S.-China tariffs and trade agreements will have on Washington's trade.

The importance of border crossings

Washington's highway and railway crossings with Canada are important transportation corridors. There are 13 land "ports of entry" between Washington and Canada, and five of these ports of entry handle railroad traffic. The Cascade Gateway complex along the I-5 corridor in Blaine handles the greatest volume of traffic between Washington and Canada. Historically, the volume of trucks travelling between Washington and Canada has remained steady, but rail traffic across the border has grown significantly over the past 20 years.

Since border crossings are important trade corridors, it is important that trucks can pass quickly through customs, and that delays are minimized. An example of work to optimize border crossings is the International Mobility and Trade Corridor Program (IMTC), which is focused on improving mobility and security for the border crossings between Whatcom County and the Lower Mainland of British Columbia.

Freight workforce labor shortages: The aging workforce in Washington, along with other factors such as labor skills and retention challenges, is affecting the state's economy and, in particular, the freight-related industries. The labor shortage resulting from these factors affects every aspect of the freight industry, from inventory levels to supplier costs, shipping schedules, and consumer prices. The resilience of supply chains, which is the ability to prepare for and adapt to unexpected events, is also affected by workforce shortage. An example is the COVID-19 pandemic, which, apart from affecting the market demands and consumer behavior, disrupted the supply chains by exacerbating the workforce issues.

The ongoing workforce shortages for freight-related professions also present opportunities for new groups, such as women and people of color, to enter the freight workforce, but further work may be needed to educate groups like these about career opportunities in these industries and the educational pathways into the industry. WSDOT's own strategic plan has significant goals of workforce development and diversity, equity, and inclusion, and the department has engaged in multiple efforts to support increasing women and diverse communities' participation in the transportation workforce.

Truck driver shortages and the need for truck parking: Washington and the broader United States continue to face long-standing shortages of truck drivers. This was the top issue identified in the FSP survey conducted in June 2022 and a topic of interest from many of the consultations conducted during the development of the FSP. Without enough drivers, companies must pay a premium to move goods

or may be unable to move them on schedule, impacting both the cost and reliability of freight services. Trucking companies also expressed concern about attracting new, younger drivers, as people entering the workforce are deterred by trucking's long hours and potential for long periods away from home. Age limits are another potential barrier, as drivers must be over age 21 to drive commercial vehicles across state lines, and many people entering the workforce before age 21 find other careers instead. By comparison, long-haul drivers cite low wages, long periods away from home, poor availability of amenities, transportation issues (including a lack of safe truck parking), and public respect as issues that impact the ability of carriers to attract and retain drivers. Other concerns from drivers were classification as contractors versus employees of trucking companies (affecting employment status, potential income, and insurance requirements) and expensive insurance requirements as barriers to entry.

A lack of truck drivers is a serious concern because it affects the affordability and reliability of freight transportation services.

Supply chain challenges:

The COVID-19 pandemic unveiled weaknesses in supply chains. The supply chain shocks of the pandemic may result in long-term changes in how and where goods are produced.

As one of the nation's leading trade gateways, Washington and its residents experienced COVID-19 related supply chain challenges firsthand. Respondents to WSDOT's FSP survey indicated that supply chain disruptions were the second-most important freight-related challenge the state faced. Additionally, manufacturers consulted during the development of the FSP also expressed ongoing concern about supply chain instability. Workforce shortages, trade disruptions, changes in freight delivery patterns, and other shocks have roiled otherwise stable supply chains, placed pressure on Washington's multimodal freight system, and impacted Washington's enterprises and households.

Early in the pandemic, China began to close factories to control the spread of the virus, leading to supply shortages for many manufacturers. As in-person business activity and consumption rapidly curtailed, many producers were unable to sell to their traditional buyers. An example of supply chain shocks can be seen in Washington's agricultural sector: COVID-19-related restrictions on in-person dining significantly depressed demand for Washington's potato and onion products in the spring and summer of 2020, and Washington's farmers were left with excess supply. This meant that agricultural producers were forced to find ways to store their excess crops or find a way for them to be manufactured into other food products. For example, some potatoes could be manufactured into French fries.

Port congestion: In summer 2021, a record number of container vessels were anchored in Puget Sound, waiting to unload in Seattle and Tacoma. This backlog of ships was caused by many factors related to different modes of transportation:

- **Ocean shipping** encountered service interruptions at Asian ports, which disrupted the usually steady pace of incoming shipments. When the interruptions stopped, it created a peak in shipping activity.
- **Trucking** issues, such as a shortage of truck drivers to haul containerized cargo in and out of the state's container ports to intermodal container railroad terminals, resulted in further port congestion and delays.
- **Railroad** congestion at intermodal yards in other parts of the U.S., like Chicago. This congestion made it harder for goods to move further inland.

These challenges illustrate how dependent the freight system is on different modes of transportation to connect global, national, and regional supply chains. These examples also illustrate how problems with different modes in different locations around the world can produce visible effects in Washington.

Container Availability: During the pandemic, heavy demand for imports led many carriers to return their empty containers to Asia quickly without export loads. As a result, Washington exporters were unable to ship their products even as international demand remained strong. If these trends continue long-term, overseas buyers may permanently switch to competing providers in other locations. In turn, this shift in sourcing patterns may impact the volume and routing of freight traveling through Washington.

Re-shoring: Global supply chains are complex, and thus more susceptible to disruptions in the world economy and global politics. Domestic production based in the U.S. can mitigate some of these risks, and the practice of re-shoring has gained momentum during the pandemic due to supply chain shortages. Re-shoring (moving supply chains back to North America from overseas) can contribute to greater resiliency as well as sustainability by bringing production and consumption hubs closer together.

Congestion or Delay Caused by Freight Movements: In addition to being affected by congestion, freight movements themselves can cause significant congestion or delay. In Washington, some types of significant congestion or delay caused by freight movements include long freight trains blocking railroad crossings, local congestion caused by heavy truck traffic at ports and warehouses, congestion created by local deliveries of e-commerce shipments, and road congestion from lift bridge operations. For example, the top 50 rail crossing in Washington state were found to be blocked by trains for an average of two hours per day, causing delays to vehicle traffic.²⁵

Changing land uses around urban industrial facilities

As Washington's population grows, residential and commercial zones of major urban areas may begin to expand into areas formerly dedicated to industrial or freight handling uses. For example, waterfront property used for cargo handling or industrial purposes can also be very attractive for residential development. Therefore, it is not uncommon to see industrially-zoned areas converted into other uses. As this conversion occurs, the potential for conflicts between freight activity and other transportation users and residents may increase. Alternately, relocating freight facilities away from urban centers can increase travel distances, adding to congestion, emissions, and conflicts with other transportation users. Additionally, once industrial property is converted into other land uses, it is very difficult to revert to its previous industrial application. WSDOT does not have a direct role in managing land use, but engagement from state and regional land use managers to preserve or protect select industrial land uses (particularly on geographically-unique waterfront areas and along the freight system) may be necessary to mitigate potential freight conflict and congestion in the future.

Impacts of e-commerce on freight infrastructure and land use

E-commerce refers to buying and selling of products or services through the internet. E-commerce's shares of U.S. total retail sales grew from 4.7 percent in 2011 to around 13.0 percent at the end of 2021. More Washington residents are shopping online than ten years ago due to the growth in the number and diversity of online shopping options. Consumers are also increasingly demanding shorter delivery times, such as one-day and same-day delivery, from online retailers. The pandemic further accelerated e-commerce growth, as quarantine and travel limitations pushed consumers to shop online more frequently.

²⁵ Source: Washington State Legislature Joint Transportation Committee. "Study of Rail-Road Conflicts in Cities." 2016.

While purchases occur increasingly online, e-commerce deliveries have real-world freight transportation and land use impacts.

Increased delivery activity and freight traffic: Statewide or regionally, increasing volumes of e-commerce purchases, as well as the associated returns and failed deliveries increase overall freight vehicle traffic. The widespread adoption of one-day or same-day delivery services and their time-sensitive nature also contributed to increased delivery traffic. In turn, this increased delivery activity has grown the volume of truck traffic traveling to and from warehouses and distribution centers and in many areas such that traditionally did not have much truck traffic.

Increased neighborhood congestion: On a more local level, trucks completing the “last mile” of e-commerce delivery trips to consumers and businesses both contribute to, and are affected by, congestion on neighborhood streets. This concern is particularly important in dense urban areas that may have a high demand for delivery services but also have limited parking space. The traffic disruptions associated with these deliveries, as a result of loading and unloading trucks blocking traffic lanes, bike lanes, or sidewalks, or drivers circling city blocks in search of proper parking, have negative impacts on productivity, quality of life, and air quality.

