

Appendix A: BENEFIT COST ANALYSIS EXECUTIVE SUMMARY

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Summary and Findings

This Benefit Cost Analysis (BCA) is for Port of Everett South Terminal Modernization Project. The Port is applying for \$10 million in FY 2016 TIGER grant funds. The funds will be used to modernize the Port's South Terminal in Everett, WA to meet 21st Century demands by strengthening the terminal to provide for intermodal transfer of cargo and adding on-terminal rail to handle heavier loads being shipped on larger ships. The larger ships are anticipated to off load more cargo at the Port than in the past. Thus, the on-terminal rail facility will be used to move the additional cargo volume by rail instead of adding truck congestion to the local/ regional roads and highways. The project will improve transportation choices for freight and improve the mobility of the local and regional population. The on-terminal rail facility allows cargo to be unloaded from the larger ships that are starting to berth at the Port in 2016. With these improvements, the cargo can be placed directly onto rail within the terminal. The cargo is then dispatched to its inland destination, with minimal disruptions to the local road and rail network. This rail option provides shippers with a cost effective transportation option not currently available at the South Terminal. *Table 1* (page 5) below summarizes the improvements and associated economic public benefits.

About the Project

The [Port of Everett's South Terminal Intermodal Modernization Project](#) is a stand-alone project that creates *independent utility* to meet current and future multi-modal freight shipping needs of the region and nation. This project allows the Port to efficiently and safely serve larger vessels that are currently being chartered by eight shipping lines. The improvements will be particularly important as Panamax class ships carrying containerized aerospace cargo are inserted into the rotation. Most notably, the Port of Everett serves as an extension of the aerospace manufacturing process, and plays a critical role in the just-in-time-delivery schedule. It transports all the oversized parts for the 747, 767 (military and commercial), 777, K-C46 Tanker and soon to be 777X airplane programs. It also serve as a backup facility to the 787.

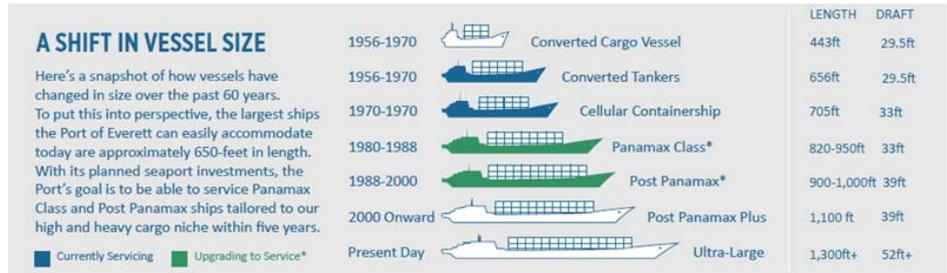
This project is necessary for the Port to meet the requirements of the heavier containers being used to transport the airplane parts for the new Boeing 777X program and export cargoes that utilize port facilities. The wharf strengthening is needed for the intermodal transfer of goods from ship to shore,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

The funds will be used to modernize the Port's South Terminal in [Everett, Washington](#) by strengthening the terminal to provide for intermodal transfer of cargo and adding on-terminal rail to handle heavier loads being shipped on larger ships. The larger ships are anticipated to off load more cargo at the Port in the future. Thus, the on-terminal rail facility will be used to move the additional cargo volume by rail instead of adding truck congestion to the local/ regional roads and highways. The project will improve transportation choices for freight and improve the mobility of the local and regional population. The on-terminal rail facility within the terminal allows cargo to be unloaded from the larger ships and directly placed for departure by rail. The cargo is then dispatched to its inland destination, with minimal disruptions to the local road and

rail network. This rail option will provide shippers with a cost effective transportation option not currently available at the South Terminal.

Effect of Larger Ships

It is anticipated the larger ships that are beginning to arrive at the Port of Everett this year, will bring discretionary inland bound cargo that in future years will be offloaded



along with the Boeing containers while the ships are at the Port’s terminal. The shipping lines are starting to put these larger ships into routing rotations that serve smaller ports such as the Port of Everett. The insertion of the larger ships into the shipping lines schedule is due to the economies of scale and efficient cost structure achieved with the larger ships. The shipping lines are very motivated to call at only a limited number of ports per rotation. Thus, the volumes assigned to be moved at each port will increase simply based upon the arrival of the larger ships. Volume moved through a port increases quickly once a modernization provides new berthing and rail capacities to handle the larger ships. This should be especially true in this case with an anchor industrial / manufacturing customer such as [The Boeing Company](#) that is requiring the larger ships and terminal capacity for their cargo. The completed South Terminal facilities will provide the Port’s eight shipping lines with additional options as the on-terminal rail is utilized to serve their inland destinations. Thus, these lines will begin to market the Port of Everett as a debarkation point for discretionary inland cargos. This cargo will be in addition to the local aerospace, agricultural and other industries currently supported by the Port. Note, this volume trend only occurs when an individual port is able to provide efficient and cost effective transportation options by adding on-terminal rail to their terminal facilities. As was envisioned in the Port’s [2008 Marine Terminals Master Plan](#), the South Terminal will become one of these intermodal terminals that serves not only their local anchor industry but is also able to provide great inland rail transportation options. The Port intends to form its own niche by concentrating on serving small destinations not already served by the larger intermodal rail ports. As the [Martin Associates Economic Impact Report](#) references, the current forecast for 2020 shows a dramatic increase in freight over what is moved today. It is anticipated that this growth in freight will be split between local and regional destinations.

Example Routing Chosen for the Analysis

There are many inland destinations for the Port of Everett to serve. It is too complicated in this analysis to model all rail-oriented destinations that may be served in the future from the Port of Everett. Thus, this BCA is focused on Chicago, Illinois, a destination served by BNSF Great Northern Corridor and can be easily served by BNSF from Everett. With both the Origin and Destination points located along the northern tier of the U.S., it is a logical pairing to be use as an example for inland routing. This representative route is used in this analysis to illustrate the public benefits achieved when rail transportation is used to reduce vehicle miles travelled on the National Highway System.

