The Economic Costs of the 2014-2015 West Coast Port Slowdown on Washington State

Prepared for

Washington Council on International Trade

Prepared by:

community attributes inc

Executive Summary

Background and Purpose

The Washington Council on International Trade (WCIT) requested an analysis of the economic impacts and costs of the recent West Coast ports slowdown on Washington state businesses. This report provides an assessment of those costs, both in total and by select industries and scenarios. Analysis draws from a variety of data sources and methodologies, including waterborne containerized exports and imports data, statistical modeling, news sources, and interviews with local businesses, ports, and industry and commodity associations.

Quantifying Impacts

Based on analytic modeling, the reduction in cargo handling productivity between October 2014 and March 2015 resulted in total near-term losses of $769.5 million to Washington businesses. This value represents the sum of net delinquent shipments and additional costs, specifically warehousing and truck idling fees.

An estimated **$555.8 million** in exports were not shipped via waterborne containers during the period of the port delays. Some of these exports were shipped via other modes, notably airfreight. Washington businesses increased their shipments of exports by airfreight by an estimated **$152.6 million** during the slowdown, and at more expensive fees (upwards of ten times waterborne shipping costs). This resulted in a net loss by value of export shipments (the value of goods not exported during the slowdown period) of **$403.2 million**.

Delayed or delinquent delivery of imported goods through Washington ports destined for Washington businesses summed to an estimated **$345.1 million**. Impacted businesses included retailers, through reduction in inventory, and manufacturers (delayed delivery of components), among other industries.

Shippers incurred additional costs, including demurrage fees (i.e., warehousing and storage costs for containers due to delays charged by the terminal operator), which summed to an estimated $7.0 million, and truck idling costs of $14.2 million. **Exhibit E-1** summarizes these estimates.

It is important to emphasize, the above findings represent only the short-term costs Washington businesses incurred due to the delays. Future costs, such as damaged client relations resulting in the loss of business or sole source contracts, can have long-lasting impacts on Washington businesses. While these impacts are not quantified in this report, they are real and potentially much greater than the near-term costs presented above. Stakeholder feedback was solicited to help understand these impacts.

Exhibit E-1. Port Delay Costs Accounting

Type of Costs (Millions $)	Expected	Actual	Net Losses
(A) Shipping Losses			
Waterborne Containerized Exports	$ 3,934.3	$ 3,378.5	-$555.80
Airfreight Mitigation			$152.60
Total Unshipped Exports			-$403.20
Waterborne Containerized Imports	$ 7,876.1	$ 7,530.9	-$345.10
Total Containerized Shipping Losses			*-$748.30*
(B) Additional Costs			
Trucking Idling Costs			-$14.20
Demmurage Port Fee of $700,000 per terminal*			-$7.00
Total Additional Losses			*-$21.20*
Total Losses (A + B)			**-$769.50**

**Refers to fees paid for storage of containers at a terminal.*
Note: actual totals for export shipments include goods normally shipped via waterborne mode but were shipped by airfreight during the slowdown period.
Sources: U.S. Census Bureau, 2015; Community Attributes Inc., 2015.

Stakeholder Feedback and Long-Term Impacts

The following sections reflect feedback from industry stakeholders, including shippers, manufacturers, and retailers.

Lost Sales Due to Seasonal Nature of Imports and Exports

Imported retail goods, such as clothing and apparel, arrived after the peak consumer period for these items. As a result, retailers were forced to clear late and extended inventory at discounted prices. Exporters absorbed both the costs of warehousing during the delays and in many cases the eventual delinquent delivery of a seasonal product. In many of these cases, the exporter assumed the added warehousing and related fees in order to preserve client relations.

Bulk Shipper Impacts

Bulk shippers were impacted indirectly through congested shipping lanes and delayed embarkment of vessels that carried bulk and containerized loads. Moreover, many bulk exporters, including farming households that rotate crops (e.g., moving from wheat to lentils or peas, the latter two reliant on containerized modes of shipment), also export containerized commodities. These households, as price-takers, have no means of passing these costs further down the supply chain, further straining a relatively low margin and volatile industry.

Storage Costs While Awaiting Export

Shippers are required to pay warehousing fees while containers remain idle at the terminals. For instance, one company alone reported paying $6,000 in additional fees for the dockside storage of delayed outbound containers. Fresh produce such as apples require refrigeration in order to prevent spoilage, resulting in added costs.

Loss of Future Market Share Overseas

Some interviewees indicated the delays forced overseas customers to contract with competitor suppliers for needed products. In some cases, what was previously a sole source contract became at risk of becoming a competitive bid, or a foregone market.

Exhibit E-2 illustrates the full costs Washington state businesses incurred due to the port slowdown:

Exhibit E-2. Possible Incurred Costs by Industry and Trade

Industries	Exporters (Costs affecting exporters)	Importers (Costs affecting importers)	Notes
Agriculture and Food Processing	Lost sales overseas through non-delivery and foreign firms switching providers; introduction of competitors overseas. Lost product through spoilage. Lost market share to foreign providers (especially in terms of animal feed). Added costs to perform same sales.	A shortfall in specialized high nutrient animal feed.	Some note added costs from paying trucks to wait in lines for cargo space. Many note per diem costs associated with keeping containers in the port waiting for available cargo ships. Providers of more perishable goods sent more product to domestic food processors. Purchasing of less cropsover the next year (particularly amongst firms that have less perishable goods).
Retail	Costs associated with excess stockpiling of product. Lost revenue associated with missing key sales periods (holiday sales/seasonal items)	Costs associated with using air freight (8-10 times more expensive) Lost revenue associated with missing key seasonal items on store shelves.	Many large firms tried to mitigate losses by importing more product before the port delays occurred.
Logistics and Transportation	Congestion became so acute port stopped accepting containers. Lost customers from port delays (Gulf of Mexico ports, Canada). Trucks idled in long container drop-off lines or were turned away, causing profit loss.	Lost customers from port delays (Gulf of Mexico ports, Canada).	Some industries/firms were affected disproportionally because of existing relationships and pre-clearance.
Manufacturing	Lost sales through slow delivery of product; introduction of competitors overseas.	Slower production process due to lack of necessary inputs.	Some manufacturers helped their suppliers import through different and more expensive transportation methods (airfreight).