Deliveries and impacts at the curbside: With the growth of e-commerce, unloading or loading delivery vehicles are increasingly in conflict with other uses of curb space on local streets, such as street parking, bus stops, bicycle lanes, and passenger pickups and drop offs for taxis and ridesharing services. Many urban roadway configurations are also not designed for large volumes of trucks, making truck operations in some areas difficult.

Seattle’s Central Business District installed sensors on curbs to understand the duration of deliveries. This information was used to establish appropriate fee schedules and dynamic pricing for use of downtown curb space. The city also sets priorities for curbside functions based on surrounding land uses. Other cities across the U.S. and Canada are also seeking to encourage off-street loading bays through code changes and other form-based ordinances for industrial developments.

The potential for decreased personal trips: As consumers shift their spending from “brick and mortar” retailers to e-commerce purchases, there is potential that this change could reduce the number of personal trips that Washington residents make for shopping. The convenience of e-commerce shopping may also make it easier for residents to live without cars.

Large warehouses and distribution centers at the edge of urban areas: One of the notable impacts of e-commerce on land use includes the creation of new, extremely large warehouses and distribution centers at the edge of urban areas. The creation of new freight facilities is increasing truck traffic in areas that may not have been initially designed to accommodate large volumes and contributing to congestion on first/last-mile connection between warehouses and major highways.

Twelve mega distribution centers have been built since 2014 or are in development in Washington. Six of these centers are or will be located in the Puget Sound region, while two are located in Southwest Washington (Clark County). The remaining new mega distribution centers are geographically dispersed in south central Washington (Yakima, Benton, and Adams Counties) and Spokane.

“Micro” distribution centers in urban neighborhoods: The pressure to meet promises of reliable and rapid delivery has pushed e-commerce companies to create small “micro” distribution centers closer to consumers. These “micro” distribution centers and package lockers are emerging in dense urban areas to serve specific neighborhoods. However, creation of these facilities can also create localized increases in truck traffic in areas not originally intended to serve large volumes of trucks.

Increased demand for air cargo facilities: The rapid shipping speed of air cargo is key to the success of e-commerce companies that promise fast delivery. With Washington’s air-dependent commodity

tonnage projected to double from 2022 to 2050, the state is expected to see an increased demand for air cargo facilities. For example, the Spokane International Airport Business Park is a key air cargo transshipment and distribution center and is adding new facilities to fulfill e-commerce air cargo needs.

Emerging e-commerce technologies. There is a rapidly evolving group of new technologies being created in response to the increasing demand for e-commerce services, and the challenges listed above. Some notable examples of new technologies to address e-commerce challenges include:

- **Electric cargo bikes.** In 2021, UPS partnered with the University of Washington to conduct a pilot test of electric cargo bikes and found that electric cargo bikes can replace trucks.
- **Cargo locker systems.** In August 2020, the University of Washington's Urban Freight Lab opened a package pick-up solution in Seattle's Belltown neighborhood to reduce delivery vehicle dwell time and carbon emissions and increase the productivity of load/unload parking spaces.
- **Sidewalk and Aerial Drones.** In 2019, Amazon tested delivery robots in Snohomish County that were able to maneuver around sidewalk obstructions to deliver packages to customers. Companies like Amazon are also exploring the potential value of utilizing unmanned aerial vehicles (i.e., "drones") to support package delivery as well.

Impacts of climate change, extreme weather, and natural disasters

Washington's freight system will have to adapt to the hazards associated with climate change. State projections show increases in temperatures during all seasons and a modest increase in precipitation year-over-year. These climate changes will increase the risk of disruptions to Washington's freight system, particularly in highly exposed areas like coastlines or floodplains, isolated areas, and systems that lack redundancy. With only a limited number of north/south and east/west road and rail routes, even where alternatives exist, they often can add time and costs, further adding to disruptions. WSDOT is taking measures to ensure the system's resiliency to withstand future natural disasters and extreme weather events such as:

- **Flooding** can disrupt freight mobility across the state. I-5 is particularly prone to flooding in lower-lying areas. These closures can last for days, cost millions of dollars, and strand truck drivers and commuters. The state expects to see increases in seasonal floods over time. Spring precipitation is expected to shift earlier, which may increase the frequency of winter-time flooding. As temperatures increase, floods are expected to become more common.
- **Storms** can close roads and rail lines, flood airfields, and even damage shipping fleets and cargo if water levels are high. Port facilities along waterways can also require more work after flash flooding, especially if they lack adequate drainage or are unprotected by levees. Projections show that storms will be longer, wider, and wetter in the North Cascades, northeastern Washington regions, and Seattle-Tacoma area. More damaging, high-precipitation, and high-wind events known as "atmospheric rivers" are also anticipated to increase.
- **Sea level rise** is already impacting Washington's freight system. For example, the maritime system is being impacted by corrosion and scouring of infrastructure caused by higher water levels and increased flooding events. Over time, the maritime system will also be impacted by lower clearance heights under fixed bridges and coastal flooding of port facilities. Similarly, rail tracks and tunnels located close to sea level may flood, and future flooding may cut off critical low-lying freight port facilities from the freight network. The majority of sea level rise in the Seattle metro area is predicted to be in the Duwamish Valley, which is close to the Port of Seattle and home to residents living in South Park and Georgetown who are already disproportionately impacted by air pollution. In response to the potential problems posed by sea level rise, WSDOT staff participate in the Washington Coastal Hazards Resilience Network, which supports capacity building and planning to address impacts of sea level rise.

- **Landslides and erosion** can lead to congestion, detours, the temporary isolation of some communities, and risk of injury. These types of events are relevant to freight because they can disrupt the flow of goods for days or weeks at a time. Washington is one of the most landslide-prone states in the country. In coastal areas, shoreline erosion is expected to increase from sea-level rise, destabilizing bluffs and increasing the potential for landslides.
- **Snowfall** can lead to road closures or roadway congestion in the freight system. Washington experiences closures of I-90 due to heavy snowfall and the risk of an avalanche each winter. Other routes also experience similar closures and delays. In a rare occurrence in January 2022, all four highway passes in the state were closed simultaneously. While WSDOT's road crews are skilled at clearing and re-opening critical freight corridors, severe snowfall events can prevent or delay opening when weather conditions make clearing operations unsafe for workers. Major snowfall events on corridors like I-5 also create significant strains on Washington's truck parking resources because the increased volume of trucks that travel on the corridor all must find places to park when mountain passes close.
- **Wildfires** have the potential to damage highway and roadway infrastructure, which inhibits freight access along key corridors. Smoke from wildfires can also reduce visibility for road, rail, and grounding aircraft and poses a health risk to people nearby. In 2021, wildfires burned about 670 thousand acres of Washington land, and in 2017, the Eagle Creek fire along the Washington-Oregon border led to the closure of I-84 and an adjacent railway. Over time, climate change will cause drier conditions that, along with other factors, can increase the severity and frequency of wildfires. The Pacific Northwest projected wildfire burn area is expected to double by the 2040s and triple by the 2080s relative to a 1916-2006 baseline. Fire severity is also projected to increase.

Figure 40: Wildfire closure of SR 410



Source: WSDOT, 2022.

- **Extreme heat** can lead to an increased risk of heat-related illness and death, as well as service interruptions if conditions are unsafe for outdoor work. Sustained high temperatures can also cause rail to buckle and asphalt to soften and shift, while concrete pavement can heave at the joints. This is especially an issue on roadways with high truck traffic. Bridges are also sensitive to thermal expansion and can be damaged over time. Electrical equipment necessary for rail, air, and sea freight carriers is also susceptible to failure or deterioration if power systems overheat. Overall temperatures and the number of extreme heat days in the Pacific Northwest are projected to increase steadily over the 21st century.

Climate Commitment Act, 2021

The Climate Commitment Act (CCA) of 2021 commits Washington to reducing greenhouse gas (GHG) emissions by 45 percent, 70 percent, and 95 percent below 1990 levels by 2030, 2040, and 2050, respectively. Achieving these goals will not be possible without a significant reduction in freight emissions. WSDOT is required to continue its efforts to reduce GHGs while simultaneously promoting environmental justice and equity.