Table 1: Project Matrix

Project Matrix for South Terminal Intermodal Freight Facility Project					
Current Status/ Base line (No Build) & Problem to be Addressed	Change to Baseline/ Alternatives	Type of Impacts	Population Affected by Impacts	Economic Benefit	Summary of Results (Mill \$ 2015)
<p>Inefficient Transportation options for oversize and containerized cargo from the Port of Everett's deep water port terminals to the cargo's inland destination. Without a modern terminal that can handle heavy oversized aerospace components and other large cargo such as construction and wind energy, etc., inefficient transportation routes will continue to be used. This causes un-needed congestion on WA roads and Interstate highways. The use inefficient long haul trucking as the primarily modal option causes inefficient and costly routing of freight into and out of the region. The current wharf and rail facilities do not have the capacity to meet current and future cargo demands. For the cargo that is moved by rail, BNSF routing currently operates at OPCON 3, or the most congested level of operation at this location due to the lack of adequate on-terminal rail loading and unloading trackage.</p>	<p>Modernize the Port of Everett's South Terminal to handle the larger ships and provide on-dock rail loading and unloading for the arriving and departing cargo. These improvements will allow future long-haul truck trips to be converted to rail using the on-dock facility to transport the freight between ships and rail very efficiently.</p>	Reduced VMT on highways and roadways	Vehicle drivers	Monetized value of reduced truck miles generating fuel savings	Estimated \$104 million of fuel savings
		Reduced pollutant emissions	Local, state, region and national populations	Monetized value of emission reductions due to reduced trucking	Estimated \$24 million in reduced emissions due to reduction in VMT by truck
		Reduced pollutant emissions	Local	Monetized value of emission reductions due to installation of electricity on the dock for cold ironing and electrified cranes	Not Monetized
		Improved efficiency in freight modal choice by switching freight to rail vs. truck	Freight Shippers utilizing the So. Terminal	Monetized value of reduced operational costs to shippers	Estimated \$40 million operational costs savings to shippers
		Reduced road maintenance cost due to the reduction of VMT on highways	Government	Monetized value of reduced road maintenance costs to due to reduced VMT	Estimated \$51 million of Road maintenance savings to states and regions
		Reduced potential fatalities on highways	General public	Monetized value of the reduction of potential fatalities on roadways to due to reduced VMT	Estimated \$45 million of reduced fatalities from reduction of Vehicle Miles Traveled
		Improved worker safety by reducing potential rail accidents.	Port and Rail Workers	Reduced potential accidents by eliminating train backing up and push, improves on-dock and rail workers safety.	Not monetized

Current Status/ Base line (No Build) & Problem to be Addressed	Change to Baseline/ Alternatives	Type of Impacts	Population Affected by Impacts	Economic Benefit	Summary of Results (Mill \$ 2015)
(Continued from prior page)	The Port of Everett has a policy that requires at least 2% of waterfront capital improvement funds be dedicated to improving public access to Puget Sound's shorelines. Specifically, the South Terminal project proposal will result in \$650,000 (2%) in capital improvements to the City of Everett's shoreline parks and trails.	Improved non-motorized mobility	General public	Improved mobility for pedestrians and bicycles	Not monetized

The period of analysis used in the estimation of benefits and costs corresponds to 23 years, consisting of the current year (2016), 3 years of construction and 20 years of operation after the completion of the Terminal plus a residual value after the final year. Total \$55.5 million South Terminal Modernization project is expected to be financed through local and federal sources. This TIGER FY2016 application requests \$10 million (18%), the FASTLANE application requested \$20 million (36%) and the local participants of this project are committed to funding \$25.5 million (46 %) of the project cost. A summary of relevant data as well as the Total Benefits and Total Costs used to derive the benefit costs analysis for the project are shown in Table 2 below.

Table 2: Summary of Pertinent Data, Quantified Benefits and Costs

Calendar Year	Total Direct Beneficiaries (Reduction in Truck VMT)	Total Benefits (2015\$)	Total Initial Costs & Residual	Maintenance Costs (2015\$)	Undiscounted Net Benefits (2015\$)	Discounted Net Present Value (7%)
2016		\$0	\$0	\$0	\$0	\$0
2017		\$0	(\$28,824,728)	\$0	(\$28,824,728)	(\$26,938,998)
2018		\$0	(\$15,434,500)	\$0	(\$15,434,500)	(\$13,481,090)
2019		\$0	(\$11,338,750)	(\$38,350)	(\$11,377,100)	(\$9,255,798)
2020	14,300,000	\$8,017,666		(\$171,850)	\$7,845,816	\$6,551,980
2021	14,300,000	\$8,017,666		(\$171,850)	\$7,845,816	\$6,143,905
2022	14,300,000	\$8,017,666		(\$171,850)	\$7,845,816	\$5,773,287
2023	14,300,000	\$8,017,666		(\$171,850)	\$7,845,816	\$5,437,445
2024	14,300,000	\$8,017,666		(\$171,850)	\$7,845,816	\$5,112,447
2025	14,300,000	\$8,017,666		(\$171,850)	\$7,845,816	\$4,808,205
2026	14,300,000	\$8,017,666		(\$171,850)	\$7,845,816	\$4,523,364
2027	14,300,000	\$8,017,666		(\$171,850)	\$7,845,816	\$4,256,658
2028	14,300,000	\$8,017,666		(\$171,850)	\$7,845,816	\$4,006,904
2029	14,300,000	\$8,017,666		(\$171,850)	\$7,845,816	\$3,763,762
2030	28,600,000	\$16,035,333		(\$171,850)	\$15,863,483	\$7,156,529
2031	28,600,000	\$16,035,333		(\$171,850)	\$15,863,483	\$6,759,625
2032	28,600,000	\$16,035,333		(\$171,850)	\$15,863,483	\$6,370,969
2033	28,600,000	\$16,035,333		(\$171,850)	\$15,863,483	\$6,006,792
2034	28,600,000	\$16,035,333		(\$171,850)	\$15,863,483	\$5,665,503
2035	28,600,000	\$16,035,333		(\$171,850)	\$15,863,483	\$5,345,615
2036	28,600,000	\$16,035,333		(\$171,850)	\$15,863,483	\$5,045,737
2037	28,600,000	\$16,035,333		(\$171,850)	\$15,863,483	\$4,764,571
2038	28,600,000	\$16,035,333		(\$171,850)	\$15,863,483	\$4,500,904
2039	28,600,000	\$16,035,333	\$ 38,999,925	(\$171,850)	\$54,863,408	\$12,494,259
Total	429,000,000	\$240,529,993	(\$16,598,053)	(\$3,475,350)	\$220,456,590	\$64,812,575