Source: Community Attributes Inc., 2015.

Introduction

Background and Purpose

Over the late fall and winter of 2014-2015, the International Longshoremen Workers Union and the Pacific Maritime Association were engaged in a lengthy contract dispute. During these negotiations, container handling productivity across West Coast ports slowed significantly, created long delays for containerized exports and imports.

Trade is an integral part of the Washington economy. The port slowdown affected many local businesses that rely on waterborne containerized trade, including those that export to overseas clients and others that import items for manufacturing companies and inventory.

The Washington Council on International Trade requested Community Attributes Inc. to assess the near- and long-term impacts of the West Coast ports slowdown on Washington state businesses.

Port Delays of 2014-2015

The International Longshore and Warehouse Union (ILWU) and the Pacific Maritime Association (PMA) began renegotiations in May 2014 on a labor contract set to expire in July 2014 that affected 13,600 workers at 29 West Coast ports.[1] Key issues in these discussions were dockworker wages, benefits, and pension packages as well as delineations of responsibility for maintaining the chassis, the specialized trailers used for transporting ocean containers on land.[2]

[1] Hornick, Mike. "Port delays 'hamstring' Washington potato, apple exports." The Packer. November 6, 2014. http://www.thepacker.com/fruit-vegetable-news/Port-delays-hamstring-Washington-potato-apple-exports-281799461.html

[2] Kapner, Suzanne and Stevens, Laura. "Port Delays Leave Retail Goods Stuck in Transit." The Wall Street Journal. December 18, 2014. http://www.wsj.com/articles/port-delays-leave-retail-goods-stuck-in-transit-1418866644

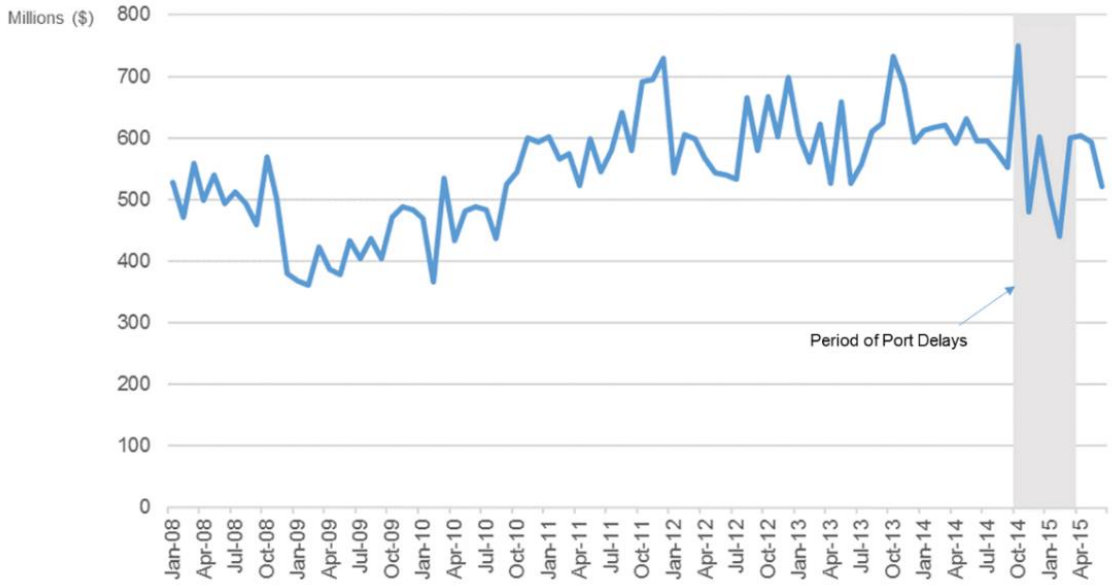
Historically, the shipping companies have supplied chassis, but recently have begun to outsource this component to third party syndicates. A substantial number of longshoremen and women are mechanics, and would have potentially lost their jobs if chassis maintenance was also subcontracted.[3]

As the negotiations continued into October 2014, the ports became increasingly more congested. Delays in Washington were first tangible at the Port of Tacoma, and then spread to the Port of Seattle. These two ports combined handle about 16% of containerized cargo on the West Coast and typically process between 25 and 35 containers per hour.

When the congestion was most severe, during the period of November 2014 through March 2015, productivity declined to 10-18 containers per hour.[4] The ILWU and PMA reached a contract agreement in late February 2015, and ports were able to resume full operation, but the slowdown caused exporters to miss crucial demand periods, and some sectors are still recovering.

Containerized exports from Washington dropped sharply in one month, falling from $749 million in October 2014 to $479 million in November 2014. The delays became worse over time, with a low of $440 million in exports by value in February 2015, the lowest monthly export total since August 2010 (**Exhibit 1**).