Source: Greenhouse gas emissions cap and invest program, Washington state Legislature, 2021.
<https://lawfilesexternal.wa.gov/biennium/2021-22/Pdf/Bills/Session%20Laws/Senate/5126-S2.SL.pdf>

Earthquakes and tsunamis

Earthquakes and tsunamis can disrupt multiple freight modes with. Washington’s entire shoreline sits on the Cascadia Subduction Zone, which has the potential to produce major earthquakes and tsunamis. As a result of these risks, WSDOT participates with other state, federal, and local partners in annual *Cascadia Rising* earthquake drills, which help major stakeholders coordinate response plans for major earthquakes and tsunamis. In addition to the risks posed by local earthquakes, Washington’s coastal communities are susceptible to tsunamis created elsewhere in the Pacific Ocean and often do not have redundant freight corridors. In the event of a tsunami, coastal communities can be cut off from the freight network for extended periods. WSDOT is addressing some of these concerns by refitting infrastructure to improve its resilience.

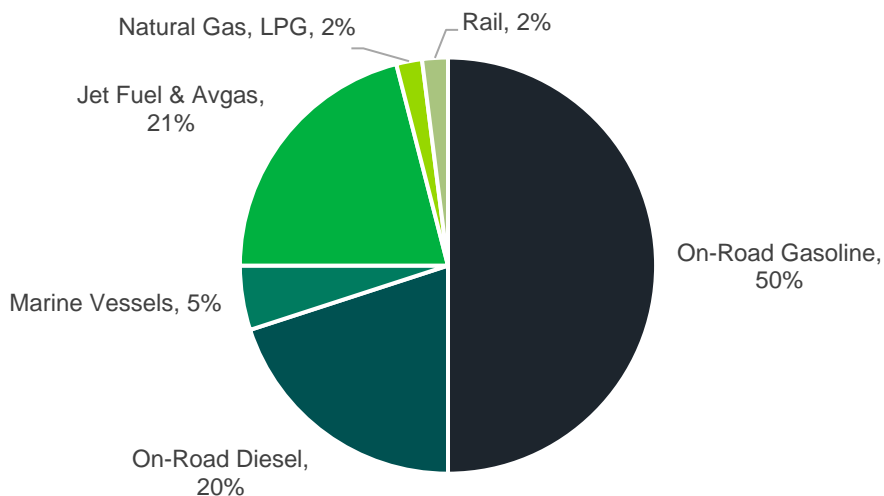
Volcanoes

Located on the Pacific Rim, Washington is home to a number of volcanoes. Most are not active at the present. However, if Mt. Baker, Mt. Rainier, or others enter an active and eruptive phase, road, rail, and maritime infrastructure are at risk. Mt. St. Helens’ 1980 eruption disrupted river traffic as flash flooding that occurred on rivers draining from the mountain filled in the navigation channel along the lower Columbia River. More temporary disruptions could stem from road, rail, and air space closures due to ash and debris creating dangerous operating conditions.

Environmental impacts

Greenhouse gas emissions (GHG): Freight is a major contributor to greenhouse gas emissions. Between 2016-2018, Washington’s transportation sector accounted for 45 percent of all greenhouse gas emissions. Despite improvements in energy efficiency, transportation emissions continued to grow by 60 percent from 2010 to 2018.²⁶

Figure 41: Washington state transportation emissions by fuel type



Source: Washington Department of Ecology Greenhouse Gas Emissions Inventory. 2018.

In 2020, the Washington Legislature set new greenhouse gas emission limits. Under the law, the state is required to reduce emissions levels to 1990 levels by 2020, 45 percent below 1990 levels by 2030, 70 percent below 1990 levels by 2040, and 95 percent below 1990 levels and achieve net zero emissions by 2050. Achieving these goals will require systemwide reductions of transportation GHG

²⁶ Washington State Greenhouse Gas Emissions Inventory: 1990-2018, Washington State Department of Ecology, January 2021. <https://apps.ecology.wa.gov/publications/documents/2002020.pdf>

emissions, including emissions associated with freight transportation. To meet Washington's GHG emission reduction commitments, WSDOT is working with partners across the transportation sectors to develop a transportation GHG reduction strategy for the state.

Washington energy strategy and the energy efficiency of freight modes

In 2021, a new energy strategy was released for the state of Washington. The energy strategy recognizes that the transportation sector contributes the largest portion of carbon emissions and that land use and road design affect freight costs. The strategy calls for improving the efficiency of the freight system by reducing bottlenecks, improving first and last mile connections, and where feasible, reducing freight miles of travel. The strategy also calls for infrastructure to support freight decarbonization, including fueling and recharging for zero emission vehicles and air quality monitoring.

While the freight transportation system is a major emitter of greenhouse gas emissions, not all freight transportation modes have similar emission footprints. Maritime transportation is the most energy-efficient mode and can move large loads exceptionally long distances with relatively little fuel. By comparison, railroads are less efficient than shipping, but more efficient than trucking. Air transportation has the highest level of emissions relative to the other modes.

The impacts of freight on flooding and stormwater runoff: Impervious surfaces like roads and parking lots generate stormwater runoff. Developing new impervious surfaces increases the amount of stormwater runoff generated and thus, the risk of flooding. If left untreated, the stormwater coming from these impervious surfaces can also convey pollutants to nearby bodies of water like creeks, lakes, rivers, and marine waters. Pollutants coming from freight vehicles include heavy metals, petroleum products, and emissions that get deposited onto surfaces or into the water. Recent studies also suggest that a chemical leaching from vehicle tire wear can cause recurring and premature death of adult coho salmon.

The impacts of freight movement on wildlife habitat loss: The freight system can impact wildlife and their habitat. Freight infrastructure can destroy or alter wildlife habitat and behavior. Truck and rail corridors cut through existing habitat areas, which can divide wildlife populations, prevent the free movement of animals, and increase the likelihood of vehicle-animal collisions. Inadequate culverts can create barriers to fish passage and marine infrastructure can destroy or alter critical aquatic habitats. Locks and dams on inland navigation systems create barriers for spawning fish and negatively alter river habitat. Maritime shipping operations can cause collisions with marine mammals and underwater noise disturbances. To mitigate some of these impacts, WSDOT has begun installing specially designed bridges and culverts to facilitate the passage of aquatic wildlife, and wildlife overpasses that allow terrestrial animals to travel over major highways. Organizations responsible for lock and dam infrastructure have installed fish ladders and taken other steps to reduce impacts to spawning salmon. Ports are creating prime new habitat areas to mitigate their development impact and are engaging with stakeholders to reduce underwater noise, such as through the Quiet Sound initiative.

Figure 42: Wildlife overcrossing concept on I-90



Source: WSDOT, 2022.

Hazardous materials: More than 20 billion gallons of oil and other hazardous substances are transported as cargo or fuel by vessels, pipeline, and rail across the state. This creates both safety and environmental risks of spillage. Hazardous materials can be explosive, flammable, combustible, corrosive, reactive, poisonous, toxic, biological agents, or radioactive. Over 4,000 oil spills are reported every year in Washington, risking the health and safety of local communities along rail lines, key freight roads, and navigable waters. Spills can also reach the stormwater drainage system and result in contamination. Preventing oil spills is critical because the average removal rate once a spill occurs is only approximately 14 percent.²⁷

The impacts of freight movement on local air pollution and environmental justice: The negative impacts of freight transportation do not fall equally on all Washingtonians, and historically the negative impacts have been concentrated or felt most acutely within specific communities. These “overburdened” communities in Washington are areas where people are “*exposed to environmental pollutants or contaminants through multiple pathways, which may result in significant adverse health outcomes or effects,*” as defined by the Climate Commitment Act.

HEAL Act 2021 defines *environmental justice* as:

“The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, rules, and policies. Environmental justice includes addressing disproportionate environmental health impacts in all laws, rules, and policies with environmental impacts by prioritizing vulnerable populations and overburdened communities, the equitable distribution of resources and benefits, and eliminating harm.”

Source: Environmental Justice, Washington State Department of Health, (n.d.). <https://doh.wa.gov/community-and-environment/health-equity/environmental-justice>

Vulnerable and overburdened communities tend to be disproportionately located next to industrial areas and freight facilities, such as ports, railyards, highways, and truck stops. Heavy-duty truck traffic increases congestion and traffic backups, roadway degradation, and safety issues (by intruding on sidewalks or other roadway lanes) within these communities. Prolonged exposure to freight noise, industrial lighting, and emissions can also be detrimental to community health. Based on engagement with overburdened communities, some organizations report that freight movement increases pollution, damages the roads, and makes many areas unsafe for pedestrians, especially those areas without sidewalks. These concerns disproportionately affect lower-income communities and communities of color, especially within urban areas, and should be considered in freight planning efforts.

