THE NORTHWEST SEAPORT ALLIANCE
Gateway to Solutions
nwseaportalliance.com

Date: May 28, 2019

To: Interested Technology Vendors

Subject: Request for Information (RFI) 2019-01 Port Community System (PCS)

Purpose for this Request for Information:

The Northwest Seaport Alliance (NWSA) is seeking information from technology vendor(s) interested in providing infrastructure, products and/or services to design and implement a Port Community System (PCS).

For the purposes of this RFI, the following PCS definitions are used:

- The PCS is a neutral and open electronic platform linked to port cargo flows, enabling the intelligent and secure exchange of information between public and private stakeholders to improve the competitive position of the NWSA.
- The PCS enables the NWSA port community to optimize, manage, and automate port and logistics processes through a common platform for all public and private stakeholders, and all modes of transportation used by cargo moving through NWSA facilities.

The NWSA envisions that a PCS will:

- Provide a neutral and trusted 3rd-party platform for the exchange of data and information;
- Reliably and securely connect supply chains and logistics for our local, national and international stakeholders;
- Make use of existing, and be able to seamlessly integrate evolving and future, IT infrastructures;
- Use APIs to connect to existing systems;
- Simplify the processes needed for user authorization and data exchange;
- Be tailored and flexible to the needs of the NWSA and its stakeholders.

The NWSA is interested in the architecture approach, staff and technical capabilities, as well as cost proposals of technology vendor(s) with the capacity to design and implement a PCS solution.

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Background:

The NWSA is the fourth-largest container gateway in North America[1]. The NWSA's facilities occupy 1,785 acres in King and Pierce Counties, including 11 container terminals, two breakbulk and project cargo terminals, six on-dock rail yards, three near-dock rail yards, and a 165-acre auto processing facility. As a major center for containerized, bulk, breakbulk, project/heavy-lift cargoes, automobiles and trucks, the NWSA connects to the second-largest concentration of distribution centers on the West Coast. In 2017, international trade accounted for more than $75.3 billion (imports were $58.3 billion, and exports were $17 billion of that total), while domestic trade was estimated at $5.4 billion in 2015. Combined, the Alliance's North and South Harbors handled approximately 3.7 million TEUs in 2017[2] at facilities located within the industrial areas of both Seattle and Tacoma. A PCS should link both harbors, covering all intermodal facilities as well as the Waterway, Rail and Truck Freight Economic Corridors that provide ingress/egress, in addition to providing information on multi-mode cargo movement by truck, rail, and ship.

Currently, the ever-changing logistics impacting intermodal freight movement in, around and near NWSA facilities are not well coordinated, leading to inefficiencies that affect the NWSA's ability to handle both existing and projected cargo growth. Terminal Operators at Alliance facilities generally do not share information as it is considered proprietary, such as on-terminal turn times, which can help identify efficient terminals. Accurate queue information for trucks waiting on-street is not available to the trucking community, leading to long truck queues, congestion and greenhouse gas emissions that cannot be adequately measured and addressed. Ineffective links among cargo modes caused by fractured data entry, coordination, and dissemination degrade the reliability and performance of carriers, shippers, and terminal operators. The lack of effective information sharing among stakeholders causes inefficiencies, resulting in unnecessary delays in the movement of containerized freight. Various Alliance stakeholder groups would benefit from data sharing, including trucking companies, marine terminals, off-port freight facilities, freight forwarders, chassis and port equipment providers, beneficial cargo owners (BCOs), state and local transportation agencies, as well as NWSA staff.

The NWSA is committed to improving port competitiveness of Alliance stakeholders through

[1] NWSA, "Delivering the goods for Pacific Northwest Exporters" - https://www.nwseaportalliance.com/sites/default/files/NWSA_ExportGateway.pdf

[2] NWSA, "2017 Annual Report" - https://www.nwseaportalliance.com/sites/default/files/2017_annual-report.pdf

supply-chain efficiency and improvements to visibility of containers. Improvements may be achieved through methods such as improved traveler information and increased efficiency, safety, and reliability of truck and rail movement within Alliance facilities, which may lead to improvements in terminal efficiency, reduced delays, reductions in truck queues, and potentially help increase (retain and grow) discretionary cargo. Collectively, these benefits may also translate to reductions in freight congestion and improvements in regional air quality. We anticipate a PCS solution would generate benefits that extend beyond the Alliance facilities, such as reduced regional congestion, emissions and job creation.

A PCS should be comprised of the infrastructure, systems and interfaces necessary to compile data, integrate it in a way that maintains the integrity of both public and potentially proprietary private data, and disseminate it to a range of private and public sector user groups in a format that enables them to act on that information. A PCS solution should interact with all Alliance stakeholders, including ocean carriers, marine terminals, railroad tracks and yards, drayage truckers, in addition to warehousing and distribution centers, and should also provide cargo movement visibility to BCOs. However, a PCS must be able to comply with confidentiality requirements of our private sector stakeholders and control individual access to authorized data. A PCS solution should also enable the NWSA's Operations Service Center to measure truck traffic congestion on, at and near the port container terminals and provide real-time truck wait and queuing information to the trucking community. This truck information may help reduce congestion by enabling drivers to make more informed routing decisions.

To address the above objectives and needs, the NWSA has completed a Systems Engineering process in conjunction with experienced industry consultants, developing a Concept of Operations (ConOps) [Attachment "A"] and the resulting System Requirements [Attachment "B"]. The ConOps document defines essential capabilities, features and functions for the secure exchange of information between public and private stakeholders, including proposed system and improvements that have been identified based on both desired changes and identified user needs of stakeholders. For the System Requirements, these stakeholder needs were analyzed and transformed into groups of verifiable requirements regarding what the system should do, but not how the system will do it. Please review the NWSA needs and requirements from the ConOps and System Requirements documents as the basis for a PCS solution.

The intended result of this RFI:

The overall aim of this RFI is to identify technology vendor(s) with capacity for a PCS solution to meet the needs and requirements of our NWSA design (i.e. - ConOps and System Requirements) along with associated technology costs and benefits to Alliance stakeholders.

We're seeking information on the high-level system design of a vendor(s) PCS solution, including infrastructure. We're also interested in the major features and functions of a recommended PCS design approach, as well as planning information on systems integration and implementation. We acknowledge that existing NWSA systems are a unique set of applications that will require custom integration into a PCS solution. The NWSA is aware of PCS technology implemented at other west coast ports containing systems integration with several common Alliance stakeholder groups, and respondents are encouraged to provide information on any existing systems integration, to include the following Alliance stakeholder groups:

Ocean Alliance	Ocean Carrier	Terminal Operators
2M Alliance	Maersk	SSA
	MSC	WUT
	HMM (Hyundai)	
	Hamburg Sud	
	Zim	
Ocean Alliance	CMA CGM	SSA
	Cosco	Everport
	OOCL	
	APL	
	Evergreen	
The Alliance	NYK Line	ITS
	Hapag Lloyd	Ports America
	K Line	
	MOL	
	Yang Ming	

When responding to this RFI, respondents are encouraged to provide further details for the following PCS technology areas:

- System design and operations documents (operations manual, training materials, communications network);
- Systems equipment specifications (hardware and software);
- Systems integration methodology and partners;
- Stakeholder data source integration, security and confidentiality; and
- Standard implementation baseline.

We'll use the information obtained from this RFI to make an informed decision on how to best proceed with the design, procurement and implementation of PCS technology that meets our vision for the system.

We intend to inform those who respond to this RFI of our intentions no later than six (6) months following the response due date stated below. This RFI does not provide a guarantee that the RFI will be followed by an RFP, and, ultimately, the selection of a vendor.

Performance Expectations:

The ideal vendor(s) response would:

- Provide technology recommendation to design a PCS solution for the NWSA;
- Provide recommended pros and cons of PCS technology as it relates to marine industry options;
- Provide information as to how a PCS solution could be expected to perform and interface with existing NWSA systems, as well as data sources for ocean carrier, marine terminal operator and rail stakeholders, and potentially be expanded;
- Establish evaluation criteria for assessment of Alliance stakeholders to ensure a PCS solution and systems integration is a good fit for the NWSA;
- Account for risk at both the vendor(s) level and the NWSA;
- Is licensed to do business in the state of Washington and bonded;
- Able to show similar project examples; and
- Provide a budgetary estimate to operate what is recommended and what the NWSA would be responsible for based on recommended PCS solution.

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Response Requirements:

In responding to this RFI, please provide general information about the following:

- A summary of your business;
- A summary of your firm's qualifications and growth profile;
- Describe at a high level your experience with:
    - Working with public agencies; and
    - Designing, implementing and maintaining technology solutions for a PCS, or equivalent systems.
- A description of the PCS solution you would provide, including:
    - The operational features and functions you would provide, and how they integrate;
    - The technical architecture/design and technology components utilized;
    - The degree to which the PCS solution is standards based, flexible and customizable.
- Pricing Model and associated costs for the PCS solution, including:
    - One-time costs for integration and implementation; and
    - Recurring/Annual costs.

Questions:

Firms are encouraged to be creative and candid in their responses. Teaming is strongly encouraged. Should you have any questions, please submit them by 5:00 PM PST June 14, 2019. Questions received after this date cannot be considered.

Questions are to be submitted electronically to:

Mark Little
Director, Contracts and Purchasing
procurement@portoftacoma.com

Response Date:

Interested firms must provide their responses to procurement@portoftacoma.com by 2:00 PM PST, on July 19, 2019.

Responses are to be returned to:

Mark Little
Director, Contracts and Purchasing
procurement@portoftacoma.com

NOTE: ALL COST INFORMATION IS FOR BUDGETARY PURPOSES ONLY AND NO CONTRACT OR PURCHASE ORDER WILL BE ISSUED AS A RESULT OF THIS RFI. SHOULD ANY OF YOUR RESPONSE BE CONSIDERED A TRADE SECRET OR OTHERWISE NOT FOR PUBLIC DISEMINATION PLEASE ANNOTATE YOUR RESPONSE ACCORDINGLY.

ATTACHMENT A
RFI 2019-01

THE NORTHWEST SEAPORT ALLIANCE
Gateway to Solutions

Port Community System

Concept of Operations

prepared for

Northwest Seaport Alliance

prepared by

Cambridge Systematics, Inc.

Transpo Group, Inc.

CAMBRIDGE SYSTEMATICS
Think Forward

transpogroup

December 19, 2018

Port Community System

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Cambridge Systematics, Inc.
Transpo Group, Inc.

date

December 19, 2018

Table of Contents

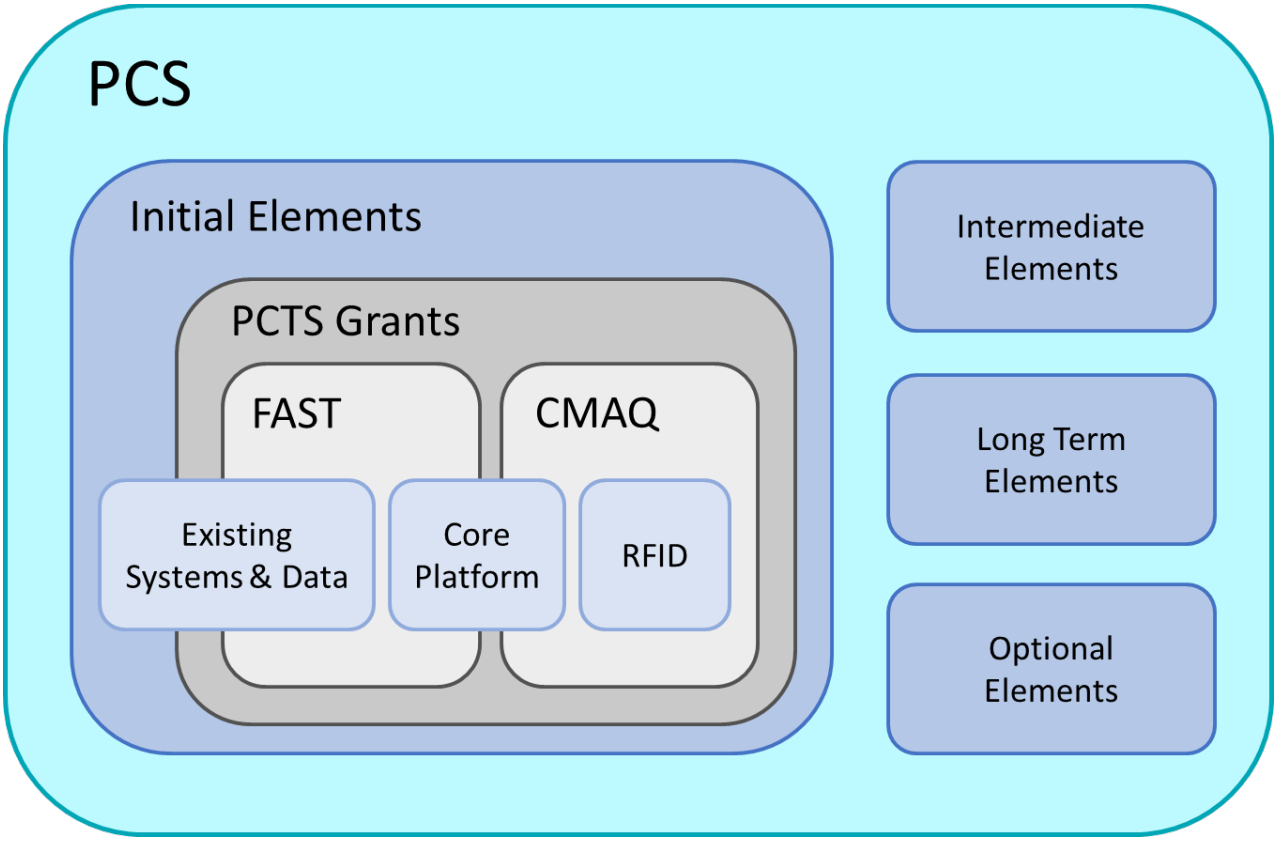
List of Tables

List of Figures

1.0 Scope

The Northwest Seaport Alliance (NWSA) is managing the design and implementation of a Port Community System (PCS), an electronic platform capable of exchanging data and information between NWSA's stakeholders. The PCS will be comprised of four groups of elements: Initial, Intermediate, Long Term and Optional, as shown in **Figure 1**. Initial Elements of the PCS will be funded in part using two existing grants: a Fixing America's Surface Transportation (FAST) grant supporting the development of a Port Community Technology System (PCTS), and a Congestion Mitigation and Air Quality (CMAQ) grant focused on King County expansion of the radio-frequency identification (RFID) system and a Freight Advanced Traveler Information System (FRATIS) truck data dissemination system. Intermediate, Long Term and Optional PCS elements have been identified, but the feasibility for inclusion will be dependent upon cost, additional hardware/software elements, data integration, data acquisition, data sharing agreements, and resources available.

Figure 1. Port Community System Concept



The Ports of Tacoma and Seattle launched the NWSA, a marine cargo operating partnership, in 2015 to strengthen the Puget Sound gateway and attract more marine cargo to the region (**Figure 2**). Port of Seattle and Port of Tacoma maintain ownership of their individual terminals in the North (Seattle) and South (Tacoma) Harbors, however, NWSA has been delegated to oversee operation and management of NWSA facilities in both harbors. The Alliance is a port development authority governed by the two ports as equal members, with each port acting through its elected commissioners. The partnership creates the third-largest

trade gateway and the fourth-largest container gateway in North America[1]. The NWSA's facilities occupy 1,785 acres in King and Pierce Counties, including 11 container terminals, two breakbulk and project cargo terminals, six on-dock rail yards, three near-dock rail yards, and 165-acre auto processing facility. As a major center for bulk, breakbulk, project/heavy-lift cargoes, automobiles and trucks, the NWSA connects to the second-largest concentration of distribution centers on the West Coast. In 2017, international trade accounted for more than $75.3 billion (imports were $58.3 billion and exports were $17 billion of that total), while domestic trade was estimated at $5.4 billion in 2015. The Alliance handled approximately 3.7 million twenty-foot-equivalent units (TEUs) in 2017[2] in the North and South Harbors combined.

Figure 2. Geographical Location of the Alliance's North and South Harbors

Port of Seattle terminals comprising the Alliance's North Harbor facilities are located just south of downtown Seattle, in the Duwamish Manufacturing Industrial Center (MIC). There are five container terminals and two intermodal rail yards. The following roadways serve the port complex: SW Spokane Street, E Marginal Way, and Alaskan Way S.

Port of Seattle facilities that are part of the Alliance include five container terminals:

- **T-5 –** Located on 185 acres and has two ship berths approximately 50 feet deep. Currently, the terminal is undergoing modernization. Future improvements include berth deepening to accommodate large container vessels, wharf rehabilitation, electrical service, and improvements to the upland portions of the property.
- **T-18 –** The terminal operates on 196 acres of the Harbor Island. There are four ship berths that are 51 feet deep[3]. There are 10 cranes and 14 inbound and 12 outbound (with eight reversible) gates operating at the terminal. Currently, 15 ocean carriers utilize the terminal. SSA Marine operates the terminal.
- **T-30 –** The terminal is located on 70 acres and has two ship berths that are 50 feet deep. There are six cranes and 13 truck lanes at the terminal. Currently, seven shipping lines utilize the terminal. SSA Marine operates the terminal.

[1] NWSA, "Delivering the goods for Pacific Northwest Exporters" - https://www.nwseaportalliance.com/sites/default/files/NWSA_ExportGateway.pdf

[2] NWSA, "2017 Annual Report" - https://www.nwseaportalliance.com/sites/default/files/2017_annual-report.pdf

[3] http://www.ssamarine.com/locations/terminal-18/

- **T-46 –** The terminal occupies 82 acres. There are two ship berths that are 50 feet deep. There are five cranes, nine inbound gates, and eight outbound gates. Three ocean carriers utilize the terminal. Total Terminals International, LLC operates the terminal.
- **T-115 –** The terminal occupies 70 acres and has four ship berths that are 30 feet deep. Alaska Marine Lines utilizes and operates the terminal.

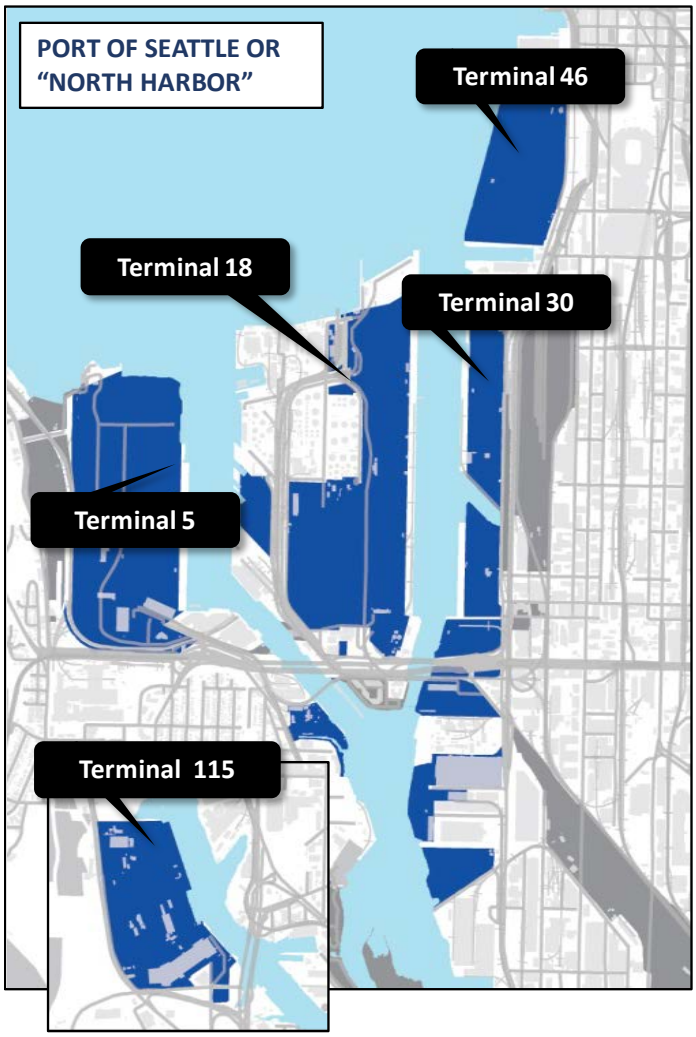


Figure 3. Port of Seattle Map

Port of Tacoma is situated in Tacoma MIC, which is a part of Pierce County and includes City of Tacoma, Puyallup Indian Reservation, and the City of Fife. Port of Tacoma is served by the following roadways: SR 509, I-5, Pacific Highway East, Port of Tacoma Road, East 11th Street, Milwaukee Way, 54th Avenue E, Taylor Way, and Lincoln Avenue.

Port of Tacoma has six container terminals:

- **West Sitcum Terminal (formerly APM Terminals)** – The terminal occupies 135 acres and has two ship berths that are 51 feet deep. There are five cranes, eight inbound truck lanes, and six outbound truck lanes. Matson shipping line utilizes the terminal. SSA Marine currently operates the terminal.[4]
- **Husky –** The terminal occupies 93 acres and has one ship berth that is 51 feet deep. There are seven inbound and four outbound gates. The following ocean carriers utilize the terminal: Hapag-Lloyd, K Line, MOL, NYK Line, UASC, and Yang Ming. West Coast Terminal & Stevedoring operates the terminal.
- **East Sitcum Terminal (formerly Olympic Container Terminal)** – The terminal occupies 54 acres. There is one ship berth, and five inbound and two outbound gates. The following ocean carriers operate at the terminal: Hapag-Lloyd, MOL, NYK Line, UASC, Westwood, Yang Ming. Ports America Group operates the terminal.
- **Pierce Container Terminal (PCT)** – The terminal occupies 141 acres with two shipping berths. There are seven cranes, and 10 inbound and six outbound gates. The following ocean carriers utilize the terminal: APL, CMA CGM, COSCO, Evergreen Line, and OOCL. Ports America Group operates the terminal.
- **Washington United Terminals (WUT)** – The terminal is located on 123 acres and has two shipping berths. There are nine inbound, four outbound, and two reversible gates. The following ocean carriers utilize the terminal: Hyundai and ZIM. Washington United Terminals operates the terminal.
- **TOTE –** The terminal is located on 48 acres and has three roll-on/roll-off ramps. Five inbound and two outbound gates serve the terminal. TOTE Maritime Alaska utilizes and operates the terminal.