Exhibit 1. Waterborne Containerized Exports from Washington, 2008-2015, Monthly



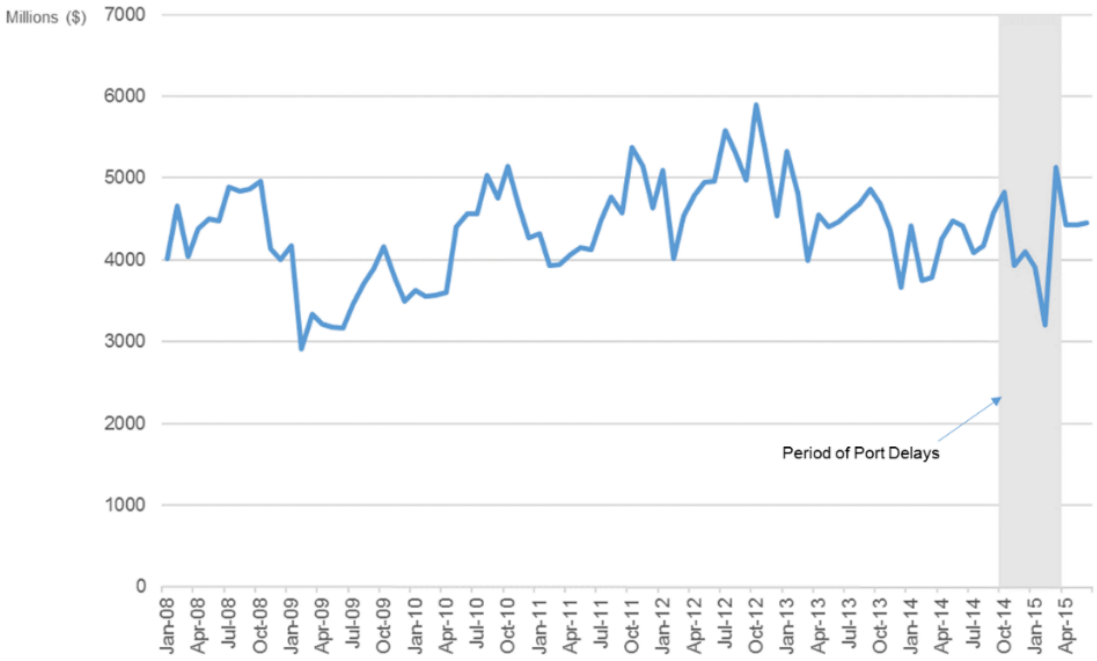
Sources: U.S. Census Bureau, 2015; Community Attributes Inc., 2015.

[3] Makings, Emily. "Congestion hurts port competitiveness." Washington Research Council. January 30, 2015. http://researchcouncil.org/2015/01/30/congestion-hurts-port-competitiveness/

[4] Garnick, Coral. "Port slowdown continues, threatening ag products." November 7, 2014. http://www.seattletimes.com/business/port-slowdown-continues-threatening-ag-products/

Similar declines occurred in containerized imports coming to Washington. From October 2014 to November 2014, containerized imports fell from $4.8 billion to $3.9 billion. Congruent with containerized exports, February 2015 was the worst month for containerized imports, falling to a low of $3.2 billion, the lowest monthly import total since June 2009 (**Exhibit 2**).

Exhibit 2. Waterborne Containerized Imports through Washington Ports, 2008-2015, Monthly



Sources: U.S. Census Bureau, 2015; Community Attributes Inc., 2015.

Costs of the Port Delays

The quantitative costs of the recent slowdown in Washington were calculated based the following impacts: 1) Washington waterborne containerized exports that were shipped; 2) waterborne containerized imports destined for Washington businesses that were not received; 3) fees associated with idle containers at the ports, borne by shippers; and 4) truck idling costs while in queue.

Costs of Delays or Non-Shipment of Containerized Exports

Losses from non-shipment of exports reflect immediate, near-term losses; in some cases, the product intended for export may have either been sold domestically (at a loss, but with some cost recovery) or sold after the end of the slowdown. Estimates presented below therefore represent the immediate loss, and do not include mitigating strategies to offset these losses.

A counter-factual statistical model was used to estimate export losses.[5] A counter-factual approach projects what would have occurred under normal conditions, and compares those projections to what actually happened during the study period. In the case of exports, the counter-factual is the projected amount of Washington exports that would have been shipped if there was no slowdown.

A projection of waterborne containerized exports from Washington over the slowdown period—based on historic and seasonal trends by product type—was compared against actual export flows during this period. The difference between the model estimate and the actual value of goods exported during this time shows the value of goods that were not shipped.

Under normal conditions, expected containerized exports from Washington would have totaled approximately $3.9 billion over the five-month period of the port delays. However, across the same period less than $3.4 billion was exported, representing a shortfall of 14.1% or $**555.8 million**.

COMPANY SPOTLIGHT

ANDERSON HAY

Anderson Hay is one of the largest animal feed exporters on the West Coast. Based out of Ellensburg, Washington, the company employs close to 400 employees across its facilities in Ellensburg, Portland, and Long Beach. The vast majority of their product is exported and requires delivery in a timely manner to support the needs of the company's overseas livestock customers. Due to their dependency on ports and trade logistics to move product, Anderson Hay acutely felt the impacts of the port delays and had to search for cost mitigation strategies such as selling to different markets.

The port delays helped to reduce Anderson Hay's exports by 20% during the slowdown period. The loss of export share had a compounding effect for Anderson Hay because many of its overseas customers were forced to source their animal feeds from other suppliers. During the period of the port delays, Anderson Hay also had to cut back hours for their employees, resulting in some employees leaving for other work due to the loss in income (costing the company time and money later re-filling these positions).

Furthermore, the cost of simply transporting hay to the port became costlier due to the traffic congestion around the port. Oftentimes trucks were not able to reach the terminal gates, causing the company to incur idling costs. These costs were further compounded due to added bank transaction fees and lot fees due to delayed cargo marooned at the port.

Anderson Hay expects to experience the effects of the port delays into the foreseeable future. The delays created excess supply, pushing down the price of animal feed in the near term; and many farmers, in response to lower prices, switched to other, more valuable crops, disrupting supply sources for the company.

Another potential long term concern is the perceived lack of reliability in timely shipping amongst Anderson Hay's overseas customers. If Anderson Hay's customers feel that they cannot receive animal feed in a timely manner, they are likely to switch to animal feed suppliers in Australia or Canada.

