Mid-Willamette Valley Intermodal Center

Market Feasibility Study

September 20, 2018

Prepared for:
Linn Economic Development Group

ECONorthwest
ECONOMICS • FINANCE • PLANNING

KOIN Center
222 SW Columbia Street
Suite 1600
Portland, OR 97201
503-222-6060

This page intentionally blank

Acknowledgments

For over 40 years ECONorthwest has helped its clients make sound decisions based on rigorous economic, planning, and financial analysis. For more information about ECONorthwest: www.econw.com.

ECONorthwest prepared this report to the Linn Economic Development Group. It received substantial assistance from Linn Economic Development Group, Terry Tate and Shawn Marshall with RailPros, Gary Weaver with Weaver Seed of Oregon, Shelly Boshart Davis with Boshart Trucking/Bossco Trading, Linn County Commissioner Roger Nyquist, State Representative Andy Olson, and the many growers, shippers, and businesspeople that met with us during the stakeholder interviews. Other firms, agencies, and staff contributed to other research that this report relied on.

That assistance notwithstanding, ECONorthwest is responsible for the content of this report. The staff at ECONorthwest prepared this report based on their general knowledge of economics, natural resources, agriculture, transportation, and on information derived from government agencies, private statistical services, the reports of others, interviews of individuals, or other sources believed to be reliable. ECONorthwest has not independently verified the accuracy of all such information and makes no representation regarding its accuracy or completeness. Any statements nonfactual in nature constitute the authors' current opinions, which may change as more information becomes available.

For more information about this report:

Adam Domanski
domanski@econw.com

Park Place
1200 Sixth Avenue
Suite 615
Seattle, WA 98101
206.388.0079

Table of Contents

This page intentionally blank

Executive Summary

Linn Economic Development Group is proposing the development of the Mid-Willamette Valley Intermodal Center (MVIC) in Millersburg, Oregon. The site is centrally located in the Willamette Valley. The site's logistical location where the Union Pacific Railroad (UPRR) mainline, Portland Western Railroad (BNSF), and Interstate 5 come together makes it ideal to serve as a centralized reload center for the valley's natural resource-based economy. With the passage of Keep Oregon Moving (HB 2017-A), the Oregon State Legislature appropriated $25 million for the development of the MVIC.

The proposed MVIC would primarily serve the agricultural community in the Willamette Valley and Southern Oregon by providing infrastructure to transfer intermodal containers from trucks to rail and vice-versa. The intermodal center has the potential to provide public benefits by reducing the number of trucks using the highways in the Portland area, which potentially would lower highway maintenance costs, reduce congestion, improve air quality, and decrease carbon emissions. The project would produce positive economic impacts through increased local spending and the creation of employment opportunities. The goal of this study is to analyze the intermodal center's potential operations under different scenarios, understand the financial and economic conditions for successful operations, and quantify the potential public benefits that would be realized.

Stakeholder Interviews

As part of the study, stakeholder interviews were conducted with representatives from the grass seed, hay, straw, pulp, potato, processed food, and shipping industries. These interviews provide insight on how agricultural production and transportation would be affected by the construction of the proposed intermodal center. The following major considerations were identified:

- **Cost** is one of the most important factors in deciding how products are shipped.
- **Reliability**. Companies that prioritize customer satisfaction are more likely to use trucks to transport their products because rail shipments can be lost or arrive late to the port.
- **Transit times**. Traffic congestion near Portland, Seattle, and Tacoma increase the transit times and costs associated with trucking.
- **Trade Imbalance**. A lack of imports coming into the Pacific Northwest, which limits access to and increases the cost of empty shipping containers
- **Container Availability**. High demand and low supply of empty containers increases shipping costs.
- **Split or Rolled Bookings**. Shipments that don't arrive on time reduce customer satisfaction and trust. For international shipments, split orders may also require two import inspection permits.

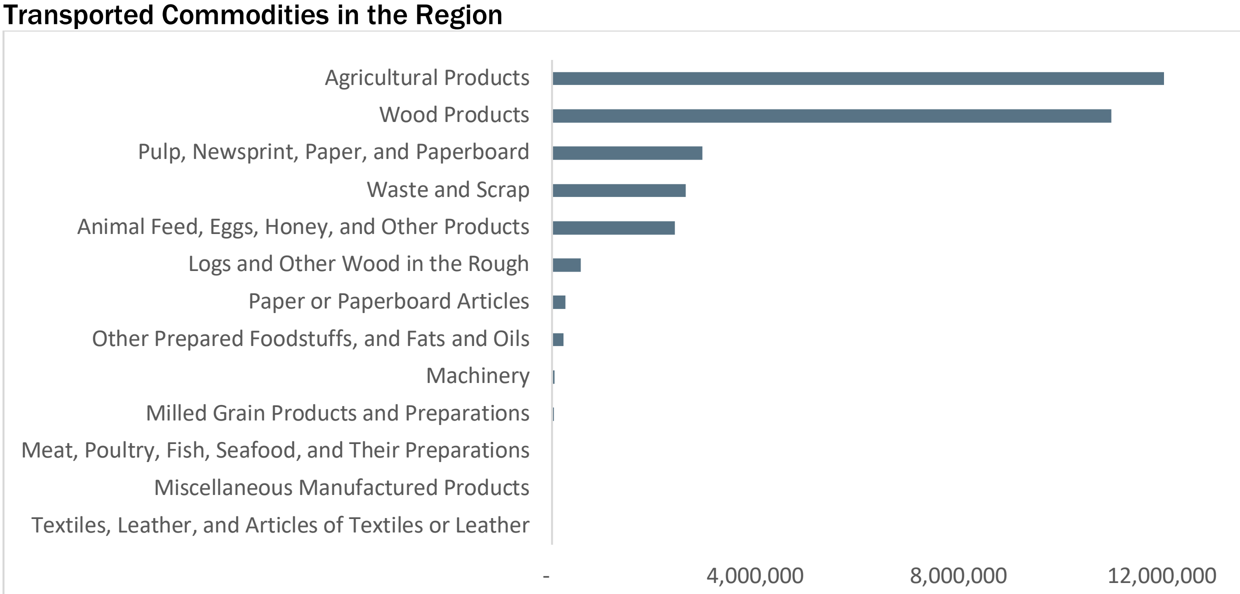
- **Quotas**. International quotas can influence shipment quantities and make some markets seasonal as a result.
- **International Markets**. Economic factors abroad influence domestic decision-making, including consideration of both potential competitors and consumers.
- **Potential Negative Effects**. Concerns exist about increased traffic congestion in Millersburg.

Commodities and Products Likely to be Served

The Mid-Willamette Valley is considered the "grass seed capital of the world," producing almost two-thirds of all U.S. cool-season grasses. Benefitting from fertile soil in the valley, mild winters, and dry summers, these seeds for turf and foraging grasses are shipped around the world. Additionally, straw is primarily a byproduct of the grass seed industry, harvested and baled after the seeds have been harvested. Most of it is sold to international markets for livestock feed. Hay is also produced directly for animal feed and represents a range of varieties. Straw and hay are relatively low-value and low-margin products that are considered to be "backhaul" by international ocean carriers: it is marginally more profitable for the ocean carrier to ship these products overseas than it is to ship the containers back empty.

Aside from grass seed, straw, and hay, a broader set of agricultural, wood, pulp, and waste products are regularly shipped out of the region.

Transported Commodities in the Region



Source: ECONorthwest analysis of Commodity Flow Survey

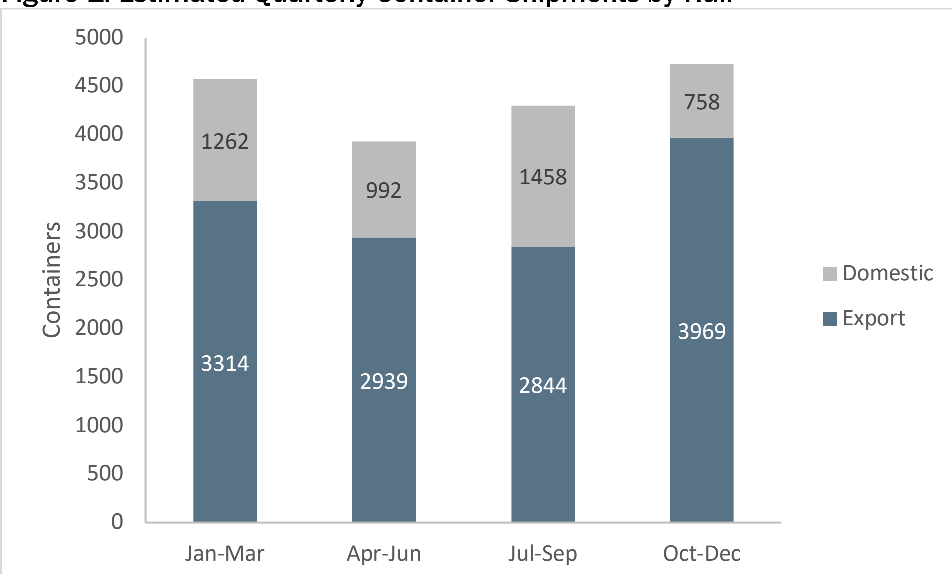
Typical Market Destinations

Approximately 81 percent of the exported agricultural products from the Mid-Valley are loaded onto ships in Seattle and Tacoma, with the remainder exported from ports in Long Beach (8 percent) and Oakland (3 percent), California. Traffic congestion near Portland, Seattle, and Tacoma have increased the transit times and costs associated with trucking products to these areas. Millersburg, Oregon, sits in a geographic location that allows agricultural producers in the region to consolidate their products efficiently and avoid highway congestion on the I-5 corridor.

Market Share in the Area That Would Use the Intermodal Center

Market analyses of existing commodity flow, phytosanitary certificates, and agricultural production data combined with stakeholder interviews indicate the expected level of rail service needed. Although the majority of products shipped out of the region are still likely to travel by truck, analysis indicates that there is sufficient demand to support 302-364 loaded containers leaving the intermodal center per week. Approximately 75 percent of these are expected to be 40′ intermodal containers destined for export, with the remaining comprising 53′ containers for domestic shipments. The respective volume is expected to be relatively constant throughout the year.

Figure 1: Estimated Quarterly Container Shipments by Rail



Source: ECONorthwest

This estimate is consistent with the results of our stakeholder interviews with an opportunistic, self-selected sample of exporters. Of the 17 participating interviewees, about half suggested they would likely use the intermodal center to ship a combined 245 export containers per week throughout the year. There is limited availability of empty containers in the Mid-Valley, and this equivalent volume of empty containers would need to arrive by train.

Anticipated Transportation Cost Savings

Private transportation cost savings may accrue to users of the facility who face lower transportation costs than current alternatives. These benefits only accrue if user fees are lower than alternative shipping modes that provide the same level of service. Since, the current mix of shipping alternatives will continue to exist, growers and shippers will be able to choose the alternative that provides the best level of service, reliability, and timeliness necessary. Calculation of the scale of anticipated private benefits, however, can performed using expected demand, expected trucking costs, and a basic set of assumptions on markets served. Under full utilization, private transportation cost savings are expected to total $2.1 million per year. When evaluated over a twenty-year timeframe—from 2020 to 2040—at a 3 percent and 7 percent discount rate, these savings amount to between $21 and $31 million. These transportation cost savings are likely to be captured in the private market by either growers, shippers, the facility operator, or the rail operator.

Size and Scale Necessary to Support Operation

The proposed intermodal center in Millersburg will have a main office, parking lot, space for approximately 100 trucks to park overnight, amenities for truck drivers, an intermodal center capable of handling both domestic and international containers with sufficient track space to handle both inbound and outbound unit trains, and a 60,000 square foot storage warehouse and docks to support reloading and transloading onto rail, with capacity for longer-term storage of product.

Return on Investment Analysis

Estimated demand is being used to develop a financial operating model, which includes fixed and variable operating costs associated with all operations at the intermodal center. Based on available market data and operating inputs from a similar (albeit smaller) intermodal center in Boardman, Oregon, it is expected that the intermodal center will generate $1.2 million in revenue in each year of operation once build-out is complete. This is sufficient to support continuous operation of the intermodal center. At full build-out, this intermodal center will require six full-time-equivalent staff to operate.

Financial Feasibility of Demand Estimated for Proposed Millersburg Intermodal Center

Business Line	Year 1 Costs (30 percent)	Year 2 Costs (60 percent)	Year 3 Costs (100 percent)	Year 4 Costs (100 percent)	Year 5 Costs (100 percent)
Total Operating Costs	$618,308	$881,771	$1,146,243	$1,180,630	$1,216,049
Total Revenues	$838,200	$1,527,720	$2,447,080	$2,447,080	$2,447,080
Total Net Income	$216,392	$642,449	$1,297,337	$1,262,950	$1,227,531

Source: ECONorthwest

Anticipated indirect job and economic impacts are calculated using a standard input-output model and include direct, indirect, and induced impacts from construction and operational expenses. The construction of the facility and rail line will support $18.8 million in direct output, $7.9 million in direct labor income, and 140 direct construction jobs. Spending circulates through the local economy resulting in indirect and induced effects. Combined with the direct effects, construction generates a total of $29.3 million in output, 11.4 million in labor income, and 220 jobs. The operations of the facility will support $2.4 million in output, $414 thousand in labor income, and six jobs every year. Summing the direct, indirect, and induced effects results in $3.1 million in total output, $614 thousand in total labor income, and 12 total jobs supported by operation of the MVIC.

Public benefits to the residents of Oregon accrue when the quality or quantity of non-market goods is improved. Although the values can often be inferred from private market transactions, public goods are not regularly bought and sold. This analysis draws information from published economic literature and relevant federal guidance to calculate a range of benefits accruing to Oregon residents from the construction of the proposed intermodal center. It is expected that the intermodal center will generate between $2.9 and $4.7 million per year in public benefits during full operation from removing trucks from roadways in Oregon. The potential present value of public benefits over the next twenty years is between $28 million to $68 million, reflecting a nearly 3-to-1 return on investment for the State at the high end

Potential Annual Benefits, 2018 dollars

Category of Public Benefit	Low Estimate	High Estimate
Potential value of fatalities prevented	$330,000	$330,000
Potential value of highway accidents avoided	$43,000	$76,000
Social Cost of Carbon	$94,000	$575,000
Human Health	$1,272,000	$1,272,000
Air Pollution Reduction	$164,000	$164,000
Congestion Reduction	$953,000	$1,324,000
Reduced Highway Road Maintenance	$0	$934,000
Total	$2,856,000	$4,675,000

Bottom Line

The proposed Mid-Willamette Valley Intermodal Center can serve transportation needs in the region. Growing highway congestion and a strong reliance on international markets provide a sufficient case for expanding transportation options. The analysis contained in this report estimates that, once fully operational, economic conditions indicate that the intermodal center will be able to operate in a financially feasible manner and generate a significant return on investment for the State of Oregon.

This page intentionally blank

1 Introduction

1.1 Background

The Keep Oregon Moving bill (House Bill 2017-A), passed in 2017, authorized $25 million for the Oregon Department of Transportation to fund an intermodal center in the Mid-Willamette Valley to address shipping and transportation needs in the region.

The Linn Economic Development Group (LEDG) has proposed developing several transportation infrastructure improvements at the former International Paper site in Millersburg, Oregon. LEDG is an affiliate of the Albany-Millersburg Economic Developmnt Corporation, a 501(c)4 non-profit economic development organization. The site is located along I-5 in Millersburg with direct access to two major rail main lines: Union Pacific (UP) Railroad and the Portland & Western (P&W) Railroad (which operates on track owned by the Burlington Northern Santa-Fe (BNSF) Railroad). The site also has an existing warehouse of approximately 60,000 square feet. The land is zoned for industrial use and is in close proximity to another 135 acres of industrially-zoned land owned by the City of Millersburg.

The proposed Mid-Willamette Valley Intermodal Center (MVIC) comprises several elements that would expand the range of logistics services available to producers in the Willamette Valley and southern Oregon.

- The centerpiece of the project, an intermodal terminal, would primarily serve the agricultural community in the Willamette Valley and southern Oregon by providing infrastructure to transfer intermodal containers between truck and rail. Other businesses that use 20-, 40-, or 53- foot intermodal containers for transporting goods would have the opportunity to use the proposed intermodal center as well.
- A separate reload operation, utilizing an existing warehouse onsite, would expand agricultural commodity dry-storage capacity in the Willamette Valley. This operation would provide a location to load goods into intermodal containers bound for both domestic and international destinations and interface with the intermodal terminal to transport the containers via rail. It could also serve as a transload operation to facilitate unloading and reloading at the same time without storing the shipments.
- A portion of the site would be dedicated to long-haul truck parking, providing a safe and secure location for drivers to rest and queue to avoid peak congestion times in the Portland metropolitan region.

The project would produce positive economic impacts through increased local spending and the creation of new employment opportunities. Each of the proposed project elements has the potential to provide public benefits by reducing the number of trucks using the highways in the Portland area, which potentially would lower highway maintenance costs, reduce congestion, improve air quality, and decrease carbon emissions. These benefits would materialize as long as the facilities operate as described throughout the analysis.

1.2 Goals of This Study

This report analyzes the economic and financial feasibility of the MVIC in an attempt to understand the conditions in which the intermodal center needs to operate to be successful over the long term. As Oregon Department of Transportation funding was dedicated to this intermodal center in the Oregon House Bill 2017, the goal of this study is to analyze the intermodal center's potential operations under different scenarios, understand the financial and economic conditions for successful operations, and quantify the potential public benefits that would be realized.

This results of this study may inform the intermodal center design, configuration, and operations to help understand the optimal conditions for operating success. This study is not designed to advocate for a particular project, outcome, or design, but rather to present a defensible evaluation of the underlying economic conditions.

1.3 Definitions

Throughout this report, the following definitions for common terms are used:

Intermodal Terminal – A facility that supports shipping intermodal containers by rail. Located on a rail line and providing specialized equipment to lift intermodal containers from truck chassis to rail flat car and back, and/or between different truck chassis.

Reload Operation – A facility that provides short and long-term storage capacity for dry goods (e.g., agricultural commodities such as grass seed) for the purpose of transferring them into or out of intermodal shipping containers, vans, or rail cars.

Transload Operation – A facility that facilitates unloading products from one mode of transportation and into another mode of transportation (e.g., intermodal container into a van for local distribution) but does not provide long-term storage capacity.

Container – An intermodal shipping container. In this report, all data for international export containers are reported in terms of a 40-foot standard height container while domestic containers are reported in terms of a 53-foot standard-height container.

Short-Haul - An intermodal freight corridor less than 700 miles long.

1.4 Organization of this Report

The economic and financial feasibilty analysis is composed of the following study elements:

1. Introduction

Introduction outlining the purpose and goals of the report.

2. Literature Review

The literature review summarizes the conclusions of feasibility studies of other similar facilities in the U.S. that provide useful context and specific considerations for the current study to address. The literature review also includes the conclusions of government reports that provide similar contextual information.

3. Stakeholder Interviews

During the course of research, a series of interviews were conducted with a variety of stakeholders, transportation industry professionals, and potential customers of the MVIC, including agricultural producers and shippers, trucking companies, freight-forwarders, and warehousing and storage operators. This section descibes the findings of these interviews and provides a summary of the issues raised. An informal estimate of the number of containers shipped for those who said they may use the intermodal center is also developed. Information collected in the interviews motivate subsequent data collection and analysis.

4. Market Description

The scope and characteristics of the potential market for the MVIC is developed using several data sources. A quantitative estimate of the universe of goods that may use the intermodal center is constructed, which serves as an input in the estimation of demand in the following section.

5. Demand Estimation

An estimate of the existing demand for commodity transport as well as the potential latent demand for additional transportation capacity provided by the MVIC is developed. Assignment of flows to highway and rail modes is constructed using existing information and standard econometric techniques. Projections of future utilization are developed based on a series of potential scenarios designed to represent the range of exogenous effects such as changes in the market prices of commodities, truck transportation costs, or production.

This information is joined with publicly available data on transportation costs, methods, destinations, volumes, weights, commodities, and time of year, to frame a conceptual model of how the MVIC could integrate into the existing regional and national commodity market.

5. Capital and Operating Cost Analysis

An evaluation of the MVIC operating costs is developed via an evaluation of the fixed and variable costs of intermodal center operations. Using estimates of demand for the intermodal center, a cash flow analysis is conducted to evaluate the break-even price for transport through the MVIC and the series of operational benchmarks necessary to ensure the financial feasibility of the MVIC.

6. Economic Impacts Analysis

Using an economic input-output model, this section calculates the potential direct, indirect, and induced economic impacts to the local economy resulting from the spending generated by this intermodal center.

7. Public Benefits

The potential public benefits of the intermodal center are calculated, including those generated via expected reduced highway accidents, carbon emissions, air pollution, congestion, and highway maintenance costs.

8. Conclusions

A description of the largest factors influencing the long-term success of the intermodal center based on current market conditions and scenario modeling as well as exogenous factors that intermodal center operations will need to monitor.

2 Literature Review

This literature review summarizes existing research, case studies, and economic models that support the goals of this study.

2.1 Trucking Industry Challenges

The transportation industry in Oregon is undergoing changes. Recent Federal Motor Carrier Safety Administration regulations on trucking, congestion, and potential tolling policies in metropolitan areas—particularly in the I-5 corridor of Oregon and Washington—all have the potential to increase trucking costs for the region.

The trucking industry is influenced by the cyclical business cycle and has seen significant growth corresponding with the ongoing economic expansion. FTR Transportation Intelligence reported that June 2018 orders for heavy semi-trucks were the highest ever recorded and up 140 percent from June 2017.[1] This growth is expected to continue, with the Bureau of Transportation Statistics projecting that trucks will be moving 16.5 billion tons by 2045, an estimated 43 percent increase from 11.5 billion in 2015.[2] Further, the agency projects that long-haul freight truck traffic on national highways may increase from 282 million miles per day in 2012 to 488 million miles per day by 2045 – a 73 percent increase.[3] This change is likely to also occur on the I-5 corridor in Washington and Oregon, where at least 8,500 average trucks travel daily on some sections of the highway.

In combination with this increase in demand, the trucking industry is facing many issues that restrict the supply and availability of trucks, ranging from limits on driving hours to parking and driver shortages to congestion.

Regulations limiting driving time

The Federal Motor Carrier Safety Administration recently implemented rules regarding the hours of service (hours of service "HOS" rule) that truck drivers are able to operate in. These rules are designed to eliminate drowsiness that can lead to crashes while operating a commercial motor vehicle (CMV).[4] Tracking and adhering to these restrictions can be logistically onerous. Originally, drivers tracked these hours manually, leading to increased

---

[1] Richter, Wolf. "The trucking industry is in a capacity crisis – but it's just part of the business cycle." *Business Insider.* July 9, 2018. Retrieved from http://www.businessinsider.com/trucking-industry-capacity-crisis-just-part-of-the-business-cycle-2018-7

[2] US Department of Transportation, Bureau of Transportation Statistics. *Freight Facts & Figures 2017 – Chapter 3 The Freight Transportation System*. Retrieved from https://www.bts.gov/bts-publications/freight-facts-and-figures/freight-facts-figures-2017-chapter-3-freight

[3] Ibid.

[4] Federal Motor Carrier Safety Administration. *Hours of Service.* Retrieved from www.fmcsa.dot.gov/regulations/hours-of-service

driver administrative burden. However, tracking is now performed electronically following the implementation of the electronic logging device (ELD) rule. This rule aims to improve highway safety and reduce the paperwork burden by requiring the use of electronic logging devices for hours of service compliance.[5] However, for some truck drivers, this regulation imposes costs and a reduction in take-home pay because of less flexible adherence to the HOS rule. Furthermore, truckers who had not previously worked with ELDs have had to invest in new equipment and develop new processes for tracking hours.

Parking shortages

In a report to Congress in 2012, the Federal Highway Administration identified truck parking shortages as a growing constraint on the trucking industry.[6] The inadequate supply of truck parking requires drivers to spend time looking for parking, making it more challenging to comply with HOS regulations. It is difficult for drivers to make up for this lost productivity because the ELD is keeping track of time spent on duty.

The HOS rule, ELD rule, and parking shortages may collectively increase the cost to ship products by truck and may require more trucks and drivers to move the same amount of freight. At the same time, a strong economy and low unemployment rates mean that the trucking industry faces strong competition for labor. According to a study by the American Trucking Association, the growth in the driver workforce has not kept pace with the demand in the shipping industry.[7] The discrepancy between the supply and the demand for truck drivers leads to higher trucking costs in the form of higher driver compensation. These higher trucking costs translate into higher shipping costs for producers.

Congestion and tolling

The congestion issues in metropolitan areas are likely to worsen in coming years. The Urban Congestion Report from the United States Department of Transportation estimates that between December 2015 and December 2016, the duration of traffic congestion increased by four minutes on average across the country.[8] More specifically, a 2017 Washington State Department of Transportation report found substantial increases in delays on I-5 in the Puget Sound region.[9] The congestion was exceptionally high along the Federal Way to Seattle commute. According to a 2016 report prepared by the Oregon Department of Transportation, traffic congestion in

---

[5] US Department of Transportation- Federal Motor Carrier Safety Administration. *Federal Register*. December 16, 2015. Retrieved from www.gpo.gov/fdsys/pkg/FR-2015-12-16/pdf/2015-31336.pdf

[6] US Department of Transportation- Federal Highway Administration. *Commercial Motor Vehicle Parking Shortage.* May 2012. Retrieved from ops.fhwa.dot.gov/freight/documents/cmvrptcgr/cmvrptcgr052012.pdf

[7] Costello, Bob. *Truck Driver Shortage Analysis*. American Trucking Associations 2017. Retrieved from progressive1.acs.playstream.com/truckline/progressive/ATAs%20Driver%20Shortage%20Report%202017.pdf

[8] US Department of Transportation- Federal Highway Administration. *Urban Congestion Report.* December 2016. Retrieved from https://ops.fhwa.dot.gov/perf_measurement/ucr/reports/52urbanareas/fy2017_q1.pdf

[9] Miller, Roger. *The 2017 Corridor Capacity Report.* December 2017. Washington State Department of Transportation. Retrieved from http://wsdot.wa.gov/publications/fulltext/graynotebook/corridor-capacity-report-17.pdf

Portland can occur at any time during the day, and hours of congestion have increased by 13.6 percent.[10]

To manage transportation flow and fund deferred maintenance costs and major infrastructure projects, many metropolitan areas are increasingly contemplating congestion pricing and tolling. Such congestion management strategies increase the marginal cost of driving during congested periods, inducing some to switch to alternative modes or times. This may lead to some truck drivers alternating their transit schedule, while others may choose to pay the tools during the peak periods. Either alternative may increase the cost of trucking and have impacts on how shippers choose to transport their products. Both Seattle and Portland are considering implementing congestion pricing and tolling to support a variety of policy interests.[11] [12]

2.2 Intermodal Shipping Trends

Intermodal shipping is gaining popularity because of the convenience of securing intermodal containers onto trucks, ships, and rails without unloading any product. Intermodal shipping comprises nearly one-quarter of all U.S. freight shipped by rail, in terms of total revenues.[13] This share is forecasted to continue growing. According to the Intermodal Association of North America, the size of the domestic intermodal fleet is projected to grow by 4.3 percent in 2018, compared to an increase of 2.7 percent in 2017.[14] Persistent growth of the intermodal sector is both helped and hindered by increased trucking costs. The intermodal system enables shippers to eliminate long truck hauls, but trucks are still required for shorter hauls to and from farms, intermodal facilities, and final destinations.

Despite the growing use of intermodal shipping, container allocation remains a logistical challenge. Globalization and trade interdependence have improved access to goods produced around the world, increasing the reliance on maritime shipping. Intermodal containers are generally owned by either ocean carriers or leasing companies[15] and these global organizations allocate containers at their discretion, often favoring high-volume ports and high-value

---

[10] Oregon Department of Transportation. *Portland Region 2016 Traffic Performance Report*. June 2017. Retrieved from https://www.oregon.gov/ODOT/Regions/Documents/Region1/2016_TPR_FinalReport.pdf

[11] Booz-Allen-Hamilton and the City of Seattle Department of Transportation. *Seattle Variable Tolling Study.* May 2009. Retrieved from https://www.seattle.gov/Documents/Departments/SDOT/About/DocumentLibrary/Reports/FINALTollingStudyreportrevised6.25.10.pdf

[12] Theen, Andrew. *5 Things to now as Portland-area freeway tilling plan moves forward.* The Oregonian/Oregon Live. June 26, 2018. Retrieved from https://www.oregonlive.com/expo/news/erry-2018/06/00456ad08f9272/5_things_to_know_as_freeway_to.html

[13] IANA. *Intermodal Fact Sheet.* Retrieved from https://www.intermodal.org/sites/default/files/documents/2018-01/IntermodalFactSheet.pdf

[14] Intermodal Freight Volume Accelerates, Raises Capacity Concerns for 2018. *Transport Topics*. Feb 5, 2018. Retrieved from http://www.ttnews.com/articles/intermodal-freight-volume-accelerates-raises-capacity-concerns-2018

[15] Ibid.

products. Any misallocation in containers worldwide can significantly hinder efficient international trade.

The U.S. has a significant trade imbalance with numerous countries in East Asia: three times as many loaded containers move from Asia to the US than in reverse.[16] Additionally, tariff imbalances, costs to transport goods on land, and the low cost of manufacturing new containers in China all impact global container allocation.[17]

The result of these trends is an accumulation of empty containers near West Coast ports.[18] Usually, sellers pay the costs of shipping their products to markets, so ocean carriers generally seek higher-margin goods where sellers have a higher willingness to pay freight costs. Ocean carriers are eager to get their containers back to Asia to deliver more goods to the U.S. but do not want to ship them empty.

Although the West Coast has many empty containers ready to ship to Asia, the majority of these are allocated to Southern California ports, such as Los Angeles and Long Beach– as these areas import much more than the Ports of Seattle and Tacoma.[19] The Ports of Los Angeles and Long Beach are the top ports in the country, importing 16.9 million twenty-foot equivalent units (TEUs) in 2017. Their import rates increased by 8 percent between 2017 and 2018.[20] Because the ports of Los Angeles and Long Beach handle such a large volume of imports (18 percent of all North American trade[21]), southern California experiences high rates of empty containers. For every empty container the port of Los Angeles imported in 2006, it exported approximately 50 empty containers.[22] While ocean carriers will avoid shipping empties back, it is often economically valuable to do so. When the value of imported cargo is high, carriers might rather

---

[16] Rodrigue, Jean-Paul, and Theo Notteboom. *Comparative North American and European gateway logistics: the regionalism of freight distribution.* Journal of Transport Geography 18.4 (2010): 497-507. Retrieved from https://people.hofstra.edu/Jean-paul_Rodrigue/downloads/107_2.2._Rodrigue.pdf

[17] Theofanis, Sotirios, and Maria Boile. *Empty marine container logistics: facts, issues and management strategies.* GeoJournal 74.1 (2009): 51.