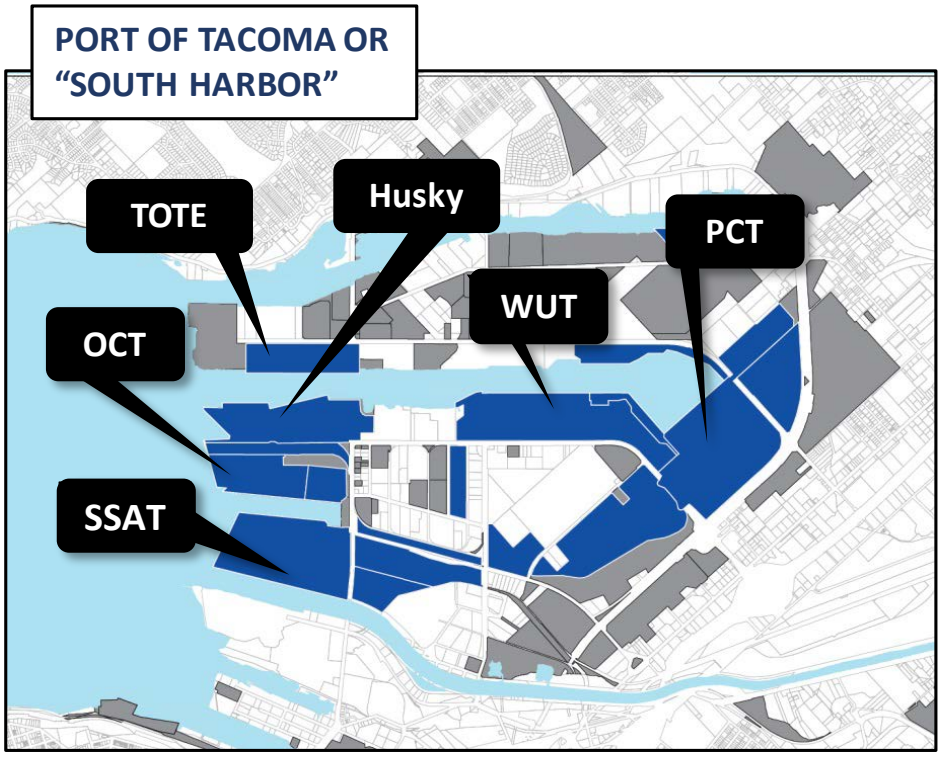


Figure 4. Port of Tacoma Map

[4] https://www.porttechnology.org/news/apmt_tacoma_terminal_lease_transfers_to_ssa_marine

Due to the urban location of the Alliance's Seattle and Tacoma facilities, both harbors experience transportation issues, such as roadway queueing outside of each facility, long marine terminal turn times, at-grade rail crossings, and truck parking violations. In addition, some of the Alliance's roadway access points have conflicting pedestrian and bicycle activity. Due to the high freight traffic volumes along these road segments, there is a challenging and dangerous environment for pedestrians and bicyclists that lead to conflicts between freight movement and non-motorized modes.

The PCS will help promote economic competitiveness of NWSA stakeholders by improving the coordination of freight movement at the port facilities. These improvements, in turn, will lead to increased terminal efficiency, reduced delays, and reductions in truck queues. Collectively, these benefits will also translate to less freight congestion and improved air quality for the region. Eventually, the PCS will encompass data and interactions relating to NWSA terminals, railroad tracks and yards, ocean carriers, and warehousing and distribution centers. It will provide information on the movement of cargo by truck, rail, and ship, as well as their interfaces, thus improving efficiency of the NWSA-related supply chain.

The objective of this document is to describe the PCS Concept of Operations (ConOps) for the Alliance. It provides recommendations of operational objectives to address needs at NWSA and the necessary improvements needed to meet these operational objectives. This document is informed by the efforts conducted as part of the 2006 PCTS project and other initiatives. It is anticipated that the ConOps is a living document intended to be updated as new technology and infrastructure investments are made or operational procedures are revised.

1.1 Identification

This document is the deliverable as defined under Task 2 of the scope of work for Transpo Group USA, Inc. project number 1.18027.00 named Port of Tacoma 2018 Consulting Services for the PCS project. Scope of work document is The Northwest Seaport Alliance and the Port of Tacoma – Professional Services Agreement No. 070894.

1.2 Document Overview

This document provides a ConOps for a PCS. The ConOps is intended as a foundational document for communicating the user needs and system requirements for the PCS to system developers. Systems engineers will use the ConOps to develop detailed technical specifications that meet the user needs defined herein.

This document is organized as follows:

- **Section 1 – Scope** defines the intent of this document, identifies the system users and stakeholders and provides a cursory overview of the contents.
- **Section 2 – Referenced Documents** describes the key sources used to develop this ConOps.
- **Section 3 – The Current System or Situation** describes current technologies utilized by stakeholders and how they are being used.
- **Section 4 – Justification for and Nature of Changes** identifies the deficiencies of the existing systems, desired changes to the systems and priorities, and assumptions and challenges.

- **Section 5 – Concept for the Proposed System** contains a description of the desired system, how it will address the concerns outlined in Section 4, how it will operate, and how users interface with the system.
- **Section 6 – Operational Scenarios** identifies potential real-world situations at the Alliance and describes how the new system, operational procedures, and stakeholders respond to each situation. This also informs how the system benefits the users.
- **Section 7 – Summary of Impacts** describes the expected operational and organizational benefits and impacts of the essential features of the new systems, as well as any impacts during development.
- **Section 8 – Analysis of the Proposed System** includes a summary of anticipated improvements, perceived disadvantages or limitations to the system, and alternatives or tradeoffs considered.
- **Section 9 – Implementation Plan / System Roadmap** provides a high-level overview of the plan for the deployment of the PCTS system.

1.3 Identified System Users and Stakeholders

Primary users of the PCS will be NWSA terminal operations managers, motor carrier operators and dispatchers, beneficial cargo owners (BCOs), public transportation agencies, and other Alliance stakeholders. Public sector stakeholders include the Ports of Seattle and Tacoma, the cities of Seattle, Tacoma, and Fife, Washington State Department of Transportation (WSDOT), and the Puget Sound Regional Council (PSRC). More detailed information on the system users and stakeholders can be found in Section 3.3. PCS data providers may include NWSA, marine terminal operators (MTOs), ocean carriers, rail companies, and third-party private data vendors.

1.4 System Overview

The PCS will implement an open standard platform for the advanced and secure exchange of information between NWSA public and private stakeholders. It is designed to optimize, manage, and automate port and logistics processes through a common platform for data exchanges. It will provide functionality, visibility, and information on the movement of cargo by truck, rail, and ship, as well as their interfaces, thus improving efficiency of the NWSA-related supply chain. This new capability will help to improve the coordination of freight movement at NWSA facilities, and will lead to improvements in terminal efficiency, reduced delays, and reductions in truck queues. Collectively, these benefits will also translate to reductions in freight congestion and improvements in air quality for the region. The PCS will encompass data and interactions relating to NWSA terminals, railroad tracks and yards, ocean carriers, and warehousing and distribution centers.

The PCS will be implemented in multiple phases. The Initial Elements phase is comprised of three main components: (1) the expansion of vehicle tracking technology and communications infrastructure into areas within King County outside of NWSA facilities, (2) the PCS Core Platform with FRATIS information dissemination, and (3) integration of several existing systems and data sources. The expansion of vehicle tracking hardware will be used to augment the data collected by the recently completed installation of RFID vehicle tracking technology at NWSA facilities. These data are used to monitor truck wait and queuing information on, at and near NWSA container terminals and will be provided to the trucking community through the PCS. Future phases of the PCS will consider Intermediate, Long Term and Optional Elements, which are further detailed in Section 5.3.

Figure 5 presents an overview of the relationship between the Users, the Data Sources, the System Concept and the Dissemination Methods. A High-Level System Architecture diagram is developed later, and presented in Section 5.5, followed by more detailed information flow diagrams developed for a series of Operational Scenarios, which are provided in Section 6.

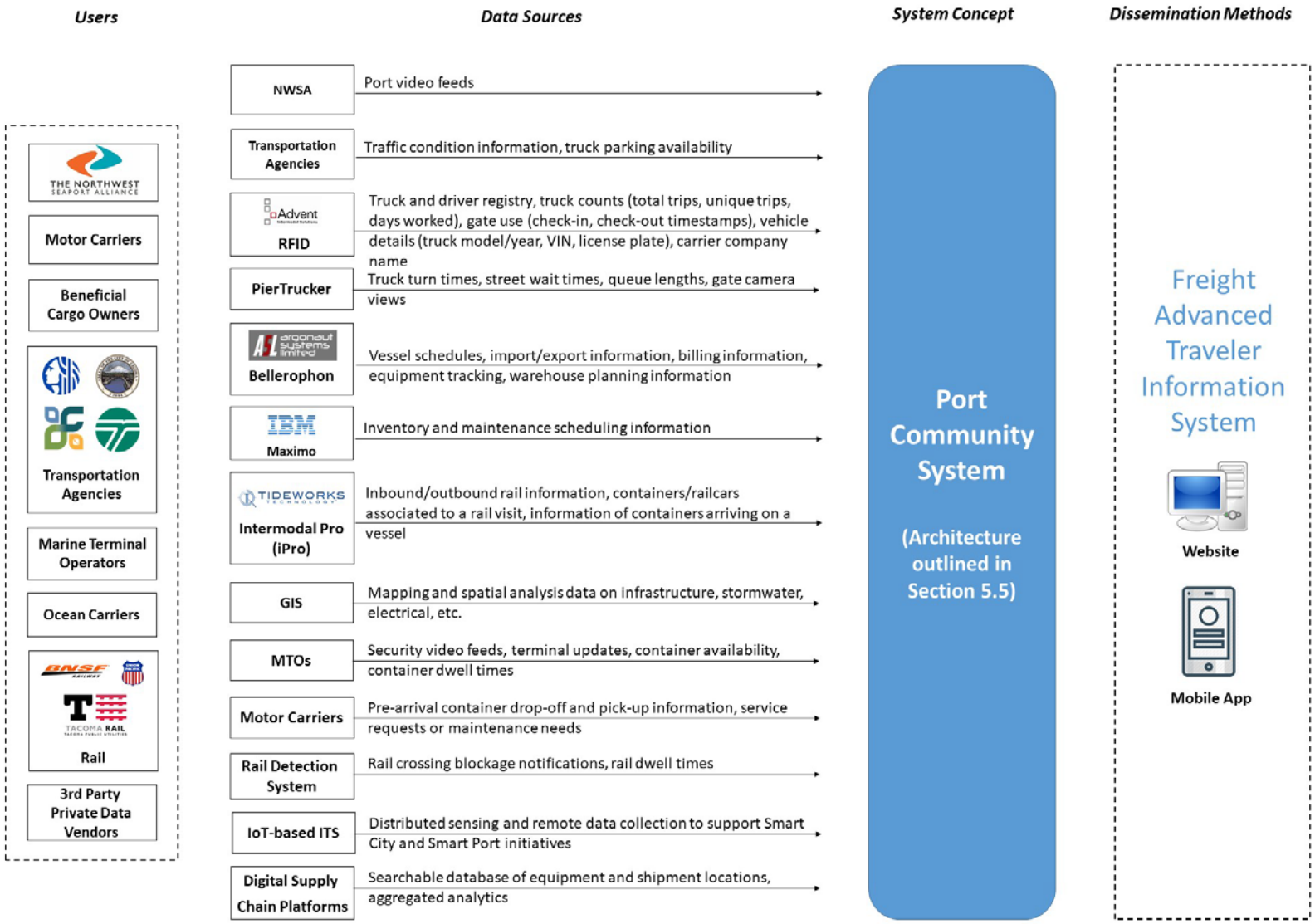


Figure 5. Elements of an NWSA PCS

2.0 Referenced Documents

The following is a listing of relevant documents, standards, and references used in preparing this report:

- Port of Tacoma Port Community Technology System Project Charter and Appendices (2006)
- Operations Service Center Joint Application Development Session (2015)
- NWSA Executive Advisory Council – Truck Visit Turn Time Action Team (2016)
- The Port of Tacoma and Northwest Seaport Alliance Vehicle Wait Time Awareness System Pilot Project Concept of Operations (2016)
- Port of Tacoma Vehicle Wait Time Awareness System Report, produced by Leidos, Inc. (2017)
- Trucker Outreach Forum in Tacoma and Seattle, Washington (2017)
- Operations Service Center Process Maps, Gap Analysis and Use Cases Report, produced by Argonaut Systems (2017)
- Port Community Technology System (PCTS) Fixing America's Surface Transportation (FAST) Grant Application (2017)
- NWSA Clean Drayage System 4G Memorandum (2018)
- King Countywide Congestion Mitigation and Air Quality (CMAQ) Grant Application (2018)
- PCS User Needs Workshops (2018)
- Guide to the Preparation of Operational Concept Documents, American National Standards Institute (ANSI)/American Institute of Aeronautics & Astronautics (AIAA) G-043A-2012
- Institute of Electrical and Electronics Engineers (IEEE) Guide for Information Technology - System Definition - ConOps Document Standard 1362-1998 (R2007)

3.0 The Current System or Situation

This section provides an overview of the current objectives of the PCS project, existing systems, and the users and stakeholders for this ConOps.

3.1 Background, Objectives, and Scope

The NWSA is the fourth-largest container gateway in North America[5]. The NWSA's facilities occupy 1,785 acres in King and Pierce Counties, including 11 container terminals, two breakbulk and project cargo terminals, six on-dock rail yards, three near-dock rail yards, and 165-acre auto processing facility. As a major center for bulk, breakbulk, project/heavy-lift cargoes, automobiles and trucks, the NWSA connects to the second-largest concentration of distribution centers on the West Coast. In 2017, international trade accounted for more than $75.3 billion (imports were $58.3 billion and exports were $17 billion of that total),

[5] NWSA, "Delivering the goods for Pacific Northwest Exporters" - https://www.nwseaportalliance.com/sites/default/files/NWSA_ExportGateway.pdf

(Footnote continued on next page...)

while domestic trade was estimated at $5.4 billion in 2015. Combined, the Alliance's North and South Harbors handled approximately 3.7 million TEUs in 2017[6].

Due to the urban location of the Alliance's Seattle and Tacoma facilities, both harbors experience transportation issues, such as roadway queueing outside of each facility, long marine terminal turn times, at-grade rail crossings, and truck parking violations. In addition, some of the Alliance's roadway access points have conflicting pedestrian and bicycle activity. Due to the high freight traffic volumes along these road segments, there is a challenging and dangerous environment for pedestrians and bicyclists that leads to conflicts between freight movement and non-motorized modes.

Currently, the ever-changing logistics impacting intermodal freight movement in, around and near NWSA facilities are not well coordinated, leading to inefficiencies that affect the NWSA's ability to handle both existing and projected cargo growth. Terminal operators at the Alliance generally do not share information as it is considered proprietary, such as on-terminal turn times, which can help identify efficient terminals. Currently, accurate queue information for trucks waiting on-street is not available to the trucking community, sometimes leading to long truck queues, congestion and greenhouse gas emissions that cannot be adequately measured and addressed. Ineffective links among modes caused by fractured data entry, coordination, and dissemination degrade the reliability and performance of carriers, shippers, and terminal operators. The lack of effective information sharing among stakeholders causes inefficiencies, resulting in unnecessary delays in the movement of containerized freight.

To address the issues above, this effort will follow the Systems Engineering process to implement a PCS, designed to serve as the data broker of various data feeds and used for the dissemination of traveler information (FRATIS sub-system). The PCS will implement the data collection infrastructure necessary to compile that information, integrate it in a way that maintains the integrity of both public and potentially proprietary private data, and disseminate it to a range of private and public sector user groups in a format that enables them to act on that information.

The PCS will encompass data and interactions relating to NWSA terminals, railroad tracks and yards, ocean carriers, and warehousing and distribution centers. The NWSA terminals are located in the Duwamish MIC and Port of Tacoma MIC. The Duwamish MIC is the northern end of an industrial corridor that extends from downtown Seattle south to the Kent Valley. Comprised of approximately 4,928 acres of marine and industrial lands, the Duwamish MIC is a unique regional resource and economic engine. The Port of Tacoma MIC comprises 5,160 acres of waterfront land and adjoining waterways on Tacoma's Commencement Bay. The MIC is home to Tacoma and Pierce County's highest concentration of industrial and manufacturing activity. The PCS will consume data from both harbors, covering all NWSA intermodal facilities, as well as the Waterway, Rail and Truck Freight Economic Corridors that provide access/egress. It will eventually provide information on the movement of cargo by truck, rail, and ship, as well as their interfaces, thus improving the supply chain.

Multiple stakeholder groups will benefit from the system, including trucking companies, marine terminals, off-port freight facilities, freight forwarders, chassis and port equipment providers, BCOs, state and local transportation agencies, and NWSA staff.

[6] NWSA, "2017 Annual Report" - https://www.nwseaportalliance.com/sites/default/files/2017_annual-report.pdf

3.2 Description of Current Situation

The current NWSA website will be home to the future FRATIS platform, once more real-time operational information is integrated. The NWSA website currently provides useful information to two primary user groups: truckers and shippers. For truckers, the website provides access to traffic information, gate cameras, truck turn times (supplied by PierTrucker.com), terminal updates, and quick links to relevant information. For shippers, the website provides scheduled vessel arrivals, 7-day projection calendar, and quick links to shipper-related frequently asked questions.

In the future, the information provided through the NWSA website will be expanded. Below is a list of systems that NWSA currently consumes data from and have been identified as potential data sources for the PCS.

3.2.1 Advent eModal - RFID System

The Ports of Seattle and Tacoma adopted the Northwest Ports Clean Air Strategy (NWPCAS) in 2008. The NWPCAS was developed with the aim to reduce air pollutant and greenhouse gas emissions from the ports' operations by implementing initiatives in the key sectors including ocean-going vessels, cargo handling equipment, trucks, rail, harbor vessels, and port administration. One of the NWSA's initiatives requires all drayage trucks serving the Alliance's international container terminals to have cleaner diesel technology, including a 2007 engine with diesel particulate filter or equivalent by January 1, 2019.

RFID and eModal drayage truck registry (DTR) systems have been used to monitor trucks entering the terminals since 2011 in the Port of Seattle. Port of Tacoma has an in-house DTR and sticker program to track compliance, but will be upgrading to the RFID and eModal DTR system in the first quarter of 2019. As of January 1, 2019, all trucks serving NWSA international container terminals are required to have an eModal-registered RFID tag.

The RFID system allows users to track the following:

- Truck counts (including total trips, unique trips, days worked)
- Gate use (check-in, check-out timestamps)
- Vehicle details (truck model and year, Vehicle Identification Number (VIN), license plate)
- Carrier (truck) company name

3.2.2 PierTrucker

PierTrucker is a privately-owned web-based platform that provides aggregated truck turn time data for port terminals across the U.S. For Alliance terminals, PierTrucker provides gate camera views and truck turn times aggregated as 2-hour average, 24-hour average, 7-days average, 30-days average, and a maximum turn time. The turn times are provided with a margin of error from 2 minutes to 105 minutes. The information is provided for T18, Husky, PCT, T46, WUT, T30, EST (TCT), Matson, and NWCS terminals. The data is compiled from the app that truckers voluntarily download to their phone. This app tracks the location of the truckers using Global Positioning System (GPS) technology on their cellphone.

3.2.3 Argonaut Systems Limited - Bellerophon

Bellerophon is an Enterprise Management System designed to manage, operate and maintain all types of cargo. The system is implemented to the Breakbulk Terminal Operations (BTO) and in Waterway and Berthing Management (WBM).

BTO system functionality includes reporting functions, inventory and yard management, imports and exports, billing, berth management and scheduling, port and vessel operations, yard planning, equipment management and tracking, personnel management and scheduling, and warehouse planning and management.

WBM's system includes vessel and call management that allows users to view, populate, and update the fields that record the data on each specific ship and voyages corresponding to each ship; call overview that provides a general overview of vessel voyages/calls; vessel schedule; and a proforma that displays the vessel schedules for individual NWSA terminals on weekly basis.

3.2.4 IBM - Maximo

IBM Maximo Enterprise Asset Management (EAM) is a web-based Java Enterprise Edition (J2EE) application. The NWSA is primarily using it to manage maintenance work orders, part inventory management, and handle contracts/procurements

3.2.5 Tideworks Technology – Intermodal Pro (iPro)

iPro is a rail terminal operation system (TOS) that allows users to view the key rail and yard data, optimize and automate operations. The system allows users to:

- Plan rail schedule
  - View inbound and outbound rail visits
  - List containers associated to a rail visit
  - List or open railcars associated to a rail visit
  - Determine and assign the railcar class
- Plan the entire rail car
  - Create the appropriate number of wells, weight allowances, length, and stack configurations for railcars
- Receive information about containers that arriving on the vessel (weight, destination, consignee, rail destination, etc.)
- View track layout
- Place railcars on a track and assign to a specific Rail Visit and Destination Rail Block

3.2.6 GIS

Geographic Information System (GIS) is a framework for managing and analyzing spatial data. NWSA GIS system uses Esri and GeoCortex (by Latitude Geographics) technologies. System consumes and displays

GIS data from Enterprise SDE databases for users to view in PortView. This system also supports the Geocortex Analytics platform for monitoring our GIS servers and services. The GIS system is used for spatial analysis and mapping data, including infrastructure, stormwater, electrical data, and for developing geospatially focused applications.

3.2.7 Video Feeds

Video feeds are available from Port of Seattle, Port of Tacoma and marine terminal camera installations. Security cameras are installed at domestic terminals and South Harbor terminals. The video feeds are used as a part of the Clean Truck Program to identify trucks that are using terminals by capturing their VIN. Using this information, the Alliance can track statistics on the type of trucks coming to the terminal, truck compliance rates, etc.