In terms of containerized imports, nearly $7.9 billion[6] was expected to be imported based this counter-factual approach, compared with actual imports of slightly more than $7.5 billion—an estimated shortfall of 4.4%, or **$345.1 million**. In order to mitigate the risk of products not being shipped on time,

[5] See Appendix for a more detailed discussion of the model estimation approach.
[6] Imports represent only shipments destined for Washington businesses. This amount is therefore smaller than total imports passing through Washington ports, since a large share of these are destined for the Midwest and other interior markets.

some firms turned to airfreight as an alternative shipping mode during the slowdown period. This mitigation strategy offset a total of **$152.6 million** in shipping losses (despite airfreight being significantly more expensive than containerized shipping). **Factoring in this mitigation strategy, net losses in shipping totaled $769.5 million across both exports and imports normal conditions.**

Based on this approach, Washington businesses were unable to ship via waterborne **$555.8 million** in containerized goods during the slowdown. This shortfall represents a 16.4% decrease in estimated shipping exports. Agriculture products experienced a 7.9% reduction in expected exports while retail exports fell 4.3%. Within manufacturing, the transportation and machinery industries experienced an estimated shortfall of 10.7% in exports.[7]

Many interview respondents indicated they used airfreight to ensure key export deliveries with valued international clients. A similar counter-factual model showed an estimated $152.6 million in containerized exports normally shipped by water were instead air shipped.[8] Total near-term net export losses therefore summed to **$403.2 million.**

Costs of Delays or Non-Shipment of Containerized Imports

Import losses during the slowdown (i.e., imports that were not shipped during the slowdown) summed to **$345.1 million**. Import losses were based on a similar counter-factual model using containerized import data through Washington ports, adjusted as a share imports destined for Washington businesses. This total therefore excludes delay or non-shipment of containerized imports to non-Washington markets, such as Chicago.

Containerized imports represent a projected total shortfall of 4.6%. Manufacturing imports such as transportation and machinery and chemicals and plastics were lower by approximately 15.0% and 8.8% respectively.

[7] Shipping "losses" only account for the loss of value of goods not shipped. It makes no assumption as to what happened to those products when they were not shipped on time. In some cases, the product was shipped late and in others the product was sold domestically or transported by other means (air freight/railroad and non-West Coast ports). See Appendix.

[8] Counterfactual forecasts were also created for air freight imports during the period of the port delays. Interestingly there is a calculated shortfall of $162 million in air freight imports as air freight exports experienced large projected gains. This suggests that was a strong shift from airfreight imports to airfreight exports as the port delays stopped shipping exports. This makes sense, as there is perhaps more elasticity in terms of exporting as opposed to importing. There is almost certainly a significant overlap between containerized shipping exports and airfreight imports, though it is difficult to accurately estimate what losses are primarily due to shipping delays and what losses are from airfreight imports exclusively. See Appendix.

Associated Costs

Additional costs tied to the delays include costs incurred from trucks idling in congested containerized trucking lanes and and fees for the storage of containers at a terminal (demurrage).

Based on information gleaned from interviews, truck operators were generally paid approximately $50 per hour to wait past their initial time allotment for a shipment to the ports.[9] While traffic congestion around the containerized terminals was always a concern, traffic congestion was at its worst from November 2014 through December 2014. Losses due to trucks delays therefore summed to an estimated **$14.2 million**.

A second important type of associated cost is port demurrage fees for containers stored at port storage facilities. These containers are stored for extended periods while awaiting movement onto rail or truck or outbound shipping vessels. Based on interviews, demurrage fees across all ten containerized shipping terminals in Washington summed to an estimated **$7.0 million**.

Sum Total of Estimated Near-Term Costs

Accounting for all losses and potential offsets, Washington businesses lost an estimated $769.5 million during the port delays (**Exhibit 3**). The above estimate does not take into account mitigation strategies to reduce these loses, e.g., selling foreign-destined perishable products domestically (typically at a lower price), or the costs associated with shipping out of alternative ports (when possible).[10] Similarly, this cost estimate does not include the longer-term impacts of the delays, such as losing market share in a foreign market, which may result in losses many times greater than the immediate costs of the delays.

These costs therefore only represent the short term effects associated with the port delays. **Since the port delays caused a large disruption in containerized shipping, its effects are likely to be felt far into the future and as such the true total costs associated with the port delays may be much greater.**

[9] Truck drivers from agricultural sectors charge a higher overtime price. See Appendix.

[10] Respondents across a variety of industries also mentioned losses due to additional warehousing time and stockpiling, and remarked on the losses associated with the slow turnaround of delivery from warehouse to port or from port to warehouse.

Exhibit 3. Port Delay Costs Accounting

Type of Costs (Millions $)	Expected	Actual	Net Losses
(A) Shipping Losses			
Waterborne Containerized Exports	$ 3,934.3	$ 3,378.5	-$555.80
Airfreight Mitigation			$152.60
Total Unshipped Exports			-$403.20
Waterborne Containerized Imports	$ 7,876.1	$ 7,530.9	-$345.10
Total Containerized Shipping Losses			*-$748.30*
(B) Additional Costs			
Trucking Idling Costs			-$14.20
Demmurage Port Fee of $700,000 per terminal*			-$7.00
Total Additional Losses			*-$21.20*
Total Losses (A + B)			**-$769.50**

**Refers to fees paid for storage of containers at a terminal.*

Note: actual totals for export shipments include goods normally shipped via waterborne mode but were shipped by airfreight during the slowdown period.

Sources: U.S. Census Bureau, 2015; Community Attributes Inc., 2015.

Types of Businesses Impacted by Delays

A wide variety of firms in Washington were affected by the slowdown. The Association of Washington Businesses administered a survey of 500 members to help illustrate how vital international trade is to the Washington state economy. More than half of the responders indicated the port congestion affected their business or day-to-day operations, and 30% reported experiencing work stoppages, an increase in layoffs, and/or a loss of customers.[11] The delays from port congestion began to increase substantially during the holiday season, which is the biggest sales period for a variety of industries. Missed sales opportunities and deadlines resulted in profit losses, as well as reputation damage that could impact future sales.