Throughout development of this plan, WSDOT sought to ensure that voices of diverse and marginalized communities were not only heard, but that the concerns of those communities were represented and prioritized. WSDOT identified key communities for inclusion in this approach using the Washington Department of Health’s Environmental Health Disparities Map alongside freight corridor data to identify communities that bear greater environmental burdens from the state freight system. This information was used along with additional data to identify areas of the state with large populations of communities of color, limited English proficiency, and lower income. WSDOT and their consultants reached out to individuals and organizations representing diverse geographies, income levels, and race and ethnicities to request an interview to discuss the impacts of the state freight network on their communities. The WSDOT team sought to listen, understand, and apply their input and feedback in the development of the 2022 Freight System Plan update. The WSDOT team also reached out to community engagement and government affairs professionals at transportation and large statewide advocacy organizations to

²⁷ Oil Spill Task Force, “Spill Prevention, Preparedness, and Response Program” Washington State Department of Ecology, 2020. <https://wwwcdn.imo.org/localresources/en/OurWork/Environment/Documents/Air%20pollution/MEPC%2077-6-1%20-%202020%20report%20of%20fuel%20oil%20consumption%20data%20submitted%20to%20the%20IMO%20Ship%20Fuel%20Oil%20Consumption%20Database%20in%20GISIS.pdf>

discuss their specific expertise, experience, and insight, and requested additional community contacts to deepen the team's understanding of the freight impacts on these communities.

The Washington State Department of Ecology has identified diesel exhaust emissions, especially diesel particulate matters, as a toxic air pollutant that contributes to adverse public health impacts such as asthma, heart and lung diseases, and cancer. In Washington, nearly five million people, especially those within low income and disadvantaged communities, live or work close to transportation corridors where they are exposed to high levels of diesel exhaust emissions, putting them at higher risk for adverse health impacts. This issue of local air pollution is particularly relevant because Washington's largest sources of diesel exhaust are heavy duty trucks, commercial marine vessels, construction equipment, locomotives, farm equipment, and buses. For example, Washington's 2017 Air Emissions Inventory estimated that on-road diesel vehicles along with commercial marine vessels and locomotives contribute to more than 2,500 tons of diesel particulate matter (DPM) each year. More than 70 percent of these emissions are associated with on-road diesel vehicles. Aside from DPM, diesel vehicles are also a significant source of nitrogen oxide (NOx) emissions, which contribute to both ground level ozone as well as secondary ambient particulate matter.

Figure 43 illustrates some areas of Washington where communities are disproportionately affected by transportation infrastructure, particularly high-traffic roadways. These communities experience disparate health impacts compared to average Washingtonians, including higher rates of asthma, cancer, and other illnesses. Overburdened communities that are disproportionately impacted by highway traffic tend to be clustered in major urban areas in the Puget Sound region and Spokane, along the I-5 corridor, Yakama Indian Reservation, and in southeast Washington. Populations especially vulnerable to diesel pollution include those along I-5 in the Puget Sound region, Centralia, the Longview I-5 corridor, the I-90 corridor from Moses Lake to Spokane, and I-82 between Yakima and Kennewick.

Multiple initiatives are underway to reduce diesel exhaust emissions, including the Department of Ecology's Air Quality Clean Diesel Grant Program, Washington Advanced Clean Trucks Rule, the NWSA's Truck Scrapping Program, and local grants through the Puget Sound Clean Air Agency. Programs and efforts like these are complemented by federal initiatives, including recently-passed zero emissions truck purchase tax credits.

Impact of innovative technologies

The freight industry is undergoing a technological revolution where new technologies have the capability to reduce the environmental impact of supply chains and improve our understanding of how, where, and when cargo moves through the freight transportation system.

Connected and automated vehicle technologies: Connected and automated vehicle technologies (CAT) include things such as self-driving vehicles, vehicles that can communicate with each other, and roadside infrastructure. The continued development of CAT is important because it may improve safety, increase efficiency, reduce labor costs, and increase fuel efficiency. This technology is important for freight transportation because autonomous vehicles could help address the trucking labor shortage while also providing potential safety improvements. In turn, these improvements could increase the reliability of freight transportation and decrease costs. WSDOT has a role to play in CAT development and implementation and is developing a CAT policy framework to guide investment priorities. The department is also helping to create opportunities for partnerships and funding opportunities to research and implement CAT.

Electrification and alternative fuels: Zero-emission and alternative fuel vehicles are an important part of global efforts to decarbonize transportation because they can significantly reduce or eliminate carbon dioxide emissions associated with vehicle operations. In addition to the significant benefit of reduced air emissions, these types of vehicles can provide environmental justice benefits to communities experiencing high truck volumes as well as support industry with the potential benefits of lower operating costs. The recently passed Inflation Reduction Act includes potential additional resources to broaden and accelerate electrification and use of alternative fuels.

In general, current zero-emission technologies are being developed for lighter, shorter, and more predictable routes first, while technologies suitable for heavy-duty, more complex, and long-range routes are anticipated to deploy over a longer timeframe. Since a large share of Washington's electricity generation is produced from renewable sources, replacing and upgrading freight vehicles and technology will help reduce GHG emissions and support Washington's climate goal objectives. However, the large power demand that is created by electric vehicles could also put stress on Washington's power grid. Additionally, significant investments will need to be made in electric charging and alternative fuel filling infrastructure in order to support widespread adoption of electricity and alternative fuels.

Washington is an innovation hub for zero and near-zero emission (ZNZE) technologies across all freight modes: cargo-handling equipment, harbor craft, shore-side power for vessels, on-ground fleet, freight rail, and aviation. Fleet owners are converting their vehicle fleets to ZNZE technologies. Currently, the focus is on trucks that travel shorter distances, as electric vehicle batteries are heavy and cannot store as much energy as a traditional diesel fuel tank on a truck. Therefore, many initial developments have focused on electricity and alternative fuels for smaller trucks, or trucks that serve regional areas, instead of those that travel nationwide. Some examples of recent developments include:

- Amazon is ordering 1,800 electric vans from Mercedes and 100,000 electric vehicles from Rivian Automotive. Amazon has also pledged to use zero-carbon ocean vessels before 2040.
- Washington State Ferries, the largest operating public ferry system in the U.S., is working on several projects to move toward a zero-emissions fleet: building new Olympic class hybrid-electric vessels, converting the existing three Jumbo Mark II vessels to hybrid-electric vessels, and developing terminal charging infrastructure.
- The Port of Tacoma is developing the Puget Sound Liquefied Natural Gas (LNG) Terminal to provide shoreside access to LNG for ships calling at the Port.

- The Ports of Seattle and Tacoma have equipped berths with shore-side power capabilities, which provide electrical power to a ship at berth while its main and auxiliary engines are turned off. These technologies reduce emissions from vessels' auxiliary diesel engines.
- Sierra Northern Railway is building a hydrogen fuel cell switcher locomotive to increase efficiencies and reduce emissions.
- Washington State University is involved in developing aviation biofuels in the Northwest. One of these programs is the Sustainable Aviation Fuels Northwest (SAFN), a four-state effort (Washington, Oregon, Idaho, and Montana) to conduct a regional assessment of the challenges and opportunities associated with the production of sustainable aviation biofuel in the Northwest. Other participants include the Port of Seattle and several of the airlines serving the market, as well as the state departments of commerce and ecology.
- Washington's first hydrogen refueling station will be built in Chehalis in 2022. The facility will serve local vehicles that utilize hydrogen fuel cells for electric drivetrains but could become part of a larger hydrogen fueling network in the state.