3.2.8 Partner Agency ITS Infrastructure Elements

Partner agencies also own and operate several intelligent transportation system (ITS) infrastructure elements that may be of use to the PCS. Notable ITS infrastructure elements in the South Harbor area include traffic signal infrastructure, fiber interconnect, as well as City of Fife and WSDOT systems such as closed-circuit television (CCTV) cameras, highway advisory radio systems (HARS), variable message signs (VMS), ramp meters, and a 511 system. In the North Harbor, ITS infrastructure elements include traffic signal infrastructure, fiber interconnect, VMSs, several rail blockage warning locations, a Transportation Operations Center (TOC) and a traveler information system.

3.3 Profiles of User Classes

The following contains a profile for each of the relevant PCS users and stakeholders.

3.3.1 NWSA Staff

NWSA staff and contracted staff are responsible for maintaining the port facilities, tracking port performance, and determining how regional investments impact port operations. Several of the internal groups listed below are Port of Tacoma staff that provide services to the NWSA via service agreements. The NWSA, with access to information such as Port video feeds, vessel schedules, and incoming containers, would be one major data source for the PCS. NWSA staff would also be one of the primary user groups of the PCS, using information provided to monitor gateway performance.

Relevant internal groups that would use the system include:

- **Operations –** Responsible for developing a Pacific Northwest rail strategy, improving access for all modes of transportation, greater visibility of shipment status and managing gateway performance through mutually-agreed upon metrics. Currently working with customers and stakeholders to establish an Operations Service Center (OSC) to improve customer service.

- **Real Estate –** Responsible for leasing, divesting and managing the port real estate portfolio and attracting major manufacturing and warehouse/distribution centers within King and Pierce County.

- **Facilities Developments** – Responsible for developing port industrial lands, equipment costing, industrial warehouse location and layout analysis, and strategic planning. This Facilities Developments

includes engineering, environmental and planning services and is also responsible for overseeing the NWSA Clean Truck Program.

- **Facilities Maintenance** – Responsible for managing and supporting port facility maintenance, renovation, and construction projects as well as day-to-day operations.
- **Equipment Maintenance** – Responsible for planning, coordinating, and resolving port mechanical and electrical equipment maintenance and operational issues.
- **Information Technology –** Responsible for managing information systems including Maximo, GIS, etc.
- **Communications** – Responsible for internal and external communications.
- **Security** – Responsible for managing port access, resolving security issues, and monitoring security feeds.

3.3.2 Truck Drivers, Motor Carrier Operators and Dispatchers

Truck drivers are responsible for cargo delivery operations between Alliance terminals, BCOs, warehousing and distribution facilities, and railyards. Motor carrier operators and dispatchers are responsible for planning trips and maintaining communications with truck drivers. Truck drivers and dispatchers currently receive port information needed for daily operations from online sources, phone calls, emails, or fax.

Truck drivers, motor carrier operators, and dispatchers would be one of the primary user groups of the PCS. They could utilize port operation information such as vessel and port schedules, estimated truck turn times, gate cameras, and terminal updates through the PCS to increase the efficiency of trips to and from NWSA facilities. Motor carriers may also be a data source for the PCS, providing information such as pre-arrival container drop-off and pick-up information, service requests, or maintenance needs.

There are more than 50 drayage providers operating at NWSA facilities. Several examples are listed below:

- Pacific Coast Express
- Intercity Express
- PCC Logistics
- RoadOne
- Flamingo Trucking
- Shippers Transport

3.3.3 Beneficial Cargo Owners

BCOs are the importers and exporters of record, who take possession of cargo at the destination such as a distribution center or warehouse. BCOs determine the details of container delivery, including the shipment origin and destination, time of the arrival and departure to and from BCO facilities, how long the shipment is stored, and who receives and moves it. BCOs rely on the container availability, terminal delay information, and discharge time information provided by the port to track delivery status and would be another PCS user group. Several examples of regional BCOs include Spiegel, Walmart, SanMar, and Nordstrom.

3.3.4 Public Transportation Agencies

Transportation public agencies are responsible for planning, designing, and maintaining transportation infrastructure. State, county, and city agencies play a key role in operating and maintaining transportation systems such as signalized intersections, variable message signs, freeway ramp meters, at-grade railroad crossing protection and notification, and traveler information systems. For the PCS, public transportation agencies would be a good source of traffic condition information and truck parking availability. The agencies listed below may also utilize the PCS to track port-related incidents that may impact roadway conditions outside of NWSA facility areas.

City of Seattle

The Seattle Department of Transportation (SDOT) plans, builds, maintains and operates the City's transportation infrastructure. The department manages short- and long-term transportation investments that connect the City with Alliance facilities in the North Harbor, and the freeway system. SDOT also reviews developer plans and issues permits for street infrastructure improvements. City of Seattle and NWSA have worked collaboratively on many transportation-related projects, including:

- Spokane Street Viaduct Improvement
- Lander Street Grade Separation
- Waterfront Seattle—Improvements on Alaskan Way along the entire Central Waterfront

City of Tacoma

The City of Tacoma manages and maintains arterial streets and residential blocks, street signs and traffic signals, and also issues permits to private developers wishing to construct within City right-of-way. The majority of traffic signals within the South Harbor area are managed by the City of Tacoma. The City of Tacoma and NWSA are jointly engaged on multiple ongoing projects including:

- Port of Tacoma Road
- Taylor Way

City of Fife

The City of Fife is located to the west of South Harbor. The City manages utilities and infrastructure including traffic lights, arterial streets, and traffic signs. The City of Fife and NWSA are jointly engaged on multiple ongoing projects including:

- I-5 and Port of Tacoma Road Interchange
- Intersection Improvements at 54th St and Pacific Highway

Washington State Department of Transportation

WSDOT manage a variety of programs and services to keep people and goods moving by operating and improving the state transportation system. WSDOT owns, maintains, and operates tolling systems, a variety of ITS and technology systems, and a regional fiber communications network. Ongoing projects near the South Harbor vicinity area that will mostly likely affect port operations include:

- Alaskan Way Viaduct Replacement Program
- Puget Sound Gateway Program – SR 167
- Puget Sound Gateway Program – SR 509

Puget Sound Regional Council

PSRC is a regional metropolitan planning organization and is responsible for planning, financing and coordinating transportation planning, economic development, and growth management for four counties in the Puget Sound area. One of their key roles is to help communities secure federal funding for transportation projects. Initial phases of the PCTS project are funded through PSRC.

3.3.5 Marine Terminal Operators

MTOs rent marine terminals from the NWSA and operate as private businesses. MTOs provide marine terminal facilities to the ocean carriers and motor carriers moving cargo. MTOs are responsible for the operations that occur at the terminal gates and within the terminal. Each MTO uses a terminal operating system that organizes, manages, and controls the movement and storage of containers. MTOs' terminal operating systems is another potential data source for the PCS. MTOs can also share security video feeds and recurring or non-recurring terminal updates through the PCS.

NWSA currently supports a total of 11 container terminals, with 10 actively receiving cargo. MTOs include:

- SSA Marine
- Total Terminals International, LLC
- Alaska Marine Lines
- West Coast Terminal & Stevedoring
- Ports America Group
- Washington United Terminals
- TOTE Maritime Alaska

3.3.6 Ocean Carriers

Ocean shipping carriers are responsible for moving international and local containerized freight between ports. More than 20 international and domestic shipping lines provide regular service between NWSA port facilities and key markets all over the world. Ocean shipping lines are responsible for providing ship arrival

times, ship delays, and service calls to NWSA (through Bellerophon) and are another potential data source for the PCS.

International shipping lines that operate within NWSA's jurisdiction include:

- Alianca
- Australia National Line (ANL)-US Lines
- American President Lines (APL)
- Compagnie Maritime d'Affrètement- Compagnie Générale Maritime (CMA-CGM)
- COSCO Shipping Lines
- Evergreen
- Hamburg Süd
- Hapag-Lloyd
- Hyundai Merchant Marine (HMM)
- Maersk Line
- Mediterranean Shipping Co (MSC)
- Ocean Network Express (ONE)
- OOCL, Pacific International Lines (PIL)
- Safmarine, SM Line
- United Arab Shipping Company
- Westwood Shipping Lines
- Yang Ming Line
- ZIM

Alliances and members include:

- 2M Alliance (Maersk Line, Mediterranean Shipping Co (MSC))
- THE Alliance (Hapag-Lloyd, Ocean Network Express (ONE), Yang Ming Line)
- Ocean Alliance (APL, CMA-CGM, Evergreen, COSCO Shipping Lines, OOCL)

Domestic shipping lines provide service to Alaska and Hawaii include:

- Alaska Marine Lines
- Aloha Marine Lines
- Matson
- TOTE Maritime Alaska

3.3.7 Rail Company Operators

BNSF Railway, Union Pacific (UP) Railroad and Tacoma Rail operate at the NWSA intermodal facilities. BNSF and UP railway operators provide cargo transporting services across U.S., connecting the Pacific Northwest to key markets across the country. Tacoma Rail operates as a publicly-owned short line railroad in the Port of Tacoma and surrounding areas.

Tacoma South Intermodal Facility (TacSim) and Union Pacific Argo Yard are near-dock facilities operated by UP that serve customers 24/7. TacSim averages truck turn times of less than 10 minutes. BNSF Railway operates the South Seattle Intermodal Facility near-dock intermodal yard, also serving customers 24/7. Both TacSim and South Seattle Intermodal Facility provide domestic and short-haul rail service.[7] NWSA operates six on-dock rail yards across both harbors and works closely with carriers to ensure that containers bound for specific inland destinations via rail are stowed on the ship so as to be the first ones unloaded and transferred to trains, decreasing the loading time of cargo headed for inland destinations.

Rail crossing blockage notifications and rail dwell times would help truck drivers bypass closed lanes. This type of information may be available to the PCS from rail companies or through rail detection systems.

4.0 Justification for and Nature of Changes

The PCS is intended to improve gateway efficiency, reduce delays, and reduce truck queues. This section outlines the problems associated with the current situation, and the desired capabilities that are motivating the proposed PCS project at the Alliance's North and South Harbors.

4.1 Justification for Changes

As noted, the ever-changing logistics impacting intermodal freight movement in, around and near NWSA facilities are not well coordinated, leading to inefficiencies that affect the NWSA's ability to handle both existing and projected cargo growth. Ineffective links among modes caused by fractured data entry, coordination, and dissemination degrade the reliability and performance of carriers, shippers, and terminal operators. The lack of effective information sharing among stakeholders causes inefficiencies, resulting in delays in the movement of containerized freight.

In 2016, the value of international exports moving through NWSA facilities was $16.6 billion. Much of the export cargo, including seeds, grains, cereals, seafood, fruits, nuts, vegetables, industrial machinery and computers, were produced in Washington. The movement of marine cargo through the NWSA accounts for 48,100 jobs and $379 million in annual state and tax revenue. NWSA handled $77 billion worth of cargo last year. That cargo is affiliated with $138.1 billion in total economic activity in the state, about one-third of Washington's gross domestic product (GDP).

Implementation of the PCS along with improvements in the physical infrastructure of NWSA terminals will help NWSA to meet its goal of increasing container throughput from 3.7 to 6 million TEUs without a commensurate increase in acreage. The increase in container volume is expected to result in over 14,000 incremental jobs in the Pacific Northwest. The PCS will improve the efficiency and reliability of truck and rail

[7] https://www.nwseaportalliance.com/sites/default/files/nwsa_mapbrochure_5-2016_web.pdf and https://www.nwseaportalliance.com/shippers/rail-lines

access and circulation within the Alliance. It will also help to improve the competitiveness of the Alliance, while generating benefits that extend beyond NWSA facilities such as reduced regional congestion and related emissions, and substantial job creation.

The problems and deficiencies associated with the traffic-related situation were sourced from the following:

- Port of Tacoma Port Community Technology System Project Charter and Appendices (2006)
- Operations Service Center Joint Application Development Session (2015)
- NWSA Executive Advisory Council – Truck Visit Turn Time Action Team (2016)
- The Port of Tacoma and Northwest Seaport Alliance Vehicle Wait Time Awareness System Pilot Project Concept of Operations (2016)
- Port of Tacoma Vehicle Wait Time Awareness System Report, produced by Leidos, Inc. (2017)
- Trucker Outreach Forum in Tacoma and Seattle, Washington (2017)
- Operations Service Center Process Maps, Gap Analysis and Use Cases Report, produced by Argonaut Systems (2017)
- NWSA Clean Drayage System 4G Memorandum (2018)
- PCS User Needs Workshops (2018)

4.1.1 Deficiencies of the Existing System

Available documentation and stakeholder input identified several common deficiencies in the existing system. Some of the key issues are summarized below and grouped under the themes of port community information, mobility and safety, port productivity, security, data management, system operations and others.

- **Port community information –** There are a number of areas where improved flow of information and integration of real-time data would help the trucking community make more informed decisions. While estimated vessel arrival times are available on the NWSA website up to a month in advance, real-time vessel tracking is not currently disseminated to the trucking community. NWSA or marine terminal staff may not be able to confirm the timing of a vessel arrival until after the scheduled arrival time passes. Real-time information on crane status, as well as conflicting train movements (especially at the 11th Avenue crossing) are also lacking. Location of chassis and empty containers are not available, causing truck drivers additional time to locate the necessary equipment for a move. Historical data and performance metrics are not currently available on the NWSA website.
- **Mobility and safety –** The majority of truck trips take place mid-day, when there is little or no commuter traffic. While truck traffic dies down during the afternoon peak commute period, there is significant overlap of truck and commuter traffic during the morning peak period. During the morning peak period, the Alliance's main terminal access may be blocked with trucks waiting to deliver goods, drop-off empty containers, or pick up containers. Backups can spill onto arterial access roads and freeways, and into the adjacent cities. Cars and bicyclists along congested routes may have to contend with queues of trucks. Emergency vehicles such as fire trucks or ambulances may be delayed. Truck drivers facing long waits sometimes exit their vehicles, increasing risk of collision or injury.
- **Port productivity –** The NWSA has little insight into asset and yard management capabilities (e.g., equipment inventories) at each terminal. Such information is manually provided to the NWSA only on an

annual basis. Many times, the NWSA doesn't learn about issues in time for potential grant opportunities. Currently, each terminal sets their own rules in regards to their appointment system. Examples of these rules include: appointments can be made once a container has discharged the vessel, but not before; same day appointments are not accepted without MTO approval; trucks without appointments have to wait until trucks with appointments have been helped; truckers cannot set appointments for containers in demurrage; appointments are required during certain work shifts; appointments will be handled at specific in-gate lanes, customs containers are not shown through the appointment system, etc. The complexity and inconsistency of terminal appointment systems can cause confusion and inefficiencies in the trucking community. While dispatchers are trying to manually determine the most efficient container pick-up order for each truck, additional time can be lost trying to track down appropriate-sized, working chassis to move each container.

- **Security –** Currently there is no single platform for stakeholders to access all port-related information of interest. Instead access to this data is fragmented across many different systems, which requires each stakeholder to set up multiple logins across a variety of private and public databases. Many stakeholders feel it is necessary because they are not willing to risk the integrity of their data with a centralized or completely open system. This tension results in continued inefficiencies, which might be resolved with more flexible data security protocols. Such a platform, offering privilege-based user roles and system logs for security and maintenance management, is critical to enabling more efficient flow of information.
- **Data management –** Port supply chain data is currently not well integrated, which harms the Alliance's ability to handle existing and projected cargo growth. Stakeholders require consistent, complete, accurate, and relevant data, and this requires improved data management processes. Steamships manually provide cargo information to the Alliance, but automated data transmission would improve efficiency and standardization of this process. Port stakeholders do not currently have access to terminal queueing information, which would help to inform routing and service decisions. Improved data visibility and integration would enable better real-time decision making, while historical data might help to identify "trouble transactions" by type and to create monthly archived reports for historical analysis. Officials currently have a poor understanding of containers' regional origins and destinations; such data would help to prioritize infrastructure projects and streamline operations. Some stakeholders may choose not to share data, due to privacy concerns .
- **System operation and other –** The Alliance is currently characterized by inefficient links between modes due to fractured data entry. Various notification systems exist for different operations at different locations. This results in problematic situations like drivers being turned away at the end of the day and unannounced early gate cutoff times.

4.2 User Needs

In order to come up with the final set of PCS User Needs listed in this section, the project team conducted an extensive review of relevant NWSA, PSRC, and WSDOT reports, studies, and forums resulting in the compilation of over 150 issues, needs, and challenges related to freight transportation technology and information. This list was consolidated into a list of 23 initial PCS User Needs which were then presented and discussed at 10 user need workshops with a variety of stakeholders including NWSA staff, partner agencies, terminal operators, steamship lines, trucking companies, BCOs, agents/pilots/tug operators, warehouse/distribution, and rail. In addition, stakeholders were able to submit PCS needs via the RSVP to the user needs workshops on-line. Based on the user outreach efforts of this project, the list of PCS User Needs was verified, revised and expanded to the 30 as presented below. These findings are used to develop the concept for the proposed PCS system (further detailed in Section 5.0).

PCS User Needs are grouped into specific functional areas, as shown in **Table 1** and ranked according to the following priority levels:

- **High –** The need is a "must-have" and should be considered essential to the initial PCS development, that is, the PCTS.
- **Medium –** The need is a "should-have" or desirable capability for which there is considerable interest, but is not necessarily critical to the initial PCS (PCTS) development.
- **Low –** The need is a "nice-to-have" or not viable in the near-term and may provide extra desirable functionality (these could potentially become add-on features in future releases).

Table 1. PCS User Needs and Functional Areas

ID	User Need	Functional Areas	Priority
UN1	Need to compile and provide high-quality and relevant, static, real-time, and historic Port community information, data, and performance indicators that are map based when appropriate.	Port Community Information; Data Management	High
UN2	Need PCS information, data, and performance indicators to be accurate, searchable, consistent, consolidated, based on defined standards, and compatible with a variety of existing and proposed internal and external systems. Create application programming interfaces (APIs) to connect stakeholder data.	Port Community Information; Data Management; System Operations and Other	High
UN3	Need to send out alerts/notifications on recurring and non-recurring basis regarding traveler information, port activities (import/export), and special events (disaster evacuation).	Port Community Information	High
UN4	Need to provide short- and long-term truck parking information.	Port Community Information	Low
UN5	Need to provide traveler information in multiple languages.	Port Community Information; System Operations and Other	Medium
UN6	Need to improve coordination between the NWSA and public sector agencies for planning efforts, information and data sharing, and communications (e.g., center-to-center [C2C], API availability and sharing, etc.).	Mobility and Safety; System Operations and Other	High
UN7	Need ability to create custom dashboards.	Port Community Information; System Operations and Other	High
UN8	Need to improve real-time situational awareness of NWSA and regional operations and trends to improve freight movement efficiency (e.g., regional weigh-in-motion [WIM] systems, street turn opportunities, pre-gate truck queues, gate activity, on-terminal turn times, Port travel times, equipment status, container location, Last Free Day, trouble transactions, vessel movements, traffic conditions, yard utilization, rail car movements, extra gates, etc.).	Mobility and Safety	High

ID	User Need	Functional Areas	Priority
UN9	Need ability to detect, monitor, and manage traffic congestion, modal conflict issues, queues and blockages in and around the NWSA areas, including potential secondary traffic safety issues.	Mobility and Safety	High
UN10	Need to provide at-grade crossing information to help reduce delay, environmental, and safety impacts.	Mobility and Safety	Medium
UN11	Need to establish coordinated, enhanced incident and evacuation management programs for NWSA and parties accessing the NWSA terminals.	Mobility and Safety	High
UN12	Need WIM systems on-site at the Alliance.	Mobility and Safety	Medium
UN13	Need to incorporate ITS, Smart City, Smart Street and Smart Port opportunities to improve access to/from and circulation within the Alliance.	Mobility and Safety	Medium
UN14	Need to provide an equitable and incentivized real-time appointment system for all transactions/activities.	Port Productivity	Medium
UN15	Need predictive analytics for data, information, and systems, where possible, to allow for more proactive port operations forecasts, planning, and actions.	Port Productivity; Port Community Information	High
UN16	Need to track freight delivery status (per diem and demurrage) and vessel information (arrival/departures).	Port Productivity	High
UN17	Need to provide real-time billing capabilities.	Port Productivity	Medium
UN18	Need to perform real-time and customizable asset and yard management capabilities - equipment utilization, available inventory, and condition.	Port Productivity	Low
UN19	Need privilege-based user roles and system logs for security and maintenance management.	Security	High
UN20	Need to utilize cybersecurity best practices and to provide access to data and information through safe and secure methods that are unique to user types.	Security	High
UN21	Need to track user modifications by user name, modification made, and time stamp.	Security	High
UN22	Need to maintain an up-to-date database of registered trucks and drivers to track compliance regulations.	Data Management	High
UN23	Need to access archived data, automated reports, and ad hoc reports (e.g., trend analysis, data to support grant applications, etc.).	Data Management	High
UN24	Need a user-friendly platform for configuration of system parameters, uploading/downloading documents and reports, and monitoring system operation in real-time.	Data Management; System Operations and Other	High
UN25	Need to automate data collection methods, data processing for consistency, stakeholder data sharing, system functions, and information dissemination processes (e.g., eliminate manual interaction such as activating mobile app when entering NWSA facilities).	Data Management; System Operations and Other	High
UN26	Need to automate and minimize maintenance costs and activities with clearly defined maintenance and operations requirements (e.g., monitor field devices remotely, redundancy, ability to report NWSA facility maintenance issues, etc.).	System Operations and Other	High

ID	User Need	Functional Areas	Priority
UN27	Need to accommodate non-disclosure agreement considerations.	System Operations and Other	High
UN28	Need to consider integration of new technologies and advanced methods (e.g., connected and automated vehicles [C/AV], dedicated short-range communications [DSRC], machine learning, artificial intelligence [AI] capability, block chain, etc.).	System Operations and Other; Data Management	High
UN29	Need PCS to be available via a mobile app and website that are fast and reliable.	System Operations and Other	High
UN30	Need PCS requirements to be non-vendor specific, open standard/open API, flexible, and scalable to allow for creative solutions.	System Operations and Other	High

4.3 Assumptions and Challenges

The PCS project team has identified some key assumptions and challenges impacting the functionality of the overall PCS. These are discussed below.