The delays particularly affected the agriculture sector, primarily due to spoilage. Apple growers produced a record harvest in 2014—up 28% from 2013. Washington producers typically export 30% of the apples they grow, of which a large share go to countries in Asia and the Middle East via waterborne containerized shipments.[12] The Washington State Tree Fruit Association has estimated 200,000 to 300,000 boxes of apples per week were not sold due to the port slowdown;[13] these losses were equivalent to $95 million.[12] Similarly, the Washington State Potato Commission (WSPC) reported losses of $23.5 million per month on frozen French fry exports. The WSPC also estimated frozen food processors lost $48 million in missed sales opportunities.[14]

Apples that could not be exported rotting in Eastern Washington. Photo credit: Q13 Fox

[11] Johnson, Kris. "Port slowdown will leave lasting mark." The Wenatchee World. March 4, 2015. http://www.wenatcheeworld.com/news/2015/mar/04/port-slowdown-will-leave-lasting-mark/

[12] Associated Press. "Washington apple exports pick up, but port labor issues make them miss key sales opportunities." The Columbian. February 27, 2015. http://www.columbian.com/news/2015/feb/27/washington-apple-exports-pick-up/

[12] Associated Press. "Washington apple exports pick up, but port labor issues make them miss key sales opportunities." The Columbian. February 27, 2015. http://www.columbian.com/news/2015/feb/27/washington-apple-exports-pick-up/

[13] Wilson, Caitlin. "Agriculture Community Works to Recover from Port Slowdown." NBC. March 16, 2015. http://www.nbcrightnow.com/story/28535273/agriculture-community-works-to-recover-from-port-slowdown

[14] Pihl, Kristi. "Mid-Columbia companies deal with losses from port slowdown." Tri-City Herald. April 3, 2015. http://www.tri-cityherald.com/2015/04/03/3494312_mid-columbia-companies-deal-with.html?rh=1

Chelan Fresh Marketing, one of Washington State's largest fresh fruit sales and marketing firms, was forced to lay off 250 employees—20% of its workforce—and convert another 100 employees from full time to part-time. The company has reported it has no plans to re-hire in the near future.[15]

Retailers faced substantial delays in the receipt of product inputs along with interruptions in the supply of ready-to-sell products. Cascade Designs, a specialty manufacturer of outdoor gear for recreational retailers such as REI, was unable to receive snowshoe parts in a timely manner from its plant in Ireland for production in Seattle.[16] The port congestion also prevented the company from sending completed products to overseas customers. Both of these factors contributed to Cascade Designs' reported sales loss of $1.2 million as of January 2015.

Retailers could pursue other shipping options, but often times these alternatives were more expensive. The President/COO of Tommy Bahama highlighted the significant cost increase associated with airfreight—the price to ship by water is $0.30-0.50 per item, but it costs $2-3 per product to transport goods by air.[17]

Interview Feedback on Impact of Delays

Fifteen interviews were conducted with a variety of Washington firms that are all highly reliant on efficient port service. Broadly, these firms represent four sectors: 1) Agriculture; 2) Retail; 3) Logistics and Transportation; and 4) Manufacturing. These sectors utilize Washington ports for a variety of export and import activities (and in the case of Logistics and Transportation, act as key components of Washington's many supply chains).

The delayed delivery of goods imposed a variety of costs on exporters and importers alike. These impacts were both direct losses incurred through unshipped or unreceived goods and related costs, such as warehousing at the port (demurrage), and indirect costs through the interrupting of shipping modes and systems due to delayed movement and shipment of containerized goods.

In other cases, the delayed shipment of a good can result in a devaluation of the product *en route*. One interviewee described the potential costs derived from market price fluctuations due to delivery schedule interruptions—if the value of the goods in the container decreases

[15] Pihl, Kristi. "Washington legislators told to expect longtime hits from export slowdown." Tri-City Herald. January 17, 2015. http://www.tri-cityherald.com/2015/01/17/3364305_washington-legislators-told-to.html?rh=1
[16] Johnson, Kris. "Port slowdown will leave lasting mark." The Wenatchee World. March 4, 2015. http://www.wenatcheeworld.com/news/2015/mar/04/port-slowdown-will-leave-lasting-mark/
[17] Kapner, Suzanne and Laura Stevens. "Port Delays Leave Retail Goods Stuck in Transit." The Wall Street Journal. December 18, 2014. . http://www.wsj.com/articles/port-delays-leave-retail-goods-stuck-in-transit-1418866644

while they are in transit, the customer can claim devaluation, and seek reimbursement for the difference in value from the seller.

Importance of Seasonality

Longer delay periods increase the likelihood that goods will be affected by seasonally induced oscillations in value. Missing the seasonal sales period was detrimental to retail firms as well. Many retailer respondents mentioned having to stockpile clothes for an extended period, and later on, selling them at a discount after missing the seasonal sales period.

Other retailers used airfreight to import stock to keep stores full in time for the holiday season. This was typically a measure of last resort because of how expensive airfreight is compared to containerized shipping. Most retail firms refrained from passing on the increased transportation costs to consumers and were therefore forced to absorb these losses. Several respondents mentioned this absorption meant the need to reduce staff (either through layoffs or reduced shifts).

As the backlog at the ports increased, more exporters had to store their products while waiting for them to be shipped out. One company reported a cost of $6,000 associated with warehouse storage, and added that it was possible for some containers to get lost among so many others awaiting shipment.

In order to avoid the aforementioned monetary and time costs at Washington and other West Coast ports, some companies opted to move products through East Coast ports in order to fulfill as many deliveries as possible. One interviewee shared that shippers were charging up to $1,000 more per container to ship out of the East Coast, making this option cost-prohibitive for some businesses. For shipments destined for Central and South American markets, Houston was an alternative option. However, this option also become overcrowded with West Coast shippers rerouting cargo there, both to Central and South America and to Europe by way of rail to the port.

In some instances, exporters planned in advance, rerouting seasonally sensitive products to Canadian ports at higher costs. However, the widespread use of this strategy resulted in some congestion at Canadian ports, as well.

Some interviewees who sold seasonally sensitive products missed the deadline for shipment to an overseas client. In other cases, even when a product was eventually shipped, the costs for demurrage ran into the thousands of dollars per shipment—costs the exporter absorbed in order to retain their overseas client.

Commodity Shippers and Perishable Goods

The port delays had a sizable impact on export sales of Washington's agriculture products. Washington fruits constitute a significant share of Washington's total agricultural industry, with the apple industry alone worth $2 billion. Many perishable agricultural products that could not be shipped in containers were typically sold to food processors (almost always at a loss), sold on the domestic market (which caused prices to drop due to an oversaturated domestic supply), or shipped to alternative export markets that didn't require the use of Washington ports (e.g., railroad freight to Mexico).