Based upon the BCA presented in the remainder of this document, the project at 7% discounted rate is expected to generate \$107 million in discounted benefits and \$42.9 million in discounted costs. Therefore, the project generates a Net Present Value (NPV) of \$64.8 million and a Benefit/ Cost Ratio of 2.5:1 at 7%. *Table 3* below summarizes the Long-term Outcomes calculated in this BCA.

Table 3: Summary of Benefit Cost Analysis

	Present Value of Capital Costs	Benefits Total	Net Present Value	Benefit/Cost Ratio
South Terminal Modernization				
Discounted at 3%	(\$35,489,029)	\$170,776,501	\$135,287,473	4.8:1
Discounted at 7%	(\$42,935,110)	\$107,747,684	\$64,812,575	2.5:1

Introduction

This document provides detailed technical information on the economic analyses conducted in support of the grant application for the Port of Everett’s South Terminal Intermodal Modernization project.

The Methodology section introduces the conceptual framework used in the BCA. The Project Overview provides an overview of the project, including a brief description of existing conditions and the proposed alternative. Assumptions describes the current and future situations used in the analysis. Project Cost and Schedule provides a summary of cost estimates and schedule. The Long Term Outcomes section discusses the general assumptions used in the estimation of project costs and benefits, Specific data elements and assumptions pertaining to the long term outcome selection criteria are summarized in this section. Estimates of the project’s Net Present Value (NPV), its Benefit/Cost ratio (BCR) and other project evaluation metrics are also discussed. Short and long term job estimates are found in the Job Creation section.

Methodology

A Benefit-Cost Analysis (BCA) is a conceptual framework that quantifies, in monetary terms, as many of the costs and benefits of a project as possible. Benefits are broadly defined. They represent the extent to which people impacted by the project are made better-off, as measured by their own willingness-to-pay. In other words, central to BCA is the idea that people are best able to judge what is “good” for them, i.e. what improves their well-being or welfare. A BCA also adopts the view that a net increase in welfare (as measured by the summation of individual welfare changes) is a good thing, even if some groups within society are made worse off. A project or proposal would be rated positively if the benefits to some are large enough to compensate the losses of others.

Finally, a BCA is typically a forward-looking exercise, seeking to anticipate the welfare impacts of a project or proposal over its entire life cycle. Future welfare changes are weighted against today's changes through discounting, which is meant to reflect society's general preference for the present, as well as broader inter-generational concerns.

The specific methodology developed for this application was designed using the above BCA principles and is consistent with the FASTLANE and TIGER guidelines. In particular, the methodology involves:

- Establishing existing and future conditions under the build and no-build scenarios;
- Assessing benefits with respect to each of the five long-term outcomes identified in the Notice of Funding Opportunity (NOFO);
- Measuring benefits in dollar terms, whenever possible, and expressing benefits and costs in a common unit of measurement;
- Using U.S. Department of Transportation (USDOT) guidance for the valuation of travel time savings, safety benefits and reductions in air emissions, while relying on industry best practice for the valuation of other effects;
- Discounting future benefits and costs with the real discount rates recommended by the USDOT (7%, and 3%).

Project Overview

Requested funds will complete a [modernization of the Port's South Terminal](#) primarily accessed by the BNSF Railway's Great Northern Corridor. The road and rail corridor runs along the northern tier of the U.S., passing through eight states from Washington on the west to Illinois on the east. From this corridor, many destinations can be reached, including the Great Lakes Region, Canada and the U.S. East Coast. Primary connections include the Ports of Seattle, Tacoma, and Vancouver in Washington; Portland, Oregon, Minneapolis, Minnesota; North Dakota and Chicago, Illinois. Following the opening of the new on-terminal rail sidings, cargo will be able to efficiently use rail versus truck along the corridor destinations.

Project comparison is with the most likely alternative and a "no build" scenario

Base Case- "no build scenario"

The base case in the BCA represents the current state "no build" state of the terminal. Currently, freight moves from the Port of Everett to inland destinations by truck. Due to the complexity of the potential commodity movements and volumes that will be generated in the future from larger ships berthing at the modernized South Terminal, a representative supply chain has been selected for the project comparison of the BCA.

This example cargo movement is based upon cargo moving between the South Terminal in Everett, WA and to rail facilities in Chicago, Illinois.

Build Alternative

This alternative measures the incremental inland “larger ship” cargo volume utilizing the on-terminal rail facility to reduce congestion on the local / regional highway freight network. Currently, ships arriving at the Port of Everett off load primarily Boeing containers for local distribution to the Boeing Everett Plant. It is anticipated in the future that when the terminal is able to easily accommodate the larger ships, these ships will bring additional goods through the Port of Everett for inland distribution. It is anticipated that the Port of Everett will draw construction materials and other cargo that is not as time sensitive as the consumer goods moving in containers to Chicago and beyond. Thus, the Port can run either smaller trains once a week or hold the cargo for a full train to be dispatch every other week.

To be conservative in the analysis, it is assumed that a good example of these inland non-time sensitive moves could be cargo moving into Chicago currently by truck. In 2020, the availability of on-terminal rail should induce shippers to convert these current truck movements to rail movements between Everett and Chicago. In the analysis, it is estimated that 125 units of freight a week will arrive in Everett off of the larger ships for an inland destination. This cargo will utilize the on-terminal rail facility and move directly from the dock on the South Terminal in [Everett, WA](#) to rail facilities in Chicago, Illinois.