4.3.1 Assumptions

- **High-priority projects will be selected based on the highly desired needs of the wide variety of user groups interviewed –** User needs were collected from a wide variety of stakeholders, which included both public and private sectors. While it will not be possible to address all user needs with the enhanced system design, high-priority projects will revolve around the user needs that are most common between user groups.

- **PCS elements that will be funded under the FAST and CMAQ grants will be implemented first –** The NWSA has grant funding from two sources (FAST and CMAQ) that will be applied to certain, high-priority elements of the overall PCS, also referred to as the PCTS. CMAQ funding will be allocated to vehicle tracking hardware in King County, as well as a portion of the PCS Core Platform with FRATIS. FAST grant funding will be used towards the remaining PCS Core Platform with FRATIS costs, in addition to integration efforts with several existing systems and data sources. Remaining PCS elements will be dependent on additional funding sources in addition to additional hardware/software elements, data acquisition, data sharing agreements with private sector partners, etc.

- **Data currently consumed or owned by the NWSA will be made available to the PCS –** The success of the PCS is dependent upon many key data inputs. A good starting point would be the systems that the NWSA already consumes data from or owns (e.g., RFID system, security video feeds, Bellerophon, iPro, etc.). Other data sources outside of the NWSA's jurisdiction will require data sharing agreements or new data subscriptions. Data visibility will be limited based on user privileges.

Additional detailed assumptions will be included in the procurement documents for the PCTS and PCS future elements.

4.3.2 Challenges

The following presents a list of expected challenges that should be addressed in developing the PCTS, and ultimately, the PCS:

- Building upon current outreach efforts to obtain participation agreements from the wide range of public and private stakeholders involved in the PCS project.
- Documenting key data inputs and outputs of the PCS and obtaining data sharing agreements from key stakeholders to provide needed information.
- Data on real-time conditions from key systems need to be made available in a timely fashion and the data quality need to meet a certain standard as to provide useful estimates of key freight movement performance metrics.
- Protecting the privacy requirements of key stakeholders with relation to proprietary or competitive information, while still providing the needed data to stakeholders. The PCS will require adequate privacy protections for proprietary data and will need to be able to aggregate data to protect individual observations.
- Development and implementation of algorithms to project future conditions such as terminal and gate waiting times and area traffic conditions.
- Integration of data from a variety of systems into a format that will allow timely and accurate processing of PCS outputs.
- Providing data in formats that will allow data to be consistent with a variety of operating systems and devices.
- Developing a structured system for obtaining feedback from users and providing updates to users.
- Providing and maintaining an archived data system that can be used to evaluate the effectiveness of the PCS and improve future versions.
- A mechanism needs to be put in place to provide timely updates to all users.
- Economic competitiveness of keeping proprietary data.
- Need to define data access requirement levels for all PCS user groups.
- The introduction of a mission critical 24x7 data exchange platform such as the PCS will require additional trained NWSA staff for operations and technical support.

5.0 Concept for the Proposed System

The identification and planning of the PCS in this ConOps came through outreach, research, and meetings conducted with the NWSA and interviews with key stakeholders in both the public and private sectors. This section of the document includes: an overview of the background and objectives; key operational policies and constraints; a description of the ConOps essential features, capabilities, and functions; profiles of the user classes; and system-level operational environment and processes.

5.1 Background and Objectives

The PCS is intended to improve the competitiveness of the NWSA through supply-chain efficiency and visibility improvements. This may be achieved through methods such as improved traveler information and increased efficiency, safety, and reliability of truck and rail movement within the NWSA facilities. In addition, the PCS is anticipated to generate benefits that extends beyond the NWSA facilities such as reduced regional congestion, emissions, and job creation.

The PCS will involve the deployment of data sharing, communications infrastructure and communications services for trucks moving cargo to and from the NWSA container terminals. The system is designed to enable the NWSA's OSC to measure truck traffic congestion on, at and near NWSA container terminals and provide real-time truck wait and queuing information to the trucking community. This in turn will help reduce congestion by enabling drivers to make more informed routing decisions.

Some of the key objectives of the deployment of the PCS include:

- Improve the NWSA's competitive position, protecting port-related jobs
- Improve the efficiency of the NWSA-related supply chain by providing improved, standardized, and centralized information on the movement of cargo by truck, rail, and ship
- Decrease costs due to inefficiencies in freight movement
- Reduce truck queues by providing a common platform for data exchanges that can be used to improve the coordination of freight moves
- Improve internal circulation on NWSA facilities by enabling drivers to dynamically change the sequence of container pick-ups based on current terminal congestion levels where feasible
- Reduce congestion and delays on Freight and Goods Transportation Systems (FGTS) and Critical Urban Freight Corridors (CUFC) facilities
- Decrease diesel and greenhouse gas emissions as a result of queuing and wait time reductions

5.2 Operational Policies

The following summarizes some of the key operational policies for system development:

- **Data security and privacy** – The systems will comply with any legal requirements and cybersecurity best practices for the protection, security, and privacy of data provided by and shared with stakeholders during system development, testing, and implementation**.**
- **Driver distraction laws** – Any applications will be designed in a fashion that prevents potential safety hazards from distracted driving. For instance, notifications will be provided in a format that does not require the driver to take his or her eyes off the road.

5.2.1 Constraints

The following summarizes key operational constraints for PCS system development and operations:

- **Budget constraints –** Currently, the PCTS will be funded by NWSA sources, including two grants previously secured by the NWSA. Additional funds will be needed to fully implement future elements of the PCS.
- **Information sharing –** Information sharing is needed from a variety of public and private sector data sources (e.g., ocean carriers, marine terminal operators, rail company operators, chassis providers, public agencies, etc.)
- **Data reliability and quality –** The usefulness of the PCTS, and eventually, full PCS is dependent on quality of real-time data as well as the reliability of those data.
- **Staffing -** The deployment and operations of the PCTS, and eventually, full PCS will be constrained by the ability of NWSA and its partner agencies and users to develop, operate and maintain the system.
- **State public records laws –** The NWSA is subject to Washington's public records laws, which mandates that members of the public (including non-residents) have the right to obtain documents and other public records from state and local government bodies. As such, private sector entities may have concerns sharing data with the PCS if the NWSA is to be the responsible party managing the data, as NWSA-owned data may be subject to public records.

5.3 Description of ConOps Essential Features, Capabilities, and Functions

The chief purpose of this ConOps is to define the essential features, capabilities, and functions for the secure exchange of information between NWSA public and private stakeholders. This section describes the proposed system and improvements that have been identified based on stakeholder desired changes and identified user needs. The descriptions are provided at a high-level, indicating the operational features and functionalities without specifying design details or technology specific solutions.

The following list describes the ***Guiding Principles of the PCTS/PCS architecture***:

- Provision of time-stamped location data initially on ocean carrier, truck and container movements and local/regional traffic information – eventually expanding to real-time data on trucks, containers, chassis, roadway information, transportation agency transportation systems management and operations (TSMO) and connected vehicle data, and other private sector data.
- A trusted system that allows for protected and secure information exchange between the set of private and public sector users of the PCS.
- Analytics available to all public and private sector users that initially provides the ability for users to optimize their portion of operations – eventually expanding to be able to provide system-level simulation and predictive analytics, and to support optimization of a port-wide appointment system.
- Flexible technology approach that will be forward thinking and adaptable enough to support emerging and future IT applications, artificial intelligence (AI)/deep learning software, vehicle automation technologies, and Smart Cities/Internet of Things (IoT) transportation sensor and data fusion applications.
- A deliberate project approach that prioritizes currently attainable deliverables, while constructing a technology architecture/platform that allows integration with third party global shipping platforms and other supply chain optimization technologies as they become available in the future.

- A data collection and data access approach that does not require Port systems or servers to serve as the primary data collection mechanism – focusing on 3rd party and cloud-based systems, but with the capability to interface in real-time with multiple data sources from public and private Port users to provide a virtual data repository of information necessary to support PCS applications.
- User-defined FRATIS applications that can be accessed quickly on a variety of platforms, that are simple to use, accurate and reliable, provide access to key PCS information in a tailored way to each user group, and which can expand over time to provide key analytics information to enhance port operations.

The following subsections list potential PCS architecture elements according to the following phases, each with increasing system sophistication:

- Initial Elements
  - Highest priority and need
  - Foundational to subsequent features/deployments
  - Funding for improvements have already been acquired
- Intermediate Elements
  - Priority level is high, but may be dependent upon implementation of Initial Elements
  - Implementation is deemed feasible, but may be dependent on additional hardware/software elements and future data integration
  - Funding for improvements may be dependent on new grant developments
- Long Term Elements
  - Features build upon the previous two PCS phases
  - Feasibility of implementation may be dependent upon additional hardware/software elements and/or data acquisition and/or data sharing agreements with public sector partners
  - Important to have but not essential, or cannot be completed in the immediate-term
- Optional Elements
  - “Nice-to-have” features
  - Elements of implementation may be out of the NWSA’s control, requires a very high level of confidence in data security on the part of private sector partners, or not technically feasible at this time
  - PCS elements were not identified by many stakeholders through user needs process
  - “Future-proof” to be opportunistic (e.g. ability to leverage developments with “Smart Cities” and Truck Automation)

Table 2. Categorization of PCS Elements

ID	System	Port Community System Element	Owner/Operator	User Need(s)
1. Initial Elements				
1.1	PCTS	PCS Core Platform hardware/cloud services	NWSA	UN1, UN2, UN20, UN30
1.2	PCTS	PCS Core Platform data management functions, repository and archive	NWSA	UN1, UN2, UN20, UN23
1.3	PCTS	PCS Core Platform data exchange interfaces	NWSA	UN1, UN2, UN3, UN20
1.4	PCTS	PCS Core Platform initial analytics (data sets to create basic reports)	NWSA	UN1, UN2, UN21, UN23, UN24
1.5	PCTS	PCS Core Platform Graphical User Interface (GUI)	NWSA	UN1, UN2, UN5, UN7
1.6	PCTS	Integration of vessel scheduling and berthing data into Core Platform data management function.	NWSA through Bellerophon	UN1, UN2, UN16
1.7	PCTS	Integration of RFID data into Core Platform data management function.	NWSA	UN1, UN2
1.8	PCTS	Integration of registered truck and driver database into Core Platform data management function.	NWSA	UN22
1.9	PCTS	NWSA Website Interface for data delivery and information exchange	NWSA	UN1, UN2, UN5, UN8, UN20, UN24, UN27
1.10	PCTS	Mobile Application Interface for data delivery and information exchange	NWSA	UN1, UN2, UN5, UN8, UN20, UN24, UN27, UN29
1.11	PCTS	Automated notifications (terminal wait times, street queue waiting times, closures)	NWSA	UN1, UN2, UN3, UN25
1.12	PCTS	King County expansion of RFID system	NWSA/WSDOT	UN8, UN9
2. Intermediate Elements				
2.1	PCS	Emergency/incident alerts and routing information (**manual upload/static** information)	NWSA	UN1, UN3, UN9, UN11
2.2	PCS	Integration (and video analytics) of MTO and Port area camera feeds into Core Platform data management function.	NWSA/MTOs	UN1
2.3	PCS	Integration of WSDOT, SDOT and other local transportation agency traffic data (congestion information, closures) into Core Platform data management function.	Transportation Agencies	UN1, UN2, UN6, UN9, UN11

ID	System	Port Community System Element	Owner/Operator	User Need(s)
2.4	PCS	Integration of NWSA GIS information (asset management, Port maps) into Core Platform data management function.	NWSA	UN1, UN2
2.5	PCS	Integration of rail scheduling interface and data exchange into Core Platform data management function.	NWSA through iPro	UN1, UN2
2.6	PCS	Integration of inventory and maintenance scheduling information into Core Platform data management function.	NWSA through Maximo	UN1, UN2
2.7	PCS	FRATIS incident, emergency, and rail crossing blockage alerts and notifications	NWSA	UN1, UN3, UN9, UN10, UN11
2.8	PCS	FRATIS emergency/incident alerts [VCC] and routing information (**automated/dynamic** information).	NWSA/Partner Agencies	UN1, UN2, UN3, UN9, UN11
2.9	PCS	PCS advanced system-wide analytics, utilizing integrated data sets in Core Platform data management function.	NWSA	UN2, UN15
3. Long Term Elements				
3.1	PCS	Ability for truckers or other Port users to enter service requests for security or maintenance needs	NWSA	UN19, UN26
3.2	PCS	Integration of Port-wide basic container availability information (including real-time alerts) and 48 hour predicted container availability information	Ocean Carriers	UN1, UN2, UN18
3.3	PCS	Integration of third-party data sets with internal data sets driving increased analytics into Core Platform data management function.	Third-Party	UN1
3.4	PCS	Integration with terminal appointment system interface and data exchange.	MTOs	UN1, UN14
3.5	PCS	Integration of third-party global shipping platform interface and data exchange.	Third-Party	UN1
3.6	PCS	FRATIS directional/route guidance for incidents or emergency situations with truck prohibited route considerations	NWSA/Partner Agencies	UN1, UN2, UN3, UN9
3.7	PCS	Develop advanced analytics capabilities, including functions such as predictive analytics, behavior analytics and machine learning	NWSA	UN28
4. Optional Elements				
4.1	PCS	Real-time container tracking system (origin/destination) interface and data exchange.	MTOs	UN1, UN2, UN18
4.2	PCS	Rail dwell time system interface and data exchange.	Rail Companies	UN1, UN2

ID	System	Port Community System Element	Owner/Operator	User Need(s)
4.3	PCS	Integration of short and long-term parking management system interface and data exchange.	NWSA	UN1, UN4
4.4	PCS	Real-time chassis tracking system interface and data exchange.	Chassis Vendors	UN1, UN2, UN18
4.5	PCS	WIM interface	NWSA	UN1, UN2, UN12
4.6	PCS	Truck location (origin/destination) interface and data exchange.	Trucking Companies	UN1, UN2
4.7	PCS	Common appointment system platform	MTOs	UN1, UN14
4.8	PCS	Real-time billing system interface.	MTOs	UN17
4.9	PCS	Tenant asset information (equipment utilization, available inventory, condition, etc.)	MTOs	UN18
4.10	PCS	Port and tenant utility usage	NWSA/MTOs	UN8
4.11	PCS	Integration with connected vehicles and data exchange	NWSA	UN13, UN28
4.12	PCS	Integration with autonomous equipment	NWSA	UN28

5.4 User Class Profiles and Other Involved Personnel

Table 3 below summarizes the user groups that will be impacted by the PCS and their desired PCS outputs.

Table 3. PCS Impacts on User Classes

User Class	Desired PCS Outputs *(Website or Mobile app)*	
NWSA Staff *Managers of the system*	• Container dwell times • Rail dwell times • Vessel schedules • Rail schedules • Terminal updates • Rail crossing blockages • Street wait times, turn times • Traffic conditions	• Incident alerts/notifications • NWSA/MTO video feeds • Service, maintenance requests • Truck parking availability • Origin/destination (O/D) information • Asset information • Key Performance Indicators (KPIs) • Query and reporting
Marine Terminal Operators	• Container information • Vessel schedules • Street wait times, turn times • Truck pre-arrival drop-off/pick-up information	• Incident alerts/notifications • Security camera feeds • Asset information
Ocean Carriers	• Terminal availability information	
Truck Drivers, Motor Carrier	• Street wait times, turn times • Container information	• Rail crossing blockages • Traffic conditions

User Class	Desired PCS Outputs *(Website or Mobile app)*	
Operators and Dispatchers	• Vessel schedules • Rail schedules • NWSA/MTO video feeds • Terminal updates	• Incident alerts/ notifications • Chassis tracking • Route guidance • Truck parking availability
Rail Company Operators	• Container information • Vessel schedules	• Incident alerts/ notifications
Beneficial Cargo Owners	• Container information • Container dwell times • Terminal updates	• Vessel schedules • Rail schedules • Street wait times, turn times
Transportation Public Agencies *Cities of Seattle, Tacoma, and Fife, WSDOT, SDOT*	• Queues • NWSA/MTO video feeds • Incident alerts/ notifications	• Traffic conditions • O/D information • Truck parking availability

5.5 Conceptual High-Level System Architecture

Design and development of system architecture for the PCS will be the responsibility of the selected PCTS (initial phase of the full PCS) System Deployment Contractor in 2019, subject to acceptance by the Port of Tacoma information technology (IT) department. To guide this development, based on the definition of the overall concept presented in this ConOps in Sections 4 and 5, and fully consistent with the ***Guiding Principles of the PCTS/PCS architecture*** that were presented in Section 5.3, **Figure 6** presents a high-level concept for the architecture of the PCS.

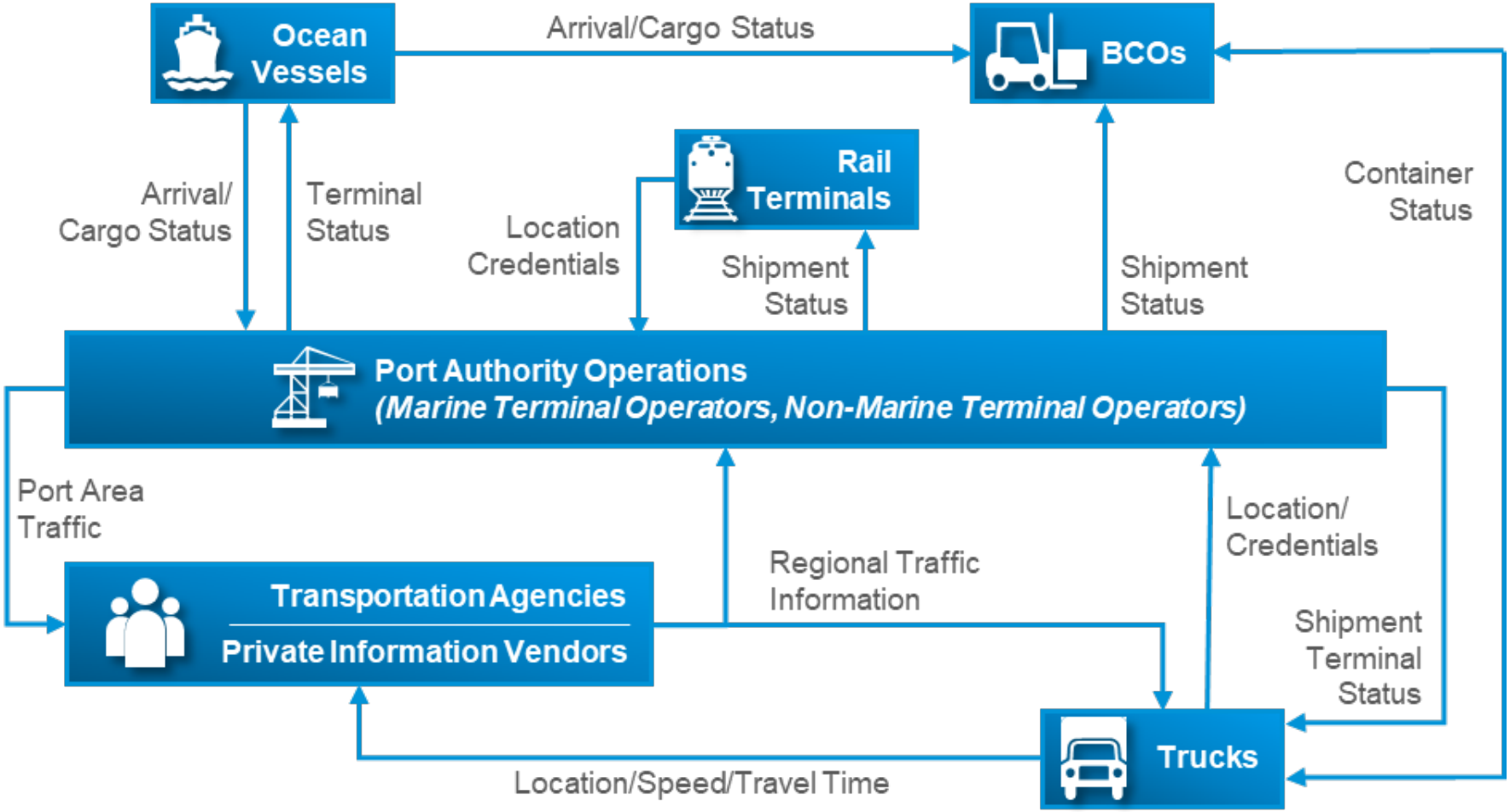


Figure 6. High-Level PCS Architecture Concept

This recommended high-level architectural approach is based on a ***non-centralized*** concept for the exchange of information between NWSA staff, PCS users, and a broad set of potential stakeholders. This concept does not prescribe in detail how this architecture will be implemented – the selected PCTS System Deployment Contractor will first propose the details of the technical architecture to the NWSA during the early 2019 procurement, and then this will be refined by that vendor in consultation with NWSA staff early in the project. However, it is recommended that the system architecture be implemented in a way that will support "application programming interface (API)-based" information exchange technology which will both allow for information exchanges across multiple public and private systems; and which will also "future proof" the system to allow it to take advantage of future developments (e.g. autonomous trucks, Smart Cities). In this regard, the following set of architectural development guidelines is recommended:

- The PCTS System Deployment Contractor selection process should be centered on *requirements-focused* request for proposal (RFP)/Procurement – focused on vendor qualifications, experience and proposed approach, but with special emphasis on how the vendor intends to meet the defined NWSA requirements and less on trying to tailor vendor-branded current solutions.
- PCS applications are developed by the 3rd Party PCTS System Deployment Contractor, but are initially conceptualized by NWSA Operations and IT Staff. (PCS is fully branded as a NWSA system).
- Use a Service Oriented Architecture (SOA/"Web Services") approach that is designed to be flexible and adaptable to support future capabilities. Approach will be a limited "Open API" that will provide secure data sharing with trusted users, and with full user control of permissions to their respective data sets.
- Ability to translate legacy data sources to support data exchange and a common data dictionary standard to support the PCTS; ability to interface with legacy systems to support data transfer (e.g. file transfer protocol [FTP], optical character recognition [OCR]).
- Ability to exchange data with emerging logistics industry shipping/supply-chain technology solutions.
- Supports PCTS/PCS analytical applications.
- 24x7 mission critical systems are heavily dependent on the availability of trained staff for customer service and technical support.