COMPANY SPOTLIGHT

BROOKS RUNNING COMPANY

Brooks Running Company is a running shoe and apparel manufacturer. The company employs more than 200 workers out of its Seattle-based headquarters and has a global workforce of 650 people, including in China and Vietnam. As a manufacturer with a global supply chain reliant on waterborne containerized shipping, Brooks was forced to search for strategies to mitigate the impact of the delays. In the months leading up to the expiration of the longshoremen's contract, Brooks began developing contingency plans in anticipation of shipping delays. The company was able to route some of its product through ports in Vancouver, Canada and around the Gulf, but ultimately began to feel the impacts of the slowdown in November 2014. The Port of Vancouver was not able to process additional containers from other West Coast ports, and routing goods through Gulf ports required a much longer lead time for shipments originating from Asia, where Brooks' factories are located. In order to continue to complete orders during the slowdown, the running company airfreighted inventories to its retail partners and fulfillment centers. However, this mitigation strategy entailed significant added costs—approximately $6.35 for a pair of shoes by air compared with $0.35 via containerized water shipment. Moreover, as the slowdown persisted, more and more companies also resorted to air freight as a mitigation strategy, constraining this option.

Using these various mitigation strategies was not without its own drawbacks. Many agriculture companies noted they had lost market share and saw the erosion their overseas partners' confidence in Washington's ability to ship perishable and time-sensitive commodities. This was most apparent in the experience of Washington hay producers.

Hay is a vital Washington crop export. Livestock feed, which is mostly composed of hay, is the state's largest agricultural export by volume, and the fourth largest by dollar amount, valued at $720 million in 2014.[18] Hay requires more container space than any other U.S. agricultural product, resulting in high transport costs for what is a relatively low-value shipment. Individual containers of hay are valued between $8,000 and $9,000, and can cost anywhere between $400 and $1,800 to ship, depending on the destination.[19]

The port slowdown significantly impacted hay exporters for a variety of reasons. Costs were incurred from port storage fees, truck overtime, and a loss of competitiveness overseas.

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[18] Kantor, Sylvia. "Did port slowdowns bust our hay export boom?" Crosscut. March 16, 2015, http://crosscut.com/2015/03/hay/

[19] Dupin, Chris. "Bumpy hay ride: Fast-growing U.S. forage exports hit by West Coast port problems." American Shipper. March 2015. http://www.americanshipper.com/Main/News/Bumpy_hay_ride_59481.aspx

Respondents described losing market shares in Japan and Korea to Australian and Canadian hay producers.
Hay futures contracts are written in the spring in anticipation of the summer growing season, while futures for other commodities are typically written once their respective growing season begins. Washington hay producers were therefore afforded less recovery time than other commodity producers to secure foreign markets after failing to deliver on contracts during the period of port congestion. The culmination of these factors has altered hay producers' business forecast for the next season. Several respondents reported purchasing fewer crops because they have a backlog that will last through 2016.

Impacts on Bulk Shipments

Hay and grain are also transported via bulk, which is another shipping method that faced notable delays during the port slowdown. Bulk transporters can utilize containers to pack cargo. One bulk shipper explained that 1,500 to 1,700 containers can fit on a bulk vessel, which translates to about one third of the capacity of a small container ship. Because these containers are loaded onto bulk vessels, they require the same logistical and stevedoring support as other types of containerized cargo handling. Resultantly, delays extended to the shipments of these goods.

The slowdown indirectly affects remaining bulk products due to the delay in loading containerized cargo onto the same vessel. Delays and congestion at the Port of Seattle and the Port of Tacoma also substantially affected both the supply of available containers and the ability to locate individual containers.[20]

Importantly, while containerized shipments of agricultural commodities constitute a small share of total agricultural shipments, the impacts are diffuse across agriculture communities. In many cases, farmers rotate crops, including peas and lentils—two crops that are commonly containerized. Farmers, as price takers and subject to very thin margins, are highly sensitive to sudden changes and losses. In the case of the recent slowdown, these losses in shipment revenues significantly impacted the bottom line for many farming families in Eastern Washington.

Respondents also noted it could take truck drivers four to five hours to find a specific container during the peak of the slowdown. Even if bulk products were not shipped in containers, the slowdown at the ports created a backlog of railcars that could not be unloaded. There is a maximum of four containers per railcar, and large bulk shippers unload roughly 100 cars per day during their busiest seasons. Each car costs the shipper $75 per day if it is not unloaded. The added cost of paying truckers to find and wait for containers coupled with a backlog of railcars led to an estimated $225,000 per month loss for one bulk shipper.

[20] This is also exacerbated by the consolidation of shipping. With many shipping companies now willing to group together many different containers with different final destinations, delays due to having to find individual containers.

Loss of Future of Business

Interviewees discussed future losses in revenue owing to the port delays. In some instances, shippers to a foreign market operated under a sole source contract with an overseas client. The advent of the delays forced foreign buyers, in order to mitigate the adverse impacts of the delays on their business process, to explore alternative sources. In fact, the long-term consequences of the port delays have the potential to be just as impactful to exporters as the direct costs; once a contract is lost, there may not be an opportunity to win back that business for five years or more. Foreign buyers not only need their products delivered on time and as expected, but they make business decisions based on reliability and reputation. If Washington exporters are considered untrustworthy because of concerns about future disruptions at West Coast ports, further economic losses could result. While these impacts were difficult to quantify for the purposes of this report, they are significant and should not be ignored.

Based on interviews and secondary sources, CAI developed an inventory of possible costs incurred by industry. Many of these industries faced significantly different challenges during the port slowdown, requiring a variety of mitigation strategies to help offset costs. The schematic below articulates these losses the Washington economy incurred during the port delays (**Exhibit 4**).