[18] Boile, M., Theofanis, S. and Mittal, N. *Empty Intermodal Containers – A Global Issue* 2004 Annual Forum of the Transportation Research Forum. Northwestern University, Transportation Center. 2018. March 24, 2004. Retrieved from https://pdfs.semanticscholar.org/d763/871833e193351c65a85c3b7c603f2fd3f37e.pdf on August 3,

[19] Los Angeles Times. *West Coast ports: What comes in, what goas out and what it's worth*. Feb 19, 2015. Retrieved from http://www.latimes.com/business/la-fi-ports-imports-exports-20150218-htmlstory.html

[20] Cushman & Wakefield. *US Ports Updates- YE 2017*. March 16, 2018. Retrieved from http://www.cushmanwakefield.com/en/research-and-insight/2018/us-ports-ye2017

[21] Rodrigue, Jean-Paul, and Theo Notteboom. *Comparative North American and European gateway logistics: the regionalism of freight distribution*. Journal of Transport Geography 18.4 (2010): 497-507. Retrieved from https://people.hofstra.edu/Jean-paul_Rodrigue/downloads/107_2.2._Rodrigue.pdf. Page 22.

[22] Rodrigue, Jean-Paul, and Theo Notteboom. "Comparative North American and European gateway logistics: the regionalism of freight distribution." Journal of Transport Geography 18.4 (2010): 497-507. Retrieved from https://people.hofstra.edu/Jean-paul_Rodrigue/downloads/107_2.2._Rodrigue.pdf. Page 23.

ship the empty container back to Asia to restock the high value cargo, rather than waiting for the lower-value goods on the backhaul.[23]

Also impacting the macroeconomic conditions for intermodal shipping containers are trade uncertainties with critical partners. The North America Free Trade Agreement (NAFTA) eliminated tariffs and quantitative restrictions between the United States, Canada, and Mexico (except for a few Canadian agricultural products) in 2008.[24] However, recent actions by the U.S. have altered the trade environment with many partner countries. In mid-2018, the U.S. imposed new taxes on steel and aluminum from Canada, and Canada retaliated with tariffs on $12.6 billion US goods.[25] These new charges and other limits to free trade in North America negatively impact the rail industry. NAFTA has enabled the rail industry to make substantial investments in capital and to establish a complex supply chain. New tariffs and changes in the freedom of trade between the countries will significantly increase the cost of goods, potentially altering the demand for rail or increasing up-front costs.[26]

Secondly, the US and China have been exchanging tariffs, duties, and other penalties on international trade in recent months. In early July 2018, the Trump Administration levied duties on $34 billion in Chinese imports, and the Chinese retaliated proportionally.[27] Much remains unknown about how much further these duties and tariffs could escalate and how they will impact the economies of each country. Both due to the uncertainty and due to the steeper costs of shipping goods between the countries, prices on certain key goods are likely to increase, causing demand to decrease.[28] Given that the US currently imports $478.8 billion worth of goods with China, this situation could significantly impact trade dynamics.[29]

Given all these trends, a great deal of uncertainty surrounds transpacific trade. Given that intermodal trade is a prominent mode of transport from Asian countries to the U.S., the intermodal industry will undoubtedly be impacted by any future trade or tariff change. The

---

[23] US Department of Agriculture. *Study of Rural Transportation Issues- Chapter 14: Ocean Transportation.* Retrieved from https://www.ams.usda.gov/sites/default/files/media/RTIReportChapter14.pdf

[24] Office of the United States Trade Representative. Retrieved from https://ustr.gov/trade-agreements/free-trade-agreements/north-american-free-trade-agreement-nafta

[25] Canada Tariffs on $12.6B of US Goods Take Effect. CBS News. July 2, 2018. Retrieved from https://www.cbsnews.com/news/canada-tariffs-on-whiskey-ketchup-list-of-on-u-s-goods-starting-july-1/

[26] With Canadian and Mexico Counterparts to Urge Successful NAFTA 2.0 Negotiations. Association of American Railroads. Jan 22, 2018. Retrieved from https://www.aar.org/news/u-s-freight-rail-industry-partners-canadian-mexico-counterparts-urge-successful-nafta-2-0-negotiations/

[27] Here's How the Trade War Between the US and China Could Get Ugly. Andrew Mayeda and Jenny Leonard. Bloomberg. July 8, 2018. Retrieved from https://www.bloomberg.com/news/articles/2018-07-08/here-s-how-a-trade-war-between-the-u-s-and-china-could-get-ugly

[28] Ibid.

[29] Office of the United States Trade Representative. Retrieved from https://ustr.gov/countries-regions/china-mongolia-taiwan/peoples-republic-china

issue of misallocation is persistent and continues to stunt efficiency in the intermodal trade industry.

2.3 Studies of a Willamette Valley Intermodal Facility

For the past several years, stakeholders and public officials have explored the feasibility of developing a facility that would reduce transportation costs and increase the efficiency of intermodal container shipments from agricultural exporters in the Willamette Valley. Driven by the closure of the Port of Portland's Terminal 6, which provided service for export shipments from the Willamette Valley to Asia, these studies explored alternatives and evaluated project feasibility to garner support for potential public investments. Two studies are described below: ECONorthwest's 2016 *Feasibility Study of an Intermodal Transfer Facility in the Willamette Valley, Oregon* and Tioga Group's 2016 *Trade and Logistics Report: Concepts and Business Case Analysis*. In addition to these studies, several public forums provided opportunities for stakeholders to express their interest in and needs for such a facility.

Feasibility of an Intermodal Transfer Facility in the Willamette Valley, Oregon

ECONorthwest completed a feasibility study[30] for a potential intermodal transfer facility (ITF) in Oregon's Willamette Valley in 2016. This feasibility study evaluated the economic and financial sustainability of an intermodal facility somewhere in the Willamette Valley. As the types of analysis requested in the current Mid-Valley Intermodal Study were similar to that requested in this prior study (potential demand for the facility, economic impacts, public benefits, and financial sustainability), the 2016 study serves as a significant source for contextual information, analytical methods, and data sources.

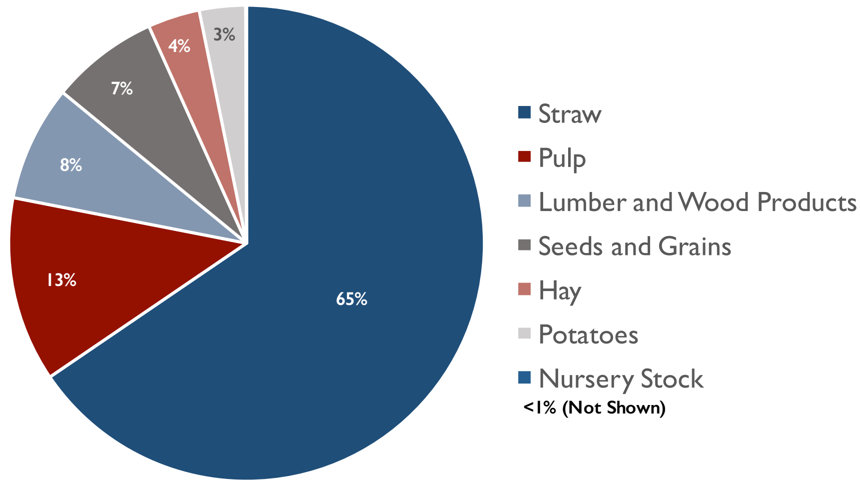
The feasibility study found that straw and hay comprised almost 70 percent of the containers leaving the Willamette Valley and Southern Oregon, with pulp, seeds and grains, and lumber making up the majority of the rest. Based on interviews and records of phytosanitary inspections of agricultural products leaving Oregon, about 38,000 containers left the study area in 2015. Figure 2 shows the shares of products being shipped. Straw dominates the export containers, followed distantly by pulp, lumber and wood products, and seeds and grains.[31]

---

[30] ECONorthwest. *Feasibility of an Intermodal Transfer Facility in the Willamette Valley, Oregon.* Business Oregon & Infrastructure Finance Authority. (2016) Retrieved from http://www.oregon4biz.com/assets/e-lib/IT/ITFrpt1216.pdf

[31] Information of pulp did not come from the phytosanitary records, but was added into the estimate of export containers based on key-informant interviews with Cascade Pacific Pulp.

Figure 2. Containerized Products Bound for Export from the Willamette Valley and Southern Oregon



Source: ECONorthwest 2016

The study concluded that the actual demand for an ITF depends on service costs, the price and availability of alternatives, and non-price preferences of shippers. The range of options available to shippers to move a container between the Willamette Valley and the Ports of Seattle and Tacoma includes trucking to Portland and railing to the Ports or trucking the entire way. The estimated average costs for these alternatives ranged from $1,200 to $1,450 per container round trip. Interviews conducted for this study revealed that non-price factors are important in shippers' decisions about how to ship their goods and that the cheapest transportation option is not always selected. Timely service, flexibility to adjust schedules, and reliability in meeting ocean carrier shipping cutoffs were identified as key variables in choosing a shipping method. Many of these factors favor trucking over rail

The feasibility study concluded that an ITF would have to provide equivalent or better service at a similar price as the other alternatives to attract customers. It is unlikely that sufficient volume would materialize immediately to allow an ITF to be self-supporting: at a minimum, shippers would need time to test the facility and adjust their operations before committing long-term. Given the small margin in cost between other transportation options available to most shippers and the importance of non-cost factors, it is possible that many shippers would not choose to ship via an ITF at all or wait until its benefits were proven first by other shippers, which may further delay sufficient operating volumes and revenues for an ITF to operate profitably.

Finally, the study found that container volume is critical to the financial independence of an ITF and that achieving sufficient container volumes would take time. It is possible they may not materialize, if other shipping options continue to offer lower costs or other advantages important to shippers. Improving the feasibility of an ITF would involve strategies to increase container volume by lowering costs, reducing transit time, and increasing reliability. Frequent rail service is critical to accomplishing this.

The market conditions and choices facing shippers in western Oregon have not changed substantially since ECONorthwest conducted this feasibility study, so its preliminary findings and conclusions are highly relevant to the current study. Using phytosanitary certificates to quantify the potential market, which was a novel method piloted in this study, remains a valid and useful method to consider for the current study.

Trade and Logistics Report: Concepts and Business Case Analysis

The Tioga Group prepared a report[32] to the Oregon Legislature to address questions related to what Oregon's public agencies can do to help the state's shippers cope with the loss of service at Terminal 6, attract and retain a replacement service, and improve Oregon's long-term trade and logistics capabilities. As part of this report, the Tioga Group reviewed the available information and data on developing a new inland intermodal port, focusing on truck-to-rail service, in the Willamette Valley. Here is a summary of the relevant findings:

- Northwest Container Services (NWCS), which operates transload facilities and container rail services from Portland and Boardman to Tacoma, investigated the feasibility of expanding its operations into the Willamette Valley in 2005-2006. Such a facility would require partnership or track right agreements with UP, which was unwilling at the time to support such a facility, possibly due to capacity issues on its lines.
- Based on customs data from the Port Import-Export Reporting System (PIERS) in 2014, counties that would potentially benefit from a mid-valley facility generated about 44,406 containers. Based on industry interviews, they determined half of the total is now being trucked to and from NWCS's terminal in Portland for transfer to rail, and the other half trucked to and from Tacoma and Seattle.
- The Tioga Group identified distance as a primary challenge for success of a Willamette Valley facility. Rail intermodal service has a high upfront terminal cost, but lower line-haul costs, compared to truck container transport. Rail becomes competitive when long trains are operated over long distances. Evidence from facilities elsewhere suggests a breakeven distance is between 500 and 1,000 miles. The distance between the Willamette Valley and Puget Sound is considerably less than this. However, NWCS has successfully operated short-line container service between Portland and Boardman and the Ports of Seattle and Tacoma, using a business model that relies on several unique factors, including handling a large volume of containers containing garbage for NWCS's parent company, Waste Connections, Inc.
- Portland & Western, Albany & Eastern, and Union Pacific Rail Roads all offer rail service in the Valley. The Tioga Group identified four potential intermodal operating options among the current rail service in the Willamette Valley, all involving new agreements for transfer between rail lines or track rights. Development of the terminal

[32] The Tioga Group, Inc. 2016. *Trade and Logistics Report: Concepts and Business Case Analysis*. February. Retrieved from http://cdn.portofportland.com/pdfs/TL-Report-Appendix-3.pdf

would cost around $10 million. This is in the neighborhood of what the NWCS Boardman facility costs.

The Tioga Group's conclusion after reviewing the data and logistics of a Willamette Valley terminal facility is that rail intermodal service over short distances needs special circumstances to succeed. NWCS has demonstrated it is possible, and its interest in a Willamette Valley terminal suggests an operation could succeed if carefully planned. However, concrete, detailed, private sector proposals have yet to emerge: the most critical elements that are not yet in place are the cooperation of a Class I rail carrier (e.g., UP or BNSF) and support from the ocean carriers.

Oregon Governor's International Trade and Logistics Forum

As part of Governor Brown's International Trade and Logistics Forum, meetings were held in 2015-2016 throughout Oregon to engage transportation and trade experts on their needs and concerns. The Forum released notes from each of these meetings and a Stakeholder Engagement Report, as an Appendix to its summary report.[33] A potential Willamette Valley Transloading Facility was brought up throughout the meetings. Key observations include:

- Major commodities coming out of the valley include hay, straw, and seed. These are high-volume, lower margin cargoes. Cost of transportation figures heavily in competitiveness in Asian markets (Albany).
- Commodities from southern Oregon that could be transloaded in the Valley include potatoes (Medford). Communities in coastal Oregon could also benefit from a Valley transload facility. Support for a Willamette Valley transload facility was the "most intense" from participants in the Medford workshop.
- In lieu of T-6 shipments, shippers from the area are either trucking to Northwest Container Service's Facility in Portland where cargo is transloaded to rail or trucking directly to Seattle or Tacoma ports.
- "Strong consensus" for the need for an inland rail load point somewhere in the Willamette Valley. This would allow forest products and agricultural products to be loaded on to rail closer to the point of production, avoiding long truck hauls.
- Eugene was most frequently mentioned for an inland port. Its main advantage is its central proximity to Southern Oregon, Central Oregon, and the South Coast, which are all too distant from the Puget Sound area for economically viable trucking.
- Short-term solution may be a truck transfer center that brings containers to the Valley, where they are loaded and driven to an intermediate inland transload facility, where they are transloaded to rail to finish the trip to the marine port.

---

[33] International Trade and Logistics Initiative, Steering Committee Report. 2016. Retrieved August 3, 2016, from http://www.oregontradesolutions.com/assets/reports/TLReport-Full.pdf.; Meeting notes from August 11, 2015 workshop in Albany: http://www.oregontradesolutions.com/assets/reports/AlbanyNotes.pdf; Meeting notes from August 12, 2015 workshop in Medford: http://www.oregontradesolutions.com/assets/reports/MedfordNotes.pdf;

- Buy-in from UP and BN, Oregon's two Class-I railways is critical. The physical infrastructure is in place, but cooperation from UP and BN is essential, even for operations by the short-line railroads in the Valley, which operate over UP and BN trackage.

2.4 Considerations for Successful Intermodal Terminals

Determining the Potential Economic Viability of Inter-Modal Truck-Rail Facilities in Washington State

Conducted by researchers in Washington State for the Washington Department of Transportation and the Federal Highway Administration, this study[34] developed an applied methodology for determining the potential economic viability of intermodal truck-rail facilities in Washington State. The methodology identifies attributes, characteristics, and market situations that are associated with successful intermodal facilities. The report presents the framework supported by a detailed literature review and a review of a broad set of case studies of intermodal facilities throughout the U.S. and Canada.

The authors present several conceptual models that identify the most relevant and important variables for assessing the economic and financial viability of intermodal facilities. These variables are categorized in Figure 3 below.

Figure 3. Factors Found to Be Important in Intermodal Truck-Rail Facilities

Locational Variables	Facility Variables
Adequate land and space for the facility	Adequate facility capacity
Appropriate distance from markets (supply and demand markets)	Services that are demanded by the market
Appropriate mix of local commodities	Time to build the facility
Appropriate prices of local goods relative to shipping costs	Degree of automation in the facility
Incentives in the local tax or zoning code	Cost of labor
Access to various modes of transport (class 1 railroads, major highways, population centers)	Operational efficiencies
Availability of local labor	Ownership structure
Proximity to population center	Adequate public support
Adequate volumes (demand)	Adequate relationship with DOT and railroads

Source: Casavant, K., E. Jessup, and A. Monet. 2004. Determining the Potential Economic Viability of Inter-Modal Truck-Rail Facilities in Washington State

The authors also identified factors that were important for ongoing financial sustainability, including the following:

---

[34] Casavant, K., E. Jessup, and A. Monet. 2004. *Determining the Potential Economic Viability of Inter-Modal Truck-Rail Facilities in Washington State.* Washington State Transportation Commission, Washington State Department of Transportation, and U.S. Department of Transportation, Federal Highway Administration. December. Retrieved August 2, from http://www.wsdot.wa.gov/Research/Reports/600/605.1.htm

1. A clear place for the facility in the market (proximity, sufficient volume, and perceived value for users)
2. Elements within the supply chain to compete (cheapest transport alternative, sufficient volume, connectivity, enough control of other pieces of the market, and appropriate operating cost)
3. A sustainable business model (sufficient volume, efficiency of operations, and appropriate operating costs)

From their assessment of the literature and review of case studies, they develop several illustrative intermodal models and identify key attributes for their success. The first model is an *Agricultural Gathering and Assembly* facility. This facility serves agricultural regions, providing transportation to marine ports for products primarily destined for export. They offer a staging area for trucks to gather and transfer cargo, a transfer area, lifts, rail car availability, and competitive rate agreements with relevant railroad companies. The efficiencies and rate agreements must combine to compete effectively with direct trucking to the ports. The second model is a *Port Clearing Inland Terminal*, which is designed to quickly move freight away from congested Ports to inland locations near distribution centers and easily accessible by trucks. These facilities are intended to increase the capacity and efficiency of marine ports. The authors point out that "the viability of intermodal centers increases when the traffic flow of the agricultural gathering model is combined with the port clearing model, generating backhauls to each respective movement."

Rail Short Haul Intermodal Corridor Case Studies: Industry Context and Issues

The Foundation for Intermodal Research and Education prepared a report[35] that highlights issues in developing short-haul intermodal projects and provides a framework for analyzing the costs and benefits of such projects. This is the minimum length the industry often considers as being cost-effective for intermodal freight movement.

One finding of the study is that freight volumes and system congestion are growing and concentrating. This means that short-haul distances once found to be uncompetitive are increasingly becoming cost-effective, especially when public costs and benefits are included in the feasibility analysis. The authors point to several successful short-haul corridors that have developed because effective highway options have been exhausted, and service innovations are able to increase efficiencies from historical levels. The authors emphasize that "scale economies are critical to cost efficient rail corridors due to high capital costs", and "terminals on a corridor need to be located and designed with respect for network consideration."

The authors provide a detailed explanation of cost factors for both trucking and rail and emphasize that planners often get the cost factors wrong for rail, as long-run variable costs are

[35] Casgar, C.S., D.J. DeBoer, and D.L. Parkinson. 2003. *Rail Short Haul Intermodal Corridor Case Studies: Industry Context and Issues.* U.S. Department of Transportation, Federal Railroad Administration and CSX Transportation, Norfolk Southern Corporation, and The Port Authority of New York and New Jersey. March. Retrieved August 3, 2016, from https://www.fra.dot.gov/Elib/Document/1649

key. They offer templates for identifying assumptions and calculating the costs of short-haul corridors and provide examples of how to appropriately compare rail to truck freight travel. They emphasize that "the economics of short haul intermodal are very site-specific. Market-by-market and lane-by-lane analysis must be undertaken, and costs will vary from corridor to corridor."

2.5 Case Studies of Intermodal Terminals

More than a dozen feasibility studies of intermodal/transload facilities and inland ports were surveyed for this literature review, and the ones most relevant to the MVIC are summarized below. A subset of the case studies document planned or implemented facilities in Washington intended to serve as inland ports to serve the Ports of Seattle and Tacoma. Evaluations of other intermodal facilities of similar scope and scale to the MVIC also provide useful context.

2.5.1 Washington Intermodal Facilities

Port of Benton, Washington

In 2017, BST Associates prepared a market analysis[36] of the rail line near Richland, Washington for the Port of Benton. The Port explored the possibility of expanding by about 2,500 acres along a rail line and the report evaluates the market potential to develop new rail cargo (both domestic transportation and international trade) and summarized the economic contribution that the new development could provide to the local economy.

The report found that economic conditions could allow the Port to offer a container shuttle service between the Port in Tri-Cities Washington and the Ports of Seattle and Tacoma. The report noted the following conditions needed to occur for the facility to be successful:

- Adequate volumes need to be secured and consistent service needs to be maintained
- Empty containers would need to be diverted to the facility
- Pricing needed to be competitive with local markets and the trucking industry, and
- The facility would need to secure a long-term commitment from one or more railroads.

Due to location constraints and the inability for double stacked containers to transit through the Stampede Pass rail line (which would cause train shipments to travel twice the distance as truck shipments), the report recommends further analysis to understand the Port's potential for intermodal service.

---

[36] BST Associates. 2017. *Port of Benton Rail Line Market Analysis.* Final Report. January 27. Retrieved from http://portofbenton.com/tricities/wp-content/uploads/2016/06/BSTPOBRailLineMarketAnalysis_1-27-2017-v2.pdf

Port of Quincy, Washington

The Port of Quincy Intermodal Terminal was included in a paper assessing case studies on Inland Ports to identify what factors are key to success.[37] The author hypothesized that four key elements were needed to develop and sustain a successful inland intermodal port:

1. Offer clear and significant value to shippers or carriers
2. Obtain clear commitment from a major rail carrier
3. Offer a location that is capable of accommodating the growth envisioned by shippers and carriers
4. Ensure public sector agency support and investment

The Port of Quincy was used as an example of a failed venture. Despite local support and federal investment in upgrading infrastructure, BNSF did not invest in expanding their facilities or formally pursing the use of Quincy to relieve container congestion in the Ports of Seattle and Tacoma. Operators successfully used the Port of Quincy to serve a refrigerated, direct train to Chicago to support Washington's fruit growers. However, as BNSF rail traffic shifted to accommodate coal and oil shipments out of the mid-west, intermodal container traffic was de-prioritized, with on-time rates falling below 5 percent by 2014. The cold train service ended in 2014, with blame directed at BNSF.[38] The author of the study concluded that although all three levels of government have invested heavily in the Port, the private sector failed to see the value proposition as a Port clearing terminal and the railroad failed to commit the resources to create success.

More recently, shippers and other stakeholders are revisiting the idea of using the modern infrastructure developed at the Port of Quincy as a potential inland Port intermodal clearing facility, relieving congestion at the Ports of Seattle and Tacoma and serving the agricultural industry in Washington.[39] In 2017, the Northwest Seaport Alliance (made up of the Ports of Seattle and Tacoma) engaged agricultural producers in central Washington about the potential for the Port of Quincy Intermodal Terminal to offer economic benefits to their operations.[40] The Northwest Seaport Alliance identified several benefits of developing the intermodal service, including

---

[37] Kirkland, C. 2007. *Assessing Potential for Inland Port Success.* Retrieved August 3, 2016, from http://www.gateway-corridor.com/roundconfpapers/documents/Kirkland_Clare_Regina.pdf

[38] Berg, T. 2015. "Founders of Failed 'Cold Train' Blame BSNF Railway, Sue for $41 Million." April 7. Retrieved from https://www.truckinginfo.com/159433/founders-of-failed-cold-train-blame-bnsf-railway-sue-for-41-million

[39] Port of Quincy. 2017. "Interest Growing in the Port of Quincy Intermodal Terminal as an Inland Port to Ship Ocean Containers by Rail to Puget Sound Ports." *Cision PR Newswire.* May 15. Retrieved from https://www.prnewswire.com/news-releases/interest-growing-in-the-port-of-quincy-intermodal-terminal-as-an-inland-port-to-ship-ocean-containers-by-rail-to-puget-sound-ports-300457420.html

[40] The Northwest Seaport Alliance. 2017. *Inland Port Impact on Growing the Agricultural Industry.* Retrieved from https://drive.google.com/file/d/0BxcR6bGtc43Vcm81TURzX3Z2bmM/view

- Relieving congestion on major roadways and mountain passes.
- Reducing the carbon footprint of moving goods.
- Increased availability of container supply near shippers.
- Attracting new investments in warehousing facilities and other industries to support the agricultural sector.
- Improved turn-times to increase reliability of connecting with ships.

It remains to be seen whether the Port will develop the intermodal service they describe. No updates were available as of summer 2018.

2.5.2 Other Inland Intermodal Ports

Utah Inland Port

Several recent studies have looked at the feasibility and market demand for an inland port facility in Salt Lake City. Researchers at the University of Utah[41] developed a list of key findings, some of which are relevant to a facility in the Willamette Valley. First, they find that there is significant nationwide interest in inland port development, which involves logistics hubs that combine containerized rail and truck interchange and warehousing. This trend is being driven by cost savings and environmental improvements achieved through increased intermodal transportation. Second, inland ports can benefit rural regions where transportation connections for agricultural and natural resource products are critical for cost-effective access to national and international markets. Finally, multiple infrastructure investments and collaboration among numerous entities, including private investors, state regulators and highway departments, and short-haul and long-haul railroads are needed. Done effectively, they note that such projects may bring state and local government together in productive ways.

Following on the study by University of Utah researchers, Cambridge Systematics and RSG worked with the World Trade Center Utah to analyze the feasibility of an inland port in the northwest quadrant of Salt Lake City.[42] The report explains that Utah can increase competitiveness for higher-value manufacturing by investing in logistics infrastructure. The consultants advocate for a port authority-like model where the government maximizes private partner infrastructure investment. They note that inland ports typically have rail intermodal facilities with warehouses and distribution spaces, as well as local policies that provide free trade zones and tax incentives. Beyond the usual intermodal facilities, the site should have low, medium and high intensity manufacturing spaces as well as airport-oriented high-velocity logistics.

---

[41] Gochnour, N. 2016. *Salt Lake Inland Port Market Assessment.* Ken C. Gardner Policy Institute, The University of Utah. August. Retrieved from http://gardner.utah.edu/wp-content/uploads/2016/10/IP-Brief-FINAL.pdf

[42] Cambridge Systematics, Inc. & Global Logistics Development Partners, Inc. 2017. *Utah Inland Port – Feasibility Analysis.* World Trade Center Utah. Retrieved from http://wtcutah.com/wp-content/uploads/2018/01/Inland-Port.pdf

California Intermodal Facilities

The literature review identified several case studies and feasibility studies of intermodal facilities and inland intermodal ports in California. These two studies represent the range of cases evaluated, illustrating an agricultural-oriented intermodal facility serving a limited market relatively distant from existing Ports and an Inland Port concept relatively close to the busiest intermodal terminals in the nation, which were designed to ease congestion in those facilities.

- **Salinas Valley Truck to Rail Intermodal Facility**.[43] This study evaluated building and operating a truck-to-rail intermodal facility to support the movement of perishable, agricultural products from the region. It evaluated potential sites for such a facility, a process for coordinating with Union Pacific Railroad, a market feasibility, and supply chain analysis and developed a preliminary business model.
- **Inland Empire Port Feasibility Study.**[44] This study assessed the feasibility and optimal site location for an inland intermodal facility to relieve congestion in the Ports in southern California. The goal of the study was to maximize a reduction in truck vehicle miles traveled in the area, by transporting container freight away from the port by rail. The study identified Mira Loma as the optimal location but determined it would not be easy to locate a facility there due to local opposition and limited site locations. In addition, significant investments in rail infrastructure at the Port and inland would be required.

East Coast Inland Intermodal Facilities

A variety of studies looked at the feasibility of Inland Ports to relieve congestion in East Coast ports. Many of these studies concluded volumes were not sufficient to support a viable container intermodal facility, competitive with truck drayage.[45] One study, the **Western North Carolina Inland Port Feasibility Study**[46], similarly concluded that there was insufficient volume to support the full-scale development of an inland port. However, it provided a roadmap of interim development steps that may ultimately lead to successful inland intermodal container service as demand increases and trucking costs increase. The steps include:

---

[43] TranSystems. 2011. *Salinas Valley Truck to Rail Intermodal Facility Feasibility Study.* Final Report. Association of Monterey Bay Area Governments. August 19. Retrieved August 3, 2016, from http://dot.ca.gov/hq/tpp/offices/ogm/CSFAP/PilotProjects/sfpp-047b.pdf

[44] The Tioga Group. 2008. *Inland Port Feasibility Study.* Project No. 06-023 Final Report. Southern California Association of Governments. August. Retrieved August 3, 2016, from http://tiogagroup.com/docs/Tioga_Grp_SCAGInlandPortReport.pdf.

[45] See, e.g., Linare Consulting. 2006. *Multi-Modal Freight Transfer Center Feasibility Study.* Lycoming County Planning Commission. June. Retrieved August 3, 2016, from http://www.lyco.org/portals/1/planningcommunitydevelopment/documents/edps_pdfs/trans/freight.pdf

[46] The Tioga Group. No Date. *Western North Carolina Inland Port Feasibility Study.* Retrieved August 3, 2016, from http://www.wcu.edu/WebFiles/WNC_Inland_Port_Feasibility_Study.pdf

- Establish a regional logistics organization (a "virtual port") to assist shippers and producers to develop logistics solutions, consolidate freight loads, and increase shipping efficiencies for the region's businesses.
- Develop a network of sub-regional freight consolidation facilities to assist businesses and shippers in consolidating and organizing shipments. Establish the site in conjunction with a rail yard and ensure expansion is possible if market conditions evolve. Develop partnership and cooperative relationships with railroads to create opportunities for new methods and facilities to facilitate freight flows.
- As new businesses are attracted to the region by the regional logistics organization and small facility investments, freight volume and demand for intermodal shipment may increase to support a large-scale intermodal facility.