6.0 Operational Scenarios

This section presents seven operational scenarios, also referred to as use cases, that describe situations in which the PCTS/PCS could significantly improve port and truck user operations and efficiency. Each operational scenario describes the user need or issue that it is intended to address as well as the outcomes or benefits they are expected to experience through the deployment of the PCTS/PCS. The following scenarios do not address all of the desired PCS improvements but demonstrate some of the key needs. The operational scenarios include:

	Scenario	PCS Phase of Deployment
1	A vessel is trending off the pro forma schedule. Users need a rolling average of past performance and real-time information for the next port call.	Initial Elements
2	NWSA staff need to generate a turn time report.	Initial Elements

	Scenario	PCS Phase of Deployment
3	A stakeholder performs a current location and discharge time prediction query for a container.	Long Term Elements
4	Tracking of export from port-of-destination, and import from port-of-origin to final destination (warehouse).	Long Term Elements
5	Early visibility of import cargo to allow for forecast planning.	Long Term Elements
6	Chassis availability (i.e., broken/good-order) - location both on-dock and off-dock.	Optional Elements
7	Container location/status (i.e., empty/full) when off-dock.	Optional Elements

6.1 A vessel is trending off the pro forma schedule. Users need a rolling average of past performance and real-time information for the next port call.

A large vessel from XYZ Lines is expected to discharge a significant number of containers upon arrival at a NWSA port of call. This is well within the operational capacity of the Alliance. However, due to a delay in transit, the vessel is unlikely to arrive on schedule. This delay will affect numerous stakeholders, including dock workers, truck drivers, dispatchers, and receivers, all of whom are preparing their operations based on the published schedule.

The first benefit of the PCS is that all stakeholders are notified of the delay and know that they must anticipate a change in their schedule. However, this only alerts them to uncertainty. The initial notification does not help them to adjust to changing circumstances.

The PCS can draw on historical arrival data, in addition to real-time location information, to better predict the vessel's trajectory. Drivers and dispatchers revise their planned arrival at the port with the maximum information available, minimizing wasted time, reducing congestion, and easing the strain on port-area truck parking that might occur otherwise.

In this scenario, real-time location data in addition to historical arrival and departure times are available through or stored in the PCS. All of these entries are linked on the query page for a given schedule. Thus, dispatchers and receivers can see at a glance the scheduled arrival, historical arrival times, and real-time location and predictions.

Due to the integrated information available within the PCS framework, facilities managers at the Alliance have early notice of a potential schedule disruption. This information is also available to other registered Port users, and can be easily disseminated to other customers on a trip-by-trip basis. The easy availability of this information helps to allocate resources in a more timely fashion, reducing congestion at the gate and Port area roadways, and easing pressure on nearby truck parking when there are delays.

Figure 7 illustrates the flow of information in this scenario and identifies key systems and data elements that will be used. The WBM system provides notice of late vessel arrival while the BTO system takes that information and determines the impact on terminal status and operations. Terminal operators may then make adjustments to adapt to the change in schedule. The PCS will identify impacts of the schedule change

relevant to truckers or rail terminal operators (depending on which mode is used) and also allow BCO's and warehouse operators to adjust their schedules to minimize turn times and traffic impacts on their shipments. Information will also be provided to the NWSA database and website so that the information can be used for future forecasts and assessment through Key Performance Indicators.

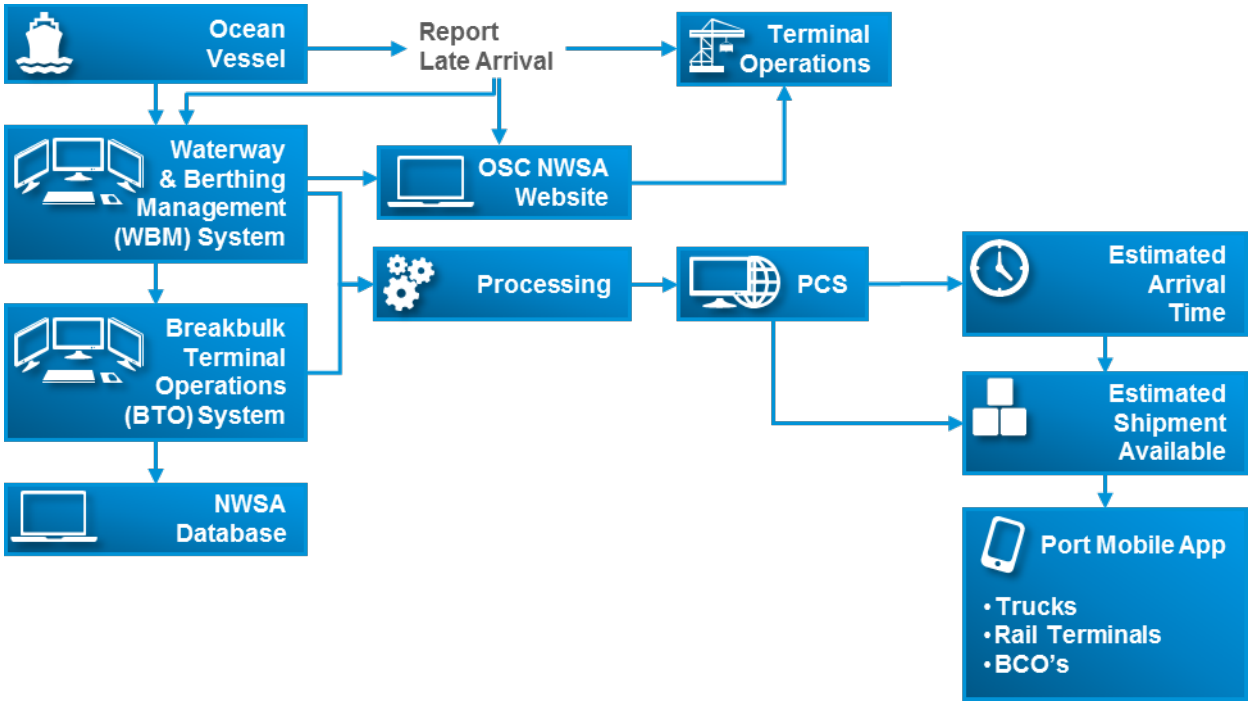


Figure 7. Vessel Off-Schedule

6.2 NWSA staff need to generate a turn time report

In order to support long-range planning and improve operational efficiency at the port, officials are requesting accurate information about truck and container volumes and how long they spend on NWSA facilities. Such information has previously been difficult, expensive, and time-consuming to collect and consolidate. A turn time report is one example of the queries and reports the PCS would support.

When the planning process began for NWSA's Strategic Business Plan, no data were available regarding truck turn times, and NWSA staff were unsure how to meet the ambitious target of handling 6 million TEUs without dramatically increasing the Alliance's physical footprint. Due to high real estate costs and concerns about encroaching on existing residential neighborhoods, geographical expansion was simply not an option. NWSA staff used the PCS data dashboard to generate a truck turn time report and analyzed average turn times, in addition to variation by hour and by day, and long-term trends. This enabled them to identify candidate strategies for how to best accommodate future growth as well as address several existing and emerging bottlenecks on NWSA property. They also were able to develop new policies for how to best spread traffic away from the peak hours of congestion based on real historical information and trends, in order to make the most efficient possible use of space.

In this scenario, the timestamps of truck entry and exit from key locations in the Port and near the terminals are captured as part of the RFID system. While the system protects the privacy of individual carriers, it also enables fast compiling and reporting of historical and real-time performance data, including turn times. This

information is easily accessible to NWSA staff who may need it for long-range planning, managing a short-term incident (e.g., responding to a Port user's complaint about excessive turn times), for environmental planning, or other purposes.

As a result of this careful data analysis, the planning for the Strategic Business Plan was especially thorough and resulted in the implementation of appropriate and effective strategies based on real data. The NWSA was able to successfully reduce congestion delays while growing total volumes to 6 million TEUs, with benefits to the entire region in the form of less congestion and higher levels of overall economic activity.

Figure 8 documents the information flow for the Turn Time Report. This scenario demonstrates how RFID information from International and Domestic gates, as well as from Exit gates will be aggregated to estimate turn times. This information will be aggregated with an existing source of turn times from PierTrucker to provide information to both Terminal Operators, Truckers, BCOs, warehouses and other stakeholders. Information will be stored in the NWSA database and used to refine future estimates.

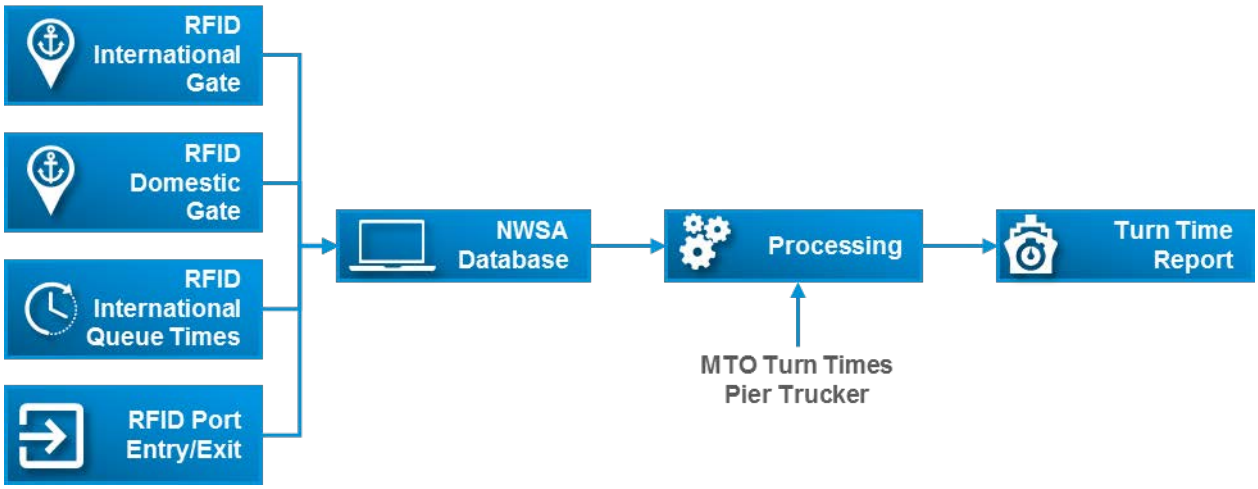


Figure 8. Turn Time Report

6.3 A stakeholder performs a current location and discharge time prediction query for a container

ABC Distribution is expecting a shipment of imported gizmos to arrive this week. After consulting the vessel schedule, the transportation manager has tentatively scheduled warehouse crews to sort the merchandise and drivers to deliver to area retailers. However, all of this activity is contingent on the timely arrival to the warehouse of the container carrying the gizmos. Before PCS implementation, the transportation manager sometimes had to choose between paying employees to sit and wait for a delayed shipment, or sending workers home early. Several of ABC's best warehouse pickers threatened to quit if they could not consistently work a full shift.

ABC's transportation manager logged in to the PCS interface to perform a current location and discharge time prediction query for the shipping container in question. The result was a real-time report on the container's status in the offloading process. Based on prior experience, the transportation manager estimated that the container would not be ready to pick up for another day. However, the PCS platform also offered a discharge time prediction based on relevant historical data, including the shipping company, day of the week, and total number of containers to be discharged. On the basis of this improved information, the

transportation manager adjusted the tentative work schedule. Resource allocation was optimized, employees were more productive, and retail customers were kept informed of schedule changes.

In this scenario, container availability is provided by through the PCS (with the cooperation of the terminal operators and information integration), then the yard location (e.g. GPS coordinates or equivalent) of containers within the yard are provided, as is historical data regarding container storage and truck turn times. The PCS aggregates the information from the various sources and calculates real-time predictions for when a container will exit the port. These predictions, along with current location status, are available to participating companies like ABC Distribution. Dispatchers and schedulers at these firms so they can make adjustments to work plans, minimizing wasted work hours and reducing driver wait times.

Figure 9 shows the key systems and outputs for this scenario. The BTO system provides key information on the estimated off-load time window which will be combined with historical turn time data from the NWSA database and historic traffic feed information. This information will be processed and location and discharge estimates provided to truckers, warehouses, BCOs and other stakeholders. This application can be targeted to either a small group of users or a wider group, depending on the situation. Information will be retained in the NWSA database, which can be used to refine future estimates.

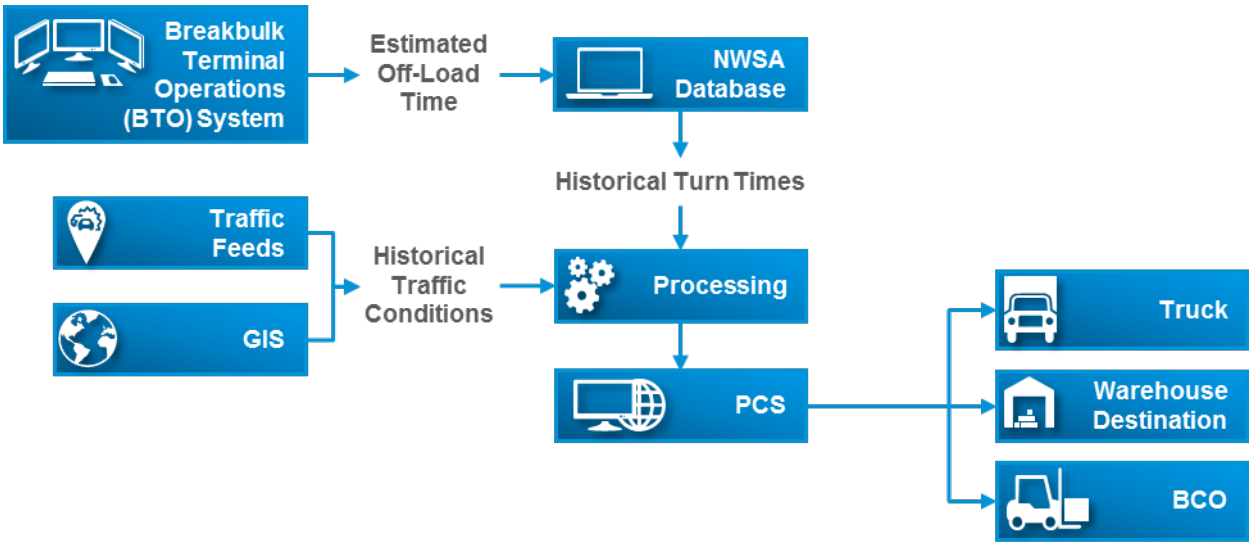


Figure 9. Location and Discharge Time Estimate

6.4 Tracking of export from port-of-destination, and import from port-of-origin to final destination (warehouse)

Northwest Importers specializes in agricultural produce and fine meats. Thus, timely tracking information is critical for both inbound and outbound orders. It has historically been quite challenging to plan around the variable transit times that can affect the business. The Chief Information Officer, after learning about the new PCS, called a meeting to discuss the benefits of this system for sales and receiving staff.

Northwest decided to implement new procedures for both import and export activities. Dispatchers consulted the PCS tracking tool to determine where their inbound containers were (including 48-hour advance notification of container availability as described previously) and better estimate when they would arrive.

Sales associates used real-time tracking information to keep their customers informed about schedule delays, increasing customer satisfaction significantly.

In this scenario, location data of a shipping container is linked to the user screen of authorized stakeholders. When they view outstanding orders within the PCS interface, they can also get up-to-date shipment status. Dispatchers are able to use this information to adjust their delivery routes and optimize driver scheduling.

Figure 10 shows key steps and data sources for this operational scenario. The estimated arrival time for ocean vessels and status of cargo is reported to and disseminated from the WBM and BTO systems. Information is provided through the NWSA website to terminal operations which can then adapt staffing levels and operational strategies as needed. Information is processed and provided to dispatchers through the PCS. This then allows dispatchers to work with truckers, warehouse personnel and BCOs to adjust schedules and staffing levels to optimize their use of resources.

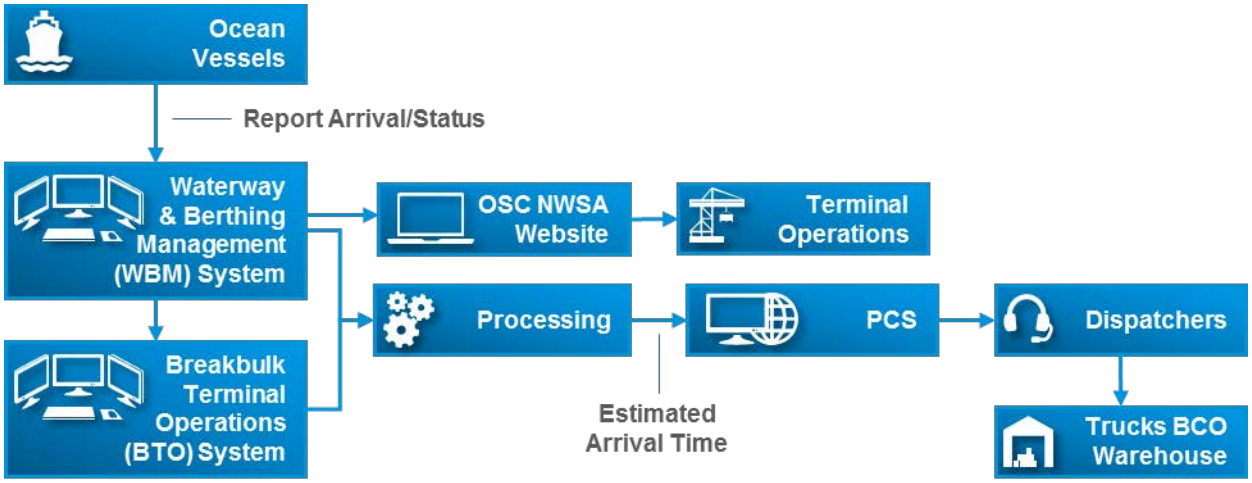


Figure 10. Export/Import Trucking

6.5 Early visibility of import cargo to allow for forecast planning

Terminal operators and NWSA staff are preparing for the week ahead. They can see that three vessel calls are scheduled for next Tuesday, but it is unclear how much they plan to offload and whether they will arrive according to schedule. In the past, this uncertainty has required incorporating a substantial buffer into the schedule to ensure that staffing levels are adequate and vessels can depart on time. Even with these precautions, the Alliance is sometimes overwhelmed by unexpectedly large freight flows. When this is not the case, gate traffic may still be substantial because trucking firms are also unsure of the schedule.

By introducing better cargo visibility, the PCS gives stakeholders a more reliable timeline for planning purposes. Individual receivers and drayage firms can verify when their cargo departed the port of origin and when it is anticipated at NWSA docks. NWSA staff and terminal operators, meanwhile, have updated information regarding vessel arrival and how many containers will be arriving and when and can schedule accordingly.

In this scenario, vessel schedules, 48-hour advanced notice of container availability (with the cooperation of the terminal operators and information integration), is synchronized with digital shipping manifests and customs documentation to provide stakeholders with a more accurate snapshot of freight flows over the next

few days and weeks. This reduces uncertainty and decreases the amount of time that truckers and port staff spend readjusting schedules and waiting for late shipments. These operational efficiencies also translate into less congestion and lower levels of air pollution on and near the port.

For future vessel calls, terminal operators log into the PCS and see up-to-the-minute vessel location and how many containers are bound for NWSA destinations. They adjust the facilities schedule in real time to account for the current status. Truckers similarly review the updated arrival time of their containers and plan their workday to minimize downtime. This relieves pressure on limited port-area truck parking and results in smoother port operations.

Figure 11 shows the data flow and key systems involved in providing early visibility of import cargo. The arrival time and status of cargo are two key inputs that will be provided the WBM system to terminal operations. The BTO identifies availability of port facilities to receive, unload and process cargo. Port schedule information that can be used to estimate unloading times and cargo status is transmitted through the PCS to dispatchers, BCO's and warehouses, who can schedule and staff accordingly.

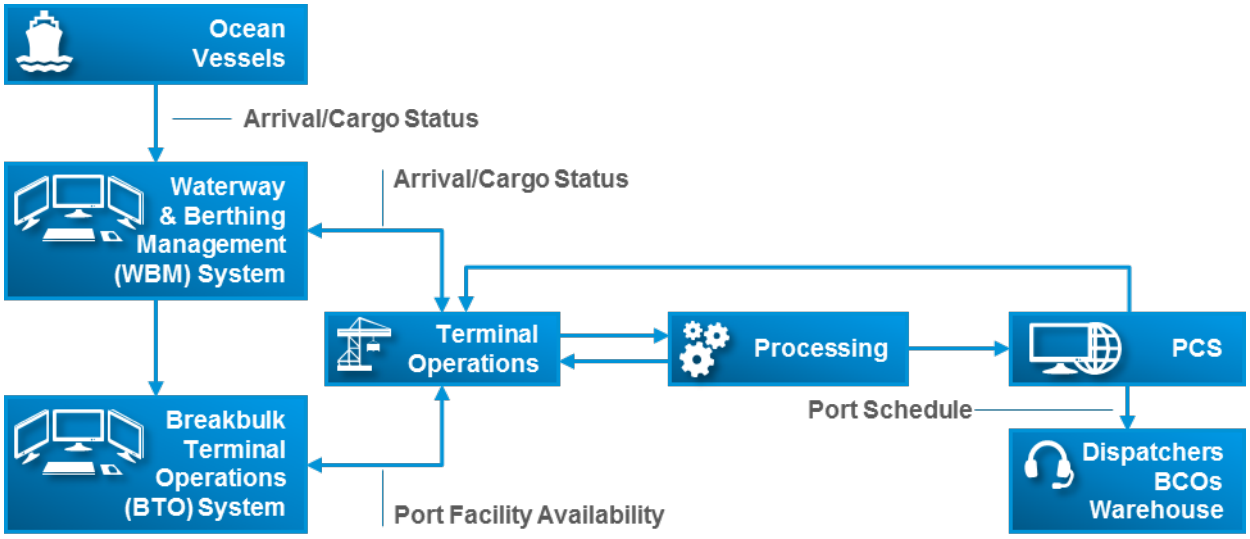


Figure 11. Early Visibility of Import Cargo

6.6 Chassis availability (i.e., broken/good-order) - location both on-dock and off-dock

ABC Drayage regularly hauls containers to and from NWSA facilities, but chassis availability can be a problem. With several chassis pools serving a variety of terminals, it is often unknown whether a chassis is available at a given pickup, or if the driver needs to bring one. Even after a chassis has been located, it may turn out to be broken or otherwise unsuitable. ABC's drivers have lost significant time trying to track down chassis in good working order.