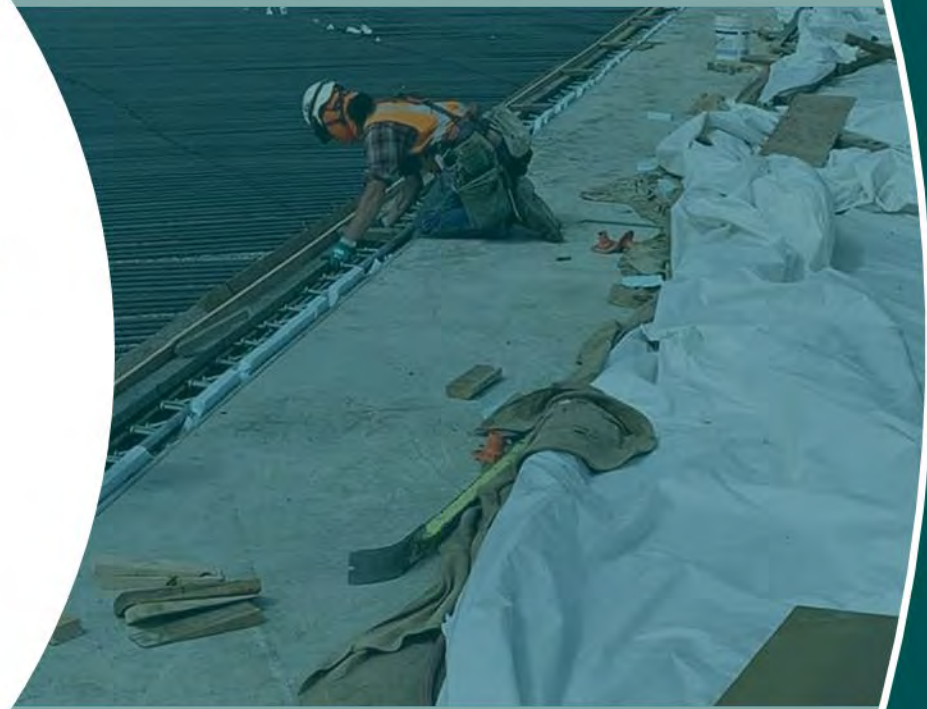
Washington Clean Fuel Standard: In 2021, Washington started its rulemaking process for the Clean Fuel Standard with House Bill 1091. The Clean Fuel Standard will require fuel suppliers to gradually reduce the carbon intensity (CI) of transportation fuels to 20 percent below 2017 levels by 2038. This means that the freight system will also need to reduce its carbon intensity over time.

Summary of findings:

The freight system is impacted by both short-term disruptions and longer-term trends, such as economic shocks, climate change, and new technologies. Supply chain challenges caused by COVID-19 raised awareness of the need for greater resiliency in the system. The freight system also has a profound impact on the environment and local communities through prolonged exposure to industrial noise, lighting, congestion, and air pollution, and the potential for hazardous material spillages. The state is making strides to address these issues. Other potential implementation strategies are discussed in the next chapter.



A System that Requires Investment



A system that requires investment

Washington's multimodal freight system requires investment to address both current and anticipated future needs on roadways, bridges, rail lines, ports, and airports. The Washington state Legislature enacts biennial transportation budgets to appropriate transportation funding to WSDOT and other state agencies. This chapter describes some the freight policies and strategies that will guide the freight related transportation investment decisions in Washington.

WSDOT's role in maintaining and improving Washington's freight system

WSDOT is one of Washington's most significant freight transportation stakeholders.

As the largest infrastructure owner in Washington, WSDOT owns and operates a substantial amount of freight-relevant infrastructure, such as highways, bridges, rest areas, passenger ferries, short line railroads, and public use airports across the state.

As a cabinet-level state agency, WSDOT is charged with maintaining, preserving, and improving the statewide multimodal transportation system. WSDOT has a leading role in developing and implementing state policy for the transportation system and implementing federal transportation policies. This role is important because it informs:

- The types of freight-specific investments that WSDOT may make in the future;
- The key freight stakeholders and partners WSDOT needs to engage with; and
- Other strategies WSDOT may implement to improve freight transportation in the future.

Investing in the future: the WSDOT family of plans

As mentioned in "A System that is Multimodal and Connected," much of Washington's freight infrastructure also serves other users, including passenger vehicles, transit riders, bicyclists, and pedestrians, and many freight needs and issues are closely connected or part of general transportation needs and issues. While the Washington State Freight System Plan is Washington's freight-specific plan, strategies and investments identified in other WSDOT plans will also impact the freight system in the future. Some of these plans include the Highway System Plan, State Rail Plan, Aviation System Plan, and Active Transportation Plan.

WSDOT's freight-specific investments

For much of the road network, freight transportation issues and general transportation issues are connected. For example, concerns about traffic congestion at truck bottlenecks and pavement conditions affect all drivers, and safety and mobility issues for trucks, such as intersection safety, are relevant to all transportation modes and users. This means that many of the general transportation investments that WSDOT makes to improve overall safety, mobility, and travel conditions will provide freight benefits as well.

However, some funding sources are specifically dedicated toward addressing freight transportation needs and issues. The National Highway Freight Program (NHFP) provides funds to states for improving the efficiency of freight movement on the National Highway Freight Network. This is a five-year, federal-aid highway formula program established under the 2015 FAST Act and has continued through the 2021 Bipartisan Infrastructure Law (BIL). The eligible uses include a broad array of activities related to project development, construction and rehabilitation, operational improvements, and certain freight rail and intermodal projects.



Supporting resources: Freight Investment Plan

If you are seeking additional information on the NHFP project selection criteria, process, or selected projects, please see [Appendix G – Freight Investment Plan](#) for additional Freight Investment Plan information.

The NHFP funds made available to Washington are estimated at \$111.8 million between federal Fiscal Years 2021 and 2025. The Washington state Legislature has directed WSDOT to allocate 50 percent of NHFP funds on state preservation projects and the other 50 percent on eligible local freight projects.²⁸ ²⁹ Figure 44 provides a summary of the amount of NHFP funds invested and matched each year. Figure 45 on the following page shows project locations.

Figure 44: Summary of NHFP funding allocation

Funding	2021	2022	2023	2024	2025	2021-2025 Total
NHFP Funding Allocation*	\$21,816,000	\$22,000,000	\$22,000,000	\$22,000,000	\$24,000,000	\$111,816,000
Other Federal Funds Leveraged	\$14,287,800	\$308,092,400	\$114,369,600	\$50,425,500	\$167,526,700	\$654,702,000
Non-Federal Match	\$17,199,900	\$54,682,400	\$22,629,100	\$19,804,000	\$67,222,200	\$181,537,600
Total Funds Invested**	\$53,303,700	\$384,078,800	\$159,694,700	\$92,229,500	\$258,748,900	\$948,055,600

Source: WSDOT, 2022.

*Funding allocation is limited by the NHFP funding amount made available to Washington each year.

**Total funds invested reflect the total amount from all funding sources invested to these NHFP projects.



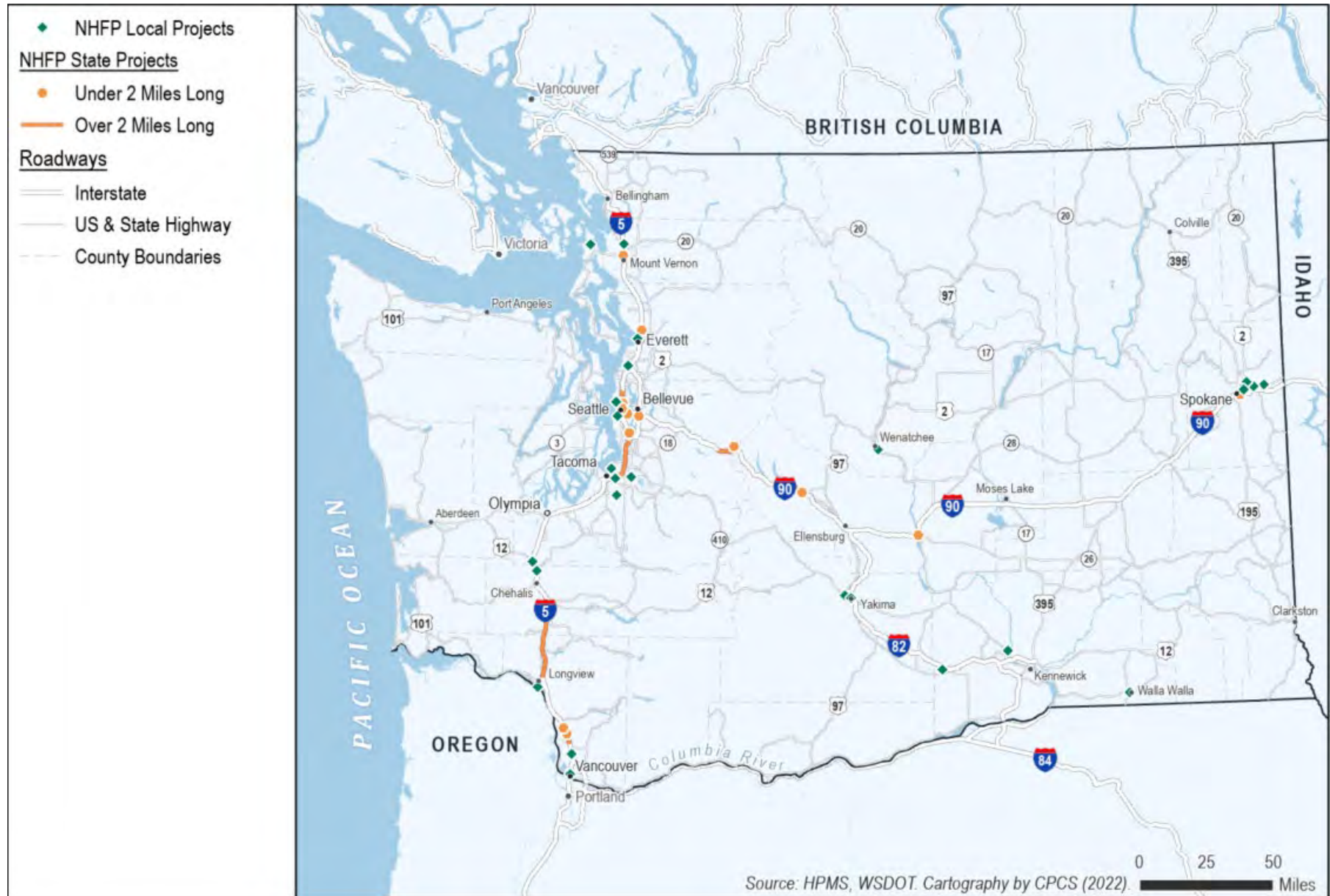
Supporting resources: critical urban and rural freight corridors