In another study, the New York State Department of Transportation (NYSDOT) consulted with Resource Systems Group (RSG) to study the feasibility of an inland port in central New York.[47] An inland port typically connects a maritime port to a land-bound site via rail. The study found one viable site for the inland port in Town of DeWitt, at an existing rail yard. In order for the inland port to be feasible, RSG says it must, at a minimum, have daily train service and produce cost savings for truck drayage and rail service between two ports in New York. Other market factors include the availability of empty containers and the building of warehouses and distribution facilities nearby.

2.5.3 Summary of Case Studies

Few case studies and feasibility analyses reviewed directly correspond to the characteristics of a proposed facility in the Mid-Willamette Valley in terms of geography, customer characteristics, product characteristics, and scale. All studies employed a similar set of methods to evaluate feasibility. For the market/demand/supply chain analyses, interviews were the primary data collection tool. Most studies relied on extensive numbers of interviews with producers and suppliers, shippers, railroad officials, and public officials. To determine volume of container shipment, PIERS customs data were commonly used in addition to data developed from interviews. Few studies included detailed network modeling analyses to understand or run scenarios of freight flows.

[47] Resource Systems Group. 2017. *Central New York Inland Port Market Feasibility Study.* New York State Department of Transportation. Retrieved from https://www.ny.gov/sites/ny.gov/files/atoms/files/Inland_Port_Study.pdf

3 Stakeholder Interviews

3.1 Methodology

To inform the market analysis of the Mid-Willamette Valley Intermodal Center, a series of interviews were conducted using an opportunity sample of stakeholders located in the Mid-Willamette Valley and Southern Oregon. Interviewees includes growers, shippers, packers, and distributors of a variety of crops and commodities. The majority of interviewees were associated with exporting hay, straw, and grass seed from the area.

These interviews provided critical insight on relevant factors such as demand for the intermodal center, potential usage, and the current state of the shipping market in the region, all of which affect the feasibility and success of the proposed intermodal center. In addition, the interviews shed light on potential negative impacts of the intermodal center. To gain a comprehensive understanding of the potential impacts of the Millersburg intermodal center, interviewers asked questions about the following topics:

- Background information on each business to ensure that perspectives were heard from a variety of business sizes, ages, and types
- The commodities dealt with to capture the full market in the Mid-Willamette Valley
- Shipment destination, method, and quantity to estimate the potential demand
- Important factors in deciding how to ship products to understand critical decision processes for using rail, truck, or another shipment method
- The impact the Millersburg intermodal center might have on each business' operations

The variation in the characteristics of the companies interviewed provide a solid foundation for the narrative of the region's shipping activity and highlight aspects of need in the shipping industry. To protect confidentiality, individual responses are not reported, but major points raised are summarized in the sections below.

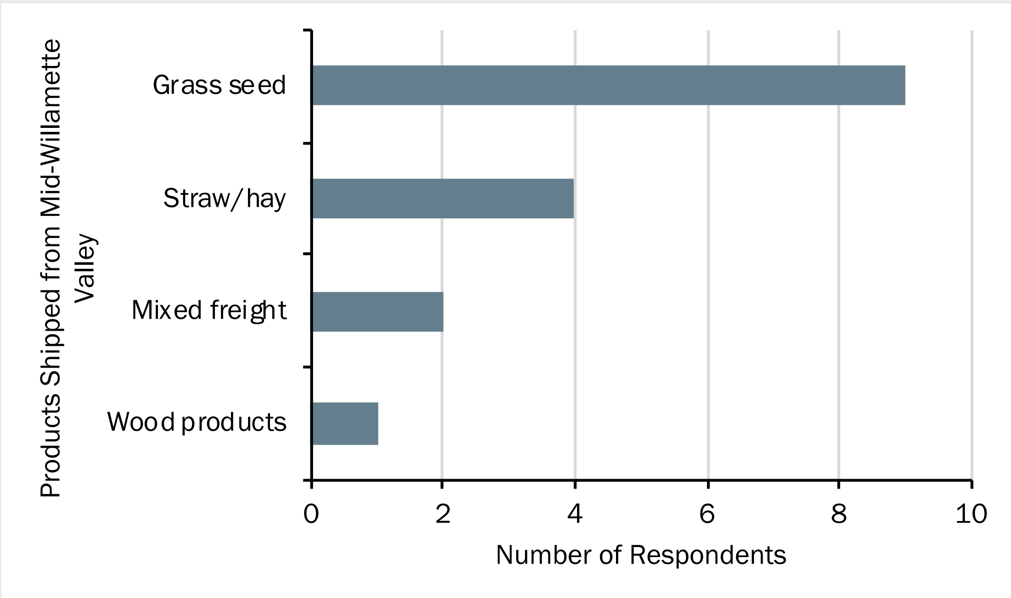
3.2 Interview Summaries

Approximately 80 percent of the business representatives interviewed predominantly ship agricultural products produced in the Mid-Valley, with the remaining businesses involved in wholesale, processing, or storage. Representatives from a potato shipper in Southern Oregon and from a wood products processor in the southern Willamette Valley also participated. Aside from these two businesses, all of the companies interviewed have operations within fifty miles of the proposed intermodal center.

Nearly half of the participating interviewees have been in business for at least thirty years, and all have been around for at least fifteen years. Businesses range in size from less than ten full-time employees to over 700 employees, though most companies interviewed have between 25 and 100 full-time employees. Nearly half of those interviewed have annual total revenues of over $20 million with the remaining having total revenues between $10 and $15 million.

Grass seed and straw were the predominant commodities shipped among interviewees, other types of goods and services making up the rest, as described in Figure 4 below.

Figure 4. Interviewee Products Shipped from Mid-Willamette Valley



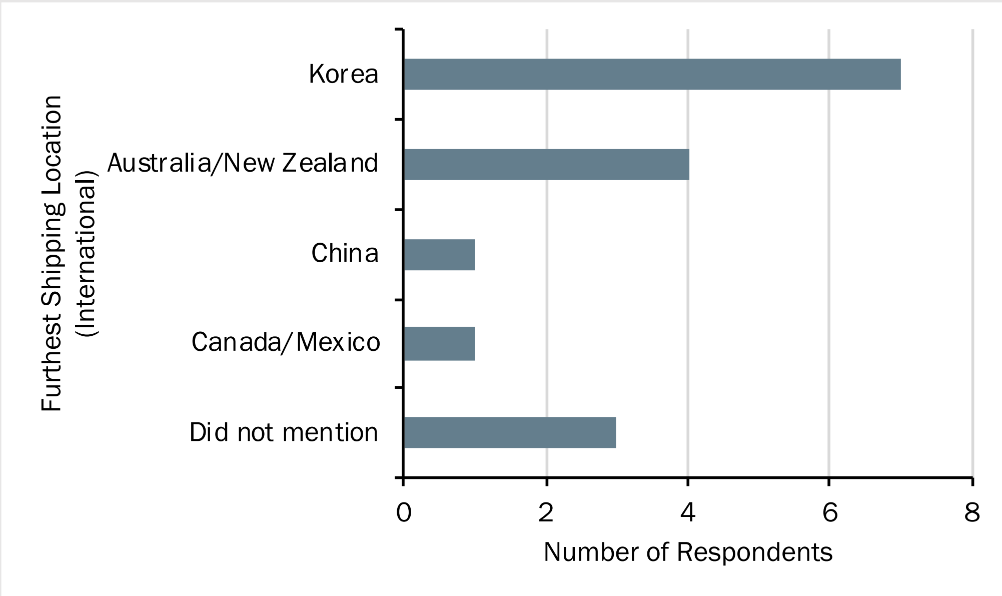
Source: ECONorthwest interviews with Mid-Willamette Valley Producers and Shippers on May 24th and 25th 2018.
Note: Additional stakeholder interviews were conducted with potato producers in southern Oregon, and processed food representatives in the Willamette Valley. These are not included in the graph above.

3.2.1 Major Destinations

All interviewees shipped products to international destination, while about 50 percent also serviced domestic markets. One interviewee exports products only to Canada and Mexico and does not rely on ocean freight, while all others ship overseas. Grass seed and wood products were the only domestic shipments in the interview sample.

For overseas exports, most interviewees use the ports of Seattle and Tacoma to ship products to Asia, while a few have shipped via the ports of Oakland and Long Beach. However, shipping out of these southern ports was rare. Products headed to international destinations include grass seed, alfalfa and hay. Figure 5 below describes the most common international shipping destinations mentioned by interviewees.

Figure 5. International Destinations Shipped from Mid-Willamette Valley



Source: ECONorthwest interviews with Mid-Willamette Valley Producers and Shippers on May 24th and 25th 2018.

When considering international shipping, several important factors were discussed that are not as relevant to the domestic shipping market.

- **Ocean Carriers**. When shipping to international markets, exporters must get their products to the port within a certain time window to make their ocean carrier booking. Missing this window may cause products to sit at the port, incurring fees, potentially deteriorating, and not arriving to customers when needed.
- **Container Availability**. Container availability is one of the most consequential concerns for international shippers because almost all of them currently ship their products in containers. One company noted that container availability tends to be related to costs; if one location offers low rates, there will be increased demand for that location, thus significantly reducing availability.
- **Trade Imbalance**. Companies interviewed emphasized the lack of imports coming into the Pacific Northwest, which can limit the availability of international shipping containers and potentially increase shipping costs. Interviewees indicated that while container availability is limited in Washington Ports, there is a surplus of empty containers in California Ports. In addition, the size and type of container, such as refrigerated containers for products that deteriorate, or chassis that can handle heavy weights,[48] are important for international shipping logistics and container allocation.
- **Split or Rolled Bookings**. When not enough containers are available at the place of origin or when containers arrive at different times, a shipper's booking may be split or

[48] A chassis is a specific trailer intended to haul international intermodal shipping containers. A super chassis is one specifically rigged for heavier loads. Definitions sourced from TRAC Intermodal, retrieved from: https://www.tracintermodal.com/wp-content/uploads/2015/03/TRAC_Chassis_Brochure_2015.pdf

rolled. Split bookings result in only part of the order making it to the destination on time, with the remaining shipment arriving at a later time. Rolled bookings occur when the container makes it to the yard or makes it to the port but does not make the train or ship it was supposed to be on and is rolled to the next shipment date. Interviewees indicated that these booking issues are a major problem because they reduce delivery consistency and reliability and can cause products to arrive in sub-optimal condition. These problems reduce customer satisfaction and trust. For international shipments, split orders may also require two import inspection permits, rather than just one. These issues are common and add to the cost, time and logistical complexity of shipping products to international customers.

- **Quotas**. Interviewees indicated that import quotas on the total products allowed into a country affect their demand for international shipping. Quotas affecting shippers in the Mid-Valley are usually in place for a calendar year, making transportation near the end of the quota date increasingly important. These quotas can influence shipment quantities and make some markets seasonal. For example, South Korea has a quota that ends in December and may be re-released anytime between December and February. If an imported product is late and misses a quota, it may be returned or sit at the destination port until the quota is re-released. These quotas have the potential to permeate into shipping costs at various times of the year.
- **International Competitors.** Several interviewees mentioned Australia as a competitor offering lower prices or faster delivery. Trends in growing seasons and crops there can influence business decisions in the Mid-Willamette Valley. When Australia has large harvests, it can offer more competitive prices to Asian markets. Additionally, some interviewees mentioned the rise of the middle class in developing economies such as China and India and how the growth of these countries can lead to greater demand for straw and hay to feed cattle for domestic consumption.

3.2.2 Current Shipping Methods

For international shipments from the Mid-Willamette Valley, exporters generally have two options: A) truck products from the fields directly to the ports of Seattle and Tacoma or B) truck products from the fields to an intermodal center in Portland, then ship products by rail to the ports of Seattle and Tacoma. Interviewees indicated benefits and drawbacks associated with each method.

Shipping costs

Interviewees highlighted cost as one of the most important factors in deciding how they ship their products. Shippers face a tradeoff: trucks are faster and more reliable than rails but are also more expensive and subject to highway traffic congestion and hours of service rules. Shippers prioritize cost over transit time depending on the season and the product being shipped, particularly with lower-margin commodities such as straw, hay, and alfalfa.

Transit times

Traffic congestion near Portland, Seattle, and Tacoma increases the transit times and costs associated with trucking and make rail more favorable. In general, trucking is still the fastest method of transportation, and some companies will pay the higher costs for trucking in order to ensure their shipments arrive at the destinations on time – particularly when facing an ocean carrier cutoff.

Several interviewees stated that transit times affect the number of turns they can get. "Turns" refer to the number of times a truck can make one trip between the field and the port. In the past, trucks could drive from the Mid-Willamette Valley to the ports of Seattle and Tacoma and back within one shift. However, with increased traffic slowing transit times, drivers can have difficulty completing even one turn in one shift.

Reliability

Interviewees cited reliability as another important factor, particularly for export and making ocean carrier cutoffs. Companies that prioritize customer satisfaction are more likely to use trucks to transport their products because rails take longer and can get lost or arrive late to the port. These delays are also costly, as the rail yards may charge storage fees for holding a container until the next sailing. Shipping to countries that have import quotas increases the need for reliable transportation as delays or split bookings can cause the shipper to miss the quota, often resulting in returned or discarded product.

3.2.3 Likelihood of Intermodal Center Use

Slightly more than 50 percent of the interviewees suggested they would likely use the proposed intermodal center in Millersburg.

Potential shipping volumes can be calculated for those stating they would use the intermodal center. For consistency, calculations assumed that the entire interviewee's shipment volume would move to the new intermodal center if they indicated they would use it. Volumes were converted from various units and time frames to a common unit of containers per week. For those who measured volume using tons, a conversion of 21 tons per container is used. Each interviewee's estimated shipping volume is then summed to approximate the stated total volume shipped through the intermodal center. The shippers interviewed indicated they would use the Millersburg intermodal center to ship 245 containers per week during the peak season.

Negative impacts of the intermodal center were also raised in the interviews, particularly to the extent that the MVIC would increase traffic congestion in Millersburg or that it would compete in a local labor market for forklift operators, warehouse labor, trucking labor, and similar positions.

4 Market Description

This section draws from previous studies, stakeholder interviews, and analyses of existing data to develop an estimate of the size of the potential market for the MVIC. Two factors define the estimate of the market for the MVIC, specifically the relevant geography and universe of goods. These are then used to develop a quantification of both exports and domestic shipments out of the Mid-Willamette Valley that inform the demand estimation in the next section.

4.1 Geography

The literature review and stakeholder interviews indicate that the economic advantage to transferring products from truck to rail are a function of the relative cost of each mode. Furthermore, it is strongly evident that the ability to move products to their final destination within a single "turn" (i.e. local trucking shipment) is a factor in shipping mode. The distance that a truck can travel within a day is used to inform the likely geography of the users of the MVIC.

Existing regulations require truckers to follow four driving limits at all times:

- Drivers may not work more than 60 hours within 7 days, or 70 hours within 8 days.
- Each workday is limited to a 14-hour "driving window" regardless of what the driver is doing (resting, waiting at a port, etc.)
- Each workday "driving window" limits actual drive time to 11 hours.
- Lastly, drivers must take a 30-minute rest break if 8 consecutive hours have passed since the last off-duty period of at least 30 minutes.[49]

These rules impose a discrete distance threshold that determines whether a shipment travels on a local truck or a long-distance truck. Taking an allowance for uncertainty, this threshold occurs at approximately the 5-hour one-way driving mark, displayed in Figure 6 below.

[49] Federal Motor Carrier Safety Administration. *Interstate Truck Driver's Guide to Hours of Service*. March 2015. Retrieved from www.fmcsa.dot.gov/sites/fmcsa.dot.gov/files/docs/Drivers%20Guide%20to%20HOS%202015_508.pdf

Figure 6: Area within a 5-hour drive of Millersburg and the Port of Seattle

Source: ECONorthwest

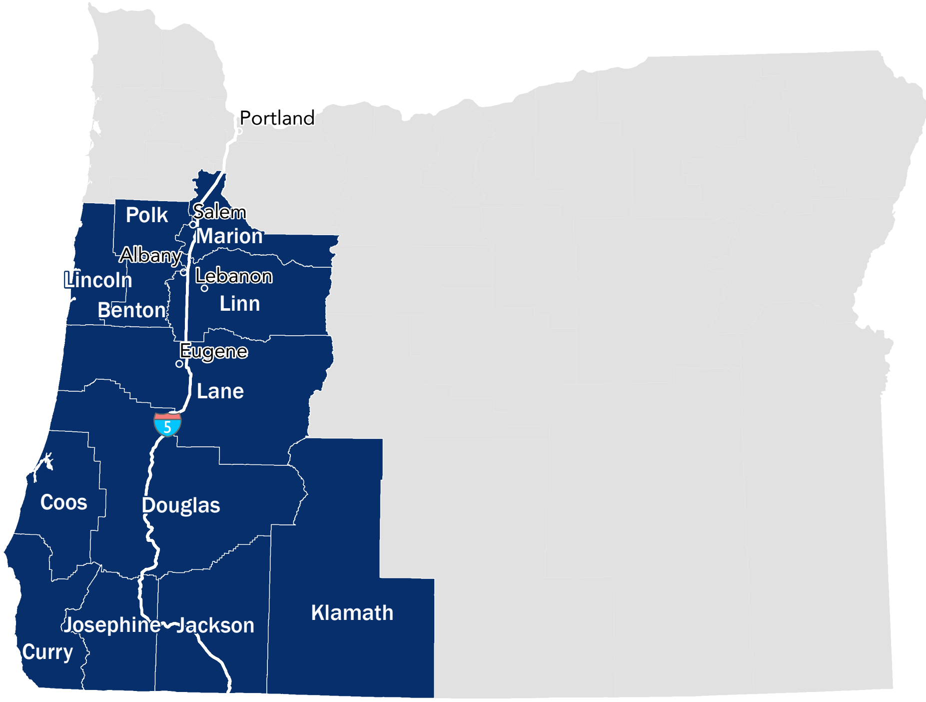
The entire shaded portions indicate the area that is within a 5-hour drive of the MVIC, while the shaded portion at the southern end represents the subset that is more than a 5-hour drive to the Port of Seattle. Depending on the time of day and resulting congestion patterns, the area within a 5-hour drive to Seattle may be considerably smaller. Upon construction of the MVIC, shippers in the southern portion of the state will be able to transfer their goods by truck within a single turn and will have the highest likelihood of using the intermodal center. Shippers within a 5-hour drive of Seattle have multiple transportation options and will make decisions based on the relative cost, timeliness, and reliability.

By providing a rail access point in the Mid-Willamette Valley, shippers in the region will be able to make shipping decisions based on the relative price and level of service of long-distance trucking versus short-distance trucking to rail. The increased availability of substitutes will allow shippers to respond to transportation-specific price changes and adjust their production and transportation choices accordingly.

Based on this spatial definition, study area is defined as the Willamette Valley from Marion County south, the coast from Lincoln County south, and southwestern Oregon, including

Klamath County to the east (see Figure 7 below). Shippers in all other areas in Oregon would likely continue to use existing container terminals in Portland or Boardman, as there does not appear be an economic incentive to divert shipments to the Willamette Valley.

Figure 7. Approximate Market Area that the Intermodal Terminal would Serve



Source: ECONorthwest

4.2 Universe of Products

The Mid-Willamette Valley is considered the "grass seed capital of the world," producing almost two thirds of all U.S. cool-season grasses.[50] Benefitting from fertile soil in the valley, mild winters and dry summers, these seeds for turf and foraging grasses are shipped around the world.[51] In the Willamette Valley, straw is primarily a byproduct of the grass seed industry, harvested and baled after the seeds have been harvested. Most of it is sold to international markets for livestock feed.[52] Hay is produced directly for animal feed and represents a range of varieties. While hay generally has more nutrients than straw, both hay and straw are considered forage and are valuable sources of fiber. Figure 8 shows the tons of hay produced in the study area, by county. Data on straw are not reported.[53] Straw and hay are relatively low-value and

---

[50] Oregon State University. 2018. *Willamette Valley Field Crops: Grass Seed.* Retrieved from: https://valleyfieldcrops.oregonstate.edu/grass-seed

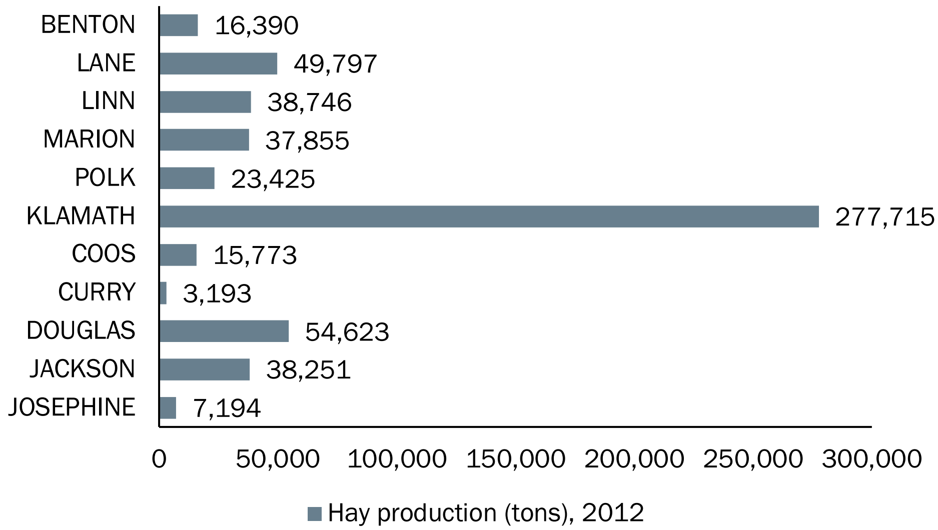
[51] Ibid.

[52] Ibid.

[53] U.S. Department of Agriculture, National Agriculture Statistics Service. 2012. *Appendix B. General Explanation and Census of Agriculture Report Form.* Retrieved from: https://www.agcensus.usda.gov/Publications/2012/Full_Report/Volume_1,_Chapter_1_US/usappxb.pdf

low-margin products that are considered to be "backhaul" by the ocean carriers: it is barely more profitable for the ocean carrier to ship these products overseas than it is to ship the containers back empty.[54]

Figure 8. Hay Production by County in Oregon, 2012



Source: ECONorthwest analysis of 2012 U.S. Census of Agriculture
Note: The U.S. Census of Agriculture reports data on hay, including alfalfa, other tame, small grain, and wild varieties, as dry tons. It does not report data on straw production. Data from the analysis of phytosanitary certificates reported by ECONorthwest in 2016 suggests that straw is exported at much higher quantities than hay from the Willamette Valley. See Literature Review for more detail.

In addition to grass seed, hay, and straw, previous research (documented in Section 2 above) and interviews conducted for this study (documented in Section 3) suggest that several other categories of products move out of the Willamette Valley by container, largely for export. A variety of vegetable seeds, including peas, clover, and radish are grown in the Mid-Valley, while pulp products are produced in the southern Valley. Some of the potatoes grown in southern Oregon are produced for export to foreign markets. Other crops produced in the Willamette Valley, such as Christmas trees and greenery, filberts, blueberries, and nursery stock, are primarily grown in the northern Valley, not produced for export, not exported by ocean carrier, or otherwise would not make up a significant portion of the potential products for export from the MVIC.

Furthermore, analysis of commodity shipment data (described in Section 5.4 below) indicates that lower value, higher volume products are more like to move via rail. Higher value commodities or those subject to more volatile market prices have a higher time-value and are more likely to move by truck, which is generally quicker and more reliable for moving individual containers to their ultimate destinations.

---

[54] US Department of Agriculture. *Study of Rural Transportation Issues- Chapter 14: Ocean Transportation.* Retrieved from https://www.ams.usda.gov/sites/default/files/media/RTIReportChapter14.pdf

When these agricultural products are shipped in and out of the region, they primarily move via intermodal containers. Broadly, these intermodal containers that flow in and out of the Willamette Valley can be grouped into four categories:

1. **Exports.** Intermodal containers (20-foot or 40-foot) bound for international markets. Currently, these containers leave the Valley either going north, to the Ports of Seattle and Tacoma, or going south, to ports in California, including Oakland and Long Beach. Based on the stakeholder interviews, a small number of containers bound for international export to Europe may make their way to east coast ports. These containers make their way to seaports via truck or rail where they are loaded onto container ships. Some Willamette Valley containers also make their way directly to Mexico or Canada by truck. Often, containers are hauled into the Willamette Valley empty to facilitate exports.
2. **Imports.** Intermodal containers (20-foot or 40-foot) arriving at ports in Washington and California with goods and raw materials bound for Willamette Valley customers. Currently, these containers are either trucked from their port of arrival or railed to Portland and trucked to their ultimate destination.
3. **Domestic Shipments out of the Valley.** Domestic intermodal containers (53-foot) bound for markets throughout the U.S. These containers are either trucked to their final destinations or are trucked to Portland and loaded onto long-haul trains headed south and east.
4. **Domestic Shipments into the Valley.** Domestic intermodal containers (53-foot) are trucked into the Valley from locations across the nation. They either travel the entire way by truck or arrive at an intermodal terminal via rail in Portland or Seattle where they are picked up and trucked to their ultimate destination in the Valley.

The containers used for domestic and international shipments differ in size, so from a shipping perspective these serve separate markets. However, the intermodal center is expected to handle both domestic and international shipments (lift equipment, for example, can accommodate both types of containers). If shippers are sending domestic and international containers in the same direction (i.e., north to Portland), it is possible that they could be combined on the same north-bound train and sorted out at their destination. Whether this would actually occur depends on many factors independent to the market definition, including how railroads choose to serve the intermodal center.

4.3 Quantification of the Market

Two of the above categories of containers that would likely use the MVIC are quantified and form the basis of the demand analysis: 1) exports, and 2) domestic shipments out of the Valley. Although there are indications that other types of use are likely to occur, shipments out of the valley were highlighted as the highest priority and need during the stakeholder interviews.

It is likely that loaded containers traveling into the Valley will use the intermodal center and help address container availability; however, these are not included in the quantification of the potential market. A number of the participants in the stakeholder interviews indicated that they pick up empty containers directly from the Ports of Seattle, Tacoma, or Portland. A previous study estimated that the volume of loaded containers entering the valley is between one-third and one-fourth of the number of loaded containers leaving.[55] Thus, the number of containers leaving the Valley serves as the limiting factor in the feasibility of the MVIC.

It is possible that the MVIC will serve as a consolidation point for empty containers in the Mid-Valley. A number of consumer product distribution centers are located in the Mid-Valley, including Amazon and Frito Lay near Salem, Lowe's and Target near Albany, and True-Value near Eugene. The MVIC presents an opportunity to match these importers with agricultural exporters in the region. Any loaded containers entering the valley can potentially reduce overall costs for shippers, however they do not influence the total number of containers passing through the intermodal center.

4.3.1 Estimate of Export Volume

Following the methodology used in the 2016 Feasibility Study, de-identified copies of all phytosanitary certificates issued in Oregon in 2016, 2017, and part of 2018 were obtained from the U.S. Department of Agriculture.[56] These phytosanitary certificates are issued to all agricultural products leaving the U.S. These data were processed using the following steps to identify a subset of records that represents the universe of agricultural products bound for export from the study area.

- Records where the mode of transport was ocean vessel were identified, and all other modes of transportation were excluded.
- Records where both the number of containers and other units (e.g., pounds, metric tons, cubic meters, thousand board feet, etc.) were specified on the certificate were used to develop units per container for each commodity type.
- Those units per container were used to estimate the number of containers for records where that number wasn't specified.
- Records associated with the Hood River, Hermiston, and Ontario duty stations were dropped, given that those products were likely outside the geographic study area. Phytosanitary certificates are issued from a number of duty stations in Oregon, and the location of the duty station serves as a reasonable proxy for the location of production and shipment origination. Records from the Portland duty station were included because it is the location of a specialized grass seed testing lab[57] that handles most of the grass seed certifications for the Willamette Valley.

---

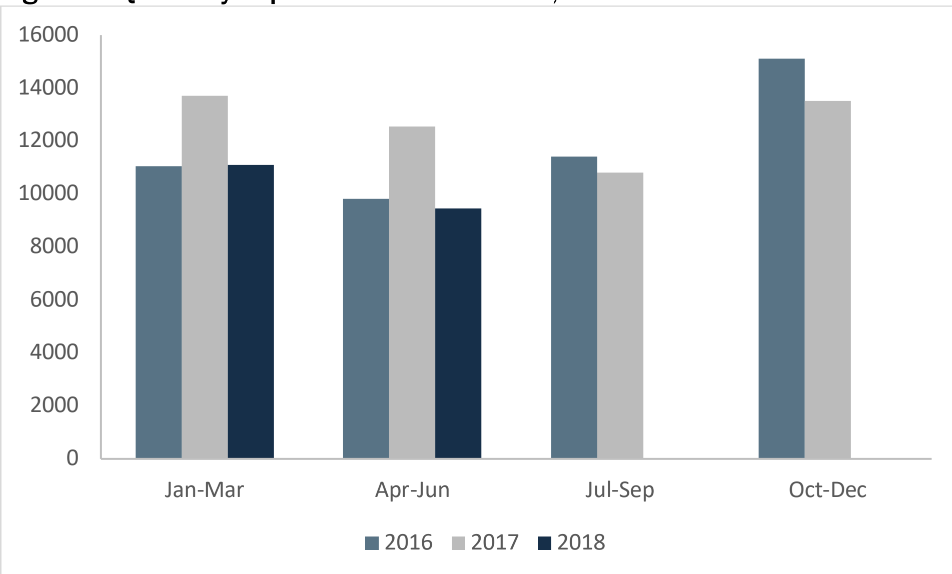
[55] The Tioga Group, Inc. 2016. *Trade and Logistics Report: Research Analysis.* February.

[56] The 2016 ECONorthwest analysis includes only the 2015 records.

[57] Personal communication with Gary Neuschwander, Trade Development Manager, Willamette Valley, Oregon Department of Agriculture.

Based on this analysis, an average of 47,992 export containers left the study area per year. Figure 9 shows the average quarterly shipments for 2016, 2017, and for the first two quarters of 2018.

Figure 9: Quarterly Export Container Volume, 2016-2018



Source: ECONorthwest analysis of USDA Phytosanitary Certificates

4.3.2 Estimate of Domestic Shipments out of the Valley

The U. S. Department of Agriculture's National Agricultural Statistics Service (NASS) conducts the Census of Agriculture every five years to generate uniform, comprehensive agricultural data. As of the writing of this report, the most recent Census of Agriculture was conducted in 2017. However, results will not be publicly available until February 2019. Thus, for the purposes of this analysis, the 2012 data is used.