When ABC's logistics manager heard about the new PCS, she immediately signed up to participate in the virtual chassis pool, giving the firm instant access to location and repair status of thousands of chassis in the region. This allowed dispatchers to identify the best chassis for a given load and route drivers accordingly. In addition, ABC and other port partners were better able to orchestrate movements of broken or poorly placed chassis. For example, ABC receives a small credit when their drivers bring a broken chassis to the off-dock

repair shop, rather than bobtailing out. This saves mechanics from having to make the trip, which would add to terminal congestion as they waited to enter and exit the port without making any container moves.

In this scenario, drivers can easily report equipment status when they pick up or drop off chassis. If necessary, a repair order is linked to the chassis' GPS coordinates. This serves to alert drivers and dispatchers to avoid broken equipment, and also helps the chassis pools' maintenance staff to organize and prioritize their workload. Facilitating this scenario is a real-time chassis tracking capability where the availability and location of chassis are accessible to users 24/7.

After participating in the virtual chassis pool for several months, ABC calculated that the firm had cut down on time wasted searching for usable chassis by over 60%. This also led to a significant reduction in bobtail trips into or out of the port, making more efficient use of both drivers' time and ABC's equipment, also reducing congestion, fuel use, and emissions.

Figure 12 illustrates the data flow and key systems involved in providing information on chassis availability. This can use RFID combined with GIS to collect data on chassis location and status. This will enable dispatchers and truckers to optimize their choice of chassis and also provide status information for maintenance purposes. Information will be provided to both terminal operators and the PCS and processed for use by dispatchers and truckers.

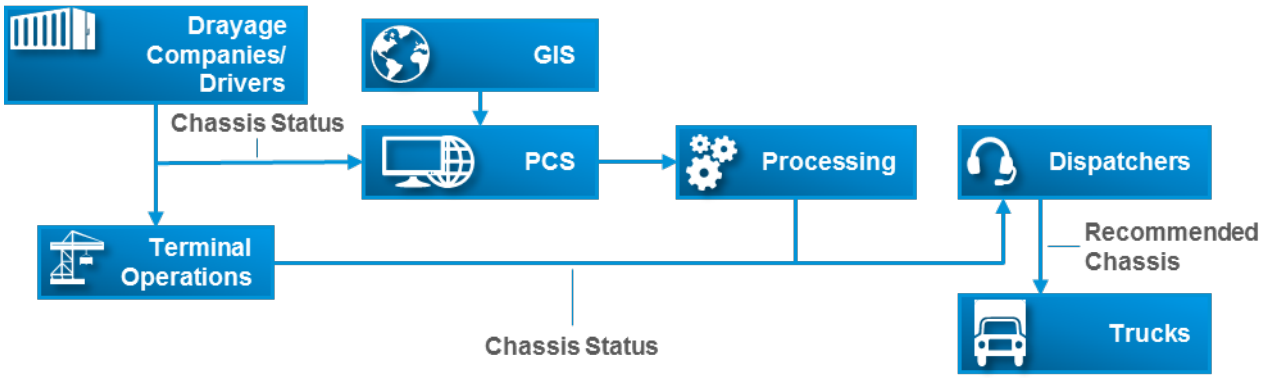


Figure 12. Chassis Availability

6.7 Container location/status (i.e., empty/full) when off-dock

Left Coast Shippers has experience exporting products around the world, but a disruption in container availability can significantly impact their operations. One of the most common obstacles is correctly identifying the location of empty containers. Especially once the container leaves the terminal, it can be difficult to figure out where the container is and whether it has been unloaded.

In an attempt to remedy this problem, Left Coast signed up to test an early version of the PCS container location and status tool. This enabled dispatchers to quickly identify the location of available empty containers. In fact, a location off-dock turned from a liability into an asset. Rather than being difficult or impossible to find, off-dock empties were available for pickup without having to enter port property. This cut down on total trip times for Left Coast and reduced gate delays for other port traffic.

In this scenario, a container tracking system, which could be based on real-time container attached technologies with GPS tracking, or on time-stamped, cataloged location information on containers, keeps the

location of containers available at all times. To protect proprietary data, such information is only displayed to a previously agreed group of stakeholders. Left Coast, for instance, did not want competitors to be able to track all of their shipments. However, they found that sharing information about available empty containers at off-dock chassis pools and crossdock facilities led to significant savings. Restricting this information with a secure login system made this information sharing feasible and effective.

With dynamic container location and status information at their fingertips, Left Coast operations staff found that they could significantly streamline daily routing and improve driver efficiency. Dispatchers spent less time trying to track down available containers and were better able to utilize equipment to move products.

Figure 13 shows the data flow and operation for this operational scenario. Containers equipped with GPS-based location technology can be identified and the information processed through the NWSA database. Information on those located off-dock will be provided to dispatchers who can then identify available trucks or railcars. An optimal pickup strategy can then be developed by the dispatcher and implemented.

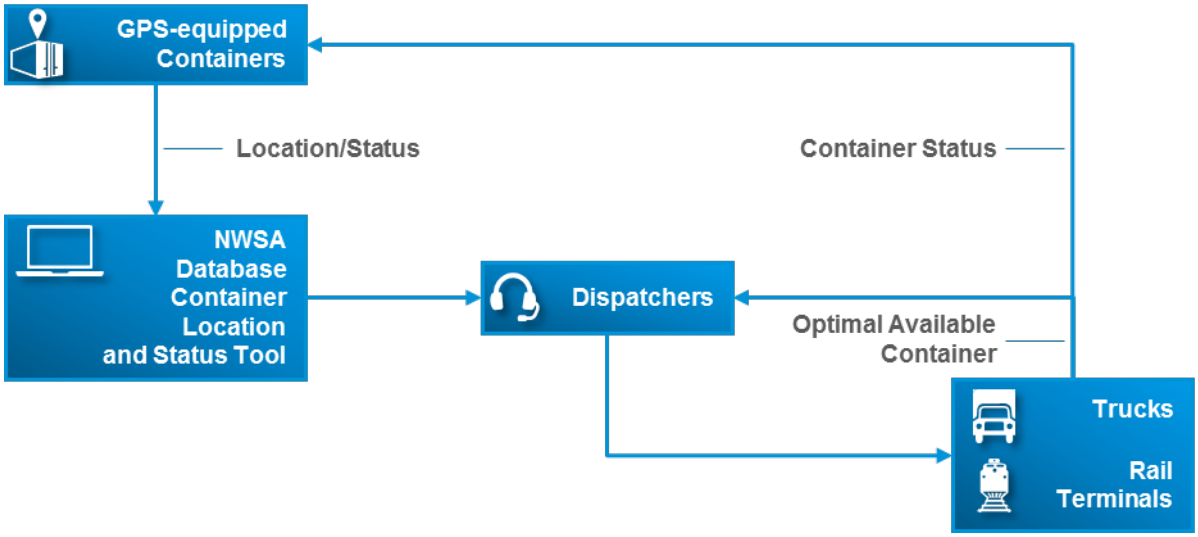


Figure 13. Container Location/Status When Off-Dock

7.0 Summary of Impacts

7.1 Operational Impacts and Benefits

The main purpose of the PCS is better management of goods movements. The system is designed to enable NWSA supply chain participants to exchange data over a common platform and better manage goods movement. As currently envisioned, a fully functioning Port Community System would be able to provide drivers, BCOs and others real-time information regarding turn times, traffic congestion, emergency response and other factors that might impact the flow of cargo. Once operational, this system would support the entire supply chain and improve the overall velocity of cargo moved through NWSA's gateway. PCS has the potential to integrate with the Clean Truck Program, as well as support operational KPIs. The PCS is consistent and supportive of the goals of both Port of Seattle and Port of Tacoma's Container Port Elements.

The anticipated operational impacts of the proposed PCS are summarized below.

7.1.1 Enhanced Supply Chain Visibility

Currently, visibility over the whole supply chain with respect to the status of cargos is limited. PCS facilitates information exchange in and around port communities, and as a result help contribute to risk management of supply chain members, including, but not limited to importers, exporters, shipping lines, freight forwarders, customs house brokers, distribution centers, and airlines. Disseminated through a FRATIS application, the PCS will provide more real-time information such as traffic conditions and incidents in and around the port, truck turn times, street wait times, vessel and rail schedules, container availability and dwell times.

This enhanced supply chain visibility will help reduce delays in cargo movements and reduce container dwell times, but more importantly, provide supply chain members and their customers with insight into the status of their cargo, resulting in better customer service. Information available through the PCS will enable truck drivers (and dispatchers assigning them) serving NWSA terminals to make dynamic routing decisions based on a real-time traffic information, street wait times and truck turn times. The PCS will enable terminal operators to share information on the availability of specific containers, and truck driver and dispatchers to provide pre-arrival container drop-off and pick-up information to the terminal operators. It will provide terminal operators with improved ability to schedule container drop-offs and pick-ups. In addition, NWSA will share information that is useful to the traveling public with its public partners (WSDOT, SDOT, and Tacoma Public Works) so that it can be incorporated into their traveler information systems.

7.1.2 Truck Operation Efficiencies

The PCS will allow for the secure and efficient exchange of data between the NWSA, beneficial cargo owners, and operators of various modes of transportation, including but not limited to ships, Alliance, terminals, drayage trucks and rail. Through the exchange of planning, shipment status and current operational data, the stakeholders within the supply chain will be able to deploy resources in the most efficient and economic manner. The PCS will be available to all public and private stakeholders engaged in the movement of containerized cargo across NWSA terminals, and the rail yards that handle intermodal cargo, in both the Duwamish and Port of Tacoma Manufacturing Centers, as well as breakbulk cargo in Tacoma.

The PCS will support a future reduction in unproductive truck trips. In the port industry, a truck trip that that does not entail container (or chassis/trailer) move is called a bobtail. Currently, each container moved by truck generates about 1.7 truck trips. That is because a truck bringing an export container may not always be able to take an import container on their return trip, and vice versa. FHWA estimates that better visibility of the location of future export containers—an expansion of the system we are planning to put in place now—will reduce bobtail trips by 10% within five, 15% within 5 – 10, and 20% after 10 years.[8]

By improving the efficiency of the NWSA-related logistics chain, it will reduce both the number of truck trips required to move the same amount of cargo by increasing dual transactions, and it will reduce on-terminal movement of yard equipment like on-terminal trucks, straddle carriers, etc., by enabling the terminal operator to better manage on-terminal container delivery, storage, and pick-up. FHWA's FRATIS project expects a 20% reduction in terminal queue time within 5 years, 35% within 5-10 years, and more than 50% after 10 years. Measures that reduce on-street terminal truck queues also improve the efficiency of unrelated truck

[8] FRATIS Concept of Operations FHWA JPO-12-067 Section 9.

(Footnote continued on next page...)

and general purpose traffic movements affected by these queues. The efficiency and emission reduction aspects of this PCS project will assist Seattle to implement the Climate Action Plan.[9]

The PCS will help stakeholders to predict and plan port operations, future freight volumes, and terminal equipment availability. This information will allow carriers and other stakeholders to project the resources needed to serve the Alliance taking into account future roadway improvement projects or any other projects that might affect Alliance operations.

7.1.3 Safety

The PCS will address safety issues by reducing truck queuing on public roadways. Trucks stopped in the public right of way can cause rear-end accidents. Currently, cars and other trucks entering and leaving businesses along congested routes have to contend with trucks queues that may block visibility. A reduction in on-street queues and related congestion will also improve the response time of emergency vehicles. FRATIS expects a reduction in the number of freight-involved incidents by 30% within 5, 35% within 5-10, and 40% after 10 years.[10] Better integration of rail and road information systems will in the future also support advance information on at-grade rail crossing blockages, reducing the likelihood of accidents at these crossings. By improving safety, freight movement efficiency, and congestion in the area, the PCS implementation creates a more favorable economic climate.

7.1.4 Emissions Reductions

The PCS includes the procurement of the Core Platform with FRATIS. FHWA's FRATIS documentation, on which elements of the PCS is based, indicates that truck emission reductions, both from reduced terminal turn and street wait times, of 5 percent are realistic for this type of technology within five years of implementation, 10% within 5-10 years, and 15% after 10 years.

This decrease in truck trips will reduce queuing and on-street congestion. The resultant pollutant reduction will provide for a healthier environment that has the potential to attract new non-motorized users. Both the reduced diesel emissions and the potential for new users being attracted to these corridors can lead to public health benefits.

Potential environmental benefits help support regional goals, including:

- Protecting and improving the quality and function of the region’s air and land resources as it relates to human health and the environment.
- Having a positive effect on the natural environment and human health, and offset potential negative effects, including those caused by private projects permitted by partner transportation agencies.
- The reduction of diesel emissions and greenhouse gas associated with this PCS project supports the region’s planning efforts to control impacts on air quality and climate change, as well the consumption of fossil fuels.
- By reducing emissions carbon dioxide, this PCS project supports Seattle's goal of reducing greenhouse gas by 30 percent from 1990 levels by 2020, and become carbon neutral by 2050.

[9] Seattle Comprehensive Plan, Environmental Element, Goal EG7.5, page 11.6.

[10] FRATIS Concept of Operations, Section 9: https://ntl.bts.gov/lib/54000/54100/54106/12-067.pdf.

7.1.5 Economic Development

This PCS project will monitor, identify and deploy mitigation measures (access limitations, congestion areas) along key freight corridors, networks and intermodal connections that provide access to cargo container facilities and the industrial areas around them. Local industry and businesses depend on efficient, clean transportation options. By improving safety, freight movement efficiency, and congestion in the area, the PCS implementation might help to attract new businesses, retain existing businesses, and inhibit industrial expansion in industrial areas, helping to support the region's goal to retain and grow its industrial sector, retain existing businesses and small firms, and actively seek to attract new industrial businesses.

The improvement in freight mobility by utilizing ITS can help address the problems of site assembly, infrastructure improvements and traffic congestion which may inhibit industrial expansion in industrial areas.[11] By improving freight mobility and transportation efficiency, this PCS will support Seattle's economic development and help maintain a competitive advantage in attracting and retaining family-wage jobs and workers.[12]

One of the reasons NWSA is implementing the PCS is to improve efficiencies that will enable the terminals to accommodate the super-large container ships entering our trade lanes today. These new ships can take advantage of economies of scale, moving more cargo the same distance and speed, using less energy and fuel. According to International Maritime Organization (IMO), a vessel that is 10% larger than the fleet average will achieve a 4% to 5% improvement in energy efficiency, and resulting in commensurate greenhouse gas and diesel particulate matter (DPM) reductions.

7.1.6 Truck Parking

The PCS will provide truck drivers with up-to-date information on the availability of truck parking spaces in and near the Alliance's facilities. In addition, information on the availability of truck parking spaces from WSDOT and other sources will be incorporated, helping drivers avoid over-subscribed truck parking facilities. This will help reduce truck vehicle miles traveled (VMT), congestion and emissions by decreasing the amount of time truckers need to spend looking for parking.

7.2 Organizational Impacts and Benefits

7.2.1 Public Sector

An important component of the PCS is the plan to provide truck queue information to SDOT and WSDOT. Both agencies have sophisticated traveler information systems in place, and both already provide freight specific information to subscribers. With this project, they will be able to add queuing information to their systems automatically. Their traffic management centers can also use that information to adjust VMSs, or signal timing along corridors and at affected intersections. Seattle is already in the process of including at-grade rail crossing blockages on its Traveler Information Map. NWSA is currently talking with WSDOT, Tacoma Public Works and Fire, as well as Tacoma Rail and the City of Fife, to eventually implement a similar system in the Tacoma Tideflats, which will be integrated with the PCS.

[11] Seattle Comprehensive Plan, Economic Element, Policy ED7 page 7.5.

[12] Seattle Comprehensive Plan, Environmental Element, Goal EG2, page 11.4.

7.2.2 Private Sector

For dispatchers and trucking company operations managers, the organizational impacts of the PCS could be significant due to the improved efficiencies that could result based on the deployment of the PCS functions described in Section 5. It is conceivable that the PCS could automate a measurable percentage of dispatching operations, such as:

- Reducing the time required for pre-trip planning;
- Automatically rerouting drivers around congestion (dispatcher time savings); and
- Facilitating automated load matching (dispatcher time savings).

7.2.3 Public-Private Partnerships

As presented in Section 5, this ConOps envisions that the PCS should be deployed at the regional metropolitan level by public-private partnerships (PPP) that include transportation public agencies, transportation data/routing/fleet management companies, and local/regional drayage trucking companies. This Project creates partnerships with organizations in the private sector and engages the community to help protect and enhance Seattle's urban ecosystems and habitat.[13]

7.3 Impacts During PCS Development

As a precursor to the development phase, select groups of PCS users and public sector stakeholders will be invited to provide feedback on this ConOps document. Partners and stakeholder groups will also be engaged throughout the Systems Engineering and system deployment process. Feedback collected from PCS stakeholders may include information that can further assist in assessing potential impacts of PCS during the development phase.

The upcoming PCS development and testing phases are expected to involve the following activities:

- Meetings with select stakeholders to review test parameters, partner roles, and conduct of demonstrations;
- Operational impacts during testing include partner labor to connect the necessary data streams to enable a system test, monitoring of application usage during the test, and reporting of results (preferably through an automated data interchange); and
- Test participants may also need to meet with a third-party independent evaluator if such evaluations are conducted for PCS tests.

[13] Seattle Comprehensive Plan, Environmental Element, Policy E6, page 11.4.

8.0 Analysis of the Proposed System

8.1 Summary of Improvements

By designing and implementing a system that meets the user needs described above, the PCS is consistent and supportive of the goals of both Container Port Elements (core area policies), as well as broader goals related to freight mobility, transportation efficiencies, and reducing air quality emissions:

North Harbor/Port of Seattle

- **CP6 –** Monitor, maintain and improve key freight corridors, networks and intermodal connections that provide access to cargo container facilities and the industrial areas around them to address bottlenecks and other access constraints. Provide safe, reliable, efficient and direct access between Port marine facilities and the state highway or interstate system, and between Port terminals and railroad intermodal facilities, recognizing that Port operations must address other transportation needs, such as pedestrian safety.
- **CP7 –** Make operational, design, access and capital investments to accommodate trucks and maintain successful railroad operations and preserve mobility of goods and services. Improvements may include, but are not limited to, improvement of pavement conditions, commute trip reduction strategies, including through transportation management associations, roadway rechannelization to minimize modal conflicts, use of intelligent transportation systems, construction of critical facility links, and grade separation of modes, especially at heavily used railroad crossings.
- **CP10 –** Continue joint City and Port efforts to implement relevant Port recommendations such as recommendations contained in the Container Terminal Access Study.
- **ED G2 –** Enhance strategic industry clusters that build on Seattle's competitive advantages.
- **ED 2.3 –** Improve the ability of industry clusters to transfer technology in cooperation with other jurisdictions and with major education and research institutions.
- **TG 5 –** Improve mobility and access for the movement of goods and services to enhance and promote economic opportunity throughout the city.
- **T 5.1 –** Enhance Seattle's role as the hub for regional goods movement and as a gateway to national and international suppliers and markets.
- **T 5.2 –** Develop a truck freight network in the Freight Master Plan that connects the city's manufacturing/industrial centers, enhances freight mobility and operational efficiencies, and promotes the city's economic health.
- **T 5.3 –** Ensure that freight corridors are designed, maintained, and operated to provide efficient movement of truck traffic.
- **T 5.4 –** Use intelligent transportation system technology to alert motorists, bicyclists, and pedestrians to the presence and anticipated length of closures due to train crossings and bridge openings for water vessels.

South Harbor/Port of Tacoma

- **CP-3 –** Promote the continued growth and vitality of port and port-related industrial activity.

- **CP-6 –** Identify, protect and preserve the transportation infrastructure and services needed for efficient multimodal movement of goods within and between the Core Area, Industrial/Commercial Buffer Area, and the regional transportation system.
- **CP-26 –** Coordinate with state and local agencies to emphasize the importance of these corridors to state and local economic health, and support improvements planned on these corridors that enhance freight mobility. These corridors are those designated with a T-1 tonnage classification (carrying over 10 million tons of freight per year) by WSDOT, as well as roads that connect the Port to the regional road system (i.e., first/last mile connector routes).
- **CP-31 –** Identify and prioritize improvements in efficiency to the roadway system, such as traffic signal timing and phasing improvements, which will improve roadway freight operations without requiring major capital investment.
- **EC-4 –** Foster positive business development within the City and proactively invest in transportation, infrastructure and utilities to grow Tacoma's economic base in target areas.
- **EC-4.8 –** Encourage the construction and maintenance of utility, communications and technology infrastructure that will help attract businesses and industry to the Tacoma community.
- **EC-4.9 –** Maintain and improve the transportation network as necessary to facilitate the efficient movement of goods and attract economic activity,

8.2 Disadvantages and Limitations

Some of the disadvantages and limitations of the proposed PCS include:

- **Geographic coverage –** The static and real-time freight traveler information will not be available for every possible roadway in NWSA's facilities; it will need to focus primarily on critical and major freight facilities.
- **No centralized database –** PCS users will be subscribers to the system.
- **User learning curve –** Participating trucking companies will have to obtain PCS applications and learn how to use them. For dispatchers, this will involve learning to navigate the website and use the various new features available to them. Truck drivers will need to learn how to use the PCS on their preferred device; some drivers may be less familiar with new technologies, creating a steeper learning curve.
- **API development –** Several data contributors may need to develop APIs that support standardized data sharing with the PCS.
- **Budget –** New budget sources will need to be identified in order for features of the full PCS to be implemented.