FHWA requires state DOTs to designate Critical Urban Freight Corridors (CUFC) and Critical Rural Freight Corridors (CRFC), and these designations are required for NHFP project funding. Washington’s CUFC/CRFC designations are based on the location of awarded NHFP projects. Additional CUFC/CRFC mileage allowed by the federal government was designated based on submissions from Metropolitan Planning Organizations (MPOs) and Regional Transportation Planning Organizations (RTPOs). More information about this designation process can be found in [Appendix G – Freight Investment Plan](#).

²⁸ SSB 5165, Sec. 311(8), Washington state Legislature, 2021.

²⁹ LEAP Project ID 200010

Figure 45: Washington's National Highway Freight Program projects



Other WSDOT roles and stakeholders:

While WSDOT may own and operate a substantial number of freight transportation assets, it does not control all components of the freight transportation system. Figure 46 provides a partial summary of the types of activities that WSDOT does – and does not control.

Figure 46: What WSDOT does, and does not control for the freight system

WSDOT Controls:	WSDOT Does Not Control:
<ul style="list-style-type: none"> • Planning, operation, and maintenance of interstates, national highways, and state highways • Operation of state-owned rail lines • Ferry operations 	<ul style="list-style-type: none"> • Commercial driver licenses • Fuel tax rates • Private shipper routing decisions • Operations of individual trucking companies • Major railroad operations • Operation of airports with commercial service • Operation of ports

WSDOT relies on many stakeholders with varied responsibilities in different areas to fulfill its agency mission.

Because WSDOT only owns and operates a part of the freight transportation system, partnerships with other agencies, businesses, and organizations are critical to helping WSDOT fulfill its mission and work towards the vision and goals of the WTP. Some major WSDOT partners are listed here and provide context for the implementation strategies in the following section.

- **Public infrastructure** is owned and managed by the government, funded by taxpayer dollars, and provides services to the general public. These include government agencies, port authorities, public sector companies, and other state-owned organizations. WSDOT works with every level of government from federal, state, regional, and local agencies to deliver services.
 - **Federal:** WSDOT is affected by policies of federal partners including the U.S. Department of Transportation, the U.S. Military (including the U.S. Coast Guard and the U.S. Army Corps of Engineers), the Environmental Protection Agency (EPA), Department of Homeland Security (DHS), the Departments of Agriculture (DOA) and Energy (DOE), and the Surface Transportation Board, among others.
 - **State:** The Washington Legislature enacts the state's budget and mandates the amount of funding for agencies, and where and how state agencies are permitted to spend. Two notable state agencies WSDOT works with are the Freight Mobility Strategic Investment Board (FMSIB) and the Utilities and Transportation Commission (UTC). Other state agencies WSDOT works with include the Departments of Ecology, Commerce (DOC), Public Health (DOH), DOA, and State Patrol (WSP), among others.
 - **Neighboring Governments:** WSDOT coordinates across the region with its surrounding neighbors, such as Transport Canada, the Idaho Transportation Department (ITD), and the Oregon Department of Transportation (ODOT), to advance freight planning that touches multiple jurisdictions.
 - **Regional and Local:** Public stakeholders at the local level include cities, counties, MPOs, and RTPOs. They also include public infrastructure owners such as public ports and airports.

Washington's Freight Mobility Strategic Investment Board.

WSDOT has closely coordinated with Freight Mobility Strategic Investment Board (FMSIB) on the 2022 State Freight System Plan update. Specifically, WSDOT has consulted with FMSIB on the development of the Freight Investment Plan by including FMSIB board members on the Freight Project Selection Committee, which reviewed and selected freight projects for National Highway Freight Program Funding allocation. WSDOT has also participated in FMSIB's 2021-2022 freight investment identification work through its Freight Policy Advisory Committee. WSDOT's participation supports FMSIB's work to meet state legislative direction through the development of a prioritized list of freight investments across Washington. This work is expected to be complete by December 2022.

- **Private infrastructure** is owned by private individuals or companies with the primary purpose of generating profit through business operations. In the freight and logistics sector, private stakeholders include drayage companies, ocean carriers, trucking companies, intermodal companies, forwarders, third-party logics companies, beneficial cargo owners, manufacturers, container yards, railroads, private port authorities, and other infrastructure owners. WSDOT engages with private stakeholders to understand how the freight and logistics sector uses the freight transportation system, to stay atop industry trends and issues, and to develop potential strategies to improve the system.
- **Non-governmental organizations (NGOs)** are non-profit groups that function independently of the government and represent specific interests. NGOs can include environmental groups, community groups, industry associations, and other groups that advocate for specific causes or provide special services that are not handled by the government. NGOs play a crucial role in helping WSDOT understand specific issues in the freight and logistics sector as well as how freight impacts other sectors, such as agriculture, forestry, local communities, and the environment.
- **Tribal Nations** are distinctly sovereign nations made up of native peoples with inherent rights. WSDOT's Tribal Liaison Office works with 35 federally recognized Tribal governments and is committed to providing consistent and equitable standards for working with various Tribes across the state.³⁰ WSDOT also coordinates with Tribal planners through the Tribal Transportation Planning Organization to participate in statewide transportation planning for both Tribal and state transportation system needs.

³⁰ Centennial Accord Plan, Washington State Department of Transportation, March 2009. <https://wsdot.wa.gov/sites/default/files/2021-10/WSDOTCentennialAccordPlan5mb.pdf>

Multistate collaboration efforts

Freight transportation does not stop at state or national borders, and multistate collaboration on specific freight topics can provide benefits for freight mobility and safety as well as infrastructure condition. A notable collaboration effort is the Interstate Bridge Replacement Project (IBR). I-5 is a vital freight route in the United States – linking the entire West Coast between Mexico and Canada. The I-5 bridge across the Columbia River between Washington and Oregon is more than 100 years old and at risk for collapse in the event of a major earthquake. It no longer satisfies the needs of modern commerce and travel and is becoming increasingly expensive to maintain. Replacing the aging Interstate Bridge across the Columbia River with a modern, seismically resilient, multimodal structure is a high priority for Washington and Oregon.

ODOT and WSDOT opened a bi-state project office to complete the planning, design, and construction work. The two states are jointly leading these efforts in coordination with eight other bi-state partner agencies: TriMet, C-TRAN, Oregon Metro, the Southwest Washington Regional Transportation Council, the cities of Portland and Vancouver, and the Ports of Portland and Vancouver. In addition, each state legislature has identified eight lawmakers to provide direction and oversight to shape the IBR program work. In total, the program has formed three advisory groups to provide feedback and recommendations: Executive Steering Group, Equity Advisory Group, and Community Advisory Group. Together ODOT and WSDOT are providing coordinated regional leadership throughout program development.