NASS reports a number of measures of agricultural production by county and crop. To estimate the universe of grass seeds that may use the MVIC, publicly available Census of Agriculture data was limited to grass seed production, by pound, in the study area. These include fescue, orchardgrass, ryegrass, and bentgrass seeds, and a total of approximately 520 million pounds of grass seed produced in the study area. This estimate is broken out by county in Figure 10 below. Using a standard grass seed density[58] and 53-foot container volume, this amounts to approximately 12,000 domestic containers per year.

[58] 11.2 pounds per cubic foot, obtained from http://caes2.caes.uga.edu/engineering/handbook/documents/Density%20of%20Agricultural%20Products.pdf.

Figure 10: Pounds of Grass Seed Produced, by County

County	Fescue	Orchardgrass	Ryegrass	Bentgrass
Benton	26,538,414	2,088,050	31,767,525	-
Lane	10,052,288	4,021,950	48,963,633	-
Linn	40,018,990	2,474,905	176,186,612	171,740
Marion	42,131,834	-	65,334,230	1,339,138
Polk	31,442,982	658,025	35,439,746	-
Douglas	-	-	1,291,500	-
Jackson	2,600	-	-	-

Source: ECONorthwest analysis of 2012 U.S. Census of Agriculture

5 Demand Estimation

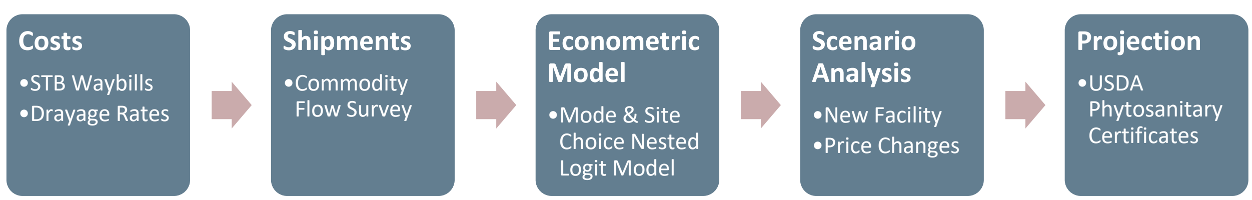
5.1 Conceptual Model

A number of different data sources are used to estimate the demand for the services provided by the proposed intermodal center. Currently, shippers have two primary alternatives for moving their products from the mid-Willamette Valley to international customers via the ports of Seattle and Tacoma, 1) trucking the product to Portland, after which it makes the remaining journey to a seaport via train, or 2) trucking the product the entire distance to the seaport. The mode-choice decision is determined by many factors including cost, timeliness, and reliability.

Although the MVIC will produce an additional shipping alternative, it is unlikely to change the existing preference structure for transportation services. That is, preferences for cost, timeliness, and reliability will still be significant factors that determine how shippers choose between the two existing modes and the new intermodal center. The MVIC will compete directly with existing modes and allow shippers to choose the alternative that provides the best level of service and price. Furthermore, due to the containerization of products, substitution between modes is relatively easy. Since shippers will maintain their underlying preference structure, existing data can be used to project the number of containers likely to pass through the proposed intermodal center.

A sequential process utilizing multiple data sources is outlined in Figure 11 below. Shipping costs by both truck and rail are calculated using observed prices from The Drayage Directory and Surface Transportation Board Carload Waybill Sample,[59] respectively. These observed costs are used to predict shipping cost for all containers exported from the region in the U.S. Census' Commodity Flow Survey[60]. These inputs are then combined in an econometric model that predicts the mode and site-choice decision for all container shipments in the region. The results of this model are then applied to a scenario representing the new intermodal center to predict the share of containers traveling by rail. This result is then applied to an estimate of the number of containers leaving the region to predict the number of containers using the intermodal center.

Figure 11: Conceptual Model Process



---

[59] Surface Transportation Board. "Carload Waybill Sample." *Industry Data: Economic Data: Waybill.* Retrieved July 26, 2018, from https://www.stb.gov/stb/industry/econ_waybill.html

[60] Bureau of Transportation Statistics. "2012 Commodity Flow Survey." Retrieved July 26, 2018, from https://www.bts.gov/product/commodity-flow-survey.

Source: ECONorthwest

Each step utilizes the best available information to construct an estimate of the projected demand for the proposed intermodal center. Although the spatial resolution at each step is broader than the Mid-Willamette Valley in most cases, the underlying information is transferable to the region. In particular, estimation of latent demand for the proposed intermodal center (where none currently exists) necessitates the use of data from outside of the region. Each element is further described in the following sections.

5.2 Costs

The cost to transport loaded containers from the Mid-Willamette Valley to the ports of Seattle and Tacoma are subject to fluctuating market conditions. Various factor inputs affect the absolute and relative prices of both truck and rail including the availability of equipment, labor costs, fuel costs, local congestion, state and federal regulations, etc. A competitive market generally provides trucking services with many players and relatively low barriers to entry. Economic theory suggests that the market price for trucking services will approximately equal the marginal cost of providing those services. Rail services, on the other hand, are provided by two major players (and their subsidiaries), providing the opportunity for price-taking behavior, as well as strategically induced artificial scarcity.

Truck and rail services operate as substitutes for transporting goods between the Mid-Valley and the ports. Thus, the prices of both services are expected to be roughly equivalent, with all other factors (e.g., timeliness and reliability) being equal. Rail, however, gains a structural competitive advantage when transporting large volumes over long distances. Rail service providers operate in a market where they seek to allocate their resources across both short and long-distance transportation optimally. These market forces are apparent when evaluating predicted marginal per-mile container transportation prices.

A cost structure for trucking was generated from a sample of 683 drayage rates from Oregon to Seattle/Tacoma ports obtained from The Drayage Directory[61] from May 2014 to June 2018. Prices ranged from $1 to $15 per mile, with an average of $5.4 per mile. Summary statistics are displayed in Figure 12 below.

Figure 12: Drayage Rates Summary Statistics

Variable	Mean	Std. Dev.	Min	Max
Miles	213	54	175	465
Rate	$1,149	$351	$195	$3,850
Rate/Mile	$5.40	$1.10	$1.0	$15

Source: ECONorthwest analysis of The Drayage Directory, May 2014 through June 2018

[61] "A Directory of Intermodal & Import / Export Trucking Companies." *The Drayage Directory - Intermodal Ocean Container Trucking*. Retrieved July 26, 2018, from www.drayage.com/.

A cost structure for rail was generated from the most recent complete version (2016) of the Surface Transportation Board Carload Waybill Sample. This dataset is a "stratified sample of carload waybills for all U.S. rail traffic submitted by those rail carriers terminating 4,500 or more revenue carloads annually."[62] The unrestricted public-use version of this dataset partially obscures geographic information to make it impossible to trace individual observations back to shippers. To best represent the market prices faced by shippers in the region, observations were restricted to container rail cars (STB car type "46") with origins and destinations in the western United States (STB "Mountain-Pacific" Freight Rate Territory). This resulted in 95,798 observations, each with an individual sampling weight. Average prices per mile are notably lower than those for trucks, ranging from \$0.05 to \$27.23 per mile, with an average of \$0.71 per mile. Summary statistics are presented in Figure 13 below.

Figure 13: Carload Waybill Summary Statistics

Variable	Mean	Std. Dev.	Min	Max
Miles	2,064	306	10	3,370
Tons	14.3	7.2	1	31.0
Rail Charge	\$1,440	\$479	\$101	\$13,260
Rate/Mile	\$0.71	\$0.29	\$0.05	\$27.23

Source: ECONorthwest analysis of STB Public Waybill Sample

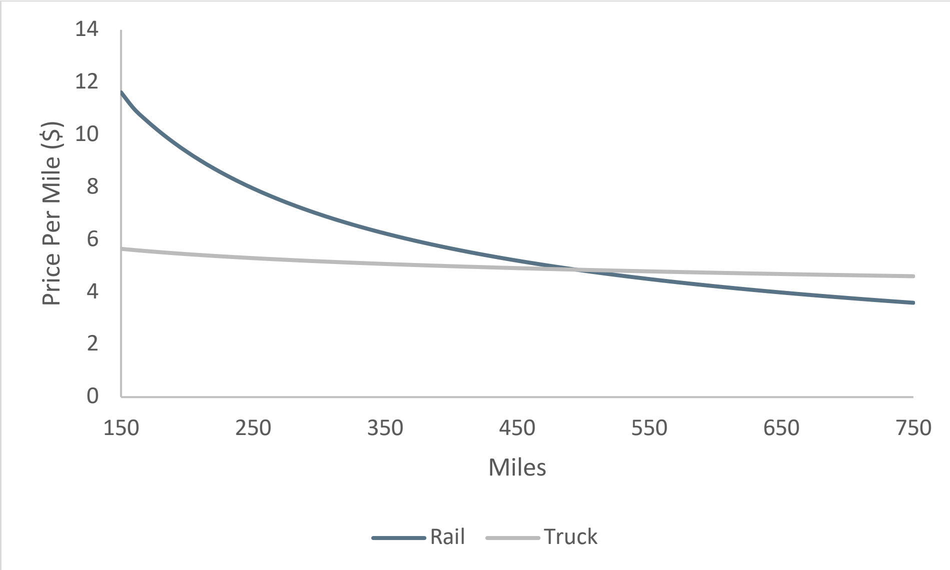
To predict the set of truck and rail prices faced for each origin-destination pair in the region, a truncated linear regression model is applied. The general specification is

$$E[Rate_{Mode}|Rate_{Mode} > 0] = (\ln(Miles), \ln(Tons), Quarter)'\beta_i + \varepsilon,$$

where ε is distributed normally. The average per-mile price to ship a container by either mode is displayed in Figure 14 below.

[62] Surface Transportation Board. "Carload Waybill Sample." *Industry Data: Economic Data: Waybill.* Retrieved July 26, 2018, from https://www.stb.gov/stb/industry/econ_waybill.html

Figure 14: Modeled Average Container Transportation Cost Structure



Source: ECONorthwest

Notably, the model predicts that transportation rates via rail are higher than truck for distances under 500 miles. Values in this range are below the minimum distance observed in the waybill sample, making this an out-of-of sample prediction which should not be considered a representation of actual rail prices observed. Rates for transporting containers over this short distance are likely to be competitive with the truck drayage rates, with all other factors being equal (i.e. timeliness, reliability, and availability of service). Although the model may have limited reliability in predicting actual rail prices charged at the intermodal center, this model is a critical input for understanding the mode choice decision for shippers across the full range of available distances in the region. The ultimate estimate of container utilization is predicted via a marginal change in mode price.

5.3 Shipments

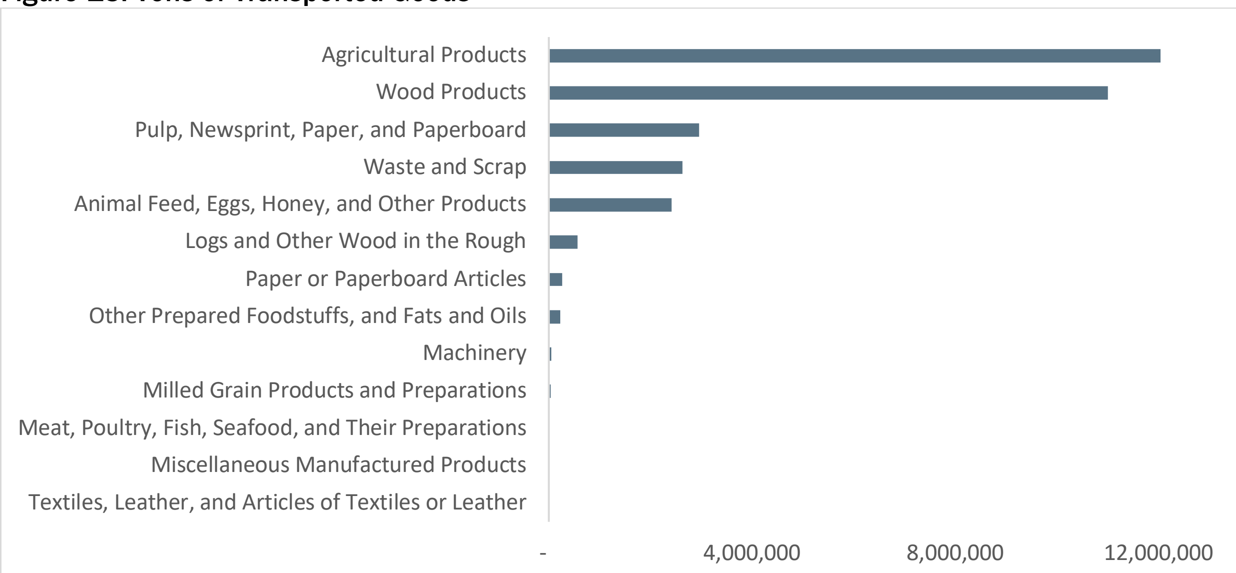
The U.S. Census conducts the Commodity Flow Survey[63] every five years to measure how products move through, in, and out of the U.S. and can be used to represent the mode and destination choice decision for shippers in the Willamette Valley. It is a broad dataset with a large number of regions, products, and shipping modes. A number of steps are taken to filter the observations down to a set of goods that most closely mirrors those being shipped in the study area. These parameters were chosen to be inclusive of all potential users of the intermodal center in the Mid-Valley, as well as all regional producers that may compete for an equivalent set of container shipping services.

[63] U.S. Census Bureau. "2012 Data." *Commodity Flow Survey.* Retrieved July 26, 2018, from https://www.census.gov/econ/cfs/

The universe of goods in the 2012 survey[64] were restricted to represent two types of users of the intermodal center: 1) exporters shipping goods via container to west coast ports, and 2) domestic producers of grass seed. The former includes non-hazmat agricultural goods labeled for export to countries other than Canada or Mexico, shipped to port locations on the west coast, and originating in Oregon or Washington. The latter category includes all non-hazmat agricultural goods not labeled for export, shipped anywhere in the United States, and originating in rural areas of Oregon or Washington.

This results in 5,418 observations of a wide diversity of products, summarized in Figure 15 below.

Figure 15: Tons of Transported Goods

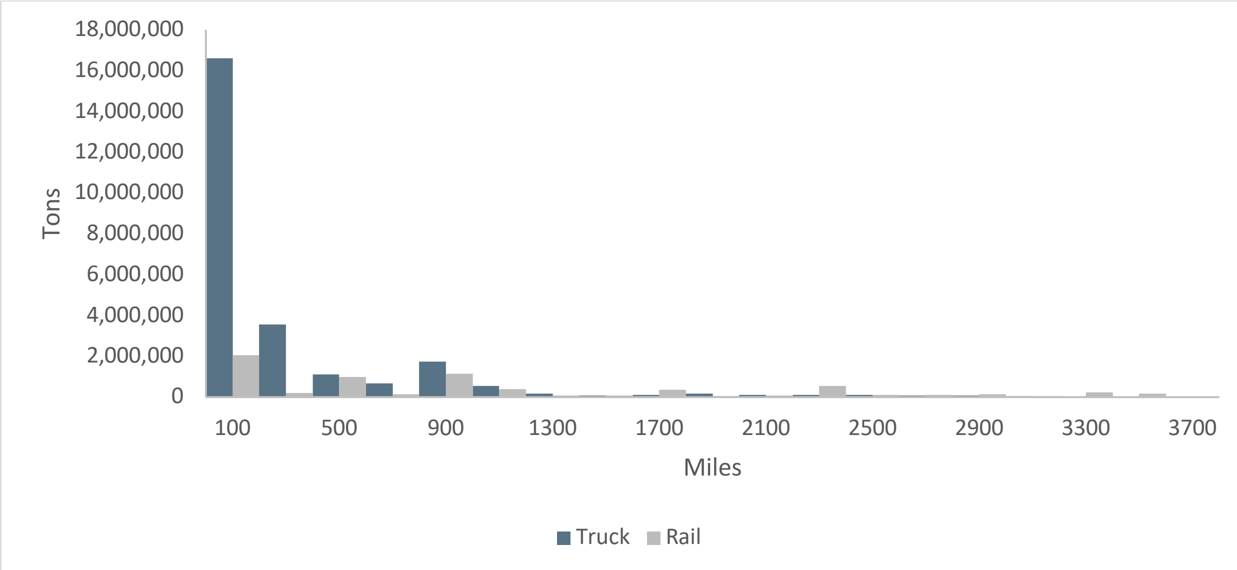


Source: ECONorthwest analysis of Commodity Flow Survey

These products were shipped by a mix of rail and truck across a wide distance band. However, over 90 percent of goods travel by truck. The distribution of tons shipped by mode and distance is summarized in Figure 16 below.

[64] Results from the 2017 survey were not yet available.

Figure 16: Tons Shipped by Mode and Distance



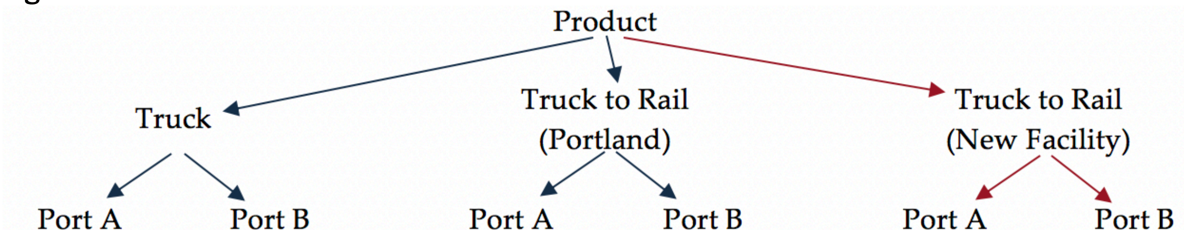
Source: ECONorthwest analysis of Commodity Flow Survey

5.4 Econometric Model

The literature review and stakeholder interviews both revealed numerous factors that determine the mode selected to ship goods with price, reliability, and timeliness indicated most frequently. Evaluation of shipping prices found that rates are widely variable, particularly concerning mode, weight, and distance. Due to this wide variety of factors along with an additional likely set of unobservable effects, a simple minimum-cost financial model is not sufficient to predict demand for the services provided by the proposed intermodal center. Instead, a full representation of the choice structure is necessary.

A nested logit model is used to jointly evaluate a shipper's mode and site-choice decision. This approach incorporates the set of decisions outlined in Figure 17 below. Black arrows on the left represent the current mode and destination alternatives, and the new intermodal center is represented by the set of red arrows on the right. A shipper jointly selects the mode (i.e., Truck or Truck to Rail) and the destination (i.e., Port A or Port B). A set of independent variables can be incorporated at each nesting level to describe the factors motivating both mode and site choice. This entire choice structure can then be applied to the new intermodal center to predict the share of products that will get shipped by rail. This type of discrete choice model uses attributes of the decision process to predict the probabilities of each of the limited number of available choices made. In this context, these choice probabilities can be interpreted as mode shares.

Figure 17: Mode-Choice Decision Tree



Source: ECONorthwest

The nested logit model is particularly attractive for this application because it allows for a rich set of possible substitution patterns. Assuming that a given shipper, *i*, receives economic profit[65] π from shipping their product to a given destination, *j*, via mode B_k,[66] profit takes the following functional form:

$$\pi_{ij} = V_{ij} + \varepsilon_{ij},$$

where V_{ij} is a set of observable variables while ε_{ij} is unobservable and assumed to have the following cumulative distribution:

$$exp\left(-\sum_{k=1}^{K}\left(\sum_{j\in B_k} e^{-\varepsilon_{ij}/\lambda_k}\right)^{\lambda_k}\right).$$

The parameter λ_k is a measure of the degree of independence among the variables within a nest. The probability of shipper *i* choosing destination *j* via mode *k* can now be calculated as:

$$P_{ij} = \frac{e^{V_{ij}/\lambda_k}\left(\sum_{j\in B_k} e^{V_{ij}/\lambda_k}\right)^{\lambda_k - 1}}{\sum_{k=1}^{K}\left(\sum_{j\in B_k} e^{V_{ij}/\lambda_k}\right)^{\lambda_k}}.$$

This model is applied to CFS data, and the quarterly rail and trucking price functions developed earlier. Given that the transportation markets (and functionality of the proposed intermodal center) are distinct for both exports and domestic shipments, separate models are estimated for each.

In both models, distance and the value per ton exhibit characteristics of a log-normal distribution, with a cluster of values at the relatively low end of the spectrum and a small number of very large values at the high end. These variables are logged in the specification, and state fixed effects are used to represent unobservable variation in shipping characteristics between Washington and Oregon. Results for both export and domestic models are displayed in Figure 18 below.

---

[65] These types of models are derived from basic utility theory. The term "profit" is used here interchangeably with the more commonly applied "utility."

[66] A more complete description of the model is available in Train, K. (2003) *Discrete Choice Models with Simulation*. Cambridge University Press.

Figure 18: Nested Logit Model Results

		Exports Coefficient	Std. Err.	Domestic Coefficient	Std. Err.
Site Choice Nest					
	Price	-0.0017	0.0000	-0.0016	-0.0000
Mode Choice Nest					
Truck	(base)				
Rail					
	Ln Distance	0.43	0.01	1.79	0.01
	Ln Value Per Ton	-0.16	0.01	-0.92	0.01
	State Fixed Effects				
	Washington	-0.56	0.03	0.49	-0.02
	Oregon (base)	-	-	-	-
Dissimilarity Parameters[67]					
	/truck_tau	0.19	0.01	3.70	0.02
	/rail_tau	2.80	0.05	1.05	0.01
Log likelihood		-469,350		-2,881,277	
Wald chi2(4)		3,049		76,044	

Source: ECONorthwest

All coefficients are statistically significant, with the coefficient on price taking an expected negative sign (indicating that destinations that are more expensive to ship to are selected less often). At the mode-choice nest, the log of distance has a positive coefficient indicating that products that are shipped further are more likely to move by rail. Additionally, the log of value per ton has a negative coefficient, indicating that lower-value products (such as straw and hay) are more likely to move by rail while higher-value products (such as vegetables, fruits, and consumer goods) are more likely to move by truck.

To ensure an appropriate representation of the mode-choice decision, a number of specifications were tested; ultimately a parsimonious model was used to avoid researcher-induced variable selection bias.

5.5 Scenario Analysis

The econometric model serves as a representation of the existing origin-mode-destination decision structure for shippers competing in the same market as those in the mid-Willamette Valley. Construction of the new intermodal center will introduce a new mode alternative with an equivalent set of unobservable attributes (e.g., timeliness and reliability) as the existing Truck-to-Rail (Portland) alternative, albeit with a different overall cost function.

[67] Although not all dissimilarity parameters lie in the unit interval, a more flexible interpretation is applied here to allow the results to serve as a local approximation of the mode and site choice decision.

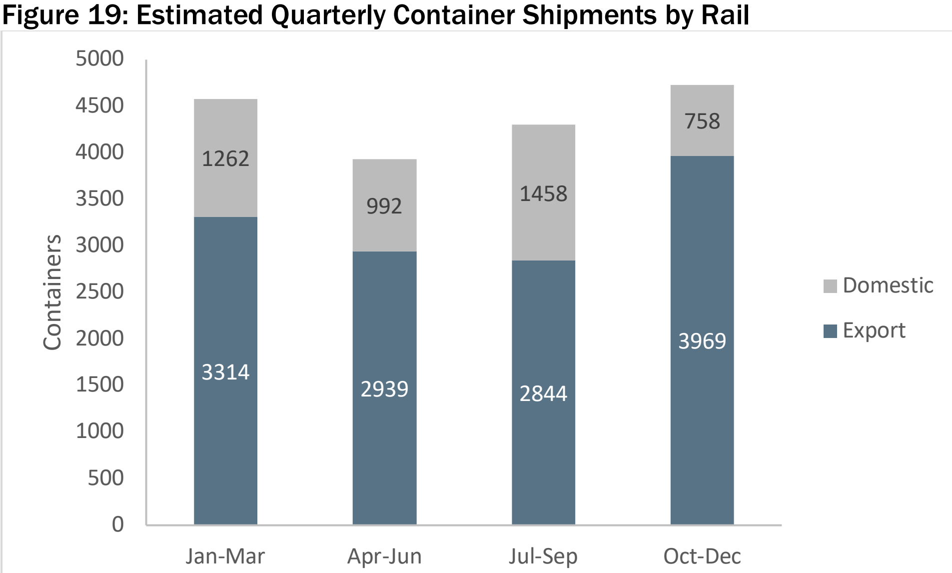
Thus, to predict the amount of goods shipped by rail from the new intermodal center, the cost function in the existing model is modified to represent the new intermodal center. In particular, the price of rail is reduced by the marginal cost to ship goods 65 miles by truck from Millersburg to the intermodal center in Portland and increased by the marginal cost to ship goods by rail over that equivalent distance. When applied to the CFS data used in the nested logit model, shippers observe an average price decrease of $326 (30 percent decline) for all rail-mode origin-destination pairs. This results in the econometric model predicting that approximately a quarter of goods will travel by rail, with significant seasonal variation.

5.6 Projection

The econometric model represents the set of preferences for transportation services in the region. This model is then applied to an estimate of the number of containers that originate in the study area and could use the intermodal center. For exports, this is calculated using USDA phytosanitary certificates, as described in section 4.3.1 on page 31 above. Domestic shipments are calculated using the U.S. Agricultural Census, as described in section 4.3.2 on page 32 above.

When applied to the estimated number of containers, the econometric model predicts that between 66 percent and 84 percent of the shipments moving through the intermodal center will be exports traveling to ports in Seattle or Tacoma, with the remainder consisting of domestic shipments traveling to other locations in the U.S. Combined, an estimated 17,537 loaded containers will pass through the intermodal center per year, with significant seasonal variation as illustrated in Figure 19 and Figure 20 below[68]. This estimate is predicated on the assumption that the intermodal center operates efficiently, is priced at market rates, and provides a level of service equivalent to that currently available throughout the region.

Figure 19: Estimated Quarterly Container Shipments by Rail



Source: ECONorthwest

[68] Note: Quarterly totals do not sum to annual total due to rounding.

Figure 20: Estimated Quarterly Container Shipments

Quarter	Export	Domestic	Total
Jan-Mar	3,314	1,262	4,576
Apr-Jun	2,939	992	3,931
Jul-Sep	2,844	1,458	4,302
Oct-Dec	3,969	758	4,727

Source: ECONorthwest

5.7 Exogenous Factors that May Affect Demand

The validity of these projections is conditional on the intermodal center operating in a manner that provides a level of service equivalent to existing rail services in the region. Aside from this operating assumption, there are a number of exogenous factors that may affect these projections. Changes in commodity value, trucking prices, and production volumes may influence shipper mode choice, and ultimately, the number of containers passing through the intermodal center.

Commodity Value Fluctuations

The relative value of commodities affects the relative likelihood of a shipper choosing rail or truck to move their products. Agricultural commodities are subject to cross-year price variation. Figure 21 below lists the three-year average price of various row crop seeds, along with their three-year price variation from 2012 - 2016.

Figure 21. Average Prices of Seeds, 2012-16

Product	Average Price Per CWT 2012-16	Range (+/-) 2012-16
Grass seed, Kentucky Bluegrass	230	6%
Grass seed, Tall Fescue	148	3%
Grass seed, Orchardgrass	194	6%
Grass seed, Ryegrass	99	6%
Alfalfa Seed	317	6%
Red Clover Seed	225	6%
Flaxseed	33	11%
Sorghum Seed	207	4%
Peanut Seed	83	25%
Potato Seed	15	7%
Soybean Seed	95	6%
Barley Seed	28	6%
Oat Seed	33	4%
Rice Seed	60	29%

Source: ECONorthwest analysis of USDA National Agricultural Statistics Service data

As seen in the nested logit model results in Figure 18 on page 41 above, lower value products are more likely to move by rail. Goods that have a higher time value are more likely to move by truck. As the relative value of shipped commodities increases or decreases, respective mode choice may change as well. Contributing factors to changes in value include changes in international tariffs, quotas, or duties that affect the availability of substitute goods in international markets.

Trucking Price Changes

The stakeholder interviews indicated that the price of the intermodal center must be competitive with other transportation options for it to be utilized. This price of available substitute services provided by the intermodal center has a strong likelihood of either increasing or decreasing utilization. As described in section 2.1 on page 5, there are a number of factors contributing to changing trucking prices, including restrictions on hours of service, a decrease in the number of available truck drivers, and parking shortages. Other factors, such as changes in fuel costs may also influence the relative price of trucking.

Production Volumes

Agricultural production is highly variable and is a function of both pre-season crop acreage allocations as well as environmental conditions including temperature, rainfall, and solar intensity. Shifts in acreage from products that might not use the intermodal center, increased rainfall during the summer, or a longer growing season may increase crop yields and resulting demand for the MVIC.

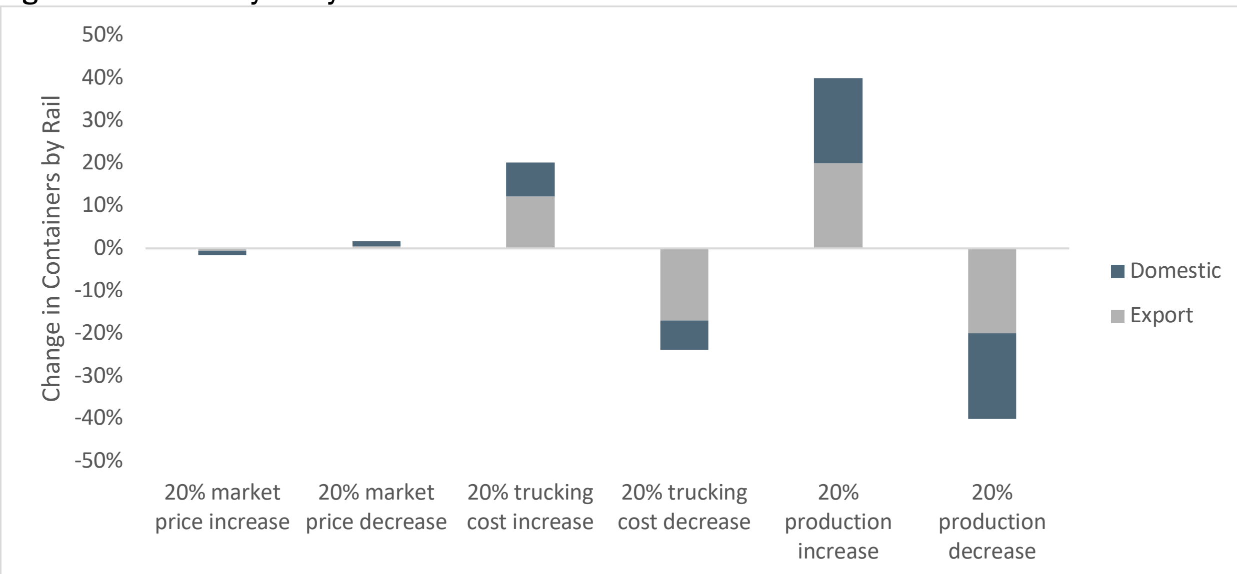
5.7.1 Sensitivity Analysis

While explicit quantification of these exogenous factors is difficult to perform with certainty, it is possible to evaluate the magnitude that each of these changes may have on the number of containers passing through the proposed intermodal center. Each of the above listed effects may operate independently or jointly and of a currently unknown magnitude. In order to test the implications of a number of different changes in macroeconomic conditions, a generic set of value, price, and production changes are analyzed. Six potential stylized scenarios are evaluated to test the sensitivity of the econometric model to exogenous effects. Each is listed below, along with an example of a potential cause of such a change:

1. A 20 percent increase in the market price of shipped commodities (example: change in international tariffs, quotas, or duties restricting available substitutes)
2. A 20 percent decrease in the market price of shipped commodities (example: increased availability of substitute goods produced in Australia)
3. A 20 percent increase in truck transportation costs (example: decrease in the number of available truck drivers)
4. A 20 percent decrease in truck transportation costs (example: decrease in fuel costs)
5. A 20 percent increase in production in the Mid-Valley (example: shift in acreage from other uses)
6. A 20 percent decrease in production in the Mid-Valley (example: drought)

Each scenario is designed to capture the net effect of many different exogenous factors and is evaluated independently. The results are displayed in Figure 22 below.