8.3 Alternatives and Tradeoffs Considered

This PCS does not directly promote commute trip reduction and other travel demand management (TDM) opportunities for the movement of people. However, the PCS will provide information on terminal truck turn and street wait times to NSWA truck drivers and their dispatchers via a smartphone application and dedicated web page. This will enable the truck drivers (and dispatchers assigning them) serving NWSA terminals to make dynamic routing decisions based on a real-time traffic information.

Several alternatives and tradeoffs discussed which affect the ConOps include:

- WSDOT Good To Go! Pass – NWSA staff have researched other technologies, such as leveraging the WSDOT Good To Go! pass, that serve both the Clean Truck Program and operations initiatives. This work will yield future advances to the PCS and environmental programs, but these technology options cannot be deployed quickly enough to support the current clean truck deadline. As such, staff are moving forward with RFID technology.
- Centralized database – While other Port Community System deployments nationwide have been designed around a centralized database, the NWSA prefers to implement a flexible data access approach that does not necessarily require Port systems or servers to serve as the primary data collection mechanism. While technical details will be left open to the vendor, the goal will be a capability to interface in real-time with multiple data sources from public and private Port users to provide a virtual data repository of information necessary to support PCS applications. Rather than acting as data owner, the NWSA will be one of many nodes (subscribers) of the system.

9.0 Implementation Plan / System Roadmap

As described in Section 5.3, the Alliance prioritized the proposed PCS elements into the four categories listed below. The Alliance took into consideration highest priority user needs, feasibility of each element, as well as available funding to determine the categorization of each element.

- Initial Elements
- Intermediate Elements
- Long Term Elements
- Optional Elements

This section describes the implementation plan of the PCTS, which includes all elements in the Initial Elements phase that can be implemented using FAST and CMAQ grant funds. Individual elements making up the PCTS are listed in **Table 4**.

Table 4. PCTS Elements

ID	System	Port Community System Element
1.1	PCTS	PCS Core Platform hardware/cloud services
1.2	PCTS	PCS Core Platform data management functions, repository and archive
1.3	PCTS	PCS Core Platform data exchange interfaces
1.4	PCTS	PCS Core Platform initial analytics (data sets to create basic reports)
1.5	PCTS	PCS Core Platform Graphical User Interface (GUI)
1.6	PCTS	Integration of vessel scheduling and berthing data into Core Platform data management function.
1.7	PCTS	Integration of RFID data into Core Platform data management function.
1.8	PCTS	Integration of registered truck and driver database into Core Platform data management function.
1.9	PCTS	NWSA Website Interface for data delivery and information exchange
1.10	PCTS	Mobile Application Interface for data delivery and information exchange
1.11	PCTS	Automated notifications (terminal wait times, street queue waiting times, closures)

ID	System	Port Community System Element
1.12	PCTS	King County expansion of RFID system

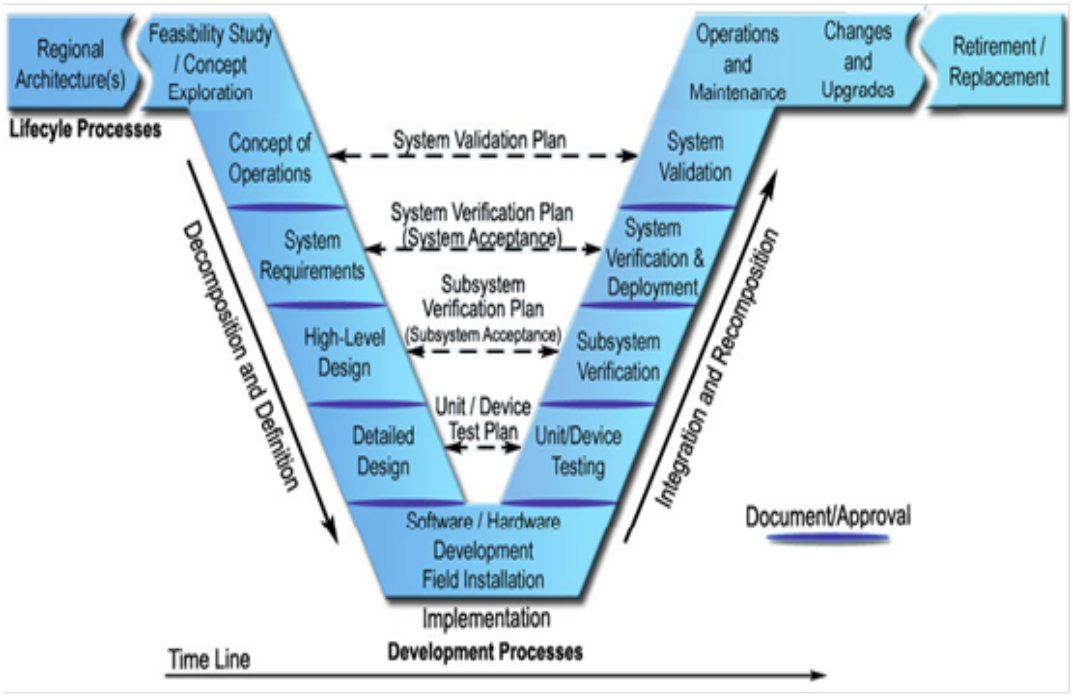
These 12 elements will adhere to the following PCTS Project Milestones:

- Systems Engineering – 2018 Q3 and Q4
- System Procurement – Begin 2019 Q1
- System Development – Begin 2019 Q3
- System Deployment – Begin 2019 Q4
- Estimated date the project will be fully implemented: December 1st, 2022

9.1 Next Steps

The implementation plan follows the traditional Systems Engineering V-Diagram "Waterfall" approach (see **Figure 14**) that is typically followed on FHWA-funded ITS projects. This Concept of Operations will be followed by the development of System Requirements. In this step, the stakeholder needs identified in this document will be reviewed, analyzed, and transformed into verifiable requirements that define what the system will do, but not how the system will do it. In addition to the ConOps, functional requirements, applicable statues, regulations and policies, as well as constraints will be taken into consideration. The System Requirements will be used to develop procurement documents to solicit a PCTS System Deployment Contractor in 2019.

Figure 14. Systems Engineering V-Diagram



Source: Federal Highway Administration

System Requirements Deliverables:

1. Draft and Final PCTS System Requirements document (including Traceability Matrix)

Documented deliverables from the PCTS System Deployment Contractor may include:

1. Contract documents
2. Equipment installation plans
3. System design and operations documents (operations manual, training material, communications network)
4. System equipment specifications (hardware and software)
5. Verification and validation plans

Appendix A. Acronyms and Abbreviations

Term	Definition
AI	Artificial Intelligence
ANL	Australia National Lines
API	Application Programming Interface
APL	American President Lines
BCO	Beneficial Cargo Owner
BTO	Breakbulk Terminal Operations
C/AV	Connected and Automated Vehicle
CCTV	Closed-Circuit Television
CMA-CGM	Compagnie Maritime d'Affrètement - Compagnie Générale Maritime
CMAQ	Congestion Mitigation and Air Quality
ConOps	Concept of Operations
C2C	Center-to-Center
CUFC	Critical Urban Freight Corridors
DPM	Diesel Particulate Matter
DSRC	Dedicated Short-Range Communications
DTR	Drayage Truck Registry
EAM	Enterprise Asset Management
FAST	Fixing America's Surface Transportation
FGTS	Freight and Goods Transportation Systems
FRATIS	Freight Advanced Traveler Information System
FTP	File Transfer Protocol
GDP	Gross Domestic Product
GIS	Geographic Information System
GPS	Global Positioning System
GUI	Graphical User Interface
HARS	Highway Advisory Radio System
HMM	Hyundai Merchant Marine
IMO	International Maritime Organization
IoT	Internet of Things
IT	Information Technology
ITS	Intelligent Transportation System
J2EE	Java Enterprise Edition
KPI	Key Performance Indicator
MIC	Manufacturing Industrial Center
MSC	Mediterranean Shipping Co.
MTO	Marine Terminal Operator
NWPCAS	Northwest Ports Clean Air Strategy
NWSA	Northwest Seaport Alliance

OCR	Optical Character Recognition
O/D	Origin/Destination
ONE	One Network Express
OSC	Operations Service Center
PCS	Port Community System
PCT	Pierce Container Terminal
PCTS	Port Community Technology System
PIL	Pacific International Lines
PPP	Public-Private Partnership
PSRC	Puget Sound Regional Council
RFID	Radio-Frequency Identification
RFP	Request for Proposal
SDOT	Seattle Department of Transportation
SOA	Service Oriented Architecture
TacSim	Tacoma South Intermodal Facility
TDM	Travel Demand Management
TEU	Twenty-Foot-Equivalent Unit
TOC	Transportation Operations Center
TOS	Terminal Operation System
TSMO	Transportation Systems Management and Operations
UP	Union Pacific
VIN	Vehicle Identification Number
VMS	Variable Message Sign
VMT	Vehicle Miles Traveled
WBM	Waterway and Berthing Management
WIM	Weigh-in-Motion
WSDOT	Washington State Department of Transportation
WUT	Washington United Terminals

ATTACHMENT B
RFI 2019-01

THE NORTHWEST SEAPORT ALLIANCE
Gateway to Solutions

Port Community System

System Requirements

prepared for

Northwest Seaport Alliance

prepared by

Cambridge Systematics, Inc.

Transpo Group, Inc.

CAMBRIDGE SYSTEMATICS
Think Forward

transpogroup

January 25, 2019

Port Community System

System Requirements

prepared for

Northwest Seaport Alliance

prepared by

Cambridge Systematics, Inc.
Transpo Group, Inc.

date

January 25, 2019

Table of Contents

List of Tables

List of Figures

1.0 Scope

This document specifies the system requirements based on the Port Community System (PCS) Concept of Operations. System level requirements defines what the system is to accomplish (functional requirements), how well the system is expected to perform its functions (performance requirements), which external systems the system is expected to interface with (interface requirements) and under what conditions will the system have to work to meet its performance goals (non-functional requirements).

1.1 Identification

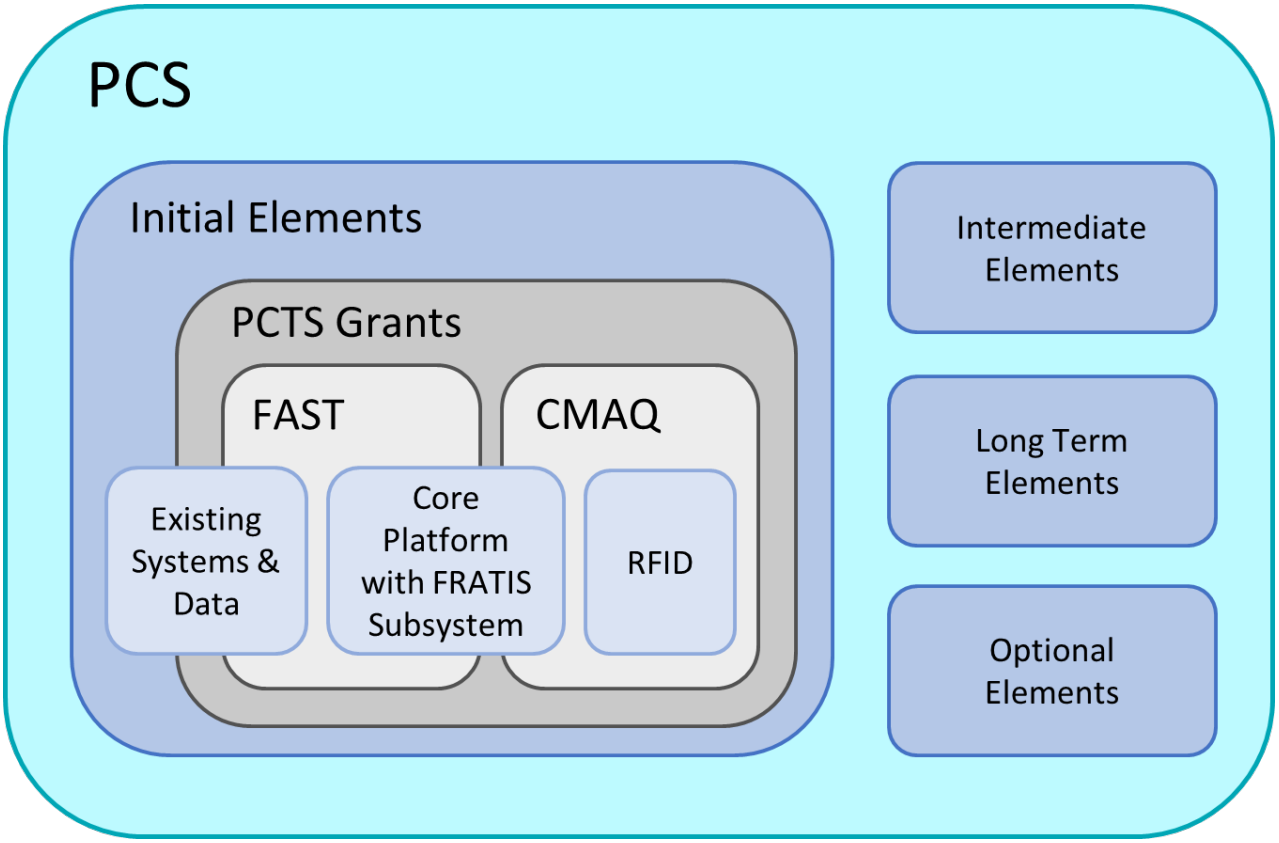
This document is the deliverable as defined under Task 3 of the scope of work for Transpo Group USA, Inc. project number 1.18027.00 named Port of Tacoma 2018 Consulting Services for the PCS project. Scope of work document is The Northwest Seaport Alliance (NWSA) and the Port of Tacoma – Professional Services Agreement No. 070894.

1.2 System Overview

The PCS will implement an open standard platform for the advanced and secure exchange of information between NWSA public and private stakeholders. It is designed to optimize, manage, and automate port and logistics processes through a common platform for data exchanges. It will provide functionality, visibility, and information on the movement of cargo by truck, rail, and ship, as well as their interfaces, thus improving efficiency of the NWSA-related supply chain. This new capability will help to improve the coordination of freight movement at NWSA facilities, and may lead to improvements in terminal efficiency, reduced delays, reductions in truck queues, and help increase (retain and grow) discretionary cargo. Collectively, these benefits will also translate to reductions in freight congestion and improvements in air quality for the region. The PCS will encompass data and interactions relating to NWSA terminals, railroad tracks and yards, ocean carriers, and warehousing and distribution centers, and should provide cargo movement visibility to beneficial cargo owners (BCOs).

The PCS will be comprised of four groups of elements: Initial, Intermediate, Long Term and Optional, as shown in **Figure 1.** The PCS will be implemented in multiple phases. The Initial Elements phase is comprised of three main components: (1) the expansion of vehicle tracking technology and communications infrastructure into areas within King County outside of NWSA facilities, (2) the PCS Core Platform with Freight Advanced Traveler Information System (FRATIS) subsystem, and (3) integration of several existing systems and data sources. The expansion of vehicle tracking hardware will be used to augment the data collected by the recently completed installation of radio-frequency identification (RFID) vehicle tracking technology at NWSA facilities. These data are used to monitor truck wait and queuing information on, at and near NWSA container terminals and will be provided to the trucking community through the PCS. The FRATIS subsystem, also referred to as the PCS Core Platform graphical user interface (GUI), is made up of two information dissemination channels: the NWSA website and a mobile application (see **Figure 2**). These will be the interfaces in which PCS users access information provided by the system. Future phases of the PCS will consider Intermediate, Long Term and Optional Elements, which are further detailed in Section 4.2.

Figure 1. Port Community System Concept



1.3 Identified System Users and Stakeholders

1.3.1 NWSA Staff

NWSA staff are responsible for maintaining the port facilities, tracking port performance, and determining how regional investments impact port operations. Several of the internal groups listed below are Port of Tacoma staff that provide services to the NWSA via service agreements. The NWSA, with access to information such as Port video feeds, vessel schedules, and incoming containers, would be one major data source for the PCS. NWSA staff would also be one of the primary user groups of the PCS, using information provided to monitor and proactively manage gateway performance.

1.3.2 Truck Drivers, Motor Carrier Operators and Dispatchers

Truck drivers are responsible for cargo delivery operations between Alliance terminals, BCOs, warehousing and distribution facilities, and railyards. Motor carrier operators and dispatchers are responsible for planning trips and maintaining communications with truck drivers. Truck drivers and dispatchers currently receive port information needed for daily operations from online sources, phone calls, emails, or fax.

Truck drivers, motor carrier operators, and dispatchers would be one of the primary user groups of the PCS. They could utilize port operation information such as vessel and port schedules, estimated truck turn times, gate cameras, and terminal updates through the PCS to increase the efficiency of trips to and from NWSA

facilities. Motor carriers may also be a data source for the PCS, providing information such as pre-arrival container drop-off and pick-up information, service requests, or maintenance needs.

1.3.3 Beneficial Cargo Owners

BCOs are the importers and exporters of record, who take possession of cargo at the destination such as a distribution center or warehouse. BCOs determine the details of container delivery, including the shipment origin and destination, time of the arrival and departure to and from BCO facilities, how long the shipment is stored, and who receives and moves it. BCOs rely on the container availability, terminal delay information, and discharge time information provided by the port to track delivery status and would be another PCS user group. PCS information would allow BCOs to make better business decisions thereby reducing costs and increasing profits, resulting in additional cargo flowing through the gateway. Several examples of regional BCOs include Spiegel, Walmart, SanMar, and Nordstrom.

1.3.4 Public Transportation Agencies

Public transportation agencies are responsible for planning, designing, and maintaining transportation infrastructure. State, county, and city agencies play a key role in operating and maintaining transportation systems such as signalized intersections, variable message signs, freeway ramp meters, at-grade railroad crossing protection and notification, and traveler information systems. For the PCS, public transportation agencies would be a good source of traffic condition information and truck parking availability. The agencies listed below may also utilize the PCS to track port-related incidents that may impact roadway conditions outside of NWSA facility areas.

Public transportation agencies of interest include Seattle Department of Transportation (DOT), City Tacoma, City of Fife, Washington State Department of Transportation (WSDOT), and Puget Sound Regional Council (PSRC).

1.3.5 Marine Terminal Operators

Marine Terminal Operators (MTOs) rent marine terminals from the NWSA and operate as private businesses. MTOs provide marine terminal facilities to the ocean carriers and motor carriers moving cargo. MTOs are responsible for the operations that occur at the terminal gates and within the terminal. Each MTO uses a terminal operating system that organizes, manages, and controls the movement and storage of containers. MTOs' terminal operating systems is another potential data source for the PCS. MTOs can also share security video feeds and recurring or non-recurring terminal updates through the PCS.

1.3.6 Ocean Carriers

Ocean shipping carriers are responsible for moving international and domestic containerized freight between ports. More than 20 international and domestic shipping lines provide regular service between NWSA port facilities and key markets all over the world. Ocean shipping lines are responsible for providing ship arrival times, ship delays, and service calls to NWSA Vessel Call Management and are another potential data source for the PCS.

1.3.7 Rail Company Operators

BNSF Railway, Union Pacific (UP) Railroad and Tacoma Rail operate at the NWSA intermodal facilities. BNSF and UP railway operators provide cargo transporting services across U.S., connecting the Pacific Northwest to key markets across the country. Tacoma Rail operates as a publicly-owned short line railroad in the Port of Tacoma and surrounding areas.

Tacoma South Intermodal Facility (TacSim) and Union Pacific Argo Yard are near-dock facilities operated by UP that serve customers 24/7. TacSim averages truck turn times of less than 10 minutes. BNSF Railway operates the South Seattle Intermodal Facility near-dock intermodal yard, also serving customers 24/7. Both TacSim and South Seattle Intermodal Facility provide domestic and short-haul rail service.[1] NWSA supports six on-dock rail yards across both harbors that are operated by MTOs and works closely with carriers to ensure that containers bound for specific inland destinations via rail are stowed on the ship so as to be the first ones unloaded and transferred to trains, decreasing the loading time of cargo headed for inland destinations.

Rail crossing blockage notifications and rail dwell times would help truck drivers bypass closed lanes. This type of information may be available to the PCS from rail companies or through rail detection systems.

2.0 References

The following is a listing of relevant documents, standards, and references used in preparing this report:

- Port Community System Concept of Operations (2018)
- Port Community Technology System (PCTS) Fixing America's Surface Transportation (FAST) Grant Application (2017)
- King Countywide Congestion Mitigation and Air Quality (CMAQ) Grant Application (2018)
- PCS User Needs Workshops (2018)
- *Systems Engineering Guidebook for Intelligent Transportation Systems, Version 3.0*, California Department of Transportation (Caltrans), et al., Federal Highway Administration, U.S. Department of Transportation, November 2009.
- Washington State Office of the Attorney General – Laws Governing Access to Public Records

3.0 Requirements, Verification Methods, Traceability Matrix

The PCS will be designed and deployed in multiple phases. See **Table 6** for list of elements included in each phase. The requirements included in this section cover all phases of implementation (Initial, Intermediate,

[1] https://www.nwseaportalliance.com/sites/default/files/nwsa_mapbrochure_5-2016_web.pdf and https://www.nwseaportalliance.com/shippers/rail-lines

Long Term and Optional). The overall design of the PCS needs to accommodate all phases of implementation, but the scope of the Initial phase will be defined in conjunction with the selected vendor(s), based on project constraints including budget and schedule.

For each requirement, the element group, User Need(s) addressed and verification method are listed.

The verification method will be one of the following:

- **Analysis –** This method describes the use of analytical data, analysis, or simulations under defined conditions to show theoretical compliance and is used where testing to realistic conditions cannot be achieved or is not cost-effective. Analysis (including simulation or simple logical conclusion) may be used when such means establish that the appropriate requirement, specification, or derived requirement is met by the proposed solution.

- **Demonstration –** This method uses a set of test activities with system stimuli (actual or simulated) selected by the system developer that may be used to show that system or subsystem response to stimuli is suitable. This is the primary method to test functional capability.

- **Inspection –** This method describes an examination of the item against applicable documentation to confirm compliance with requirements. Inspection is used to verify properties best determined by examination and observation (e.g. platform compliance).