In addition to collaboration on this important infrastructure project, WSDOT collaborates with neighboring states on broad trucking issues. For example, WSDOT participates in:

- A monthly coordination meeting with California (CalTrans) and Oregon (ODOT) to discuss freight movement and trucking issues. One topic of mutual concern is the lack of available truck parking. The group is evaluating developing a pooled fund study to comprehensively examine truck parking issues across the three states.
- The Western Association of State Highway and Transportation Officials, a regional organization made up of 18 state DOTs that works as a liaison between state DOTs, the public, and the federal government.
- The North/West Passage Corridor – a group of state DOTs along I-90 and I-94 that collaborate on sharing, coordinating, and integrating traveler information and operational activities across state and provincial borders. This organization also has a Freight Task Force dedicated to research and information sharing on multistate freight issues.
- The International Mobility and Trade Corridor Program, an initiative to identify and promote improvements to mobility and security for border crossings between Whatcom County and mainland British Columbia.

Ongoing WSDOT goals, strategies, policies, and programs

As noted at the start of this plan, there are multiple federal requirements that WSDOT must fulfill to receive National Highway Freight Program (NHFP) Funding, and compliance with these requirements must be documented in the FSP. WSDOT has numerous goals and strategies that already meet the federal requirements, and the links between federal requirements and WSDOT's ongoing efforts are documented in Figure 47 below. WSDOT will continue to advance these goals, strategies, policies, and programs over the next 4 years in support of the freight planning requirements of the FAST Act and BIL. Further details about these efforts are available in Appendix F.

Figure 47: Ongoing WSDOT engagement on federally noted freight topics

Strategies and goals guiding freight-related transportation investment decisions in the state

The **Washington Transportation Plan 2040 & Beyond** is Washington’s overarching transportation policy and includes freight-specific policy goal elements described in the first chapter of this plan. The Washington State Legislature has also provided direction on how Washington’s NHFP funds should be utilized.

Improving the safety and efficiency of freight with innovative technologies and strategies

WSDOT has established a **Cooperative Automated Transportation (CAT)** program that focuses on how methods of transportation work together and share information. This program’s freight-specific work includes exploring truck parking and interstate truck platooning pilot projects. WSDOT also conducted an electric airplane feasibility study, which highlighted the potential for more efficient air cargo movement.

Reducing roadway deterioration from travel by heavy vehicles

One of Washington’s top transportation system policy goals is preservation. It is WSDOT’s policy that all its pavements handle expected freight traffic levels, as noted throughout the WSDOT Pavement Policy. Additionally, when facing constrained funding for pavement preservation, **WSDOT has continually prioritized heavy freight routes because they are the most likely to deteriorate faster and require more substantial rehabilitation.** To the maximum extent feasible, this approach avoids costly freight delay and costly rehabilitation of thicker pavement structures.

Deterioration of condition by heavy trucks was also accounted for in Washington’s selected National Highway Freight Program projects: **roughly one half of the 2021-2025 NHFP investments are allocated solely to roadway and bridge preservation projects** on the I-5 and I-90 corridors.

These investment and design efforts are complemented by commercial vehicle weight enforcement work. WSDOT administers the vehicle size and weight through a special motor vehicle permit program, and its partner Washington State Patrol, **enforces vehicle size and weight laws including truck weight limits,** which further reduces the potential for roadway deterioration from over-loaded trucks. Enforcement is accomplished through deployment and utilization of weigh-in-motion technology at weigh station sites across the state.

WSDOT also has several rail initiatives that help mitigate the pavement impacts of heavy truck movement by supporting movement of heavy cargo by other modes, including the ownership of the **Washington Grain Train** and **Palouse River and Coulee City Rail System.** Both systems move heavy bulk agriculture products and mitigate the wear and tear on roadways that would occur if goods were moved by truck.

In addition to support for these systems, WSDOT supports the movement of goods on alternate modes through the **Freight Rail Assistance Program** and **Freight Rail Investment Bank,** which are designed to support freight rail capital needs and make rail shipping available to more communities and businesses.

Addressing freight mobility issues, including congestion or delay caused by freight

Another one of the Washington Transportation Policy goals is mobility: to improve the predictable movement of goods and people throughout Washington, including congestion relief and improved freight mobility.

In recognition of this goal, **NHFP solicitations** for local projects included scoring criteria based on a project’s potential benefits for improving freight mobility and reliability.

Additionally, WSDOT is currently undertaking multiple projects intended to address traffic congestion, including delay caused by freight. For instance, the Puget Sound Gateway Program is a combination of major roadway and bridge projects that will complete critical missing links in the state’s freight network and build new connections to the Ports of Seattle and Tacoma and the Sea-Tac Airport. The project is expected to be completed by 2028 and includes a new SR 99 bridge over existing SR 509 highway, a new SR 509 expressway providing new access to SeaTac Airport, a new SR 167 bridge over I-5, and a new connection between I-5 and Port of Tacoma. This program will improve regional freight mobility and reduce port-related truck traffic on nearby local streets, further reducing traffic congestion caused by trucks.

WSDOT and its partners have also made information-sharing improvements to address traffic congestion caused by freight. For example, **WSDOT's border crossing wait time information system** provides freight brokers and dispatchers with commercial vehicle wait times, helping them to structure their operations to avoid expected times of congestion, and reduce congestion overall.

WSDOT's ongoing efforts to address weather and disasters' impacts on freight include: a **Freight System Delay Notification** system for real-time messaging users of the freight system, participating in a Multi-Agency Hazard Mitigation Work Group, and FEMA-led **Cascadia Rising Exercises**.

Decreasing the impacts of freight movement on local air pollution

Ongoing WSDOT efforts related to air pollution include WSDOT's adherence to **Washington's Climate Commitment Act** to reduce greenhouse gas emissions, and membership in the **Multi-State Zero Emission Vehicle Task Force**. WSDOT also administers zero-emission vehicle grants, including **Zero-Emission Vehicle Partnerships** grants for electric charging and fueling infrastructure. Air pollution and impacts on overburdened communities were also used as scoring criteria for WSDOT's NHFP project solicitations.

In addition to WSDOT's work, agencies such as the Department of Ecology, and Puget Sound Clean Air Agency administer **programs intended to reduce harmful diesel emissions** by supporting the purchase of new more-efficient trucks or trucks powered by alternative fuels and electricity.

Decreasing the impacts of freight movement on flooding and stormwater runoff

WSDOT recognizes the significant impact that transportation infrastructure can have on the quality and volume of stormwater runoff and flooding. Many of the actions WSDOT takes to comply with its National Pollutant Discharge Elimination System (NPDES) and State Waste Discharge Municipal Stormwater General Permit help to avoid, minimize, and mitigate for these impacts. WSDOT's design strategy defined in its Highway Runoff Manual as well as the Secretary's Executive Order to **protect and preserve Washington's wetlands** also direct employees to avoid, minimize, and mitigate for impacts. Further, WSDOT has developed a **Stormwater Management Program Plan, Stormwater Retrofit Management Plan, and included stormwater management as a criterion for NHFP project selection.**

Decreasing the impacts of freight movement on wildlife habitat loss.

WSDOT's **Wildlife Connectivity Program** has two primary goals: 1) reduce wildlife-vehicle collisions and 2) increase the permeability of the state highway system in regard to wildlife movement. WSDOT has developed a ranking system that rates all segments of the state highway system for the potential benefit to ecological conservation as well as animal vehicle collision severity. This information is used in corridor planning and project analysis to assess potential benefits for designs that promote wildlife connectivity. WSDOT is partnering with other agencies, academics and conservation NGOs to promote wildlife habitat connectivity through research into animal activity, wildlife corridor management and effective measures to improve safe crossings for wildlife. More details can be found in WSDOT's Highway System Plan.

WSDOT has taken additional steps to reduce transportation's impact on wildlife and habitat, including issuing Executive Order 1031.02, **Protections and Connections for High Quality Natural Habitats**, to ensure road and highway programs protect ecosystem health, the viability of aquatic and terrestrial wildlife species, and the preservation of biodiversity, along with other needs. Specific actions include a **fish passage** program, focus on removing fish barriers and reconnecting streams, and inclusion of **wildlife habitat considerations in NHFP solicitations and scoring**. Finally, the **Murray/Inslee Initiative** aims to develop a comprehensive solution for salmon recovery in the Columbia River Basin, assessing whether means exist to replace benefits, including freight transportation, provided by the existing Snake River dams.

Enhancing the reliability or redundancy of freight transportation

As noted in this plan, Washington's freight system faces a number of disruptive threats such as severe weather, natural disasters, climate change, and accidents that can interrupt the flow of freight. WSDOT's Strategic Plan guides all of the Department's work, and one of its three key areas is resilience. This resilience goal includes guidance to improve the resilience of the transportation system, as well as lead the development of transportation that combats climate change and enhances healthy communities for all.