Figure 22: Sensitivity Analysis



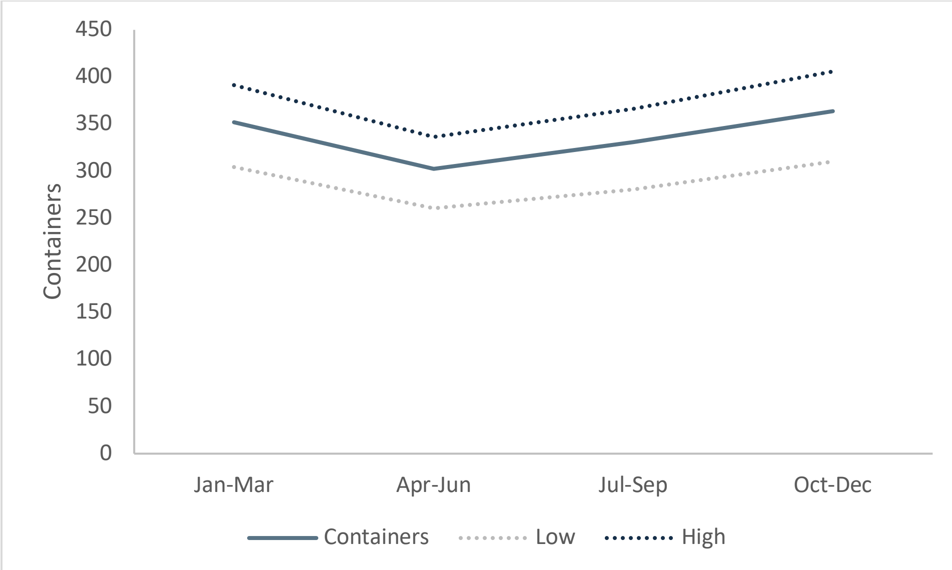
Source: ECONorthwest

The first two scenarios evaluating a change in the market price of goods indicate that both exports and domestic shipments are relatively price-inelastic with little change in volume from a 20% change in market price.

The second two scenarios evaluating a change in trucking prices have a dramatic positive effect on the use of the intermodal center. A 20 percent increase in trucking costs will lead to an 11 percent increase in the number of containers traveling by rail, while a 20 percent decrease in trucking costs will lead to a 14 percent decrease.

The final two scenarios have a direct 1:1 effect on the number of containers traveling through the intermodal center. Assuming that a change in production does not affect market prices or trucking costs, the allocation of containers between truck and rail will not change. The change in the number of containers using the intermodal center will mirror the change in production.

Figure 23. Estimated Weekly Container Shipments



Source: ECONorthwest

Each of these scenarios impact the quarterly projections of the econometric model. Figure 23 above shows the estimated weekly number of containers, with the highest and lowest scenarios plotted alongside. This projection estimates a wide range of potential use of the intermodal center depending on seasonal and exogenous effects, with 310-405 containers passing through the intermodal center per week in the peak season, and 260-336 containers passing through per week in the low season.

6 Capital and Operating Cost Analysis

Using the demand estimates and sensitivity analyses from Section 5, this section evaluates the potential operating and capital costs to assess the intermodal center's financial feasibility and sustainability over a five year period. Also included are a description of the site, basic site design, and a description of how the faciltiy will operate.

6.1 Site Location and Configuration

The proposed intermodal center would be located on the former International Paper Mill Site in Millersburg, OR. As described earlier, the site is situated with direct access to I-5 and two rail lines.

The proposed center will have a main office, parking lot, space for approximately 100 trucks to park overnight, amenities for truck drivers, an intermodal center capable of handling both domestic and international containers, and a storage warehouse and docks to support reloading and transloading onto rail, with capacity for longer-term storage of product. The three business lines (intermodal, reload and warehousing, and truck parking) are described individually below. The site is big enough to allow for future expansion either by connecting existing rail lines or adding additional warehousing and storage.

6.1.1 Intermodal Services

The intermodal center would provide rail access and lifting equipment to transfer intermodal containers from truck to rail and vice-versa. Both domestic containers and international intermodal containers would be able to use the intermodal center. This operation is designed to receive and send both empty and full containers, either by truck or by rail.

As a rail facility, it is anticipated that inbound intermodal trains will arrive heading westbound (compass south) and set inbound cars onto one of two of the onsite support tracks and use the other track to pull outbound cars and leave heading eastbound. The intermodal center operator will move inbound cars onto working tracks for intermodal operations and then move outbound cars back onto one of two support tracks, leaving one of these two support tracks open for inbound cars from the mainline railroad and utilizing the other track for placing outbound cars. Sufficient switching length is provided to clear any of these four tracks with a full cut of cars and shove them onto another track while staying clear of the mainline. The outbound intermodal train will move north to Portland, with the northbound business being added to the intermodal facilities there.

6.1.2 Reload Operation and Warehouse

The reload operation and warehouse would provide a convenient location for loading intermodal containers and trucks bound for both domestic and international export. It would allow both unloading and reloading of product at the same time without long-term storage, and could also provide longer-term storage for producers without their own storage facilities. The warehouse could also become a certified USDA inspection facility, offering shorter-term storage and quarantining for imported agricultural products. The site configuration has existing rail infrastructure adjacent to the storage warehouse, which could allow shippers to load railcars bound for domestic markets throughout the U.S. in a future expansion.

The reload operation would utilize the existing 60,000 square foot warehouse. It is assumed that half of the warehouse could be used for long-term storage: approximately 30,000 square feet of lateral storage space with an assumed height of 25 feet would provide about 750,000 cubic feet of storage. This warehouse has the potential to expand dry-storage capacity for agricultural commodity producers in the Willamette Valley.

Product moving through the reload operation and warehouse could arrive containerized, in totes, or palletized. It would have staff available for hand stacking product and forklifts for moving totes or palletized product around the warehouse.

6.1.3 Overnight Truck Parking

A portion of the site would be dedicated to long-haul truck parking, providing a safe and secure location for drivers to rest and queue to avoid peak congestion times in the Portland metropolitan region. The site is expected to be built to accommodate 100 semi-trucks needing to park overnight. This parking could complement a new truck stop just north of the site on Old Salem Road. In addition, the intermodal center will have refrigerated hookups and amenities for truckers.

Existing studies demonstrate that the availability of truck parking in Oregon is limited. According to a 2014 Federal Highway Administration survey, Oregon had approximately 4,520 truck spaces in public and private facilities across the state. There are approximately 81 parking spaces per 100,000 daily truck vehicle miles traveled (VMT)—about 71 are provided by private facilities and 10 provided by public facilities. When ranked by this measure, Oregon has the 15th fewest number of spaces per 100,000 daily truck VMT. When ranked by the number of parking spaces per 100 miles of national highway system, Oregon has the 18th fewest with 100 spaces per 100 miles.[69]

Overnight parking and truck staging have the potential to greatly improve the timing for when trucks drive through the Portland metro area. In addition, for product heading to the Port of Portland and the intermodal center near the Port's Terminal-6, parking has become an issue in neighborhoods and communities. The Port terminal operates from 8 am to 5 pm Monday through Friday. Since trucks can arrive at all hours of the day, there is not currently an adequate parking or staging area close by to accommodate trucks that arrive early.

---

[69] U.S. Department of Transportation, Federal Highway Administration. 2014. *Jason's Law Truck Parking Survey Results and Comparative Analysis: III. Survey of State Capability to Provide Adequate Truck Parking (Table 4 Results of Assessment of Key Indicators).* Retrieved from: https://ops.fhwa.dot.gov/freight/infrastructure/truck_parking/jasons_law/truckparkingsurvey/ch3.htm

6.2 Capital Costs

The capital to purchase and construct the faciltiy will be provided by ODOT's Keep Oregon Moving funds. These funds are only available for capital costs and will not be used for operating costs. Hard construction costs will be used to purchase the site land, prep and grade it for construction, construct the rail lines, switches, and infrastructure, construct the office, pave and stripe the parking lot, and buy equipment and machinery. Soft construction costs will include architecture, engineering, legal, and accounting costs.

Figure 24. Estimated Capital Costs for Constructing the Proposed Intermodal Center

Cost Category	Estimate
Right-of-way acquisition for railroad extensions north of the site	$11,838,000
Site Construction	$1,927,000
Electrical Improvements	$292,000
Rail Improvements	$11,571,000
Landscaping and Existing Structure Renovations	$728,000
Storm Sewer Construction	$60,500
Total Estimated Project Cost	$26,417,000

Note: Rounded to the nearest thousand; Includes contingencies
Source: Linn Economic Development Group

6.3 Operating Model

To evaluate the possible financial feasibility and sustainability of the proposed intermodal center, an operating proforma is constructed to examine potential revenues, costs, and profits. The analysis is done quarterly to adjust for seasonal differences in demand and track seasonal profitability. The model includes three sources of revenue:

1) Intermodal center revenues consisting of lift fees for international and domestic containers and a transportation fee for international containers leaving the center on rail;
2) Reload and warehousing fees charged per hundred-weight; and
3) Truck parking revenues.

The model allows for line-item data inputs, projects revenue and expenses over a five-year time horizon and differentiates between different levels of demand (baseline, high- and low-demand states).

Data is sourced from the Bureau of Labor Statistics, internet research, and interviews with potential intermodal center users, agricultural producers in the Valley, rail and intermodal industry experts, and the proposed operations manager of the intermodal center who manages a similar facility in Boardman, Oregon. The following assumptions are employed across a five-year time frame and three-year build-out:

- The intermodal center operates five days a week.
- Shifts are eight hours long.
- Each quarter has 13 weeks.

- Once operating at estimated demand, rail car quantities neither increase nor decrease.
- Fixed and labor costs appreciate at 3 percent per year.
- No allowances for increased fees are included.

6.3.1 Five-Year Horizon and Three-Year Build-Out

The operating proforma evaluates the intermodal center over a five-year time period, but it is assumed that the intermodal center will take three years to become fully operational. During this build-out, year one is estimated at 30 percent of demand, year two at 60 percent of demand and years three through five at 100 percent of demand.

The warehousing revenues are not adjusted for the build-out period, but truck parking and total container movements are adjusted. The truck parking is adjusted because it is assumed that it will take a few years for the trucking industry to become aware of the parking spaces, and the intermodal center is not expected to advertise (advertising costs are not modeled). The intermodal container movements are adjusted assuming that the intermodal center needs to ramp up production, staff, and capacity over time.

Fixed costs are not adjusted for the build out, but variable costs relating to the intermodal center are measured on a per-container basis and are thus increased with the build-out in the number of containers. In years one and two, the intermodal center is operating with full fixed costs and lower revenues and is thus less profitable than in years three through five.

6.3.2 Revenues

The intermodal center is expected to operate three lines of business: intermodal services, reload and warehousing services, and overnight truck parking and staging. Revenues and expenses for each are described below.

Intermodal Services

The primary service that the intermodal center offers is rail access and the equipment needed to transfer containers across modes of transport. The intermodal center will use special equipment to 'lift' containers from trucks and then onto the rail. A lift is defined as moving a container from a truck to a rail car (or vice-versa) or movement within a rail yard.[70] [71] It is assumed that each container is lifted twice, in two possible scenarios:

---

[70] Lindhjem, C. *Intermodal Yard Activity and Emissions Evaluations.* Retrieved from https://www3.epa.gov/ttnchie1/conference/ei17/session11/lindhjem.pdf

[71] R^2 Freight and Logistics Inc. "Intermodal Terms & Definitions." Retrieved from http://www.r2freight-logistics.com/intermodal-glossary

- Full containers could be lifted once from a truck to a stack and again from the stack to the rail. It is logistically impossible for each container to arrive exactly when it needs to be loaded onto a train, so stacking and storage are inevitable.
- Empty containers could be lifted from truck to rail (or rail to truck) upon entering the intermodal center, and again when arriving full and moving from truck to train to its final destination.

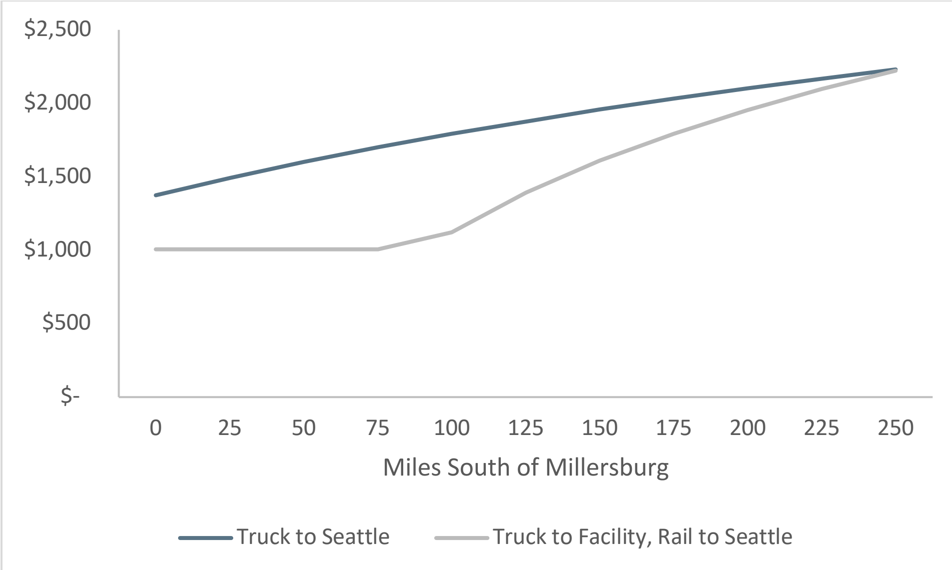
Research[72] and interviews with the proposed operations manager identified that there are different charges for international and domestic containers. Volumes coming through the intermodal center are based on the number of international and domestic containers projected in the demand section (see Figure 19 on page 42).

International containers are charged a $20.00 lift fee when empty, and a $30.00 lift fee when full. International containers are also charged a transportation fee to cover the cost of shipping by rail to the port.

For the purposes of this analysis, this fee covers additional costs of transporting containers on rail less the payment made to the railroads. This transportation fee fluctuates with the market and is expected to be set in-line or slightly below the cost of shipping by truck. The prices charged by the railroads are proprietary and subject to change. This analysis uses a $50.00 per container transportation charge (net of the railroad fee) as a starting point. Analysis for truck and rail transportation rates in Section 5.2 on page 35 indicate that these operating fees are reasonable and supportable by the market. Figure 25 below shows the predicted total truck and rail prices for transits of one loaded to Seattle for customers of varying distance from Millersburg at proposed operating fees. For all customers south and within 250 miles, there is a potential cost savings from using the intermodal center.

[72] ECONorthwest. *Feasibility of an Intermodal Transfer Facility in the Willamette Valley, Oregon.* Business Oregon & Infrastructure Finance Authority. (2016) Retrieved from http://www.oregon4biz.com/assets/e-lib/IT/ITFrpt1216.pdf

Figure 25: Projected Costs to Ship a Container from the Mid-Valley to the Port of Seattle



Source: ECONorthwest
Note: Assumes a one-way transit of one loaded container from a customer south of Millersburg.

Domestic containers are charged a $50 lift fee (both empty and full) but are not charged the transportation fee. Interviews suggest that domestic shippers generally arrange their own transportation costs to their final destinations and work directly with the railroad provider.

Total quarterly and annual revenues from both international and domestic containers moving through the intermodal center services in are listed in Figure 26 below, including the three year build out schedule.

Figure 26. Projected Annual Intermodal Revenues

Weekly Containers	Quarterly Containers	Year 1 (30 percent)	Year 2 (60 percent)	Year 3 (100 percent)	Year 4 (100 percent)	Year 5 (100 percent)
Q1: 255	4,576	$137,280	$274,560	$457,600	$457,600	$457,600
Q2: 226	3,931	$117,780	$235,560	$392,600	$392,600	$392,600
Q3: 219	4,302	$129,090	$258,180	$430,300	$430,300	$430,300
Q4: 305	4,727	$141,570	$283,140	$471,900	$471,900	$471,900
Total	17,537	$525,720	$1,051,440	$1,752,400	$1,752,400	$1,752,400

Source: ECONorthwest
Note: Model assumes a three-year build out and that years one and two are operating at 30 percent and 60 percent of demand, respectively. Quarterly containers do not sum to total due to rounding.

Reload and Warehousing Services

The primary service that the reload operation would offer is loading docks and equipment to unload products (palletized or in totes), storage, and services to reload or transload product onto rail. The warehouse capacity is assumed to be 30,000 square feet, half the floor space of the existing warehouse. This assumption is made to allow sufficient space for equipment, forklift maneuvering, and space for short-term reloading of product. It is assumed that product will be stacked 25 feet high, for a total of 750,000 cubic square feet of storage capacity at the warehouse.

Interviews suggest that the commodity most likely to use longer-term storage is grass seed destined for international export. Because the Mid-Willamette Valley has other warehousing facilities nearby that offer blending and other services, and because some grass seed producers have their own storage and warehousing facilities, the model assumes this warehouse will operate at 75 percent capacity. This number could be considered a conservative value, as interviews with stakeholders in the region indicate that there is a high likelihood that this warehouse, which provides the added benefit of proximity to rail access, may operate at full capacity. Figure 27 demonstrates the translation from volumes to hundred-weight to arrive at the revenue stream for this business line.

Figure 27. Translating Storage Volume to Hundred-Weight of Grass Seeds

Cubic Feet of Warehouse	75 percent Utilization (cubic feet)	Density of Grass Seed	Weight of Grass Seed	CWT of Grass Seed
750,000	562,500	11.2 pounds per cubic feet	6,300,000	63,000

Source: ECONorthwest
Note: Estimate of Orchard Grass bulk density of pounds per cubic foot[73]

Warehousing handling fees are charged when product moves in and out of the warehouse. The model assumes products are stored for an average of six months and the total volume in the warehouse turns over twice per year. Longer term storage fees are charged per hundred-weight per month.

Interviews suggest that the price for long-term storage for agricultural products in the Mid-Willamette Valley ranges between $0.18 and $0.50 per hundred-weight (cwt). Handling fees upon entry and exit of the storage warehouse were suggested to vary between $0.05 and $0.25 per cwt (each direction). As a conservative measure, the model assumes storage fees of $0.18 per cwt and handling fees of $0.05 per cwt each direction ($0.10 total). Should proximity to rail be viewed as a positive attribute of this warehouse, it may be possible to charge slightly higher fees.

Total quarterly and annual revenues from the reload and warehousing operation are listed in Figure 28 below. Since the warehouse structure already exists, no build-out period is assumed.

[73] College of Agricultural and Environmental Studies. University of Georgia. "Weight per bushel and bulk densities of grains and seeds." Retrieved from: http://caes2.caes.uga.edu/engineering/handbook/documents/Density%20of%20Agricultural%20Products.pdf

Figure 28. Projected Annual Reload and Warehousing Revenues

Grass Seed Stored at Any Point in Time (CWT)	Average Storage Duration	Total Annual Grass Seed (CWT)	Annual Reload and Warehousing Fees
63,000	6 months	126,000	$148,680

Source: ECONorthwest

Overnight Truck Parking

Based on the current site design and layout, the intermodal center is expected to have room for 100 semi-trucks to park overnight as well as amenities for drivers. An average overnight truck parking fee of $20.00 is assumed. While the rest of the intermodal center is expected to operate five days a week, truck parking will be available seven days a week. This line of business is expected to grow with the intermodal center build-out, as it will take time for the trucking industry to gain awareness of the parking options. This revenue source is modeled to operate at 75 percent capacity due to the presence of other truck parking facilities nearby. No seasonality is built into the model. Figure 29 below demonstrates expected annual revenues for truck parking at the intermodal center.

Figure 29. Projected Annual Truck Parking Revenues at 75 Percent Capacity

Weekly Trucks	Price per Night	Year 1 (30%)	Year 2 (60%)	Year 3 (100%)	Year 4 (100%)	Year 5 (100%)
525	$20	$163,800	$327,600	$546,000	$546,000	$546,000

Source: ECONorthwest
Note: Model assumes a three-year build out and that years one and two are operating at 30 percent and 60 percent of demand, respectively.

Total Intermodal Center Revenues

Figure 30 below demonstrates the three-year build-out schedule and projected annual revenues for the full intermodal center over five years. After the intermodal center is built out to 100 percent capacity, revenues of approximately $2.4 million per year are expected, assuming no change (increase or decrease) in container volumes, truck parking, lift fees, or prices for truck parking and warehousing.

Figure 30. Intermodal Center Build Out and Project Annual Revenues by Business Line

Business Line	Year 1 (30 percent)	Year 2 (60 percent)	Year 3 (100 percent)	Year 4 (100 percent)	Year 5 (100 percent)
Intermodal Services	$525,720	$1,051,440	$1,752,400	$1,752,400	$1,752,400
Reload and Warehousing Services	$148,680	$148,680	$148,680	$148,680	$148,680
Truck Parking	$163,800	$327,600	$546,000	$546,000	$546,000
Total Revenues	$838,200	$1,527,720	$2,447,080	$2,447,080	$2,447,080

Source: ECONorthwest

6.3.3 Operating Costs

Operating three lines of business, the intermodal center has numerous fixed and variable operating costs. Each component of the intermodal center requires different equipment and different levels of staffing. As there is not a meaningful difference in shipping volumes across seasons, variable staffing levels and fuel and equipment costs do not change significantly. Additionally, the model assumes efficiencies of scale exist between the reload and intermodal facilities, with some costs shared across the full site. The model includes the fixed and variable costs listed in Figure 31. Property taxes are omitted due to the non-profit status of the intermodal center owner/operator.

Figure 31: Fixed and Variable Costs

Fixed Costs	Cost Assumption	Unit	Source & Notes
Intermodal Center			
Manager Salary (1)	$90,000	Per Year	Bureau of Labor Statistics
Contract Staff (3 built out)	$16.00	Per Hour	Full time 2 FTE in year 1 1 more FTE in year 2
Taxes and Benefits	30% of payroll	Per Year	Bureau of Labor Statistics
Reload Operation			
Logistics Manager Salary (1)	$70,000	Per Year	Bureau of Labor Statistics
Contract Staff (1)	$16.00	Per Hour	Full time
Taxes and benefits	30% of payroll	Per Year	Bureau of Labor Statistics
Forklifts (2)	$25,000	Each	Industry Research Purchase one in Y1Q1 Purchase one at 3% inflation in Y2Q1
Batteries (4)	$5,000	Each	Industry Research Purchase two in Y1Q1 Purchase two at 3% inflation in Y2Q1
Truck Parking and Shared Costs			
Utilities	$15,000	Per Year	Similar facility operating costs and interviews with proposed intermodal center operator
Property and liability insurance	$6,000	Per Year	Similar facility operating costs and interviews with proposed intermodal center operator
Property Maintenance, security, rentals, etc.	$30,000	Per Year	Similar facility operating costs and interviews with proposed intermodal center operator
Variable Costs	**Cost Assumption**	**Unit**	**Source & Notes**
Intermodal Center			
Equipment and maintenance	$13	Per Container	Similar Facility Operating Cost (calculated)
Fuel and grease	$23	Per Container	Similar Facility Operating Cost (calculated)
Other supplies	$1	Per Container	Similar Facility Operating Cost (calculated)

Source: ECONorthwest

Variable costs for the intermodal center are modeled on a per-container basis, using the total estimated volume of international and domestic containers expected to pass through the intermodal center. These costs were estimated from operating data supplied by the proposed operations manager of the intermodal center who manages a similar intermodal facility in

Boardman, Oregon. All operating costs (including labor) are modeled to increase 3 percent per year.

Equipment

INTERMODAL

The intermodal center requires unique lifting equipment to stack containers and move them from truck to rail. It is assumed that this is included in capital costs for construction spending.

RELOAD AND WAREHOUSING

The reload and warehousing operation will require forklifts and forklift batteries, since gasoline cannot be used in enclosed warehouse spaces. It is assumed that the operation would need two forklifts to operate in peak season. Data from a reload center in Boardman, Oregon was scaled for the number of container-equivalent loads expected to run through this operation. With a maximum of 73 containers per quarter in peak seasons, one forklift could likely service all needs. A second one would provide backup. The model assumes one forklift and two batteries are purchased in Q1 of year one, and another forklift and two batteries are purchased in Q1 of year two. The model assumes prices increase 3 percent in year two.

Industry experts suggest that forklifts have a five-year warranty. Since this is the time period modeled, no additional maintenance expenses were included. Research demonstrates that forklift batteries can last up to five years, assuming they run eight-hour shifts 300 days a year.[74] The model assumes two batteries per forklift to ensure power beyond an eight-hour shift and for backup. Interviews with industry experts suggest forklifts cost $25,000 each and batteries $5,000.

The model assumes a straight line 20-year depreciation schedule on all equipment and machinery that will be replaced. Replacement prices are not included in the model's five-year horizon.

TRUCK PARKING

The truck parking business line item would have truck hookups and amenities for truck drivers. Hookups and facilities are expected to be part of capital costs during construction. There would not be much additional equipment associated with this part of the intermodal center. Utilities are included in shared expenses.

Staffing

The model assumes the reload and intermodal facilities would have separate managers. Bureau of Labor Statistics estimates are used to determine salary and benefits.[75]

---

[74] Raymond Handling Concepts Corporation. 2018. "What is the battery life of a Crown electric forklift?" Retrieved from: https://raymondhandling.com/learn/warehouse-faqs/what-is-the-battery-life-of-a-crown-electric-forklift/

[75] Bureau of Labor Statistics. 2018. "Employer Costs for Employee Compensation for the Regions: Employer costs per hour worked for employee compensation and costs as a percent of total compensation: Private industry workers, by

INTERMODAL

The intermodal manager would carry out day-to-day operations, handle logistics with the rail lines, coordinate with the local agriculture producers, and oversee accounting, payroll, and other administrative functions as well. Contract staff shifts are assumed to be eight hours. Interviews with the proposed manager demonstrate that the intermodal center would likely need three full time staff to operate the lift equipment. These staff are included in the intermodal center build out, with two hired in year one and a third hired in year two.

RELOAD AND WAREHOUSING

The reload operation manager would coordinate imports and exports, arrange long-term storage, and oversee the staff needed to unload and reload containers. Data from a reload center in Boardman, Oregon was scaled for the number of container-equivalent loads expected to run through this operation to determine staffing and equipment levels needed for operations. With limited movements estimated to occur within the facility, one forklift operator could likely service all needs.

TRUCK PARKING

No staff are modeled with the truck parking business line.

Total Operating Costs

Figure 32 below demonstrates total operating costs for the five-year time period, by business line. Fixed costs increase in years one and two as the equipment is purchased, then increase in years four and five due to a 3 percent increase built into the model. Variable costs (intermodal) increase during the build out through year three, then increase 3 percent in years four and five.

Figure 32. Projected Annual Operating Costs

Business Line	Year 1 Costs (30 percent)	Year 2 Costs (60 percent)	Year 3 Costs (100 percent)	Year 4 Costs (100 percent)	Year 5 Costs (100 percent)
Intermodal	$398,044	$654,900	$949,696	$978,187	$1,007,533
Reload	$169,264	$174,342	$142,441	$146,714	$151,115
Shared	$51,000	$52,530	$54,106	$55,729	$57,401
Total Operating Costs	$618,308	$881,771	$1,146,243	$1,180,630	$1,216,049

Source: ECONorthwest

6.4 Financial Feasibility

The financial operations for each business line at the proposed MVIC are displayed in Figure 33 below. Operating profits vary across each business line, with the intermodal center and truck parking businesses more profitable than the reload operation, based on pricing, demand estimates and informed assumptions about how each will operate. The intermodal center and the truck parking business line are built out over the three-year build-out schedule but are operating with full fixed costs in years one and two. This greatly impacts the profitability of the

census region and division." Pacific West Division. Retrieved from: https://www.bls.gov/regions/southwest/news-release/employercostsforemployeecompensation_regions.htm intermodal center but has a smaller effect on the truck parking business because it has so little in operating costs. Further, because the model assumes prices and volumes do not change, but includes 3 percent annual cost increases, profitability of each business line declines after year three.