The analysis starts with two trains per month in 2020, or 6,500 units of freight per year, and holds the volume constant until year ten. In, year ten, it is estimated that the incremental volume will reach a level of one train per week between the two rail yards.

Assumptions

For the purposes of this analysis, the proposed project is compared with a no build alternative. The analysis includes total project costs of the remaining design, environmental documentation, permitting and upcoming construction for a total project cost of \$55.5 million. The BCA was run for a period of 23 years, beginning with the base year of 2016 and including a residual value calculated in 2039 of \$39 million, for the remaining estimated life of the improvements of the project elements.

A project cost analysis recently completed by project engineers indicates the cost to complete this project is \$55.5 million in 2016 dollars.

Estimation of costs and benefits are limited to the 2016 to 2039 period. The analysis incorporates assumptions based upon the availability of on-terminal rail and the increasing size of ships that will berth at the facility starting in 2020. Currently, eight shipping lines that call the Port of Everett. To assure that the BCA presents a conservative estimate of the public benefits, the BCA assume the first rail shipments from the modernized terminal will occur in January

2020. The movements related to this example are based upon modal conversion of containerized cargo that currently moves by truck out of the Port. In 2020, inland bound cargo be able utilize the on-terminal rail. Rail loading/ unloading is estimated to be two trains per month (125 units of freight per week) for 10 years post construction. To be conservative, the volume is held at 125 units of freight per week until year 11, when it is anticipated that volume will have grown to generate a train per week (250 units of freight) loaded/unloaded in the rail on the terminal. These assumptions are detailed below.

Estimated loads were developed on a 125 units of freight per week or 6,500 truckloads per year basis. The demand to move cargo through Everett will continually increase as the Port is able to berth and serve the larger ships that are starting to arrive at the Port this year. Due to the weakness of the berth decking, the current South Terminal is not suitable to transfer cargo from ship to shore. Nor is it capable of attracting additional inland bound cargo at this time. This will change when the terminal is strengthened and electrification is added during the modernization process needed to handle the larger ships.

Current Situation

The current movement to the example destination requires a 2,200 mile truck trip between the two points. This is a 4,400 mile round trip for the trucks.

Future Situation

The proposed improvements construct an on-terminal rail facility in the South Terminal at the Port of Everett, WA, enabling shippers to move their cargo by rail versus truck. The ability to more efficiently route their cargo using on-site rail saves the example shippers millions of dollars per year in transportation costs and allows them to experience the cost per ton differential of rail versus truck along the supply chain.

The rail move is estimated to be a 2,127 mile trip from the Port of Everett to the rail facilities in Chicago, Illinois. This modal conversion is estimated to eliminate over 14 million truck miles in the first year of operation.

Project Cost and Schedule

Project Costs

Table 4: Total Project Budget

Project Budget	in Millions	%
Construction	\$35.6	64%
Final and Construction Eng./Admin	\$5.6	10%
Contingency	\$14.3	26%
Total Cost	\$55.5	100%

Table 5 below, shows the break out of the project funding. The TIGER 2016 grant application requests \$10 million (18%), the previously submitted FAST LANE application requested \$20 million (36%) for a total of \$30 million (54%) in Federal support and a local investment of \$25.5 million. The local investment of \$25.5 million (46%) is comprised of funds committed by the Port and Washington State Department of Commerce.

Project Funding

Table 5: Project Funding Sources

SOUTH TERMINAL MODERIZATION PROJECT			
Funding Sources	Amount	Status	Purpose
Port of Everett	\$ 24.5 M	Committed	FE, Environmental, and Construction
WA Dept of Commerce	\$ 1.0 M	Committed	Construction
FASTLANE Request	\$ 20.0 M	Requested	Construction
TIGER Request	\$ 10.0 M	Requested	Construction
Total Project Funding	\$ 55.5 M		

The Port is requesting a FY2016 TIGER grant for \$10 million and FAST LANE grant for \$20 million. A total federal investment of \$30 million is required to complete the project.

Project Schedule

Table 6: Project Schedule

Project Schedule*		
Task	Terminal Rail Improvements	South Terminal Modernization
Complete Prelim. Engineering	2015	February 2016
Complete NEPA/SEPA	July 2016	July 2016
Receive Federal Permits	N/A	January 2017
Receive Grant Award Notifications	September 2016	September 2016
Issue Call-For-Bids	September 2016	March 2017
Obligate Federal Funds	October 2016	May 2017
Award Construction Contract	October 2016	May 2017
Begin Construction	November 2016	August 2017
Substantially Completion	Spring 2017	Early 2019

*The Port understands this schedule is aggressive based upon the ability to obligate the Federal Funds but wants to demonstrate the Port's readiness pending funding becoming awarded and obligated.

Project Completion

Federal grant funds received from the FY 2016 TIGER and FAST LANE requests will enable the applicant to complete the terminal modernization project. Due to limited funding options, the

project will otherwise be delayed if these funds are not awarded under and FY2016 TIGER and FAST LANE until the final funding becomes available in another federal funding source. With the successful award of these grant requests in late summer of 2016, construction for the project can begin as soon as fall 2016 and the strengthened berth and rail facility could be completed and opened in early 2019.

The rail portion of the project will be 100% ready to start construction in fall 2016. The berth improvements can start in the summer of 2017, as that is when the federal regulatory agencies allow for in-water construction in Washington State. The Port is currently completing final [design and engineering](#) in preparation for project funding in fall 2016. The design team foresees no complicating or project ending factors. However, to mitigate any unforeseen risk, an \$11 million contingency fund has been budgeted and established for the project. The project site is owned by the applicant, so there are no land purchases or right of way issues. A previous companion intermodal wharf strengthening and rail project to the north was recently completed. Best Practices were taken from that project and the Port is ready to proceed with the final stages of this current project based upon the knowledge gained from the companion project.