WSDOT and other Washington agencies have been examining and addressing these resiliency concerns through a variety of measures. For example, WSDOT's roles in supporting Washington's overall resiliency are detailed in the State Emergency Management Division's **Enhanced Hazard Mitigation Plan**, and WSDOT participates in a **Multi-Agency Hazard Mitigation Work Group** that is responsible for monitoring and implementation for the Mitigation Plan. WSDOT is also participating in operational exercises to improve resilience, such as FEMA-led **Cascadia Rising Exercises**, which identify preparedness needs for major disruptive natural disasters.

WSDOT also collaborates with other stakeholders on resiliency topics, an example of this work is WSDOT's participation and data-sharing through Washington Sea Grant's **Coastal Hazards Resilience Network**, a community of practice intended to help strengthen the resilience of coastal communities.

Finally, WSDOT's investment choices reflect the need to continue improving the reliability and redundancy of freight transportation, and **the NHFP project selection criteria** included a scoring category that evaluated projects on their potential improvements to freight transportation network resiliency, or the ability to rapidly restore service after a closure.

Potential future implementation strategies

The freight system requires investment to meet the needs of Washington's communities and businesses, and to adapt to a changing world. Potential strategies are actions that WSDOT may take in the future to address other freight transportation needs and issues. Some of the potential strategies for WSDOT and its partners to consider implementing in the future are noted below. Successful implementation of these strategies requires the partnership and support of multiple partners, including local, regional, state, and federal agencies, Tribal Nations, ports, railroads, airports, and freight stakeholders. These potential strategies also correspond to the state transportation goals, and specific potential strategies are listed in Figure 48.



Preservation: Maintenance of pavement in good condition saves seven to 16 times the cost of rehabilitating or reconstructing pavements when in worse condition. WSDOT works to “maintain, preserve, and extend the life and utility of prior investments in transportation systems and services, including the state ferry system.” As the largest infrastructure asset owner in the state, WSDOT will continue to raise awareness of the need for increased state investment in infrastructure maintenance and preservation.



Safety: Freight-related safety across all modes is a vital component of WSDOT's goal to “provide for and improve the safety and security of transportation customers and the transportation system.” WSDOT's Target Zero plan outlines a multi-agency strategy to improve highway safety over time. WSDOT will continue to implement the Target Zero plan with a focus on truck-involved fatalities and serious injuries.



Mobility: Freight volumes are forecast to increase significantly over the next 30 years, impacting congestion levels and the capacity of the overall freight system. Investments to leverage existing and developing new multimodal capacity will be needed to address not just the growth in volume, but also changes in how freight will move in the future. WSDOT works to “improve the predictable movement of goods and people throughout Washington, including congestion relief and improved freight mobility.” WSDOT may consider assessing methods to increase capacity on the multimodal state freight system and to relieve freight bottlenecks such as freight traffic signal prioritization on major freight corridors.



Environment: Climate change is expected to increase the frequency and severity of system disruptions, such as flooding, snowfall, landslides, wildfires, and extreme heat. To address climate change, the state has enacted GHG reduction goals. WSDOT works to “enhance Washington's quality of life by making transportation investments that promote energy conservation, enhance healthy communities, and protect the environment.” Achieving the state climate goals will not be possible without a significant reduction in freight emissions, which includes transitioning away from

fossil fuels and optimizing freight modes and technology. Reducing GHG emissions from the freight system requires the participation of not only WSDOT, but many of its partner organizations as well.





Stewardship: Freight does not necessarily follow or organize itself along political boundaries. Positioned at the center of the bi-national region of the Pacific Northwest, Washington must collaborate across the region to address shared issues and needs. WSDOT works to “continuously improve the quality, effectiveness, resilience, and efficiency of the transportation system.” To accomplish this, WSDOT can continue to collaborate with neighboring states and provinces on all freight decision-making affecting multiple states.




Economic Vitality: Supply chain issues can threaten economic vitality at any stage along the process -- sourcing, production, manufacturing, assembly, inventory, warehousing, and final delivery to businesses and consumers. WSDOT works “to promote and develop transportation systems that stimulate, support, and enhance the movement of people and goods to ensure a prosperous economy.” To support multimodal transportation options for shippers, WSDOT may facilitate engagement with the private sector and public partners to promote economic vitality.

Further strategies related to each of the statewide policy goals are included in Figure 48. Detailed suggestions and tactics to implement each of these strategies are contained within the Appendices.

Figure 48: Potential strategies

Issue	Potential Strategy
 Preservation	
Roads	Continue to invest in road preservation and encourage partners to invest in road preservation. Continue to include freight traffic volumes and FGTS designations in prioritization of preservation projects.
State Rest Areas	Continue to raise awareness of the need for increased state investment in maintenance and preservation.
Freight Rail	Preserve the condition of state- and publicly -owned and operated rail lines and continue to provide funding for preserving other rail lines through FRIB and FRAP.
Maritime	Continue to maintain navigable waterways and sufficiently maintained public ports as well as preserve, maintain, and enhance state and interstate route access to seaports.
Aviation	Maintain airport facilities at established airport classification level and preserve, maintain, and enhance state and interstate route access to airports
 Safety	
Highway	Implement the Target Zero plan with a focus on truck-involved fatalities and serious injuries.
Truck Parking	Expand truck parking capacity by keeping existing state rest areas open and facilitating the development of new truck parking sites statewide.
Freight Rail	Work with relevant authorities to address rising cases of trespassing, at-grade rail crossing collisions, rail cargo theft, and sabotage.
Maritime	Work with ports and relevant federal agencies to facilitate continuous improvement in maritime safety and security.
Hazardous Materials	Work with regulated communities and others to minimize the environmental threat of oil spills.

Issue	Potential Strategy
Complete Streets	Coordinate between WSDOT Rail, Freight, and Ports Division and Active Transportation Division to support incorporation of freight consideration in Complete Streets project implementation, when relevant.
	Mobility
Capacity	Assess methods to increase capacity on the multimodal state freight system and relieve freight bottlenecks.
Connectivity	Continue to support infrastructure projects that maintain and enhance Washington shippers' access to domestic and global markets.
	Environment
Weather, Natural Disasters, and Resiliency Impacts	Develop a plan to address transportation assets and system vulnerabilities to current and future disruptions. Improve freight resiliency planning and develop freight resiliency approaches, techniques, and effective practices for implementation. Continue to participate in inter- and intra-agency planning coordination to amplify freight resiliency planning effectiveness.
Greenhouse Gas Emissions	Facilitate the replacement and upgrading of vehicles and technologies to reduce GHG emissions.
Flooding and Stormwater	Continue to manage stormwater impacts in accordance with regulatory requirements and invest in mitigation measures including stormwater retrofits to control the flow of and treat stormwater.
Wildlife Habitat	Coordinate with relevant authorities on strategies to minimize freight impacts on wildlife.
Local Air Quality and Environmental Justice	Prioritize investments to mitigate negative freight impacts in areas where residents have been disproportionately impacted. Collaborate with community groups to identify opportunities for improved air quality through transportation system investments.
	Stewardship
Funding	Raise awareness of freight funding and financing needs statewide.
Tribal Relations	Consult and coordinate with Tribal Nations on all relevant freight policies, programs, and projects early in the planning process.
Pacific Northwest Collaboration	Collaborate with neighboring states and provinces on all freight decision-making impacting multiple states.
State and Local Agency Cooperation	Provide state freight expertise, guidance, data, and support to regional and local agencies.
	Economic Vitality
Sourcing	Facilitate engagement with the private sector and public partners to better support multimodal transportation options for shippers.
Warehousing	Increase system efficiency in order to optimize freight system capacity.
E-Commerce	Support local jurisdictions with last-mile freight planning support and best practices.

Issue	Potential Strategy
Workforce	Facilitate growth in the freight system workforce through increasing diversity, removing barriers to training, and providing more training options.

Summary of findings

Washington’s multimodal freight system requires investment to address both current and anticipated future needs on roadways, bridges, rail lines, ports, and airports. As Washington’s largest infrastructure owner, WSDOT has a critical leadership role in maintaining and improving Washington’s freight transportation system. However, the freight network is complex and requires active participation and collaboration with many public, private, NGO, and Tribal stakeholders to safeguard the freight transportation system for the future.

 **Supporting resources: potential freight strategies**

More information related to potential freight strategies and improvements on the system across each of the statewide policy goals is available in [Appendix F – Needs, Issues, and Potential Improvements](#).