Figure 33. Financial Feasibility of Demand Estimated for Proposed Millersburg Intermodal Center

Year	1 (30 percent)	2 (60 percent)	3 (100 percent)	4 (100 percent)	5 (100 percent)
Intermodal Services					
Revenues	$525,720	$1,051,440	$1,752,400	$1,752,400	$1,752,400
Operating costs	$398,044	$654,900	$949,696	$978,187	$1,007,533
Share of Costs	$31,987	$36,153	$38,746	$39,909	$41,106
D&A	$0	$0	$0	$0	$0
Net Income	$95,688	$360,387	$763,957	$734,304	$703,761
Reload and Warehousing Services					
Revenues	$148,680	$148,680	$148,680	$148,680	$148,680
Operating Costs	$169,264	$174,342	$142,441	$146,714	$151,115
Share of Costs	$9,046	$5,112	$3,287	$3,386	$3,488
D&A	$3,500	$3,500	$3,500	$3,500	$3,500
Net Income	($33,130)	($34,274)	($548)	($4,920)	($9,423)
Truck Parking					
Revenues	$163,800	$327,600	$546,000	$546,000	$546,000
Operating Costs	$0	$0	$0	$0	$0
Share of Costs	$9,966	$11,264	$12,072	$12,434	$12,807
D&A	$0	$0	$0	$0	$0
Net Income	$153,834	$316,336	$533,928	$533,566	$533,193
Total Net Income	***$216,392***	***$642,449***	***$1,297,337***	***$1,262,950***	***$1,227,531***

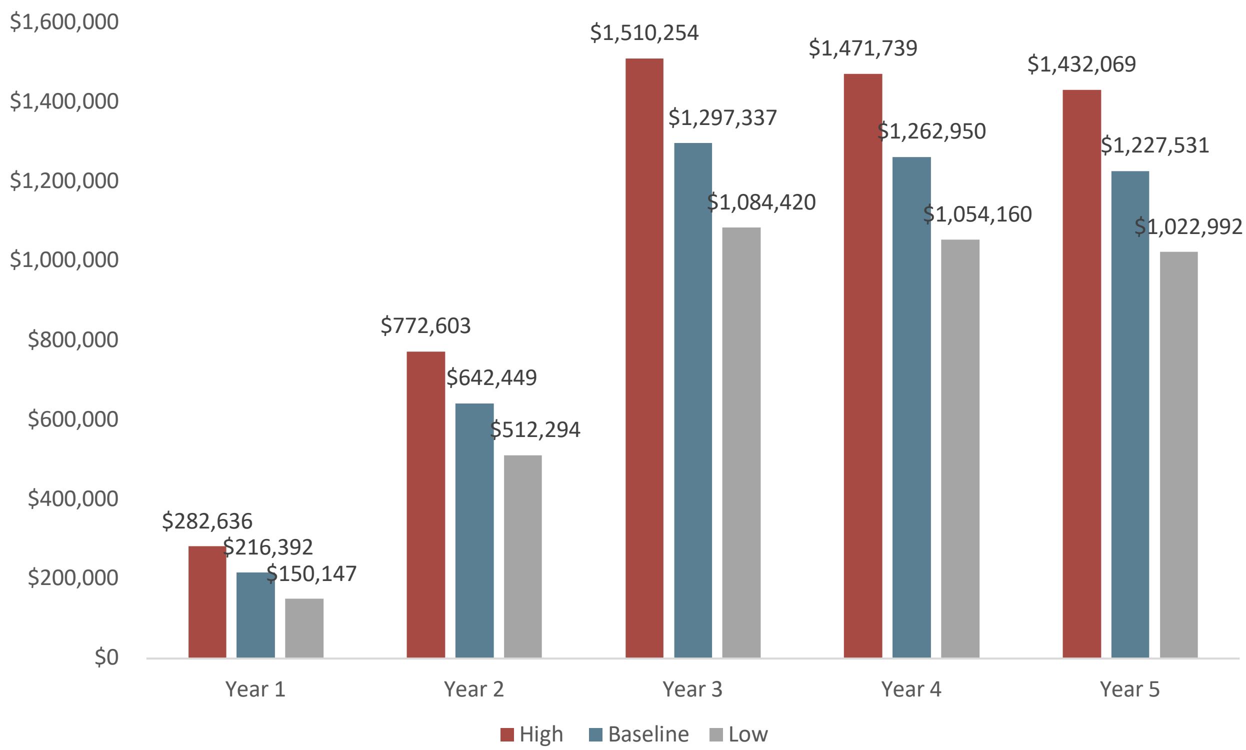
Source: ECONorthwest
Note: "Share of costs" is determined by each business line's revenue as a percent of total intermodal center revenues. Costs include utilities, insurance and general property expenses like security.

Although the reload and warehousing services operate as an individual business line loss, the operation serves to direct additional containers through the facility, thus supplementing the intermodal center business line.

6.4.1 Financial Sensitivity Analysis

The model allows financial sensitivity testing for different levels of demand. Using the high and low demand estimates from the sensitivity analysis in section 5.7.1 (page 44), the model shows the financial outcomes if production volumes, gas prices, or market prices for the goods transported increase or decrease. The estimates in Figure 33 are the baseline. As Figure 34 below demonstrates, the model assumes the proposed intermodal center would see positive net income in each demand state.

Figure 34. Financial Sensitivity Analysis, Proposed Millersburg Intermodal Center



Source: ECONorthwest

6.4.2 Breakeven Analysis

The model also allows for a breakeven analysis on each business line. Given that lift prices, warehousing prices, and truck parking prices vary with the market, the model allows a goal to seek to determine the prices each operation needs to charge to break even.

- For the intermodal center, the transportation fee charged on the international containers headed to port can be assessed using the breakeven analysis. Using all the assumptions and model structure previously discussed and keeping lift fees fixed, the model demonstrates that this fee could be set to zero and the business line would still make a small profit.
- The reload and warehousing operation as structured does not make a profit but the presence of reload and storage capacity near the intermodal center benefits the container movement business line. A breakeven analysis can determine the necessary volume of the warehouse that needs to be occupied at current prices to become profitable. The model currently assumes the 75 percent of available warehouse storage area (50 percent of the floor area) is occupied, which does not generate a profit at the business-line level. Breakeven analysis indicates that this operation becomes profitable at 83% utilization. However, if container movement revenue is accounted for, the business line at these assumed storage and handling fees would become profitable if greater than 77 percent

of the warehouse storage area is occupied. Interviews with stakeholder in the region indicate belief that utilization at this level is feasible.

- The truck parking business line is highly profitable, due to the number of stalls and very limited operating costs. The breakeven analysis demonstrates that charging any price (above zero) could create profit for this business line as it is structured.

7 Economic Impact Analysis

The proposed intermodal center in Millersburg can generate positive economic impacts by increasing local jobs, incomes, and output. Any increase in economic activity has in the study area has the potential to filter through the economy and create downstream benefits in the region. This section performs an economic impact analysis of the proposed intermodal center and estimates how the number of jobs, profits of certain industries, and government tax revenues might change.

Economic impacts are calculated as marginal impacts that occur as a result of one or more scenarios. For the purposes of this analysis, the baseline scenario is considered to be the status quo state of the world, in which no intermodal center exists in the mid-Willamette Valley and all goods are transported by truck to intermodal facilities in Portland or the seaports in Seattle, Tacoma, of California. The alternative scenario includes the construction of the intermodal center in Millersburg that will operate at levels outlined in other sections of this report. Although the proposed intermodal center will result in shippers reducing their reliance on other shipping alternatives in the baseline scenario, no estimate in the decline in jobs or revenue to existing intermodal facilities or the trucking industry is included. Furthermore, the opportunity cost of the State of Oregon's contribution to the intermodal center is also not included. To this extent, the estimate produced can be considered an estimate of the gross economic contribution of the intermodal center.

Economic impacts must also be calculated within a defined geography. The effects of the proposed intermodal center's economic activity are quantified relative to the counties adjacent to the site, which for this section includes Polk, Marion, Benton, Linn, and Lane counties.

7.1 Methodology

Upon construction of the proposed intermodal center, economic impacts can potentially occur through three primary mechanisms:

1) Construction Spending – Expenditures on labor, raw materials, and transportation associated with construction of the intermodal center. These are primarily derived from the portion of the State of Oregon's capital investment in the intermodal center.
2) Intermodal Operations – Expenditures on labor associated with operating the intermodal center. These are derived from fees that users will pay.
3) Grower/Shipper Cost Savings – Cost savings that accrue to users of the intermodal center that are then spent on other economic activities in the region. This is conditional on the costs of using the intermodal center being lower than existing alternative transportation options.

Items #1 and #2, above, are easily quantified based upon available information. Construction Spending impacts are developed based on estimates detailed in section 6.2 on page 49 above.

Intermodal Operation impacts are developed from the proforma which estimates the labor requirements necessary to operate the intermodal center.

Item #3 is more nebulous, difficult to quantify, and is not included as an input in the economic impact analysis. Although there are potential direct benefits to growers and shippers in the region if the intermodal center offered an unlimited quantity of service at lower costs than currently available from alternative transportation means (as described below in section 8.1 on page 66), there is limited available information on the investment, spending, and debt patterns of growers and shippers in the region. This lack of information makes reliable calculation of how any cost savings will be spent and the estimation of the resulting indirect and induced effects difficult. To the extent that growers and shippers do ultimately observe lower transportation costs, additional economic impacts in excess of those estimated here are likely to occur.

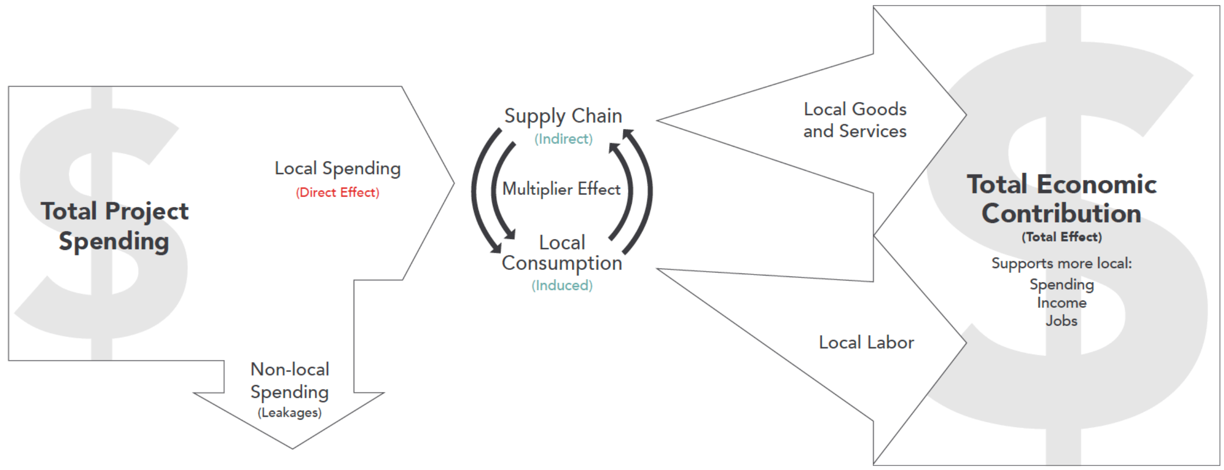
7.1.1 Input-Output Modeling

The economic contribution of the proposed intermodal center is calculated using the 2016 version of IMPLAN, an input-output model that calculates the increases in jobs, incomes, and output statewide that happen as money is spent locally. The increases are the result of the "multiplier effect" that occurs as dollars circulate throughout the economy.

Economic contribution studies use specific terminology to identify different types of economic effects that can be modeled using input-output tools. More specifically, the IMPLAN model provides estimates of the effects of the expenditures on income and employment that follow from direct, indirect, and induced expenditures (See Figure 35).

- **Direct effects** are the output, jobs, and income associated with the immediate effects of final demand changes. These are typically described as the "inputs" to the model.
- **Indirect effects** are production changes in backward-linked industries caused by the changing input needs of directly affected industries. Suppliers to the directly involved industry will also purchase additional goods and services; spending leads to additional rounds of indirect effects. Because they represent interactions among businesses, these indirect effects are often referred to as supply-chain effects.
- **Induced effects** are the changes in regional household spending patterns caused by changes in household income. The direct and indirect increases in employment and income enhance the overall purchasing power in the economy, thereby inducing further spending by households. Employees in these industries, for example, will use their income to purchase groceries or take their children to the doctor. These induced effects are often referred to as consumption-driven effects.

Figure 35. Economic Effects Arise from Spending to Generate Total Economic Contribution



Source: ECONorthwest

Taken together, these combined economic effects (direct + indirect + induced) describe the total contribution to the regional economy from the proposed intermodal center. These effects are measured in terms of output, income, and jobs, which are defined as:

- **Output** represents the value of all goods and services produced from an event, and it is the broadest measure of economic activity.
- **Labor Income** consists of employee compensation and proprietor income, and it is a subset of output. This includes workers' wages and salaries, as well as other benefits such as health, disability, and life insurance, retirement payments, and non-cash compensation.
- **Jobs** are measured in terms of full-year-equivalents (FYE). One FYE job equals work over twelve months in an industry (this is the same definition used by the federal government's Bureau of Labor Statistics).

Although the intermodal center will be built in Millersburg, not all of the initial expenditures are re-spent in the counties specified above. Some spending leaks out of the economy from labor and construction expenditures that occur outside the primary study region. The approach utilized here does not capture these "spillover" effects, but only includes the gross economic contribution to Polk, Marion, Benton, Linn, and Lane counties.

7.1.2 Limitations of Input-Output Analysis

Input-output models are static models that measure inputs and outputs in an economy keeping prices and macroeconomic conditions fixed. With this information and the balanced accounting structure of an input-output model, an analyst can: 1) describe an economy at one time-period, 2) introduce a change to the economy, and then 3) evaluate the economy after it has accommodated that change.

This type of "partial equilibrium" analysis permits comparison of the economy in two separate states but does not describe how the economy moves from one equilibrium to the next. In partial equilibrium analysis, the researcher assumes that all other relationships in the economy remain the same (other than the initial economic stimulus).

Contrary to dynamic models, static models assume that there are no changes in wage rates, input prices, and property values. In addition, underlying economic relationships in input-output models are assumed constant; there are no changes in the productivity of labor and capital, and no changes in population migration or business location patterns. All production functions in the model are assumed to be linear and substitution effects are generally absent from input-output models. Although these simplifying assumptions can misstate the true effects on the economy of a project or policy, in situations the applications are relatively small, these models can produce a useful approximation.

7.2 Data Inputs

Two primary data sources are necessary to calculate the economic contribution of construction and operations of the MVIC. Linn Economic Development Group provided preliminary construction cost estimates by general category, including site construction, electrical improvements, rail improvements, landscaping, renovations of existing structures, and storm sewer construction (summarized in Figure 24 on page 49 above). Only a subset of project construction expenditure is assumed to occur within the Oregon counties included in the analysis. For example, specialized railroad equipment and labor are assumed to come from outside the study area, while other construction activities using local labor and materials are included.

7.3 Results

Figure 36 and Figure 37 show the economic contributions of the construction and operations of the proposed facility. Construction contributions occur only during the construction period and cease once complete. Operational contributions occur every year that the facility operates.

Figure 36. Economic Contribution of Construction Activities, 2018$

Impact Type	Output	Value Added	Labor Income	Jobs
Direct	8,735,444	4,668,006	3,659,794	65
Indirect	1,919,287	984,518	641,984	13
Induced	2,947,010	1,693,086	973,959	24
Total	13,601,741	7,345,610	5,275,738	102

Source: ECONorthwest

The construction of the facility and rail line will support $8.7 million in direct output, $3.7 million in direct labor income, and 65 direct jobs. Spending circulates through the local economy resulting in indirect and induced effects. Combined with the direct effects, construction generates a total of $13.6 million in output, $5.4 million in labor income, and 102 jobs.

Figure 37. Economic Contribution of Operations, 2018$

Impact Type	Output	Value Added	Labor Income	Jobs
Direct	2,379,675	1,205,849	431,846	6
Indirect	412,355	264,256	83,412	3
Induced	352,393	202,402	116,511	3
Total	3,144,423	1,672,507	631,769	12

Source: ECONorthwest

The operations of the facility will support $2.4 million in output, $432 thousand in labor income, and six jobs every year. Summing the direct, indirect, and induced effects results in $3.1 million in total output, $632 thousand in total labor income, and 12 total jobs supported by the facility.

8 Transportation Cost Savings

Construction of the proposed intermodal center has the potential to generate cost savings, both to private users of the intermodal center as well as to the general public. The following sections use inputs from sections 5 and 6, along with information from federal regulatory impacts analyses to estimate the anticipated savings to Oregon's transportation network. All calculated values are estimates that demonstrate appropriate scale and are rounded to the nearest thousandth to implying undue precision.

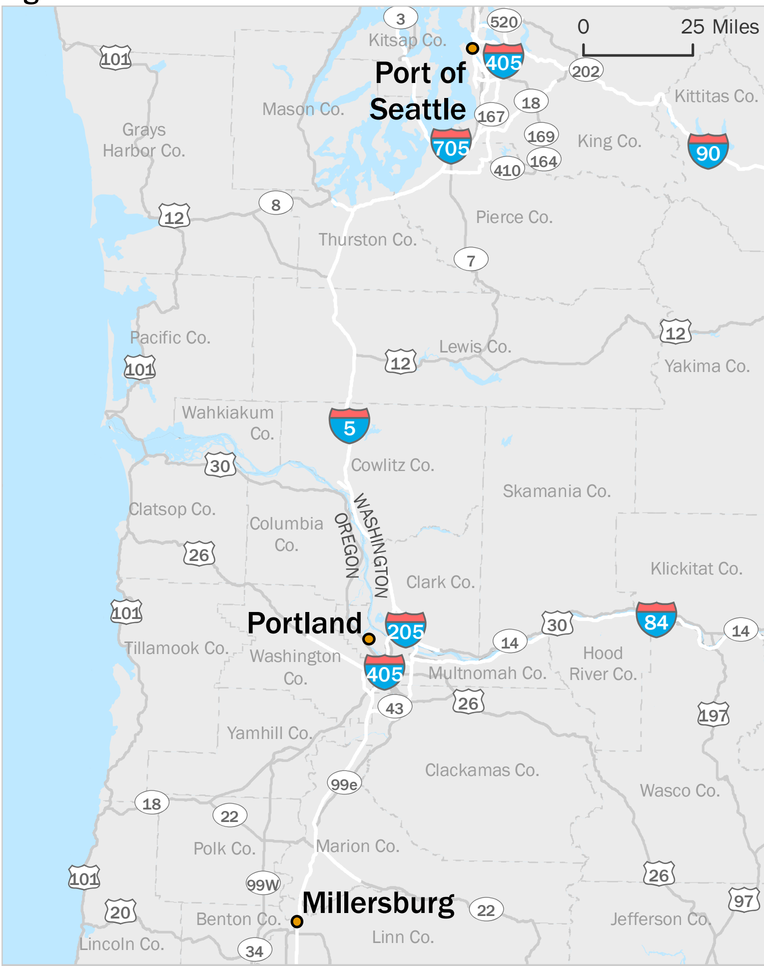
8.1 Private Benefits

Private transportation cost savings may accrue to users of the intermodal center who face lower transportation costs than current alternatives. These benefits only accrue if user fees are lower than alternative shipping modes that provide the same level of service. Although, generally, rail per-mile transportation costs are lower than truck for large volumes over long distances, these lower costs may not always be observed at the proposed intermodal center. There are many underlying economic reasons this might not occur, including scarcity induced by the capacity of the intermodal center and availability of substitutes. Since the intermodal center is being constructed at a scale that is incapable of handling the total volume of products shipped in the region, competition for available capacity will occur, resulting in pricing that most efficiently allocates that capacity. Furthermore, the current mix of shipping alternatives will continue to exist, allowing growers and shippers to choose the alternative that provides the best level of service, reliability, and timeliness necessary. Calculation of the scale of anticipated private benefits, however, can be calculated using expected trucking costs and a basic set of assumptions on markets served.

8.1.1 Framework

Section 5 above calculates the estimated demand for the intermodal center. The volume of exported containers will replace one of two existing transit options 1) trucking loaded containers all the way to ports in Seattle and Tacoma, and 2) trucking loaded containers to an intermodal rail facility in Portland. The volume of domestic containers is expected to complete replace truck shipments to facilities in Portland. These locations are identified in Figure 38 below.

Figure 38. Location of Alternative Intermodal Destinations in Relation to Millersburg



Source: ECONorthwest

There may be cost savings incurred by transporting containers by rail from Millersburg to the Seattle/Tacoma area as opposed to trucking the entire way. However, in order to generate conservative estimates of benefits, this section assumes that truck transportation cost savings accrue only for forgone trucking costs for the 65 miles from Millersburg to Portland. These benefits are mitigated by the additional rail transit costs to ship the approximately 236 miles from Millersburg to Seattle/Tacoma (as opposed to the approximately 171 miles from Portland to Seattle). Both elements are calculated using the truck and round-trip marginal rail cost structures estimated in section 5.2 on page 35. Intermodal center charges are likely to be roughly equivalent at both facilities and are excluded from the estimate of private transportation cost savings. The resulting calculation is as follows:

Potential value of private transportation cost savings:

Private Transportation Cost Savings = (Cost to ship to Portland by Truck – Marginal cost to ship the added distance to Millersburg by Rail) * (Distance) * (Containers)

Private Transportation Cost Savings = ($5.65 per mile – $3.79 per mile) * (65 miles) * (17,537 containers)

Private Transportation Cost Savings = $2,120,000 per year

When evaluated over a twenty-year timeframe—from 2020 to 2040—at a 3 percent and 7 percent discount rate, these savings amount to between $21,032,000 and $30,682,000. These transportation cost savings are likely to be captured in the private market by either growers, shippers, the intermodal center operator, or the rail operator.

8.2 Public Benefits

This section calculates the monetary value of the public benefits derived from the proposed intermodal center, particularly by shifting container transportation from Oregon highways to rail. Public benefits accrue when goods that are non-rival and non-excludable are improved. Although the values can often be inferred from private market transactions, public goods are not regularly bought and sold. This analysis draws information from published economic literature and relevant federal guidance to calculate a range of benefits accruing to Oregon residents from the construction of the proposed intermodal center.

The existing baseline scenario involves empty container trucks departing from the Seattle/Tacoma area and traveling down the Willamette Valley toward Millersburg, Oregon. Once they reach their loading destination, empty containers and chassis are exchanged for full containers destined for international customers. These same trucks then transport these containers back up to ports in Seattle and Tacoma. Although the full suite of public benefits is broad, this analysis only focuses on the benefits of removing eighteen wheelers from highways inside the State of Oregon. As described earlier, the proposed intermodal center is expected to remove approximately 17,537 northbound containers per year.

Intermodal container transportation produces public benefits, which are often used to justify public investment in intermodal infrastructure.[76] The transportation industry has adopted intermodal containers, in part, because they can take advantage of efficiencies associated with each form of transportation. These efficiencies produce private cost benefits, as well as benefits that accrue to the public, including reduced pollution, congestion, highway wear and tear, and fewer accidents. The subsections that follow discuss the benefits of removing eighteen wheelers from urban interstates. They are as follows:

- Highway Safety
- Air Pollution and Greenhouse Gas Reduction
- Congestion Reduction
- Reduced Highway Maintenance Costs

[76] Casavant, K., E. Jessup, and A. Monet. (2004). *Determining the Potential Economic Viability of Inter-Modal Truck-Rail Facilities in Washington State.* Washington State Transportation Commission, Washington State Department of Transportation, U.S. Department of Transportation Federal Highway Administration. December. Retrieved from: https://www.wsdot.wa.gov/research/reports/fullreports/605.1.pdf.

8.2.1 Framework

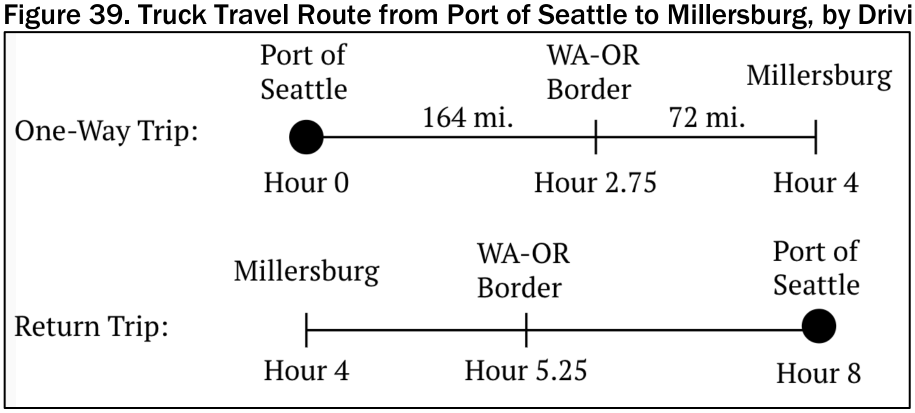
Figure 39 depicts the conceptual basis for estimating benefits for removing trucks from highways in the State of Oregon. Since the marginal effect of many of the public benefits varies across time and distance, it also details the distance traveled on I-5 and the relative driving hour for when drivers cross the Washington-Oregon border into Oregon. While this conceptual example does not precisely mirror the full set of transportation actions being made, it is roughly representative and serves as a basis for estimating the scale of public benefits.

In the analysis to follow, it is important to note the calculations monetizing these public benefits rely heavily on assumptions. These calculations do not account for specific trade-offs when trucks are removed from Oregon interstates. For example, when calculating the benefit of reduced congestion, the potential scenario of private passenger vehicles or light trucks replacing the space created on highways as a result of the eighteen wheelers removed is not considered. Additionally, assumptions are made on the given weight for each eighteen-wheeler, a specific driving route, and an amount of time taken to drive this route. Any deviation from these assumptions will result in public benefits being reduced (e.g., private passenger vehicles replacing eighteen wheelers, trucks taking a longer driving route, trucks being only partially loaded) or increased (e.g., highway congestion worsens). For this reason, all values are produced as a range and are intended to demonstrate the potential scale of public benefits.

Driving Distance Assumptions

The distance from the Port of Seattle down to Millersburg is approximately 3 hours and 55 minutes, or about 236 miles.[77] From the Port of Seattle to the Washington-Oregon state border, it is about 164 miles or 2 hours and 42 minutes. Truck drivers travel on Oregon interstates for approximately 72 miles in one direction or about 144 miles over their entire trip. Thus, drivers spend about 2.5 hours of their driving route on Oregon interstates. For simplicity, it is assumed truck drivers occupy Oregon interstates for their full third and fourth hours of driving. Their fifth hour, while partial, is also in Oregon.

Figure 39. Truck Travel Route from Port of Seattle to Millersburg, by Driving Hour



Source: ECONorthwest.

[77] This distance is according to Google Maps. Note the approximate times of travel do not account for every driving contingency such as congestion, road construction, inclement weather, or crashes.

Truck Weight Assumptions

Two assumptions are made regarding the weight of eighteen wheelers. These will be restated when employed in calculations to follow.

- The typical weight of a Class 8 truck tractor is approximately 17,000 pounds or 8.5 tons.[78,79]
- A standard empty container and chassis has an approximate tare weight (empty) of 15,000 pounds (7.5 tons) and can hold up to a maximum of 44,000 pounds (inclusive of its tare weight).[80]

Combining the weight of the truck tractor with an empty container and chassis, the typical tare weight of an eighteen-wheeler is about 16 tons. It is important to note, however, that this tonnage can vary widely based on the type of truck tractor and the trailer attached to it. Using publicly available measures for the density of pressed straw, a full container is estimated to carry a load of 21 tons.

An eighteen-wheeler with a full load of pressed straw weighs about 37 tons on its return trip. However, on its drive from the Washington-Oregon border toward Millersburg, it weighs about 16 tons. Thus, when performing calculations in the following sections where weight is a key factor, both legs are incorporated.

8.2.2 Marginal Costs

Marginal costs are essential for understanding travel impacts as they illustrate the incremental cost per extra mile driven on interstates. These costs, though not regularly considered by road users, are imposed on drivers (travel time, costs of vehicle operation), public agencies (road maintenance), and they externally affect other highway users by congestion and, more broadly, communities by pollution. It should be noted that while these marginal costs illuminate the incremental cost per extra mile, their value can vary based on time of day. For example, the marginal cost of congestion during peak travel periods through Portland will be higher than during non-peak travel periods.

---

[78] U.S. Department of Energy, Office of Energy Efficiency & Renewable Energy. (April 2010). *Fact #620: April 26, 2010 Class 8 Truck Tractor Weight by Component*. Retrieved from: https://www.energy.gov/eere/vehicles/fact-620-april-26-2010-class-8-truck-tractor-weight-component.

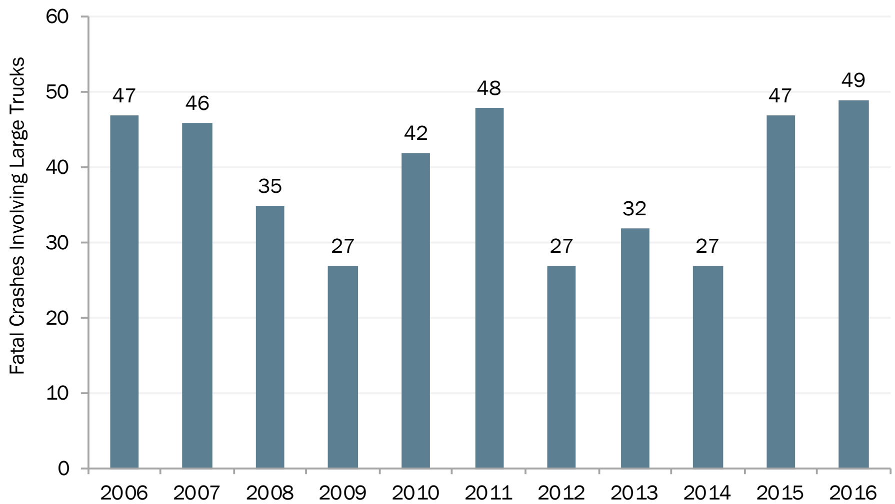
[79] This is according to the Federal Highway Administration. Class 8 trucks are classified as weighing more than 33,001 pounds. See the Alternative Fuels Data Center at https://www.afdc.energy.gov/data/10380.

[80] Ship North America Transportation. Equipment – Truck, Truck Trailers & Van Specifications. Retrieved from: https://www.shipnorthamerica.com/htmfiles/equipment.html.

Highway Safety

Large trucks have been involved in fatal crashes on Oregon roadways. To contextualize the number of fatal crashes and fatalities, Figure 40 and Figure 41 provide trend analyses of these statistics over the last eleven years, respectively.[81] It is important to note that not all of these fatal crashes and fatalities necessarily occurred on interstate freeways; more generally, these statistics describe the number of fatal truck crashes on public roadways. Over the 2006 to 2016 timeframe in Oregon, the largest number of fatal crashes occurred in 2016 at 49 with an overall average of 43 fatal truck crashes occurred per year.