The project meets all local requirements for approvals and permits. State and federal requirements will be met no later than spring 2017, so that, if funded in fall 2016, USDOT would be able to obligate funding very quickly. Project risks have been identified and mitigation strategies incorporated. The project schedule illustrates that all contract bid documents will be finalized quickly, with the rail portion of the project ready for bid by fall 2016, followed by the berth portion in the first half of 2017.

With FY2016 TIGER and FAST LANE funding, the full project can be completed by spring 2019, well within the 18 month window from obligation to construction required under FAST LANE.

Long Term Outcomes

Summary of the Benefit Cost Analysis

Table 7 (page 14) displays the summary of the BCA. Quantified benefits include the transportation cost savings of modal conversion to rail, reduced emissions due to reduced truck miles, better fuel efficiency, and improved safety by the reduction of potential accidents anticipated from the reduction of truck vehicle miles traveled when this project is completed.

This BCA follows guidance set forth in the Benefit-Cost Analysis Resource Guide and the 2016 Benefit-Cost Analysis Guidance for Grant Applications.

A **discount rate of 3 %** was used, following the TIGER BCA Resource Guide updated 3/1/2016. Bottom line, the present value (PV) of costs in 2015 dollars is \$35.5 million and the PV of benefits is \$107 million. This rate yields conservative estimates of NPV and benefit cost ratio, but per the NOFO guidance, it is appropriate because funds are public and would be spent on other public projects. This analysis yields a NPV of \$135 million and a benefit-cost ratio of 4.8:1. The greatest

share of benefits is Economic Competitiveness from operational savings as a result of the modal change from truck to rail for the forecasted cargo shipments.

Table 7: Project Benefit to Cost Ratio Analysis Summary

Benefit to Cost Ratio					
Selection Criteria	Social Benefit	Inputs	Value	Monetized Value	
				Discount Rate 7%	Discount Rate 3%
State of Good Repair	Reduction of maintenance on US Roads & Hwys, Consistent with State and Regional Plans	Maintenance, preservation and upgrade savings of Highways	429 million VTM reduced off the highways	\$ 19,841,092	\$ 33,330,984
Economic Competitiveness	Operational cost savings	Savings of rail transport vs. truck transport	569 million ton miles @ \$0.071 savings per mile (truck vs. rail)	\$ 15,581,270	\$ 26,174,922
Quality of Life	Fuel savings due to reduced miles traveled by cargo using Rail from the terminal vs. Truck	Gallons of fuel saved	46 million gallons of fuel saved by reducing miles traveled with modal shift to Rail	\$ 40,138,465	\$ 67,428,472
Environmental Sustainability	Environmental Benefits from Reduced Emissions by modal change to rail	CO ₂ cost savings	407,000 metric tons of CO ₂ saved	\$ 15,044,154	\$ 15,044,154
Environmental Sustainability	Environmental Benefits from Reduced Emissions achieved by using electric cranes vs. diesel cranes	CO ₂ cost savings	Not Calculated		
Environmental Sustainability	Environmental Benefits from Reduced Emissions achieved by cold ironing	CO ₂ cost savings	Not Calculated		
Safety	Reduced fatalities from reduction of VMT	Fatality cost savings of 5.1 fatalities	\$44.5 million saved	\$ 17,142,704	\$ 28,797,970
Total Cost				(\$42,935,110)	(\$35,489,029)
Total Benefits				\$107,747,684	\$ 170,776,501
Net Present Value				\$ 64,812,575	\$ 135,287,473
Benefit to Cost Ratio				2.5:1	4.8:1

When a **discount rate of 7% was used**, the PV of costs in 2015 dollars is \$42.9 million and the PV of benefits is \$107.7 million. This rate also yields conservative estimates of NPV and benefit cost ratio per the NOFO guidance. This analysis yields a NPV of \$64.8 million generating a benefit-cost ratio of 2.5:1 over the analysis. The greatest share of benefits is from the Economic Competitiveness Category from the operational cost savings by moving the cargo on rail vs. truck.

The use of rail service for the cargo shipments instead of the current truck route eliminates at least 429 million commercial truck miles off of the local roads and highways. This reduction in commercial vehicle miles reduces the probability of 5.1 fatality accidents during the 20 year analysis from occurring on the related roads and highways. This results in a monetized safety value of \$17 million at the 7% discount rate.

Affected Populations and Types of Impacts

Personal vehicle users, commercial carriers, and local residents are the three main groups benefiting from improved mobility with less trucks on local and regional roads and highways. The following description and tables attempt to present costs and benefits for each type of impact that could be monetized:

Quantified benefits include:

- Improved economic competitiveness based upon the reduction of transportation costs for the Port of Everett shippers;
- Reduction of gallons of fuel used to transport cargo;
- Improved state of repair of the roads and highways, due to the reduction of truck miles;
- Reduced emissions due to lower Vehicle miles traveled by commercial trucks;
- Improved safety, resulting in reduced economic costs of potential fatalities on the highway due to the reduced VMT of the trucks.

Costs include construction and lifecycle costs. Construction costs are best available estimates at the 30% design level as of March 2016. This analysis anticipates general operations and maintenance costs. Unquantified benefits include:

- Downtown benefits from reduced truck congestion;
- Benefits to the local community by increased job opportunities at the Port and the improved availability of transportation mobility for area residents for their daily activities such as work, education and other services, and based upon \$76,900 per job, 722 temporary construction jobs and 382 permanent direct jobs.
- Benefits to the area citizens of the increased connectivity across town for non-motorized modes of transportation that will provide access to work centers, educational sites, and daily services when rail is used as the primary mode of transportation for cargo using the South Terminal.