Exhibit 4. Possible Incurred Costs by Industry and Trade

Industries	Exporters (Costs affecting exporters)	Importers (Costs affecting importers)	Notes
Agriculture and Food Processing	Lost sales overseas through non-delivery and foreign firms switching providers; introduction of competitors overseas. Lost product through spoilage. Lost market share to foreign providers (especially in terms of animal feed). Added costs to perform same sales.	A shortfall in specialized high nutrient animal feed.	Some note added costs from paying trucks to wait in lines for cargo space. Many note per diem costs associated with keeping containers in the port waiting for available cargo ships. Providers of more perishable goods sent more product to domestic food processors. Purchasing of less cropsover the next year (particularly amongst firms that have less perishable goods).
Retail	Costs associated with excess stockpiling of product. Lost revenue associated with missing key sales periods (holiday sales/seasonal items)	Costs associated with using air freight (8-10 times more expensive) Lost revenue associated with missing key seasonal items on store shelves.	Many large firms tried to mitigate losses by importing more product before the port delays occurred.
Logistics and Transportation	Congestion became so acute port stopped accepting containers. Lost customers from port delays (Gulf of Mexico ports, Canada). Trucks idled in long container drop-off lines or were turned away, causing profit loss.	Lost customers from port delays (Gulf of Mexico ports, Canada).	Some industries/firms were affected disproportionally because of existing relationships and pre-clearance.
Manufacturing	Lost sales through slow delivery of product; introduction of competitors overseas.	Slower production process due to lack of necessary inputs.	Some manufacturers helped their suppliers import through different and more expensive transportation methods (airfreight).

Source: Community Attributes Inc., 2015.

Summary of Findings and Conclusion

The recent port slowdowns resulted in sizable costs for Washington state businesses. This analysis delineates these costs, including both near-term delinquent or delayed shipment of goods, and the longer-term costs of lost market share and other less quantifiable yet real impacts.

Based on the analytics presented, during the slowdown period, Washington state businesses lost $769.5 million in the near-term in lost sales and related costs.

These impacts were felt throughout the state economy, both directly and through interruptions to supply chains.

The losses to Washington state businesses extend beyond these near-term impacts. Delayed shipments in some cases resulted in the cancellation of orders and the introduction of foreign competitors into overseas markets. Many of these long-lasting impacts of the delays will not materialize this year, but will occur in the years to come. The findings from this study constitute an important benchmark from which to understand the potential impacts of future delays.

Credits

Special thanks for the successful completion of this report go to the **Association of Washington Business, BNSF Railways, Cascade Designs, Greater Spokane Incorporated, the Northwest Horticultural Council, SSA Marine, the Washington Association of Wheat Growers, the Washington State Farm Bureau, the Washington State Grain Commission, the Washington State Potato Commission.**

This report was prepared by Community Attributes, Inc. by lead analysts Spencer Cohen and Sudarshan Sampath and analysts Alexandra Streamer and Katy Nally.

Appendix

Methods

The report draws on a combination of quantitative and qualitative methods, leveraging waterborne containerized import and export data, statistical modeling, news articles, other secondary sources, and interviews with fifteen businesses, industry representatives, and other stakeholders.

The analysis presented in this memo demonstrates: 1) the near-term estimated losses Washington state businesses incurred through the delays; 2) the longer-term impacts associated with the recent slowdown; and 3) the diversity of impacts by industry and product. The near-term impacts presented in this memo are based on losses incurred through the non-delivery of containerized products during the intended period of shipment. In some cases, products (such as perishable goods) may have be diverted to a domestic market, albeit at a lower price point, thereby mitigating losses. This report does not attempt to estimate these domestic market mitigation strategies, nor the eventual revenue (after the resolution of labor negotiations) of delayed shipments. Near-term impacts thus present one potential scenario of the delays. Findings of this report will help stakeholders engaged in international trade understand the costs Washington businesses incurred due to delayed shipments.

Data Sources

Data for containerized imports and exports for both shipped freight and airfreight comes from the U.S. Census Bureau. All export data is collected by state of origin data specifically to Washington State. The data reported according to harmonized system (HS) codes that represent different commodities that are containerized and shipped. Trade data was aggregated by HS codes into the following macro groupings: Food and Agriculture, Apparel, Transportation and Machinery, Metal and Stone, Raw Hides and Wood, Chemical and Plastics and finally Miscellaneous and Services.

The number of trucks is taken from a legislative brief provided by the Port of Seattle, which details the number of truck visits to containerized Terminal 46 at the Port of Seattle. The Northwest Seaport Alliance provides the number of containerized terminals in Washington and the number of trucking lanes that service those ports. Data on related costs such as truck overtime fees and port demurrage costs were gleaned from interviews.

Estimating costs from truck congestion

Form the interviews, it was determined that trucking delays occurred roughly between November 2014 through the end of February 2015. However, full days of delays were rare, with extreme congestion only occurring between November and December 2014. Furthermore, the interviews shed light on general trucking costs after the initial allotted time for a typical delivery. This cost was found to generally be $50 dollars per hour of overtime after an hour's grace period. The exception was found in terms of agriculture products.

The overtime charge for agriculture deliveries was found to be $100 dollars per hour. Since there is a difference in overtime costs, the costs associated with agriculture trucking are weighted according to the weight of agriculture imported and exported in containers, which is 29% of all containerized shipping in Washington. Using this information, it was possible to estimate what the average cost was to a trucking firm per percent of the containerized shipping market that is not associated with agriculture[21] over the period of the port delays.

[21] Each percent of market share associated with agriculture is double the estimated percent cost for a non-agriculture trucking firm.

Estimating port demurrage costs

Based on interviews, demurrage fees collected by a single terminal was approximately $700,000 dollars. There are 10 containerized terminals in Washington. Estimated port demurrage costs are thus the product of the demurrage fees of one terminal and all 10 containerized terminals.