Figure 40. Fatal Crashes Involving Large Trucks, 2006-2016



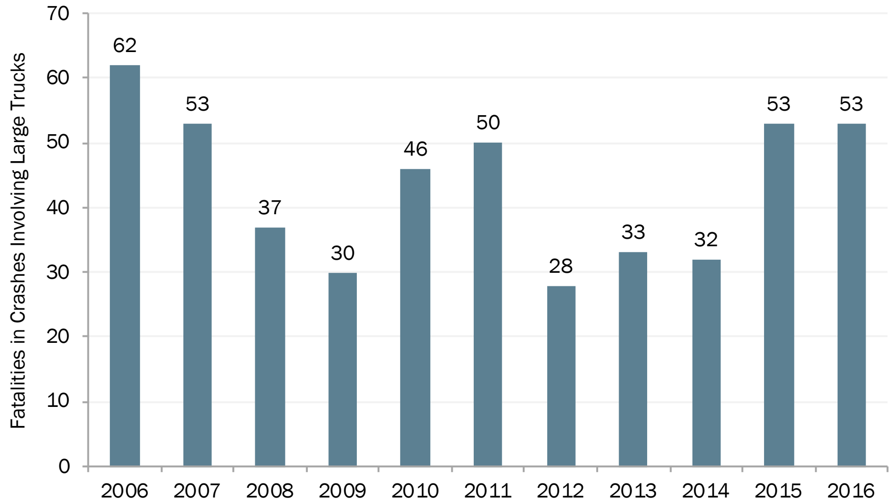
Source: U.S. Department of Transportation, Large Truck and Bus Crash Facts 2016.

The number of fatalities from crashes involving large trucks has fluctuated over the last eleven years. During the 2006 to 2016 timeframe, the largest number of fatalities occurred in 2006 at 62. Over these eleven years, the lowest number of fatalities was 28 in 2012. In 2015 and 2016, however, the number of fatalities rose to 53 in each year. On average, 39 fatalities from crashes involving large trucks occurred each year in Oregon over the past eleven years.

---

[81] U.S. Department of Transportation, Federal Motor Carrier Safety Administrations, Analysis Division. (May 2018). Large Truck and Bus Crash Facts 2016. Report No. FMCSA-RRA-17-016. Retrieved from: https://www.fmcsa.dot.gov/sites/fmcsa.dot.gov/files/docs/safety/data-and-statistics/398686/ltbcf-2016-final-508c-may-2018.pdf.

Figure 41. Fatalities in Crashes Involving Large Trucks, 2006-2016



Source: U.S. Department of Transportation, Large Truck and Bus Crash Facts 2016.

There are additional estimates of the rate of large truck at-fault crashes reported by the Oregon Department of Transportation.[82] From 2013 through 2017, there was an average of 0.43 large truck crashes involving a fatality, injury, or disabling damage per million vehicle miles traveled. Additionally, there were 1.32 deaths per 100 million vehicle miles traveled on Oregon roads in 2016.

Two ranges are used to approximate the monetary value of increased highway safety via the removal of trucks from Oregon interstates. One range uses the Value of a Statistical Life (VSL) to approximate the monetary value of fatalities prevented. The other range is based more broadly on accidents, specifically how removing trucks from highways would decrease this negative externality experienced by other users of interstates.

First, the range for potential fatalities prevented as a result of removing trucks from Oregon interstates is calculated. The U.S. Department of Transportation (DOT) reported a VSL of $9.6 million for 2016 in its revised VSL Guidance memorandum.[83] Using the Consumer Price Index published by the Bureau of Labor Statistics, the 2016 VSL value is adjusted to 2018 dollars.[84] This inflation adjustment raises the VSL to $9.91 million.

---

[82] ODOT Motor Carrier Division and ODOT Transportation Development Division, Crash Analysis and Reporting Unit.

[83] U.S. Department of Transportation, Office of the Secretary of Transportation. (August 2016). Memorandum to: Secretarial Officers Modal Administrators; Subject: Guidance on Treatment of the Economic Value of a Statistical Life (VSL) in U.S. Department of Transportation Analyses—2016 Adjustment. Retrieved from: https://www.transportation.gov/sites/dot.gov/files/docs/2016%20Revised%20Value%20of%20a%20Statistical%20Life%20Guidance.pdf.

[84] Bureau of Labor Statistics. (2018). *Consumer Price Index, All Urban Consumers, Not Seasonally Adjusted Series, All Items, U.S. City Average*. Retrieved from: https://www.bls.gov/cpi/data.htm.

Potential value of fatalities prevented, U.S. DOT VSL:

- Potential value of fatalities prevented = (U.S. DOT VSL) * (Fatality rate, per mile) * (Truck trips removed from interstates per year) * (Miles per truck trip)
- Potential value of fatalities prevented = ($9.91 mill.) * (1.32 / 100 mill) * (17,537 trucks) * (144 miles)
- Potential value of fatalities prevented = $330,000 per year

Aside from reducing fatalities on roadways, there are additional benefits from the reduction in general accidents. In a technical report from Blanco, *et al.* (2011), they estimate the rate of Safety Critical Events (SCE) as a function of driving hour.[85] An SCE is any crash, near-crash, crash-relevant conflict, or unintentional lane deviation. These rates help estimate the potential number of crashes that could occur from eighteen-wheelers while driving through Oregon. Using Blanco, *et al.*'s estimates provided in Figure 42, the average rate of SCE occurrence for driving hours 3, 4, and 5 is 0.154.

Figure 42. Rate of SCE Occurrence by Driving Hour

Driving Hour	SCEs Per Driving Hour	Total Opportunities Per Driving Hour	Rate of SCE Occurrence
1	218	1,864.60	0.117
2	230	1,826.97	0.126
3	235	1,786.90	0.132
4	285	1,715.56	0.166
5	263	1,612.94	0.163
6	265	1,477.66	0.179
7	248	1,261.41	0.197
8	154	1,021.06	0.151
9	125	808.78	0.155
10	98	553.16	0.177
11	76	321.48	0.236

Source: Blanco, *et al.* (2011). Table 11, page 29.

It is expected that there will be a reduction in approximately 6,752 safety SCEs per year (0.154 SCE rate * 17,537 trucks * 2.5 hours driving per truck) from removing trucks from the roads.

While there is no precise monetary estimate for a reduction in SCEs, a range of values of general accidents prevented by removing trucks from Oregon interstates is available from evaluations of several federal highway regulations. According to the EPA's final rulemaking regarding greenhouse gas emissions standards and fuel efficiency standards for heavy-duty trucks, the marginal cost per freeway mile driven of an accident range from a low estimate of $0.01 to a

[85] Blanco, et al. (May 2011). The Impact of Driving, Non-Driving Work, and Rest Breaks on Driving Performance in Commercial Motor Vehicle Operations. U.S. Department of Transportation, Federal Motor Carrier Safety Administration. Retrieved from: https://www.researchgate.net/publication/280569039.

high of $0.08.[86] To generate an approximate value, the 'Middle' estimate, or $0.03, is used to approximate the value of accidents avoided.

Figure 43. Cost of Highway Externalities for Combination Tractors per Mile, in 2018 dollars

Highway Impact	High	Middle	Low
Noise	$0.06	$0.02	$0.01
Accidents	$0.08	$0.03	$0.01
Congestion	$0.37	$0.13	$0.03
Combined	$0.51	$0.18	$0.05

Source: U.S. EPA. Final Rulemaking to Establish Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles, Regulatory Impact Analysis. Table 9-10: Low-Mid-High Cost Estimates.

For comparison, Figure 44 details the marginal cost of each urban interstate mile driven for various externalities by truck weight per the Federal Highway Administration's (FHWA) 1997 Addendum to their Highway Cost Allocation Study. A number of the externalities listed will be referenced in later sections and employed in other calculations. These values, initially reported in 2000 dollars, have been adjusted to 2018 dollars using the CPI. Given the focus on eighteen wheelers, the pertinent estimates for marginal crash costs from Figure 44 are in rows '60 kip 5-axle Comb.' (empty trucks on their way to Millersburg) and '80 kip 5-axle Comb.' (loaded trucks returning to the Port of Seattle). The values for these two vehicle classes are identical for crashes, so $0.017, or approximately two cents per interstate mile driven is used to calculate the potential value of avoiding highway accidents involving large trucks.

Figure 44. Marginal Cost of Incremental Highway Mile Driven, by Vehicle Class on Urban Interstates, in Cents per Mile, 2018 dollars

Vehicle Class on Urban Interstate	Pavement	Congestion	Crash	Air Pollution	Noise	Total
40 kip 4-axle S.U. Truck	$0.045	$0.352	$0.012	$0.065	$0.022	$0.496
60 kip 4-axle S.U. Truck	$0.261	$0.470	$0.012	$0.065	$0.024	$0.832
60 kip 5-axle Comb.	$0.151	$0.265	$0.017	$0.065	$0.040	$0.537
80 kip 5-axle Comb.	$0.589	$0.289	$0.017	$0.065	$0.044	$1.002

Source: U.S. Department of Transportation, Federal Highway Administration. Addendum to the 1997 Federal Highway Cost Allocation Study, Final Report.

Potential value of highway accidents avoided, EPA accident value:

- Value of accidents avoided = (EPA's marginal cost of crash) *(Truck miles driven) * (Number of trucks removed from interstates per year)

---

[86] U.S. Environmental Protection Agency, Office of Transportation and Air Quality, and U.S. Department of Transportation, National Highway Traffic Safety Administration. (August 2011). *Final Rulemaking to Establish Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles, Regulatory Impact Analysis*. Report No.: EPA-420-R-11-901. Retrieved from: https://nepis.epa.gov/Exe/ZyPDF.cgi/P100EG9C.PDF?Dockey=P100EG9C.PDF.

- Value of accidents avoided = ($0.03) * (144 miles) * (17,537 trucks per year)
- Value of accidents avoided = $76,000 per year

Potential value of highway accidents avoided, FHWA accident value:

- Value of accidents avoided = (FHWA's marginal cost of crash) * (Truck miles driven) * (Number of trucks removed from interstates per year)
- Value of accidents avoided = ($0.017) * (144 miles) * (17,537 trucks per year)
- Value of accidents avoided = $43,000 per year

Greenhouse Gas Reduction and Air Pollution

Shifting intermodal containers from trucks to rail reduces greenhouse gases (GHGs) and air pollution. The primary reason for this is that rail can transport cargo further per ton-mile of fuel consumed. According to the EPA, "the most important greenhouse gases directly emitted by humans include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and several other fluorine-containing halogenated substances."[87] In their 2018 Inventory of U.S. Greenhouse Gas Emissions and Sinks, the EPA reports approximately 2.2 percent of the U.S.'s GHG emissions (CO_2, CH_4, N_2O, HFCs, Other Emissions from Electric Power) in 2016 came from rail transportation. Medium- and heavy-duty trucks contributed to 22.9 percent of the total GHG emissions (CO_2, CH_4, N_2O, HFCs) in 2016. Other gases accounted for in this section include indirect greenhouse gases, which do not necessarily contribute to the global warming effect, but they indirectly impact the Earth's atmosphere "by influencing the formation and destruction of tropospheric and stratospheric ozone …."[88] Among these are carbon monoxide (CO), nitrogen oxides (NO_x), volatile organic compounds (VOCs), sulfur dioxide (SO_2), and others. Particulate matter ($PM_{2.5}$), ammonia (NH_3), nitrogen oxides, sulfur dioxide, and VOCs are gasses that affect human health and air quality.[89] The human health component is monetized later in this section as it relates to the reduction of these harmful gasses from fewer trucks.

The Texas Transportation Institute (TTI) estimated railroads moved approximately one ton of cargo 478 miles per gallon of fuel in 2009. In comparison, trucks moved one ton of cargo 150 miles per gallon.[90] Thus, railroad transportation is more fuel efficient for moving cargo relative to trucks, and as a result of consuming less fuel, railroad transportation produces fewer GHGs.

---

[87] U.S. EPA. (April 2018). Inventory of U.S. Greenhouse Gas Emissions and Sinks, 1990-2016. Report No.: EPA 420-R-18-003. Retrieved from: https://www.epa.gov/sites/production/files/2018-01/documents/2018_complete_report.pdf.

[88] *Ibid*.

[89] U.S. EPA. (May 2018). CO-Benefits Risk Assessment (COBRA) Health Impacts Screening and Mapping Tool. https://www.epa.gov/statelocalenergy/co-benefits-risk-assessment-cobra-health-impacts-screening-and-mapping-tool.

[90] Kruse, J. C., Protopapas, A., Olson, L. E. (2012). *A Modal Comparison of Domestic Freight Transportation Effects on the General Public: 2001-2009*. College Station, TX: Texas Transportation Institute, The Texas A&M University System. Retrieved from: http://nationalwaterwaysfoundation.org/study/FinalReportTTI.pdf.

The TTI report estimates railroads produce one ton of GHG per 47,308 ton-miles while trucks produce one ton of GHG per 5,802 ton-miles.[91] Below are the calculations for the quantity of GHG emitted by a single truck driving on Oregon interstates by the leg of the route.

From Washington-Oregon border to Millersburg (one way; first leg):

- Travels 72 miles at 16 tons (empty container) = (72 miles) * (16 tons) = 1,152 ton-miles

From Millersburg to Washington-Oregon border (round trip; second leg):

- Travels 72 miles at 37 tons (loaded container) = (72 miles) * (37 tons) = 2,664 ton-miles

Thus, for one truck driving on Oregon's interstates, it travels 3,816 ton-miles (1,152 plus 2,664) and produces 0.66 tons of GHG (3,816 divided by 5,820).

One way to estimate the impacts of taking trucks off the road in favor of intermodal rail is calculating the reduction of carbon dioxide (CO_2) emissions by using the social cost of carbon (SCC). Figure 45 shows the social costs of CO_2 per metric ton across various discount rates published by the EPA.[92]

Figure 45. Social Cost of Carbon per Metric Ton, 2012–2050, 2018 dollars

Year	5% Avg. Discount	3% Avg. Discount	2.5% Avg. Discount	3%, 95th Percentile
2012	$6.10	$26.64	$43.36	$81.04
2015	$6.85	$28.40	$45.72	$85.53
2020	$8.10	$31.31	$49.66	$96.09
2025	$9.86	$35.16	$54.63	$107.58
2030	$11.61	$38.99	$59.59	$119.07
2035	$13.37	$42.84	$64.56	$130.56
2040	$15.12	$46.68	$69.54	$142.05
2045	$16.90	$50.07	$73.47	$152.11
2050	$18.69	$53.46	$77.40	$162.18

Source: U.S. EPA. *Final Rulemaking to Establish Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles, Regulatory Impact Analysis*.

Using the 2020 SCC value across various discount rates from Figure 45, displays a range of values for carbon removed from the atmosphere as a result of taking 17,537 eighteen wheelers off the road each year.

---

[91] *Ibid*.

[92] U.S. Environmental Protection Agency. (August 2011). Final Rulemaking to Establish Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles, Regulatory Impact Analysis. Report No. EPA-420-R-11-901. Retrieved from: https://nepis.epa.gov/Exe/ZyPDF.cgi/P100EG9C.PDF?Dockey=P100EG9C.PDF.

Social cost of carbon, 5 percent discount rate:

- SCC at 5 percent discount = (2020 value at 5 percent) * (Tons of GHG produced by one truck) * (Number of trucks removed from interstates per year)
- SCC at 5 percent discount = ($8.10) * (0.66 tons of GHG per truck) * (17,537 trucks per year)
- SCC at 5 percent discount = $94,000 per year

Social cost of carbon, 3 percent discount rate:

- SCC at 3 percent discount = ($31.31) * (0.66 tons of GHG per truck) * (17,537 trucks per year)
- SCC at 3 percent discount = $362,000 per year

Social cost of carbon, 2.5 percent discount rate:

- SCC at 2.5 percent discount = ($49.66) * (0.66 tons of GHG per truck) * (17,537 trucks per year)
- SCC at 2.5 percent discount = $575,000 per year

In addition to computing the social cost of carbon, an estimate of the human health impacts of air pollution is generated. These impacts manifest themselves through respiratory complications, premature mortality, cardiovascular illnesses, and other afflictions. Delucchi *et al.* (2010) estimated an air pollution health cost value of 1.55 cents per ton-mile (in 2006 dollars) for heavy-duty diesel vehicles using the Co-Benefits Risk Assessment Screening Model (COBRA).[93] COBRA is a screening and mapping tool developed by the EPA that estimates "the economic value of the health benefits associated with clean energy policies and programs to compare against program costs."[94] It estimates emissions of particulate matter, sulfur dioxide, nitrogen oxides, ammonia, and volatile organic compounds. As a result, this estimate calculated by Delucchi, *et al.* (2010) does not overlap with the public benefits accrual associated with carbon reduction. Using the CPI, the cost estimate is adjusted to 2018 dollars, resulting in a health cost of approximately 1.91 cents per ton-mile, or $0.019. For comparison, the human health cost associated with rail is $0.0043.

Human health benefit of reducing air pollution, heavy-duty diesel vehicles:

- Value of air pollution reduced = (Delucchi, *et al.*'s value of air pollution) * (Ton-miles driven per truck) * (Trucks removed from interstates per year)
- Value of air pollution reduced = ($0.019) * (3,816 ton-miles) * (17,537 trucks per year)

---

[93] Delucchi, M. and McCubbin, D. (2010). External Costs of Transport in the U.S. Davis, CA: University of California, Davis, Institute of Transportation Studies. Retrieved from: https://escholarship.org/uc/item/13n8v8gq.

[94] U.S. EPA. (May 2018). CO-Benefits Risk Assessment (COBRA) Health Impacts Screening and Mapping Tool. https://www.epa.gov/statelocalenergy/co-benefits-risk-assessment-cobra-health-impacts-screening-and-mapping-tool.

- Value of air pollution reduced = $1,272,000

Human health benefit of reducing air pollution, rail:

- Value of air pollution reduced = ($0.0043) * (3,816 ton-miles) * (17,537 trucks per year)
- Value of air pollution reduced = $288,000

The difference between the two values calculated above is $984,000. In other words, removing 17,537 trucks per year from Oregon interstates would yield an approximate human health benefit of $984,000 assuming no private passenger vehicles replace the space created by the absent trucks.

The FHWA similarly reports air pollution marginal cost per driving mile of $0.065 in Figure 44, though this value is more general, and it does not directly evaluate the impact on human health. It estimates the difference in air pollution concentrations between highway traffic and no highway traffic. The calculation below can be interpreted as a lower bound estimate of the public benefit of air pollution reduction as its value hinges on cents per mile and not cents per ton-mile as Delucchi, *et al.*'s does.

Benefit of reducing air pollution, FHWA air pollution estimate:

- Value of air pollution reduced = (FHWA's marginal cost of air pollution) * (Truck miles driven) * (Trucks removed from interstates per year)
- Value of air pollution reduced = ($0.065) * (144 miles) * (17,537 trucks per year)
- Value of air pollution reduced = $164,000

Congestion Reduction

Shifting intermodal containers from highways to railways affects highway congestion by reducing the number of eighteen wheelers on the road. This benefits other highway traffic, particularly passenger vehicles, motorcycles, and light-duty trucks. Since eighteen wheelers occupy more space than other types of highway traveling vehicles, the benefit of removing them from the road can either reduce congestion or allow additional vehicles to take their place.

Sulbaran and Sarder (2013) state, "… freight trains are capable of carrying loads equivalent of 280 trucks in a single haul making space for 1,000 or more passenger automobiles."[95] Reducing congestion produces benefits for every commuter on the road, by reducing the amount of time spent driving, allowing people to do other things. It also has the potential to make businesses more efficient, by reducing travel times for employees who drive on the job. A 2014 report on the economic impacts of congestion in Oregon found that businesses have already implemented strategies to avoid and mitigate current congestion issues, and expected increases in congestion

---

[95] Sulbaran, T. and Sarder, MD. (2013). *Logistical Impact of Intermodal Facilities*. 2013 ASEE Southeast Section Conference.

would impose direct costs, including reduced service levels (e.g., fewer deliveries per day), which would have an increasingly negative impact on Oregon's economy.[96]

A crucial dimension to consider in calculating the public benefit of congestion reduction is hyper-congestion, which can become acute on Portland's I-5 stretch during peak traffic flow periods. The Portland area has grown over recent years and highway congestion in the region has increased. These congestion impacts affect both shippers transiting through the region as well as local residents. As described in section 2.1 on page 5, the Portland region is considering implementing congestion tolling to alleviate these impacts. This type of tolling sets a price for limited highway resources, leading to a more efficient allocation by inducing lower-value users to substitute to other times or transportation modes. When congestion tolling revenues are spent by a public agency appropriately, congestion tolling is a net welfare maximizing policy. However, individual user welfare may increase or decrease depending on their respective profit or utility function. Regardless of the implementation of congestion tolling, the MVIC will give shippers the opportunity to either avoid regional congestion in Portland, or the avoid the tolls. From a public benefits perspective, any reduction in trucks traveling through the area has the potential to either reduce travel times or increase the number of cars that can take the place of trucks on the roads. The calculation below estimates benefits that largely accrue to the Portland area and is a direct function of the volume of trucks removed from I-5.

Additional concerns have been raised about non-traditional truck parking in the Portland area. In an attempt to avoid hyper-congested hours in the region, some trucks have been observed arriving outside the Port of Portland before they open and parking in non-traditional areas (e.g. neighborhood streets, school parking lots, and in commercial shopping centers). The trucking parking facilities at the MVIC are designed to alleviate these localized impacts. Due to incomplete information on the location of truck parking and no direct value of their localized impacts, this element of public benefits is only included qualitatively.

To calculate the value of potential highway congestion reduction, it is assumed that unloaded trucks departing from the Seattle area leave at a range of times early in the morning toward Millersburg, between the hours of 3:00 AM and 6:00 AM. Drivers spend about 2.75 hours on the road before broaching the Washington-Oregon border and thus arrive in Portland sometime between approximately 5:45 AM and 8:45 AM when congestion is rather dense. Using vehicular volume estimates of 5 axle trucks on I-5 in Portland, a weighted estimate of marginal cost per mile driven for these heavy-duty vehicles is generated. This value is added to the existing marginal cost estimates in Figure 43 and Figure 44 for the miles driven through Portland to Tigard (18 miles).

Figure 46 displays the marginal cost per mile driven by eighteen wheelers for distinct segments of I-5 by direction of travel. Across Portland to Tigard, the marginal cost is approximately $25.69 per truck moving in the southbound direction using the EPA value of $0.13 per mile from Figure 43 on page 74. Using the FHWA's value of $0.265 (Figure 44 on page 74) for the

---

[96] Economic Development Research Group, Inc. (2014). *Economic Impacts of Congestion in Oregon.* Final Report. February.

southbound leg of truck travel, the marginal cost is approximately $28.09, or $2.40 higher than the EPA-derived marginal cost. Once a truck moves beyond Tigard, the marginal cost of travel decreases as traffic tends to become less dense and thus imposes a smaller cost on drivers sharing the interstate. When the truck travels on its return trip from Millersburg up to Tigard, and then through Portland, the marginal cost of traveling through Portland is less as the trucks are passing through at a time preceding the rush-hour peak (between 8:15 AM and 11:15 AM).

Figure 46. Marginal Cost of Congestion, EPA and FHWA Values

Marginal Cost of Congestion, EPA Value	
Southbound: WA-OR Border through Tigard, per truck	$25.69
Southbound: Tigard to Millersburg, per truck	$7.05
Northbound: Millersburg to Tigard, per truck	$7.05
Northbound: Tigard though Portland, per truck	$14.57
MC of congestion, FHWA values	
Southbound: WA-OR Border through Tigard, per truck	$28.09
Southbound: Tigard to Millersburg, per truck	$14.36
Northbound: Millersburg to Tigard, per truck	$15.66
Northbound: Tigard though Portland, per truck	$17.40

Source: ECONorthwest, U.S. EPA, and U.S. FHWA.

A range of benefits earned from removing 17,537 eighteen wheelers from Oregon interstates using the marginal cost estimates is calculated in Figure 46. These amounts already encapsulate the mileage driven for each leg of the trip. Summing across each of the EPA- and FHWA-based values, the marginal cost of congestion is estimated to be $54.35 and $75.52 per truck, respectively.

Marginal cost of congestion, EPA value:

- Value of congestion removed = (Marginal cost of congestion per round trip) * (Trucks removed from interstates per year)
- Value of congestion removed = ($54.35 per round trip) * (17,537 trucks per year)
- Value of congestion removed = $953,000 per year

Marginal cost of congestion, FHWA value:

- Value of congestion removed = ($75.52 per round trip) * (17,537 trucks per year)
- Value of congestion removed = $1,324,000 per year

Thus, the estimate of the public benefit of congestion reduction via removing 17,537 trucks per year from Oregon interstates is about $953,000 to $1,324,000.

Reduced Highway Maintenance Costs

Freight rail advocates argue that increased rail freight movement significantly reduces highways infrastructure maintenance and expansion costs.[97] Trucks are substantially heavier

[97] Sulbaran and Sarder, 2013.

than private passenger vehicles. A GAO report states, "Although a five-axle tractor-trailer loaded to the current 80,000-pound Federal weight limit weighs about the same as 20 automobiles, the impact of the tractor-trailer is dramatically higher … a tractor-trailer has the same impact on an interstate highway as at least 9,600 automobiles… ."[98] The eighteen wheelers driving on Oregon interstates do not reach the maximum Federal weight limit, though, on their return trip, they come close (37 tons). Again referencing Figure 44 on page 74, the '60 kip 5-axle comb.' and '80 kip 5-axle comb' values are used to derive estimates for the roadway maintenance eighteen wheelers impose on Oregon interstates.

Marginal cost of highway road maintenance, trip to Millersburg:

- Value of highway maintenance = (Marginal cost of highway road maintenance, 60 kip 5-axle combination truck) * (Truck miles driven) * (Trucks removed from interstates per year)
- Value of highway maintenance = ($0.151) * (72 miles) * (17,537 trucks per year)
- Value of highway maintenance = $191,000 per year

Marginal cost of highway road maintenance, return trip to Port of Seattle:

- Value of highway maintenance = (Marginal cost of highway road maintenance, 80 kip 5-axle combination truck) * (Truck miles driven) * (Trucks removed from interstates per year)
- Value of highway maintenance = ($0.589) * (72 miles) * (17,537 trucks per year)
- Value of highway maintenance = $744,000 per year

Summing across each leg of the Oregon truck driver trip, the estimate of the public benefit of removing 17,537 eighteen wheelers from interstates annually is approximately $934,000. States and the Federal Government regularly conduct Highway Cost Allocation Studies to evaluate highway-related costs attributable to different vehicle classes and determine whether fees paid by different vehicles (e.g. through tolls, transit charges, or gasoline taxes) cover their highway cost responsibility[99]. A fully efficient fee structure where trucks are paying weight-mile fees, motor fuel excise taxes, and registration fees that properly account for their impact on the highway network would result in no external public costs. In order to accommodate the full range of potentially fee efficiency, the value above is used only in the "high" estimate, while a value of zero is used in the "low" estimate.

---

[98] Comptroller General's Report to Congress. *Excessive Truck Weight: An Expensive Burden We Can No Longer Support*. Washington, DC: U.S. Government Accountability Office. Retrieved from: http://archive.gao.gov/f0302/109884.pdf.

[99] The last Federal Highway Cost Allocation Study was conducted in 1997: https://www.fhwa.dot.gov/policy/hcas/final/toc.cfm.

8.2.3 Summary of Public Benefits

Diverting export containers from trucks to rail would help relieve a handful of public costs exerted on the environment, human health, highway maintenance, and congestion. The most substantial benefits to highway users manifest through congestion reduction, lower levels of particulate matter emission and thus a benefit on human health, and a reduction in highway road wear and tear. While the sum of all of these public benefits is not gargantuan, the reduction of eighteen wheelers is still noteworthy. Figure 47 summarizes the low and high estimates calculated for each public benefit category in order of appearance in this public benefits section.

Figure 47. Potential Annual Benefits, 2018 dollars

Category of Public Benefit	Low Estimate	High Estimate
Potential value of fatalities prevented	$330,000	$330,000
Potential value of highway accidents avoided	$43,000	$76,000
Social Cost of Carbon	$94,000	$575,000
Human Health	$1,272,000	$1,272,000
Air Pollution Reduction	$164,000	$164,000
Congestion Reduction	$953,000	$1,324,000
Reduced Highway Road Maintenance	$0	$934,000
Total	$2,856,000	$4,675,000

Figure 48 projects and sums the public benefits in Figure 47 over a twenty-year timeframe—from 2020 through 2040—at a 3 percent and 7 percent discount rate. This analysis timeframe and the chosen discount rates are consistent with federal guidelines for preparing economic analyses. The potential present value of public benefits over the next twenty years for the 'Low Estimate' is between $28 million (7 percent discount) and $41 million (3 percent discount). For the 'High Estimate', the benefits are estimated to be between $46 million to $68 million.

Figure 48. Potential Present Value Benefits over 2020 to 2040, 2018 dollars

Discount Rate	Low Estimate	High Estimate
3 percent	$41,252,000	$67,526,000
7 percent	$28,277,000	$46,287,000

9 Conclusions

The proposed Mid-Willamette Valley Intermodal Center can serve transportation needs in the region. Growing highway congestion and a strong reliance on international markets provide a sufficient case for expanding transportation options. The analysis contained in this report estimates that, once fully operational, the intermodal center will move approximately 17,537 loaded containers, generate approximately $1.2 million in net operating income, and prevent approximately 11,600 tons of greenhouse gas emissions per year.

Given the findings of financial feasibility and private benefits, it is worth considering the following fundamental economic questions:

1) Why hasn't the private market already provided this service?
2) Why should to State of Oregon intervene in this market?

To address the former, it is worth considering the transportation cost savings versus the capital construction costs. Over a 20 year time-frame, the private transportation cost savings are conservatively calculated in section 8.1 on page 66 to be between $21and $31 million in present value, while the total land acquisition and construction costs are estimated to be approximately $25 million. At the high end, a private investor has the potential to capture sufficient transportation cost savings to cover the cost of constructing the intermodal center. However, it is unlikely that the operator of the intermodal center would be able to capture all of these profits. Using projected net income calculated in Figure 33 and assuming these continue through 2040, the present value income ranges between $10.9 and $16.3 million. This income is insufficient to recoup the initial investment.

To address the latter question, the calculation of public benefits serves as a basis to evaluate the State of Oregon's return on investment. As calculated in section 8.2 on page 68, the public benefits range between $28and $68 million. These values are monetized estimates of social externalities that cannot be purchased on the private market. At the higher end, this intermodal center delivers public benefits to the State or Oregon at a level that produces a nearly 3-to-1 return on investment.

However, there remains a set of necessary conditions for the projections contained in this report to come true. In particular,

- **Cost** – the intermodal center must offer transportation options at or below the cost of utilizing trucks to ship containerized goods.
- **Reliability** – the intermodal center and rail line must provide a level of service that is consistent and predictable.
- **Timeliness** – containers passing through the intermodal center must reach their subsequent destination in a relatively competitive time window to alternative transportation modes.