Quantified Costs and Benefits Measurement of Long-Term Outcomes

The largest positive benefits at a 7% discount rate result from the economic competitiveness criteria. The availability of on-terminal rail generates a reduction of 569 million tons miles off of the roads and highways. The reduction in truck VMT results in an annual operating savings of approximately \$51 million due to the lower ton/mile transportation costs generated by the energy efficiency of rail versus truck. On its own, this accounts for 14% of the total benefits. Over the 20 years of the analysis it is calculated that 46 million gallons of fuel will be saved; \$104 million or 37% of the long-term benefits. The monetized saving of the reduction of a total of 5.1 highway fatalities due to the reduction of VMT generates a Safety benefit of \$45 million, accounting for 16% of the benefits. Reduced emissions and saving in road maintenance from the improvements account for the remaining 32% of the monetized benefits.

State of Good Repair

Table 8: Decreased road maintenance

Decreased road maintenance due to construction of Project and use of on-dock rail						
Year	Truck Miles saved	Maintenance rate/ mile	Total savings	No Build Total Miles	No Build Total Maintenance Cost	Decrease in Maintenance Costs using 2 trains per month vs. truck
		\$ 0.12				
2020	14,300,000	\$ 0.12	\$ 1,716,000	14,300,000	\$ 1,716,000	\$ 1,716,000
2021	14,300,000	\$ 0.12	\$ 1,716,000	14,300,000	\$ 1,716,000	\$ 1,716,000
2022	14,300,000	\$ 0.12	\$ 1,716,000	14,300,000	\$ 1,716,000	\$ 1,716,000
2023	14,300,000	\$ 0.12	\$ 1,716,000	14,300,000	\$ 1,716,000	\$ 1,716,000
2024	14,300,000	\$ 0.12	\$ 1,716,000	14,300,000	\$ 1,716,000	\$ 1,716,000
2025	14,300,000	\$ 0.12	\$ 1,716,000	14,300,000	\$ 1,716,000	\$ 1,716,000
2026	14,300,000	\$ 0.12	\$ 1,716,000	14,300,000	\$ 1,716,000	\$ 1,716,000
2027	14,300,000	\$ 0.12	\$ 1,716,000	14,300,000	\$ 1,716,000	\$ 1,716,000
2028	14,300,000	\$ 0.12	\$ 1,716,000	14,300,000	\$ 1,716,000	\$ 1,716,000
2029	14,300,000	\$ 0.12	\$ 1,716,000	14,300,000	\$ 1,716,000	\$ 1,716,000
2030	28,600,000	\$ 0.12	\$ 3,432,000	28,600,000	\$ 3,432,000	\$ 3,432,000
2031	28,600,000	\$ 0.12	\$ 3,432,000	28,600,000	\$ 3,432,000	\$ 3,432,000
2032	28,600,000	\$ 0.12	\$ 3,432,000	28,600,000	\$ 3,432,000	\$ 3,432,000
2033	28,600,000	\$ 0.12	\$ 3,432,000	28,600,000	\$ 3,432,000	\$ 3,432,000
2034	28,600,000	\$ 0.12	\$ 3,432,000	28,600,000	\$ 3,432,000	\$ 3,432,000
2035	28,600,000	\$ 0.12	\$ 3,432,000	28,600,000	\$ 3,432,000	\$ 3,432,000
2036	28,600,000	\$ 0.12	\$ 3,432,000	28,600,000	\$ 3,432,000	\$ 3,432,000
2037	28,600,000	\$ 0.12	\$ 3,432,000	28,600,000	\$ 3,432,000	\$ 3,432,000
2038	28,600,000	\$ 0.12	\$ 3,432,000	28,600,000	\$ 3,432,000	\$ 3,432,000
2039	28,600,000	\$ 0.12	\$ 3,432,000	28,600,000	\$ 3,432,000	\$ 3,432,000
	429,000,000		\$ 51,480,000			\$ 51,480,000

It is anticipated that there will be 429 million truck miles saved with the opening of the on-terminal rail siding at the South Terminal. This is a total savings in road maintenance of \$51 million over the 20 year post-construction analysis period.

Economic Competitiveness Benefits

Table 9: Operational Savings

Decreased Operational Costs due to construction of the project and conversion to rail between Everett, WA and Chicago, IL			
Year	Total ton miles on rail after opening the on-dock rail	saving / mile	Reduction in operation cost based upon differential rate/mile rail vs truck
		\$ 0.071	
2020	18,980,000	\$ 0.071	\$ (1,347,580)
2021	18,980,000	\$ 0.071	\$ (1,347,580)
2022	18,980,000	\$ 0.071	\$ (1,347,580)
2023	18,980,000	\$ 0.071	\$ (1,347,580)
2024	18,980,000	\$ 0.071	\$ (1,347,580)
2025	18,980,000	\$ 0.071	\$ (1,347,580)
2026	18,980,000	\$ 0.071	\$ (1,347,580)
2027	18,980,000	\$ 0.071	\$ (1,347,580)
2028	18,980,000	\$ 0.071	\$ (1,347,580)
2029	18,980,000	\$ 0.071	\$ (1,347,580)
2030	37,960,000	\$ 0.071	\$ (2,695,160)
2031	37,960,000	\$ 0.071	\$ (2,695,160)
2032	37,960,000	\$ 0.071	\$ (2,695,160)
2033	37,960,000	\$ 0.071	\$ (2,695,160)
2034	37,960,000	\$ 0.071	\$ (2,695,160)
2035	37,960,000	\$ 0.071	\$ (2,695,160)
2036	37,960,000	\$ 0.071	\$ (2,695,160)
2037	37,960,000	\$ 0.071	\$ (2,695,160)
2038	37,960,000	\$ 0.071	\$ (2,695,160)
2039	37,960,000	\$ 0.071	\$ (2,695,160)
	569,400,000		\$ (40,427,400)

The Economic Competitiveness Benefits are realized by monetizing the decreased operational costs to the shipper being achieved based upon rail transportation being more cost effective than trucking. *Table 9* (left) shows the operational savings to the shippers of rail routing vs. truck routing.

This chart shows the estimated operational cost saving based upon the differential cost of \$0.071 per ton savings which will total \$40 million over the analysis period. This is anticipated to be achieved by shippers choosing to move their cargo from the Port of Everett inland by rail versus the current trucking method to the same destination.