Interviews with Washington Firms

CAI contacted 13 businesses and industry organizations representing four different industry sectors that rely heavily on containerized shipping. The four industries were Agriculture, Retail, Logistics and Transportation and Manufacturing. Through these interviews, it was possible to learn about a broad list of possible costs Washington firms incurred during the period of the port delays. Once a firm understanding of what the major costs were, it was then possible to formulate a set of analytics that could estimate those losses across the Washington economy. Interviewed stakeholders are listed below:

Company/Organization	Interviewee	Industry
Spokane Seed	Andrew Fontaine	Agriculture/Farmers
Washington Grain Commission	Glenn Squires	Agriculture/Farmers
Apple Farmer / Columbia Fruit	Marc Pflugrath	Agriculture/Farmers
Calaway Trading, Inc	Mary Ann Levine	Agriculture/Farmers
Andersen Hay	Steve Gordon	Agriculture/Farmers
Stemilt Growers LLC	West Mathison	Agriculture/Farmers
James Farrell & Co.	Jeff Vandel	Logistics/Ports/Cargo Handling
SSA Marine	Joe Ritzman	Logistics/Ports/Cargo Handling
MacMillan-Piper	Steve Stivala	Logistics/Ports/Cargo Handling
Cascade Designs	David Burroughs	Manufacturers
Basic American Foods	Joyce Mikesell	Manufacturers
Phillips	Russell Blood	Manufacturers
Brooks Running Company	Thomas Ross	Manufacturers
SanMar	Angela Schaefer	Retail & Wholesale
National Retail Federation	Jon Gold	Retail & Wholesale

Modeling Details

Losses in shipping are calculated by using a counterfactual model to estimate what containerized imports and exports to Washington would have been had there been no port delays.[22] To create this counter factual model, shipping data was collected monthly for all containerized imports and exports into Washington ports from January 2003 through September 2014, just before the port delays which started in October 2015. Using this dataset,[23] a forecast was generated to compare the forecasted monthly containerized imports and exports which actual import and export values during the period of port delays.

[22] This exact same methodology is used to estimate the gains in air freight exports and imports during the period of port delays.

[23] The data was also tested to see if the variance was unstable as to require a Box-Cox power transformation. No transformations were needed to be performed.

The forecast used was an ARIMA (p, d, q) model[24] that attempts to describe the inherent autocorrelations in the data and then make forecast predictions based on those trends. The generalized form of an ARIMA (p, d, q) model is:

$$\left(1 - \varphi_1 B - \cdots - \varphi_\rho B^\rho\right)(1 - B)^d y_t = c + (1 + \theta_1 B + \cdots + \theta_q B^q)e_t$$

This model requires the calculation of p,q and d in order to generate an accurate model. Variable d reflects differences required for stationarity[25]. The number of differences required for stationarity are calculated using repeated Kwiatkowski-Phillips-Schmidt-Shin (KPSS) tests.[26] The differencing operation used are first differences, which is the following transformation[27]:

$$y_t' = y_t - y_{t-1}$$

The p and q sections of the ARIMA (p, d, q) model are found using the Hyndman-Khandakar algorithm ARIMA modeling schematic. Rather than going through the autocorrelations of the data or all possible combinations of p and q, the algorithm models four general ARIMA (p, d, q) models and selects the best one based on a corrected form of Akaike's Information Criterion (AIC) which selects predictors for regression and selects the smallest order of p and q.[28]
The general AIC equation is[29]:

$$AIC = -2\log(L) + 2(p + q + k + 1)$$

The corrected AIC which is minimized to find the smallest orders of p and q is:

$$AIC_{Corrected} = AIC + \frac{[2(p + q + k + 1)(p + q + k + 2)]}{T - p - q - k - 2}$$

The four general ARIMA (p, d, q) models that are tested are: 1) ARIMA $(2, d, 2)$; 2) ARIMA $(0, d, 0)$; 3) ARIMA $(1, d, 0)$; and 4) ARIMA $(0, d, 1)$. If $d = 0$ then a constant c is included; if $d \geq 1$ then the constant c is set to zero. These four models are also tested across variations of ± 1 for

[24] Where, p is the order of the autoregression, d is degree of differencing required to ensure time series stationarity and q is the order of the moving average.
[25] Stationarity is the state of a time series in which whose properties do not depend on the time at which the series is observed. That is to say, its traits are invariant to time properties such as growing seasons or business cyclicality. This is important when creating forecasting models as nonstationary data cannot be accurately forecasted (more specifically, the errors generated by the model that are subsequently used to forecast future data points are correlated with each other and thus provide unreliable results).
[26] KPSS tests are repeated in so far as the data is tested after each differencing operation. Once stationarity is assured the KPSS test accepts the null hypothesis of a stationary time series dataset.
[27] The differencing operations creates a stationary condition such that $y_t - y_{t-1} = e_t$ or $y_t = y_{t-1} + e_t$ are true. This also means that the error terms generated by any subsequent model act as a random walk or white noise.
[28] The smallest corrected AIC is desired as it provides the most efficient and consistent forecasting estimates.
[29] Where L is the likelihood of the data and $k = 1$ if $c \neq 0$ and $k = 0$ if $c = 0$. Note that the last term in the parenthesis is the number of parameters in the model (including σ^2, the variance of the residuals).

p and q and to include and/or exclude constant c. The model which provides the smallest corrected AIC value is then selected to provide the counterfactual forecast.
Once the most efficient ARIMA (p, d, q) model is specified, the model residuals are studying using Portmanteau tests to see if it is indistinguishable from a random walk or white noise of errors. If it is, forecasts can be generated which the knowledge that they are efficient and accurate predictors. The containerized exports forecast model is an ARIMA (2, 0, 1) model while the containerized imports forecast model is an ARIMA (0, 1, 1) model[30]

The losses are calculated by looking at the difference from the forecasted monthly containerized exports and imports and the actual monthly values reported by the U.S. Census on containerized trade in Washington. Negative values as compared the generated point forecasts are labelled as 'losses' while any potential gains seen in the point forecasts are considered as a zero change from the actual values reported by the U.S. Census. This difference represents the value of containerized goods not shipped during the five-month period of port delays.

This approach does not capture alternative shipping options mitigation strategies,[31] for example selling originally export-destined products on the domestic market (albeit at a loss relative export sales). From interviews, it was found that roughly 70% of all imports into Washington ports are destined for inland markets. As such, import losses were discounted 70% to account for the share of imports to Washington exclusively.

[30] Air freight export forecasts were modelled by an ARIMA (0,0,3) and Air freight import forecasts were modelled by an ARIMA (1,0,0).
[31] This is aside from any offsets found from the air freight forecasts.