- **Container Availability** – given relative scarcity of containers in the study area (and Pacific Northwest as a whole), empty containers will need to be shipped to the intermodal center.
- **Access to International Markets** – Producers in the region must be able to maintain consistent and unfettered access to international customers.

Should these conditions be met, the intermodal center is expected to operate in a self-sustaining manner, generate positive regional economic impacts, and serve as a good investment for the people of Oregon by conveying public benefits that exceed the public financial contributions.

Appendix: Geographic Comparative Analysis

Background

This appendix evaluates the set of economic conditions that vary along the Interstate 5 (I-5) corridor in the Mid-Willamette Valley which may affect the respective geographic market, market share, and public benefits if the proposed intermodal center were to be constructed in a different location than the proposed site in Millersburg, Oregon. Specifically, this analysis evaluates three alternative geographic locations in Oregon (South to North):

- Eugene: ~46 miles south of Millersburg,
- Lebanon: ~16 miles southeast of Millersburg, and
- Brooks: ~28 miles north of Millersburg.

This analysis evaluates the following elements:

- Anticipated market area within a one-day "turn" of each location,
- Share of the market likely to use the intermodal center,
- Relative change in user transportation cost savings of each location, and
- Relative change in public benefits of each location.

1.1 Anticipated Market Area

Utilization of an intermodal center in any location is a function of the demand for transportation services and the availability of substitutes. Currently, Willamette Valley shippers transport agricultural commodities by truck to either their final destination or to intermediate intermodal facilities in Portland. These shippers are spatially distributed throughout the valley, however, all products destined for ports in Seattle and Tacoma pass through Portland on trucks on I-5. Intermodal facilities in Portland are ideally located to serve as a feasible alternative for all containers heading north. The decision to stop in Portland and transfer to rail – as opposed to continuing by truck to the ports – is determined by the marginal cost to truck the container the remaining ~175 miles compared to the cost to transfer the container to rail in Portland, rail charges between Portland and Seattle, and the level of service of rail (e.g. timeliness and reliability).

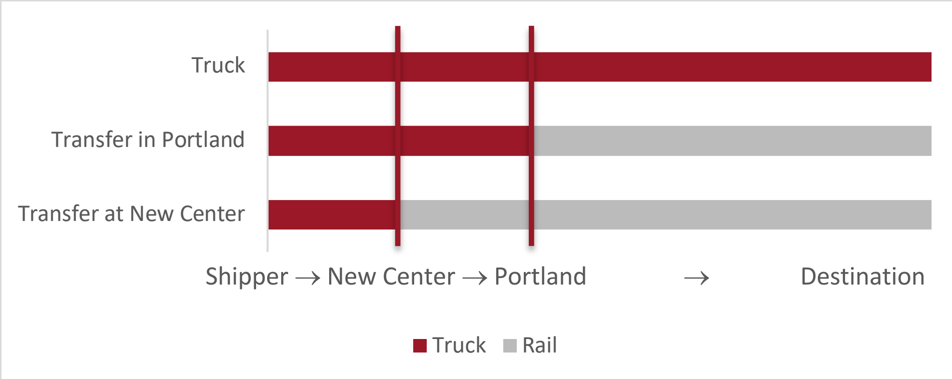
Figure 1 below shows the relative areas within a five-hour drive of each potential location. Locations further south (i.e. Eugene) slightly expand the market area further than Millersburg, while locations further north (i.e. Brooks) slightly reducing it.

Figure 1. Areas within a 5-hour Drive of Each Potential Location

Source: ECONorthwest

Construction of an additional intermodal center south of Portland introduces a new mode alternative but does not fundamentally change the preference structure for shippers. That is, shippers will continue to make decisions based upon the optimal mix of price and quality of service. The new set of transportation options for all shippers located south of the proposed intermodal center is described in Figure 2 below.

Figure 2. Transportation Alternatives - Shippers South of New Intermodal Center



Source: ECONorthwest

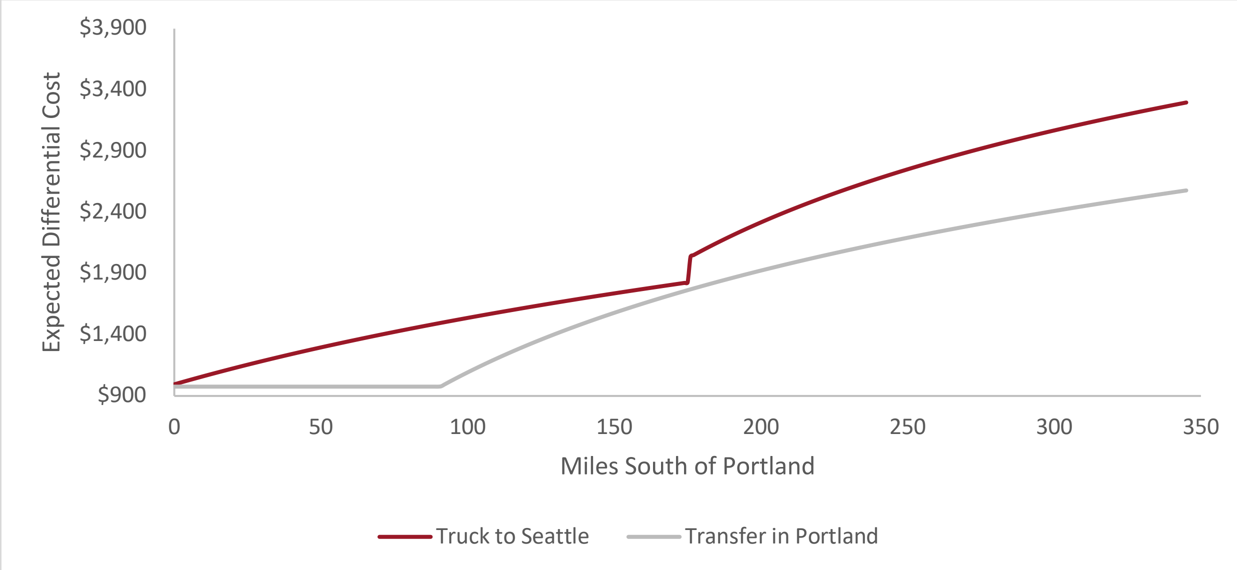
In the demand analysis in the main report, the quality of service is captured in the mode choice model, but does not have spatial resolution to predict utilization at specific sites in the Mid-Willamette Valley. The expected price, on the other hand, can be calculated using the expected cost functions of all transportation options, which vary based on location. As described in the main report, shippers face several cost components for every transportation alternative including loading, transit, handling, and unloading charges. When comparing transportation modes, all costs that are constant regardless of mode choice can be excluded from analysis. Only the differential charges between modes determine the lowest cost alternative.

As noted in the main report, the differential price for trucking is calculated by fitting a regression model to a sample of 683 drayage rates from Oregon to Seattle/Tacoma ports from May 2014 to June 2018, obtained from The Drayage Directory.[1] The differential price for rail is generated from two costs: the expected rail transit charges, estimated from the most recent complete version (2016) of the Surface Transportation Board Carload Waybill Sample[2], plus the projected intermodal center charges identified in the Capital and Operating Cost analysis in the main report. The expected differential prices of all alternatives are calculated for a hypothetical shipper located along the I-5 corridor south of Portland. The expected values for existing transportation alternatives (e.g. truck all the way to Seattle or transfer at a Portland intermodal center) are described in Figure 3 below. For simplicity, destinations other than the ports of Seattle and Tacoma are excluded from this analysis.

[1] "A Directory of Intermodal & Import / Export Trucking Companies." *The Drayage Directory - Intermodal Ocean Container Trucking*. Retrieved July 26, 2018, from www.drayage.com/.

[2] Surface Transportation Board. "Carload Waybill Sample." *Industry Data: Economic Data: Waybill.* Retrieved July 26, 2018, from https://www.stb.gov/stb/industry/econ_waybill.html

Figure 3. Expected Differential Prices of Existing Transportation Options for a Hypothetical Shipper



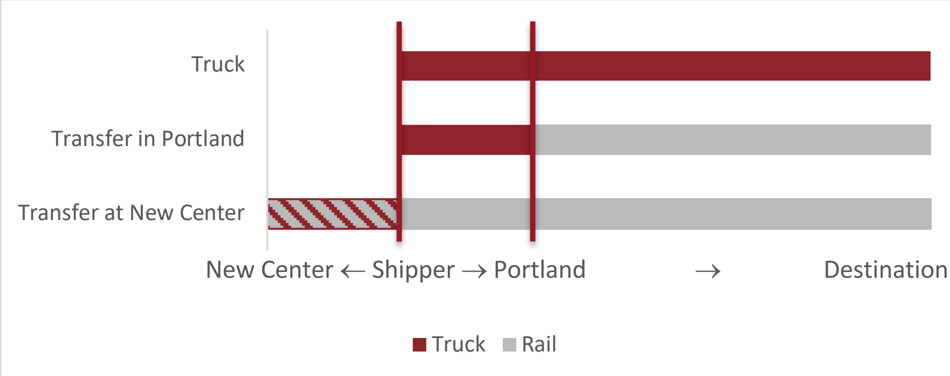
Source: ECONorthwest

The trucking cost function exhibits both fixed and variable cost components, with decreasing marginal per-mile costs with distance. Additionally, the data indicate that there is a minimum drayage rate for any distance before the per-mile costs begin affecting the total price. This causes a non-linear kink for trucking distances under approximately 90 miles. Shippers with their own trucking resources may be able to achieve lower per-mile costs than the drayage rates observed on the open market. There is an additional non-linear kink that distinguishes a one-day versus multiple-day transit since additional costs are incurred when a driver spends a night away from home. This occurs at approximately the 350-mile point. Including the distance to Seattle, this occurs approximately 175 miles south of Portland, and can be seen in Figure 3 above. As a result of this expected cost structure, intermodal transfers in Portland are price-competitive with trucking the entire distance to Seattle from all likely locations in the Willamette Valley.

Thus, the transportation costs of using any new intermodal center south of Portland should be compared to the cost of transferring at existing facilities in Portland. As in the example above, all shippers located south of Portland and the new intermodal center incur costs to a) truck to the intermodal center, b) transfer to rail, and c) transit on rail for the remaining distance.

However, a subset of shippers located south of Portland but north of the new intermodal center must decide to either truck south to the new intermodal center or truck north directly to Portland. Transportation options for these shippers are displayed in Figure 4 below.

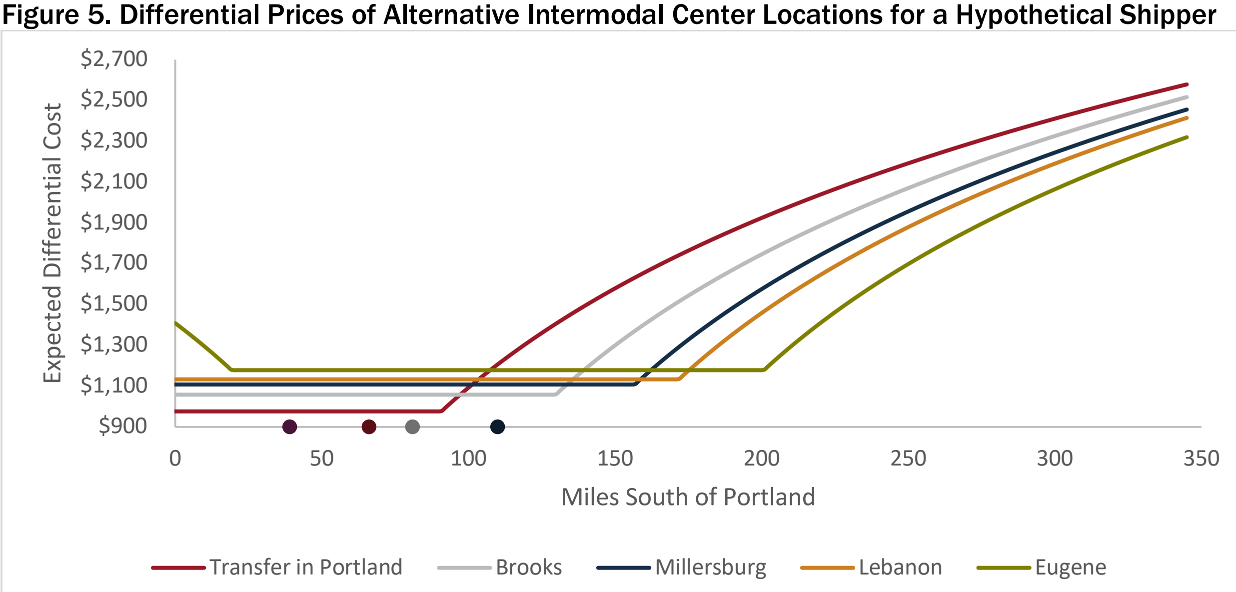
Figure 4. Transportation Alternatives - Shippers South Portland and North of New Intermodal Center



Source: ECONorthwest

Comparison of expected differential prices for shippers is performed using the same cost functions described above for possible facilities located in either Brooks, Millersburg, Lebanon, or Eugene, Oregon. These cost functions are displayed in Figure 5 below. The dots identify the location of each potential intermodal center.

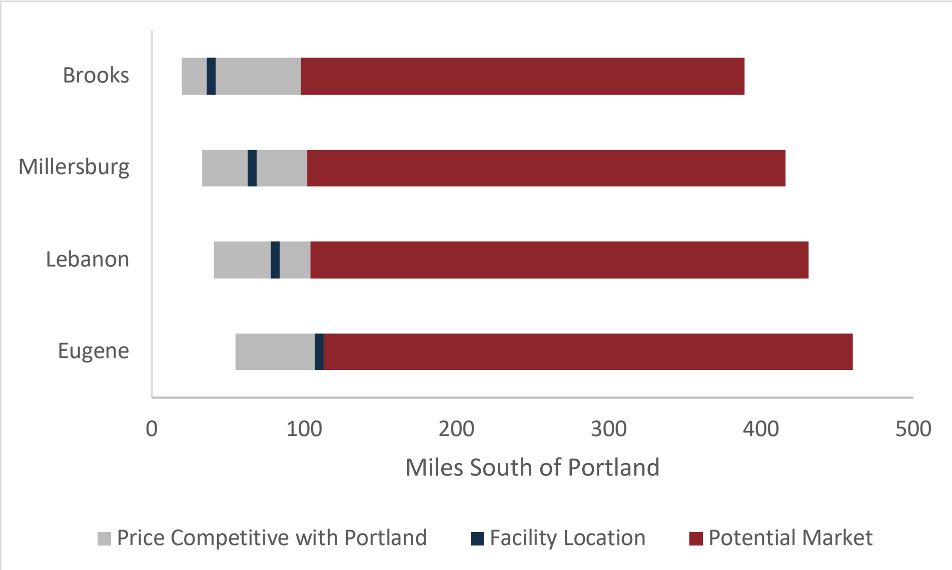
Figure 5. Differential Prices of Alternative Intermodal Center Locations for a Hypothetical Shipper



Source: ECONorthwest

Using the expected cost functions and a set of general assumptions, an approximation can be made of the market area (by the distance from Seattle) for each location. The specific assumptions are: 1) Only one new intermodal center will be constructed, 2) intermodal center access costs are equal across all potential locations, 3) railcar and container availability is equal across all potential locations, and 4) shippers located between the potential location and Portland chose either intermodal center with equal probability unless a clear price differential exists. This results in three choices displayed in Figure 6 below. One is the market area that is most likely to use existing facilities in Portland. Second is the market area that is closer to the potential location, however, Portland remains a price-competitive alternative. The third is the potential market area within a one-day drive that observes lower costs through the new intermodal center.

Figure 6. Market Areas by Distance



Source: ECONorthwest

A clear tradeoff exists between locations. Potential locations further north capture a greater portion of the market in the northern Willamette Valley, however, they also compete with existing intermodal facilities in Portland. Potential locations further south capture a greater portion of the rural southern and eastern market within a one-day drive of the intermodal center, however fewer trucks from northern portions of the Willamette Valley will ship south to the intermodal center and be diverted from roadways in Portland.

1.2 Relative Anticipated Market Share

Using the distance bands identified by the process above with the estimate of containers transiting through the Millersburg location as a baseline, a rough approximation can be made of the volume of containers passing through each intermodal center and thus diverted from roadways in Portland. Additionally, the volume of likely products in each distance band will also determine the number of containers. As described in the full report, the major products likely to pass through an intermodal center in the valley destined for international export are low-value, high volume products such as hay and straw while the largest domestic product share is expected to be grass seed. The approximate distance bands overlaid with county-level production estimates of hay and grass seed can serve as a proxy and benchmark for the volume of containers expected to pass through each potential location. Figure 7 shows the total and share of hay and grass seed produced by each county in the expanded study area, which also includes Yamhill and Clackamas counties.

Figure 7. Hay and Grass seed Production Accessible to Each Potential Location

Potential Location	County	Hay (tons), 2012	% of total	Grass seed (tons), 2012	% of total
Brooks	YAMHILL	39,434	6%	23,029	8%
	CLACKAMAS	32,414	5%	3,300	1%
Brooks & Millersburg	MARION	37,855	6%	54,403	19%
	POLK	23,425	4%	33,770	12%
	BENTON	16,390	3%	30,197	11%
	LINN	38,746	6%	109,426	38%
Brooks, Millersburg, Lebanon, & Eugene	LANE	49,797	8%	31,519	11%
	DOUGLAS	54,623	9%	646	0%
	COOS	15,773	2%		0%
	CURRY	3,193	1%		0%
	JOSEPHINE	7,194	1%		0%
	JACKSON	38,251	6%	1	0%
	KLAMATH	277,715	44%		0%

Source: ECONorthwest analysis of 2012 U.S. Census of Agriculture

Each of the production estimates for hay and grass seed is assigned to respective facilities to represent the universe of goods likely to use the intermodal center. The baseline estimate for Millersburg includes all counties from Marion through Klamath but excludes Yamhill and Clackamas counties, as these latter two counties are further north and shippers may be more likely to use existing facilities in Portland as opposed to trucking south. The Brooks estimate includes all counties, adding Yamhill and Clackamas. Although much of these area in these two counties is still north of the potential facility location in Brooks, their closer proximity makes it a more feasible alternative. Shippers in Yamhill and Clackamas counties may opt to turn south to the Brooks location as opposed to shipping to Portland but are less likely to do so for the Millersburg location. The Eugene and Lebanon locations only include Lane through Klamath counties, as shipper further north are outside the likely market geography for these two sites.

Figure 8. Projected Container Volume by Location

	Export		Domestic		Total	
	Change	Containers	Change	Containers	Change	Containers
Brooks	11%	14,545	9%	4,881	11%	19,426
Millersburg	0%	13,066	0%	4,470	0%	17,537
Lebanon	-18%	10,670	-80%	913	-34%	11,583
Eugene	-18%	10,670	-80%	913	-34%	11,583

Source: ECONorthwest

By applying level adjustments to the mode choice model estimated for the Millersburg intermodal center in the main report, the broad set of shipping decisions including price, timeliness, and reliability are already captured. These adjustments only reflect differences in the extent of the market due to the respective location. By being able to capture additional volume originating in Yamhill and Clackamas counties, the Brooks location may observe an 11% higher volume of containers. Since this new area overlaps with the region that is already price competitive with existing facilities in Portland, any increase is likely to be diverted from existing intermodal transfers in Portland. The Lebanon and Eugene locations may observe 34% lower volumes due to their inability to capture products originating further north.

1.3 Relative Transportation Cost Savings

Using the same frameworks as the main report, relative changes in transportation cost savings are calculated in the following sections.

1.3.1 Private Benefits

As in the main analysis, the volume of exported and domestic containers will replace either the trucking of loaded containers all the way to ports in Seattle and Tacoma or trucking loaded containers to an intermodal center in Portland. As in the main analysis, there may be cost savings incurred by transporting containers by rail from a proposed intermodal center to the Seattle/Tacoma area as opposed to trucking the entire way. However, to generate conservative estimates of benefits, only truck transportation cost savings from each location to Portland are included. Since options to ship via rail from Portland to Seattle/Tacoma already exist and the price implications of additional competition from the proposed facility are uncertain, savings on this stretch are excluded from the calculation.

Truck transportation cost savings are reduced by the additional rail transit costs to cover the distance from the intermodal center to Portland. Both elements are calculated using the truck and round-trip marginal rail cost structures used above. Intermodal center charges are likely to be roughly equivalent at all facilities and are excluded from the estimate of private transportation cost savings. Additionally, any rail savings costs from Portland to Seattle are likely to be equivalent across all locations and are also excluded. The resulting calculation is as follows:

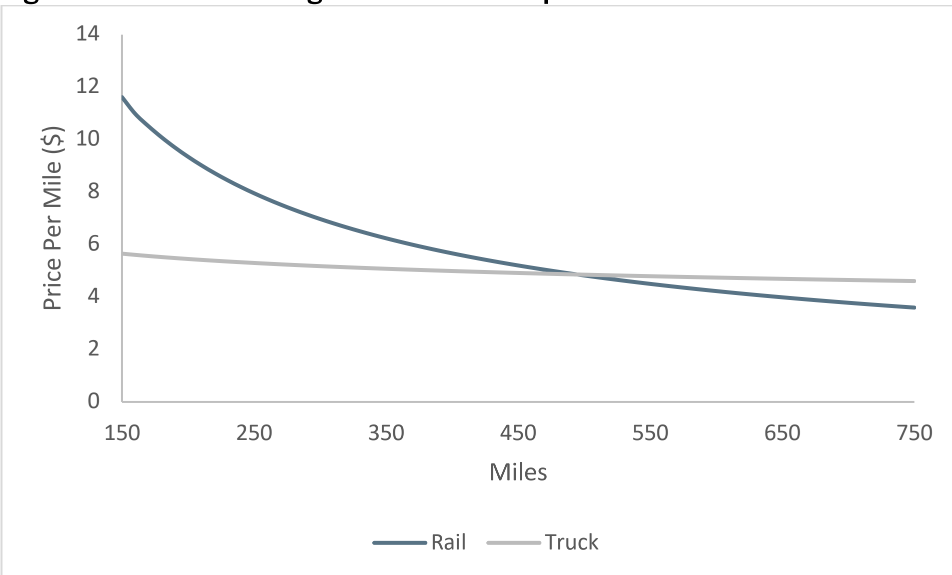
Potential value of private transportation cost savings:

*Private Transportation Cost Savings = (Marginal cost to ship to Portland by Truck – Marginal cost to ship to Portland by Rail) * (Distance) * (Containers)*

Both the trucking and rail marginal cost functions are observed to decrease over distance, however, as shown in Figure 9[3] average trucking costs per mile are relatively constant over short distances.

[3] Figure repeated from the main report

Figure 9. Modeled Average Container Transportation Cost Structure



Source: ECONorthwest

Thus, the marginal rail cost per mile (calculated based on the entire distance to Seattle/Tacoma) decreases over the respective site locations, while trucking costs do not. Calculations for each location are shown in Figure 10 below. Annual savings estimates are rounded to the nearest thousand.

Figure 10. Projected Annual Private Transportation Cost Savings

Location	Trucking Cost, Per Mile	Rail Cost, Per Mile	Distance	Containers	Annual Savings
Brooks	$5.65	$4.62	39	19,426	$780,000
Millersburg	$5.65	$3.79	65	17,537	$2,120,000
Lebanon	$5.65	$3.33	81	11,583	$2,177,000
Eugene	$5.65	$2.74	110	11,583	$3,708,000

Source: ECONorthwest

When evaluated over a twenty-year timeframe—from 2020 to 2040—at a 3% and 7% discount rate, these savings amount to the values by location listed in Figure 11. These transportation cost savings are likely to be gained in the private market by the growers, shippers, the intermodal center operator, or the rail operator.

Figure 11. Cumulative Private Transportation Cost Savings, 2020-2040

Location	7% discount rate	3% discount rate
Brooks	$7,738,000	$11,289,000
Millersburg	$21,032,000	$30,682,000
Lebanon	$21,597,000	$31,506,000
Eugene	$36,786,000	$53,665,000

Source: ECONorthwest

Transportation cost savings are driven by switching containers from truck to rail over the distance from the intermodal center to Portland. Any trucking costs from the shipper to the intermodal center, charges to transfer containers at the intermodal center, and costs to ship from Portland to Seattle/Tacoma by rail are relatively constant across all alternative locations and are this excluded from the calculation for transportation cost savings. Due to the varying distances of truck travel along I-5 from each location to Portland, an intermodal center in Eugene would generate the largest private transportation cost savings. The Millersburg and Lebanon locations generate roughly equivalent savings, while the Brooks location would generate the least.

1.3.2 Public Benefits

As described in the main report, public benefits accrue from reduced pollution, congestion, highway wear and tear, and fewer accidents. The categories calculated include: 1) Highway Safety, 2) Air Pollution and Greenhouse Gas Reduction, 3) Reduced Highway Maintenance Costs, and 4) Congestion Reduction. The first three categories accrue based on the total highway miles driven, while congestion reduction occurs primarily in the Portland metro area and is mostly independent of the miles of highway driven outside of this region. Thus, to calculate a relative change in public benefits across locations, some estimates are scaled by both projected volume and miles driven, while congestion is scaled only by volume. Figure 12 lists the estimated public benefits for the Millersburg location from the main report.

Figure 12. Annual Public Benefits, Millersburg Intermodal Center

Category of Public Benefit	Low Estimate	High Estimate
Potential value of fatalities prevented	$330,000	$330,000
Potential value of highway accidents avoided	$43,000	$76,000
Social Cost of Carbon	$94,000	$575,000
Human Health	$1,272,000	$1,272,000
Air Pollution Reduction	$164,000	$164,000
Congestion Reduction	$953,000	$1,324,000
Reduced Highway Road Maintenance	$0	$934,000
Total	$2,856,000	$4,675,000

Source: ECONorthwest

Figure 13 lists the adjustment factors relative to Millersburg, for each location. The congestion adjustment reflects the change in volume, while the distance & volume adjustment is the product of distance and volume.

Figure 13. Public Benefit Adjustment Factors by Location and Category

Location	Distance	Containers	Congestion Adjustment	Distance & Volume Adjustment
Brooks	39	19,426	11%	-34%
Millersburg	65	17,537	0%	0%
Lebanon	81	11,583	-34%	-18%
Eugene	110	11,583	-34%	12%

Source: ECONorthwest

Applying these adjustment factors to the categories of public benefits calculated for the Millersburg intermodal center baseline produces the following estimates for each location, displayed in Figure 14 below. Values are rounded to the nearest thousand.

Figure 14. Potential Public Benefits, by Location

	Brooks	Millersburg	Lebanon	Eugene
Congestion Benefits				
Low Estimate	$ 1,056,000	$ 953,000	$ 629,000	$ 629,000
High Estimate	$ 1,467,000	$ 1,324,000	$ 875,000	$ 875,000
Safety, Emissions, and Maintenance Benefits				
Low Estimate	$ 1,265,000	$ 1,903,000	$ 1,566,000	$2,127,000
High Estimate	$ 2,227,000	$ 3,351,000	$ 2,758,000	$3,746,000
Annual Total				
Low Estimate	$ 2,320,000	$ 2,856,000	$ 2,196,000	$2,757,000
High Estimate	$ 3,694,000	$ 4,675,000	$ 3,633,000	$4,620,000

Source: ECONorthwest

When evaluated over a twenty-year timeframe – from 2020 to 2040 – at a 3% and 7% discount rate, these savings amount to the values by location listed in Figure 15 below.

Figure 15. Cumulative Public Benefits, 2020-2040

	Low Estimate		High Estimate	
	7% discount rate	3% discount rate	7% discount rate	3% discount rate
Brooks	$ 22,970,000	$ 33,510,000	$ 36,574,000	$ 53,357,000
Millersburg	$ 28,277,000	$ 41,252,000	$ 46,287,000	$ 67,526,000
Lebanon	$ 21,742,000	$ 31,719,000	$ 35,970,000	$ 52,476,000
Eugene	$ 27,297,000	$ 39,823,000	$ 45,742,000	$ 66,732,000

Source: ECONorthwest

Public benefits accrue based on the volume of trucks removed from highways in the Portland area (i.e. congestion benefits) plus the per-mile benefits of removing trucks from highways throughout the State of Oregon (i.e. safety, emissions, and maintenance benefits). Locations that have higher utilization generate greater congestion benefits, while locations further south generate large per-truck safety, emissions, and maintenance benefits. When combining all of these elements the Millersburg location generates the largest public benefits, followed by Eugene, Brooks, and Lebanon. Millersburg and Eugene are the only locations that generate a greater than one-to-one return on investment for the State of Oregon at the cumulative low estimate calculated at a 7% discount rate. On average, the Millersburg location generates 2% greater public benefits than Eugene, 25% more than Brooks, and 29% more than Lebanon.

1.4 Conclusion

The optimal location for a publicly funded intermodal center is a function of feasibility by volume, private transportation cost savings, and public benefits. These various factors should be weighted differently depending on the goals of the State of Oregon. If the primary goal is to maximize volume, then the northernmost location in Brooks would accomplish this goal, with an expected volume 11% higher than the next location south in Millersburg. However, while a location in Brooks may maximize volume, it would deliver the fewest private transportation cost savings due to the shorter distance that trucks are removed from Oregon highways. The estimates of private transportation cost savings at Brooks are 63% lower than Millersburg and 79% lower than Eugene. If the State's goal is to maximize public benefits to residents through reduced pollution, highway wear and tear, and fewer accidents, then the optimal location would be Millersburg, followed closely by Eugene. The estimates can be spatially delineated as well. Benefits to the Portland area in terms of reduced congestion are maximized at the Brooks location, while benefits to the remainder of the state are maximized in Eugene, with values nearly twice as large.

Figure 16. Respective Ranking of Potential Locations

Ranking	Container Volume	Relative Share	Private Transportation Cost Savings	Relative Share	Public Benefits	Relative Share
1	Brooks	100%	Eugene	100%	**Millersburg**	100%
2	**Millersburg**	90%	Lebanon	59%	Eugene	98%
3	Lebanon	60%	**Millersburg**	57%	Lebanon	80%
4	Eugene	60%	Brooks	21%	Brooks	77%

Source: ECONorthwest

Ultimately, the priorities of the State must be considered when determining where the intermodal center should be built. The Millersburg location captures a sizeable share of the market, removes a large number of trucks from roadways in the state, generates generous private transportation cost savings, and maximizes public benefits.