Quality of Life

Table 10: Gallons of Fuel and CO2 Saved

Gallons and CO2 MT Saved due to shift in mode			
Year	Total gallons saved (reduced) in modal shift to rail	Fuel savings due to reduced VMT @ \$2.285 / gal	CO2 Reduced (Metric Tons)
2020	1,519,240	\$3,471,462	13,565
2021	1,519,240	\$3,471,462	13,565
2022	1,519,240	\$3,471,462	13,565
2023	1,519,240	\$3,471,462	13,565
2024	1,519,240	\$3,471,462	13,565
2025	1,519,240	\$3,471,462	13,565
2026	1,519,240	\$3,471,462	13,565
2027	1,519,240	\$3,471,462	13,565
2028	1,519,240	\$3,471,462	13,565
2029	1,519,240	\$3,471,462	13,565
2030	3,038,479	\$6,942,925	27,129
2031	3,038,479	\$6,942,925	27,129
2032	3,038,479	\$6,942,925	27,129
2033	3,038,479	\$6,942,925	27,129
2034	3,038,479	\$6,942,925	27,129
2035	3,038,479	\$6,942,925	27,129
2036	3,038,479	\$6,942,925	27,129
2037	3,038,479	\$6,942,925	27,129
2038	3,038,479	\$6,942,925	27,129
2039	3,038,479	\$6,942,925	27,129
Total	45,577,188	\$104,143,873	406,939

The reduction of trucks on the roads increases the mobility of local and regional residents, especially those trucks that are no longer traveling through the downtown corridor. The project will improve the quality of life in Everett and along the US2, I-5 and I-90 Corridors, supporting the core livability principles established by the Partnership for Sustainable Communities. Addition of on-terminal rail provides a safer transportation mode for freight movement to and from the Port of Everett and its respective markets.

Fuel savings are calculated upon shippers choosing to use the more energy efficient rail mode to transport cargo from the Port of Everett to Chicago, Illinois. Fuel savings are anticipated as the cargo is loaded directly on to rail at the terminal and is moved directly inland by rail versus the current trucking method. *Table 10* (left) shows the

estimated number of gallons of fuel saved by converting the current transportation method to rail. The construction of the project will reduce fuel usage by over 45 million gallons of fuel during the analysis period, which will save shipper over \$104 million at today’s average fuel prices of \$2.29/gallon as of March 14, 2016.

Environmental Sustainability Benefits

The project is also expected to save 406,000 Metric Tons of greenhouse gas emissions over the analysis period, as shown in *Table 10* (above). This is calculated based on reduced emissions of CO2 by the reduction of fuel used in rail transportation vs. trucking.

Safety benefits

Table 11: Conversion of Collision Statistics

Conversion of Collision statistics based upon 100 Million miles travel by truck								
Collision Type					Annual Average	Current est. accident costs	Effect on Accidents with conversion to rail	
AIS Level	Severity	Fraction of VSL	Unit value (\$2015)*	Conversation of Truck Traffic	Accident Count by KABCO	Current Annual social cost of Accidents	Estimated reduction in injuries by 70 % per Insurance	Estimated Annual accident costs savings
AIS 0	no injury					\$0	\$0	
AIS 1	Minor	0.003	\$28,200			\$0	\$0	\$0
AIS 2	Moderate	0.047	\$451,200			\$0	\$0	\$0
AIS 3	Serious	0.105	\$1,008,000			\$0	\$0	\$0
AIS 4	Severe	0.266	\$2,553,600			\$0	\$0	\$0
AIS 5	Critical	0.593	\$5,692,800			\$0	\$0	\$0
AIS 6 reduction VMT	Unsurvivable	1.000	\$9,600,000	0.231660	0	\$2,223,936	\$1,556,755	\$2,223,936
AIS 6 due to crossing closure	Unsurvivable	1.000	\$9,600,000		0	\$0	\$0	\$0
Property Damage Only			\$4,198			\$0	\$0	\$0
						\$2,223,936	\$1,556,755	\$2,223,936
							annual savings	

*TIGER BENEFIT-COST ANALYSIS (BCA) RESOURCE GUIDE updated 3/1/2016

Conversion of Collision statistics based upon 100 Million miles travel by truck			
US Traffic Fatalities Per 100 Million miles traveled on Roads			Annual
Total Truck miles reduced over the 20 years	429,000,000	/20	21,450,000
Total Truck miles divided by 100 million miles	4.29		0.2145
Estimated Fatalities Per 100 million miles travel based upon average US's experience			
2015 Unsurvivable value	\$9,600,000	1.08	0.23166
Annual life savings based upon reduced truck mileage			\$2,223,936
Total lives saved over 20 years			5.10
Dollars saved based upon estimated mileage saved per year			\$44,478,720

Safety benefits on *Table 11* (above) are estimated at \$44.5 million in total social benefit of 5.1 lives saved over the 20 years after project construction is completed. This is calculated based upon the reduction of potential fatalities due to the reduction of truck miles in the example rail move between Port of Everett and Chicago, Illinois.

Qualitative Benefits not Quantified.

The project does not permit economic quantification of some factors. Unquantified factors include general vitality of downtown Everett due to improved accessibility and attractiveness to residents, visitors and investors with trucks not traversing downtown on their way to and from the National Freight Highway System. These factors are expected to be positive benefits to the community.

The project team did not try to monetize the benefits of the electrification brought to the terminal with this modernization effort. It is believed that there will be additional savings to the community that cannot easily be monetized. Examples of these non-quantified benefits that could be monetized under economic competitiveness and Environmental Sustainability categories but have not been in this analysis include **decreased emissions and the reduction of ship engine noise** from the ability to hotel the ships with **shorepower** while at berth and electrification of the cranes as well as the improved access that will be gained with the construction of public access through the Port's 2% for Public Access Fund.

Quality of Life

A benefit not quantified in this calculation of the BCA is from access improvements that the 2% (\$650,000) contribution makes to the [Port's voluntary Public Access Fund](#). These funds will be used to the enhanced livability of Everett, which is expected to benefit the area and its many users. The project's primary livability goal is to foster a livable community through the application of existing policies and new investments to increase transportation choices and improve access to transportation services. The livability investments included in this project will deliver transportation benefits and are designed and planned in such a way that they will have a positive impact on the qualitative measures of community life.

The project may also stimulate new opportunities in downtown as mobility is enhanced by the reduction of truck traffic through the area. This may encourage rehabilitation or redevelopment of existing downtown structures to accommodate a higher density or intensity of use. Redevelopment often occurs where a property location can support more intense development, such as areas where mobility has been enhanced.

Job Creation

Table 12: Construction Jobs Created by the Total Project

Direct Jobs by Calendar Quarter				
	2017	2018	2019	Total
Q1	94	200	147	
Q2	94	200	147	
Q3	251	200	0	
Q4	375	200	0	
Capital Spending in Mill.	\$ 28.8	\$ 15.4	\$ 11.3	\$ 55.5
Total Annual Jobs at \$76,900/yr	375	200	147	722

Short-Term Impacts on Employment

Short-term job creation impacts from this project are estimated in *Table 12* (above). The construction of this project generates 722 short-term family wage jobs at \$76,900 per job year in the years spanning 2017-2019. This includes investment that covers the final design, final approvals, and construction period of the South Terminal Modernization Project. Positive economic impacts resulting from these jobs are not included in the benefit-cost ratio per the methodology prescribed by USDOT. To demonstrate this economic impact, the project team used the administration's jobs formula to calculate short-term employment impacts of the project in this analysis. Please note, that Martin Associates also include short-term construction jobs estimates in their report. The two analysis generate different job numbers as the Martin report uses a job calculation tailored to the Seattle-Tacoma region versus the administration job formula given in the BCA guidance documentation. Martin Associates has calculated that the \$55 million of expenditures will also have significant one-time construction impacts. Using employment and income multipliers developed for the Seattle-Everett for Martin Associates by

the US Bureau of Economic Analysis, Regional Input-Output Modeling System, it is estimated that the \$55 million of construction expenditures will generate \$39.6 million of personal income, \$3.5 million of state and local taxes and \$7.1 million of Federal Taxes.

Long-Term Job Creation

[Martin Associates](#) further analyzed the project for long term job creation and related impacts as shown in *Table 13* below.

Table 13: Long-term Economic Impacts of the South Terminal

As this table indicates, at startup with a 35,000 TEU throughput, 300,000 tons of break bulk cargo and 35,000 tons of cement, the South Terminal will generate about 382 direct jobs. These direct job holders are projected to receive about \$28.5 million in personal wages and salaries, for an average annual salary of \$74,626. As the result of the local and regional purchases by these direct job holders, 436 induced jobs will be supported in local supplying industries. It

Year	1	6	11	16	21
Jobs					
Direct	382	791	937	1,069	1,275
Induced	436	845	991	1,133	1,341
Indirect	88	183	216	247	299
Total	906	1,818	2,144	2,449	2,915
Personal Earnings (Millions)					
Direct	\$28.5	\$54.1	\$68.3	\$72.4	\$85.5
Re-spending/Consumption	\$62.6	\$118.9	\$139.1	\$159.1	\$188.0
Indirect	\$3.4	\$7.1	\$8.4	\$9.6	\$11.4
Total	\$94.5	\$180.1	\$210.8	\$241.1	\$284.9
Business Revenue (Millions)					
	\$56.3	\$107.1	\$128.3	\$141.9	\$167.4
Local Purchases (Millions)					
	\$15.3	\$31.8	\$37.6	\$42.9	\$51.2
State/Local Taxes (Millions)					
	\$8.9	\$16.9	\$19.8	\$22.7	\$26.8
Federal Taxes (Millions)					
	\$17.0	\$32.4	\$37.9	\$43.4	\$51.3
Fed Tax Direct Only (Millions)					
	\$5.1	\$9.7	\$11.4	\$13.0	\$15.4

is important to emphasize that the re-spending and local consumption impact of \$62.6 million should not be divided by the 436 induced jobs to estimate induced income, since the re-spending impact also includes local consumption purchases, and this calculation would overstate the average induced jobs salary. The firms employing the 382 direct jobs are projected to make \$15.3 million of local purchases, which in turn is estimated to support 88 indirect jobs. These indirect job holders are projected to earn \$3.4 million of wages and salaries annually. Local businesses providing the services to the vessels and handling the freight as well as the surface transportation firms are projected to receive about \$56.3 million annually with a throughput of 35,000 TEUs, and 300,000 tons of break bulk cargo. A total of \$8.9 million of state and local taxes and \$17.0 million of Federal taxes are projected at start-up.

By full build out of the South Terminal, 20 years after start-up in year 21, the impacts are projected to grow significantly. Container throughput at the South Terminal is projected at 200,000 TEUs and break bulk cargo is projected to grow to 400,000 tons annually. By the twentieth year, it is estimated that 1,275 direct jobs will be supported annually by the modernized South Terminal. These individuals are projected to earn \$85.5 million in wages and salaries annually, and as the result of the re-spending of this direct personal wage and salary impact, an additional 1,341 induced jobs are projected to be supported in the local economy. The local businesses providing the direct services are projected to earn \$167.4 million of annual revenue, of which \$51.2 million of local purchases are projected. These local purchases will

support an additional 294 indirect jobs, for a total annual job impact in year 21 of 2,911 jobs. State and local taxes generated at full build out are estimated at \$26.8 million annually, and Federal tax revenues are projected at \$51.3 million annually. If only the direct impact is considered, in 20 years, the activity is projected to generate \$15.4 million of direct Federal tax revenue annually.

SOURCES

All sources and additional notes have been cited in the Benefit Cost Analysis excel workbook that can be found at the project website.

The Martin Associate's report on The Economic Benefits of Investments at the South Terminal at the Port of Everett can also be found on the project website: www.portofeverett.com/tigergrant