- **Test –** This method describes an action by which the operability, supportability, or performance capability of an item is verified when subjected to controlled conditions that are real or simulated.

3.1 Functional Requirements

Table 1. PCS Functional Requirements

ID	Category	Description	Element Group	User Need	Verification Method
1.1	**PCS Core Platform – General**				
1.1.1	PCS Core Platform	The PCS Core Platform shall have a scalable architecture.	Initial	UN30	Demonstration
1.1.2	PCS Core Platform	The PCS Core Platform shall be customizable to support individual user operational environments.	Initial	UN7, UN19	Demonstration
1.1.3	PCS Core Platform	The PCS Core Platform shall be adaptable for integration with external data sources including small and large scale Intelligent Transportation System (ITS) deployments under NWSA's jurisdiction or other PCS users.	Initial	UN2, UN30	Demonstration
1.1.4	PCS Core Platform	The PCS Core Platform shall include a modular software architecture in which the system is configured	Initial	UN2 UN30	Demonstration

		based on various integrated subsystems.			
1.1.5	PCS Core Platform	The PCS Core Platform shall integrate seamlessly into a single user-specified interface.	Initial	UN7, UN29	Demonstration
1.1.6	PCS Core Platform	The PCS Core Platform shall be an information technology (IT) system comprised of:	Initial	UN30	Demonstration
1.1.6.a	PCS Core Platform	PCS Core Platform hardware and/or cloud services	Initial	UN1, UN2, UN20, UN30	Demonstration
1.1.6.b	PCS Core Platform	PCS Core Platform data management functions, repository and archive	Initial	UN1, UN2, UN20, UN23	Demonstration
1.1.6.c	PCS Core Platform	PCS Core Platform data exchange interfaces and logic	Initial	UN1, UN2, UN3, UN20	Demonstration
1.1.6.d	PCS Core Platform	PCS Core Platform initial analytics (data sets to create basic reports)	Initial	UN1, UN2, UN21, UN23, UN24	Demonstration
1.1.6.e	PCS Core Platform	PCS Core Platform Graphical User Interface (GUI), which will be referred to as the FRATIS subsystem moving forward.	Initial	UN1, UN2, UN5, UN7	Demonstration
1.1.7	PCS Core Platform	The PCS Core Platform shall include all necessary third-party licensing to make modules, functions, and data exchanges work.	Initial	UN1	Demonstration
1.1.8	PCS Core Platform	The PCS Core Platform shall allow users from multiple entities to act as data providers and/or data subscribers of the system.	Initial	UN1, UN2	Demonstration
1.2	**PCS Core Platform – Information Dissemination and Automated Notifications**				
1.2.1	Information Dissemination	The FRATIS subsystem shall be capable of being launched and operated within a common standard Internet browser, and not specific to any one particular browser.	Initial	UN29	Demonstration
1.2.2	Information Dissemination	The FRATIS subsystem shall provide a single integrated GUI to access data from all modules, subject to permitted roles-based permissions and user-specified interface/dashboard.	Initial	UN20	Demonstration
1.2.3	Information Dissemination	The FRATIS subsystem shall be comprised of:	Initial	UN29	Demonstration
1.2.3.a	Information Dissemination	NWSA Website Interface for data delivery and information exchange	Initial	UN29	Demonstration

1.2.3.b	Information Dissemination	Mobile Application Interface for data delivery and information exchange	Initial	UN29	Demonstration
1.2.3.c	Information Dissemination	Automated notification generation (terminal wait times, street queue waiting times, closures).	Initial	UN3	Demonstration
1.2.3.d	Information Dissemination	An optional interface for system administration functions.	Initial	UN24	Demonstration
1.2.4	Information Dissemination	The PCS Core Platform shall provide access to PCS user types including, but are not limited to (See **Table 7** for user types):	Initial	UN19	Demonstration
1.2.4.a	Information Dissemination	Guest Users	Initial	UN19	Demonstration
1.2.4.b	Information Dissemination	Registered Users	Initial	UN19	Demonstration
1.2.4.c	Information Dissemination	System Administrators	Initial	UN19	Demonstration
1.2.5	Information Dissemination	The FRATIS subsystem shall disseminate static and real-time Port information via customizable dashboards including, but not limited to:	Initial	UN7, UN8	Demonstration
1.2.5.a	Information Dissemination	General Port alerts	Initial	UN8	Demonstration
1.2.5.b	Information Dissemination	Street and terminal queue wait times	Initial	UN8	Demonstration
1.2.5.c	Information Dissemination	Terminal turn times	Initial	UN8	Demonstration
1.2.5.d	Information Dissemination	Vessel schedules	Initial	UN8, UN16	Demonstration
1.2.5.e	Information Dissemination	Performance reports based on available data (e.g., average turn times, vessel on-time arrivals, etc.)	Initial	UN8	Demonstration
1.2.6	Automated Notifications	The FRATIS subsystem automated notifications shall:	Initial	UN1, UN2, UN3, UN25	Demonstration
1.2.6.a	Automated Notifications	Issue, at a minimum, the following types of notifications: 1. Street wait times 2. Terminal queue times 3. Terminal turn times 4. NWSA facility closures	Initial	UN1, UN2, UN3, UN25	Demonstration
1.2.6.b	Automated Notifications	Display alarms, events, and notifications received from any subsystem or interface (i.e. local agency traffic data).	Initial	UN1, UN2, UN3, UN25	Demonstration

1.2.6.c	Automated Notifications	Allow the user to configure, sort and filter the alarm, event, and notification list based on different parameters, such as, but not limited to alarm type, severity, date/time, action, and region.	Initial	UN1, UN2, UN3, UN25	Demonstration
1.2.6.d	Automated Notifications	Allow a custom action (e.g., delete) to be executed when an alarm is triggered.	Initial	UN1, UN2, UN3, UN25	Demonstration
1.2.6.e	Automated Notifications	Archive each alarm, event, and notification reported.	Initial	UN1, UN2, UN3, UN25	Demonstration
1.2.6.f	Automated Notifications	Log all notifications, alarms and events.	Initial	UN1, UN2, UN3, UN25	Demonstration
1.2.6.g	Automated Notifications	Allow users to query the database and generate reports that are customizable by user, and able to be exported in csv, xlsx, and pdf format.	Initial	UN1, UN2, UN3, UN25	Demonstration
1.3	**PCS Core Platform – User Access and Settings**				
1.3.1	User Access	Guest Users shall be able to access the FRATIS subsystem without entering login information, but shall only have access to a limited set of mobile app modules. Refer to **Table 7** for allowed permissions.	Initial	UN19, UN20	Demonstration
1.3.2	User Access	Registered Users shall be able to log into the FRATIS subsystem using the email address and password they used to set up their PCS account and have access to permission-based modules. Refer to **Table 7** for allowed permissions.	Initial	UN19, UN20	Demonstration
1.3.3	User Settings	Guest Users shall be able to opt-in as a Registered User by creating a user profile and accepting a User Agreement or End User License Agreement.	Initial	UN19, UN20, UN27	Demonstration
1.3.4	User Settings	Guest Users who completed the opt-in process shall either be automatically registered for a PCS account, or the System Administrator shall approve their application after verification of credentials.	Initial	UN19, UN20, UN27	Demonstration
1.3.5	User Settings	Registered Users shall be able to change their own password.	Initial	UN19, UN20	Demonstration
1.3.7	User Settings	A Registered User's customized settings shall be applied to all platforms used by the User (e.g., web browser, tablet, or smartphone).	Initial	UN19, UN20	Demonstration
	User Settings	Registered Users shall be allowed to select the format(s) by which the	Initial	UN19, UN20	Demonstration

		alerts are delivered (e.g., in-app, SMS, audible, email).			
1.3.8	User Settings	System Administrators shall have the ability to configure various website and mobile app settings that apply to specified User types. Refer to **Table 7** for allowed permissions.	Initial	UN19, UN20	Demonstration
1.4	**PCS Subsystems – Initial Elements**				
1.4.1	RFID Information	The integration of RFID Information into the PCS Core Platform data management function shall:	Initial	UN1, UN2	Demonstration
1.4.1.a	RFID Information	Receive current and average travel time and speeds between specific RFID detectors.	Initial	UN1, UN2	Demonstration
1.4.1.b	RFID Information	Receive current and average street wait time, terminal turn time, and total turn time at each marine terminal.	Initial	UN1, UN2	Demonstration
1.4.1.c	RFID Information	Log the tag identification number and time of reading.	Initial	UN1, UN2	Demonstration
1.4.1.d	RFID Information	Receive alerts of malfunctioning field equipment.	Initial	UN1, UN2	Demonstration
1.4.1.e	RFID Information	Allow users to query archived data and generate reports that are customizable by user, and able to be exported in csv, xlsx, and pdf format.	Initial	UN1, UN2	Demonstration
1.4.2	Supplementary Vehicle Tracking Information	The PCS Core Platform shall support the integration of Supplemental Vehicle Tracking Information obtained outside of NWSA facilities.	Initial	UN1, UN2	Demonstration
1.4.3	Vessel Schedule Information	The integration of Vessel Schedule Information into the PCS Core Platform data management function shall:	Initial	UN1, UN2, UN16	Demonstration
1.4.3.a	Vessel Schedule Information	Include, but is not limited to vessel name, estimated time of arrival (ETA) date/time, berth, estimated time of departure (ETD) date/time, and earliest receiving date (ERD) date/time.	Initial	UN1, UN2, UN16	Demonstration
1.4.3.b	Vessel Schedule Information	Calculate and report vessel on-time performance metrics as defined by the Port, numerically and graphically.	Initial	UN1, UN2, UN16	Demonstration
1.4.3.c	Vessel Schedule Information	Store the calculated on-time performance metrics in the database, along with the data and parameters used to perform that calculation.	Initial	UN1, UN2, UN16	Demonstration
1.4.3.d	Vessel Schedule Information	Allow users to query archived vessel on-time performance data and generate reports that are customizable by user, and able to be exported in csv, xlsx, and pdf format.	Initial	UN1, UN2, UN16	Demonstration

1.4.4	Registered Truck Information	The integration of Registered Truck Information into the PCS Core Platform data management function shall:	Initial	UN22	Demonstration
1.4.4.a	Registered Truck Information	Be obtained from RFID transaction data on NWSA servers.	Initial	UN22	Demonstration
1.4.4.b	Registered Truck Information	Provide truck compliance information.	Initial	UN22	Demonstration
1.4.4.c	Registered Truck Information	Be used to verify credentials, where needed.	Initial	UN22	Demonstration
1.4.4.d	Registered Truck Information	Be used to identify individual trucks from RFID readings.	Initial	UN22	Demonstration
1.4.4.e	Registered Truck Information	Allow users to query the database and generate reports that are customizable by user, and able to be exported in csv, xlsx, and pdf format.	Initial	UN22	Demonstration
1.5	**PCS Subsystems – Intermediate Elements**				
1.5.1	Manual Alerts and Routing Information	The integration of Manual Alerts and Routing Information into the PCS Core Platform may:	Intermediate	UN1, UN3, UN9, UN11	Demonstration
1.5.1.a	Manual Alerts and Routing Information	Allow users to manually upload emergency and incident alerts.	Intermediate	UN1, UN3, UN9, UN11	Demonstration
1.5.1.b	Manual Alerts and Routing Information	Allow users to manually upload static routing information.	Intermediate	UN1, UN3, UN9, UN11	Demonstration
1.5.1.c	Manual Alerts and Routing Information	Allow a custom action (e.g., delete) to be executed when users receive these notifications.	Intermediate	UN1, UN3, UN9, UN11	Demonstration
1.5.1.d	Manual Alerts and Routing Information	Archive each alarm, event, and notification reported.	Intermediate	UN1, UN3, UN9, UN11	Demonstration
1.5.2	MTO and Port Area Camera Feeds	The integration (and video analytics) of MTO and Port area camera feeds into the PCS Core Platform data management function may:	Intermediate	UN1, UN8	Demonstration
1.5.2.a	MTO and Port Area Camera Feeds	Allow users to view publicly available camera feeds.	Intermediate	UN1, UN8	Demonstration
1.5.2.b	MTO and Port Area Camera Feeds	Utilize vehicle detection technology and algorithms to measure vehicle positions and speeds.	Intermediate	UN1, UN8	Demonstration
1.5.2.c	MTO and Port Area	Utilize vehicle detection technology and algorithms to detect long vehicular queues and potential	Intermediate	UN1, UN8	Demonstration

	Camera Feeds	incidents, and report these events to PCS users.			
1.5.2.d	MTO and Port Area Camera Feeds	Automatically report video signal loss, unacceptable video stream quality, camera malfunction, or other performance disabling events.	Intermediate	UN1, UN8	Demonstration
1.5.3	Local Agency Traffic Information	The integration of WSDOT, SDOT and other Local Transportation Agency Traffic Information into the PCS Core Platform data management function may:	Intermediate	UN1, UN2, UN6, UN9, UN11	Demonstration
1.5.3.a	Local Agency Traffic Information	Provide congestion and road closure information along major arterials and interstates typically used by Port users.	Intermediate	UN1, UN2, UN6, UN9, UN11	Demonstration
1.5.3.b	Local Agency Traffic Information	Generate a single, regional view of Port area traffic conditions in near-real-time.	Intermediate	UN1, UN2, UN6, UN9, UN11	Demonstration
1.5.4	GIS Information	The integration of NWSA GIS Information into the PCS Core Platform data management function may:	Intermediate	UN1, UN2	Demonstration
1.5.4.a	GIS Information	Display NWSA GIS base layers for user-customized Port maps.	Intermediate	UN1, UN2	Demonstration
1.5.4.b	GIS Information	Display asset management information for use as additional map layers.	Intermediate	UN1, UN2	Demonstration
1.5.5	Rail Scheduling Information	The integration of Rail Scheduling Information into the PCS Core Platform data management function may:	Intermediate	UN1, UN2	Demonstration
1.5.5.a	Rail Scheduling Information	Provide planned rail schedule of inbound and outbound rail visits.	Intermediate	UN1, UN2	Demonstration
1.5.5.b	Rail Scheduling Information	Provide list of containers associated to a rail visit	Intermediate	UN1, UN2	Demonstration
1.5.5.c	Rail Scheduling Information	Provide additional information regarding containers arriving on the vessel such as, but not limited to weight, destination, consignee, and rail destination.	Intermediate	UN1, UN2	Demonstration
1.5.5.d	Rail Scheduling Information	Allow users to query and create reports of train activity in the Port from archived train detection data that are customizable by user, and able to be exported in csv, xlsx, and pdf format.	Intermediate	UN1, UN2	Demonstration

1.5.6	Inventory and Maintenance Scheduling Information	The integration of Inventory and Maintenance Scheduling Information into the PCS Core Platform data management function may:	Intermediate	UN1, UN2	Demonstration
1.5.6.a	Inventory and Maintenance Scheduling Information	Allow users to submit and view status of maintenance work orders and part inventory.	Intermediate	UN1, UN2	Demonstration
1.5.6.b	Inventory and Maintenance Scheduling Information	Allow users to query and create reports of maintenance and inventory history that are customizable by user, and able to be exported in csv, xlsx, and pdf format.	Intermediate	UN1, UN2	Demonstration
1.5.7	Rail Crossing Blockage Alerts	The integration of Rail Crossing Blockage Alerts into the PCS Core Platform data management function may:	Intermediate	UN1, UN3, UN9, UN10, UN11	Demonstration
1.5.7.a	Rail Crossing Blockage Alerts	Display rail crossing blockage notifications.	Intermediate	UN1, UN3, UN9, UN10, UN11	Demonstration
1.5.7.b	Rail Crossing Blockage Alerts	Allow a custom action (e.g., delete) to be executed when users receive these notifications.	Intermediate	UN1, UN3, UN9, UN10, UN11	Demonstration
1.5.7.c	Rail Crossing Blockage Alerts	Archive each alarm, event, and notification reported.	Intermediate	UN1, UN3, UN9, UN10, UN11	Demonstration
1.5.8	Dynamic Alerts and Routing Information	The integration of Dynamic Alerts and Routing Information into the PCS Core Platform data management function may:	Intermediate	UN1, UN2, UN3, UN9, UN11	Demonstration
1.5.8.a	Dynamic Alerts and Routing Information	Automatically detect emergency and incident situations and issue alerts accordingly.	Intermediate	UN1, UN2, UN3, UN9, UN11	Demonstration
1.5.8.b	Dynamic Alerts and Routing Information	Dynamically adjust routing information to minimize delay caused by emergency and incident situations detected, with consideration for truck prohibited routes.	Intermediate	UN1, UN2, UN3, UN9, UN11	Demonstration
1.5.8.c	Dynamic Alerts and	Allow a custom action to be executed when users receive these notifications.	Intermediate	UN1, UN2, UN3,	Demonstration

	Routing Information			UN9, UN11	
1.5.8.d	Dynamic Alerts and Routing Information	Archive each alarm, event, and notification reported.	Intermediate	UN1, UN2, UN3, UN9, UN11	Demonstration
1.5.9	System-wide Analytics	The PCS Core Platform may integrate data from multiple subsystems to allow users to optimize their operations by identifying opportunities for increased efficiency.	Intermediate	UN2, UN15	Demonstration
1.6	**PCS Subsystems – Long Term Elements**				
1.6.1	Customer Service Request Information	The integration of Customer Service Request Information into the PCS Core Platform data management function may:	Long Term	UN19, UN26	Demonstration
1.6.1.a	Customer Service Request Information	Allow users to enter customer service requests, such as service requests for security or maintenance needs.	Long Term	UN19, UN26	Demonstration
1.6.1.b	Customer Service Request Information	Provide users ability to track status of each request.	Long Term	UN19, UN26	Demonstration
1.6.1.c	Customer Service Request Information	Archive each request reported, current status, and each action taken to fulfill the request.	Long Term	UN19, UN26	Demonstration
1.6.2	Basic Container Availability Information	The integration of Basic Container Availability Information into the PCS Core Platform data management function may:	Long Term	UN1, UN2, UN18	Demonstration
1.6.2.a	Basic Container Availability Information	Provide Port-wide basic and 48 hour predicted container availability and customs clearance information, including but not limited to discharge time, yard location, Port exit time.	Long Term	UN1, UN2, UN18	Demonstration
1.6.2.b	Basic Container Availability Information	Provide real-time alerts regarding container status.	Long Term	UN1, UN2, UN18	Demonstration
1.6.2.c	Basic Container Availability Information	Utilize historical container availability information to calculate predicted container availability information.	Long Term	UN1, UN2, UN18	Demonstration
1.6.2.d	Basic Container Availability Information	Allow users to query archived container availability information and generate reports that are customizable by user, and able to be exported in csv, xlsx, and pdf format.	Long Term	UN1, UN2, UN18	Demonstration

1.6.3	Third-Party Data Sets	The PCS Core Platform may integrate third-party data sets with PCS data feeds to drive increased analytics into the data management function. Examples of third-party data sets may include, but are not limited to PierTrucker for supplemental turn time information, Inrix and/or HERE for travel time data, and Waze for crowd-sourced incident data.	Long Term	UN1	Demonstration
1.6.4	Terminal Appointment System Information	The integration of Terminal Appointment System Information into the PCS Core Platform interface and data exchange may:	Long Term	UN1, UN14	Demonstration
1.6.4.a	Terminal Appointment System Information	Allow PCS users to view appointment information using the PCS mobile application and website.	Long Term	UN1, UN14	Demonstration
1.6.4.b	Terminal Appointment System Information	Notify PCS users if incidents/delays will cause them to miss a scheduled appointment.	Long Term	UN1, UN14	Demonstration
1.6.4.c	Terminal Appointment System Information	Allow PCS users to reschedule missed appointments.	Long Term	UN1, UN14	Demonstration
1.6.5	Third-Party Global Shipping Platform Information	The integration of Third-Party Global Shipping Platform Information into the PCS Core Platform interface and data exchange may:	Long Term	UN1	Demonstration
1.6.5.a	Third-Party Global Shipping Platform Information	Allow PCS users to view shipper information within the PCS mobile application and website.	Long Term	UN1	Demonstration
1.6.5.b	Third-Party Global Shipping Platform Information	Allow users to query archived information and generate reports that are customizable by user, and able to be exported in csv, xlsx, and pdf format.	Long Term	UN1	Demonstration
1.6.6	Advanced Analytics	The addition of Advanced Analytics into the PCS Core Platform may:	Long Term	UN28	Demonstration
1.6.6.a	Advanced Analytics	Include functions such as predictive analytics, behavior analytics and machine learning.	Long Term	UN28	Demonstration
1.6.6.b	Advanced Analytics	Support system-level simulation.	Long Term	UN28	Demonstration
1.7	**PCS Subsystems – Optional Elements**				
1.7.1	Real-Time Container Tracking Information	The integration of Real-Time Container Tracking Information (origin/destination) into the PCS Core Platform interface and data exchange may:	Optional	UN1, UN2, UN18	Demonstration

1.7.1.a	Real-Time Container Tracking Information	Provide information regarding off-dock empties that are available for pick-up.	Optional	UN1, UN2, UN18	Demonstration
1.7.1.b	Real-Time Container Tracking Information	Provide yard locations of offloaded containers.	Optional	UN1, UN2, UN18	Demonstration
1.7.1.c	Real-Time Container Tracking Information	Provide shippers status on the anticipated arrival time of their cargo.	Optional	UN1, UN2, UN18	Demonstration
1.7.2	Rail Dwell Time Information	The integration of Rail Dwell Time Information into the PCS Core Platform interface and data exchange may:	Optional	UN1, UN2	Demonstration
1.7.2.a	Rail Dwell Time Information	Detect the front and rear end of the train via video to estimate train length and speed.	Optional	UN1, UN2	Demonstration
1.7.2.b	Rail Dwell Time Information	Calculate rail dwell times.	Optional	UN1, UN2	Demonstration
1.7.2.c	Rail Dwell Time Information	Issue alerts of rail crossing blockages and anticipated clearance times.	Optional	UN1, UN2	Demonstration
1.7.2.d	Rail Dwell Time Information	Allow users to query archived rail dwell time information and generate reports that are customizable by user, and able to be exported in csv, xlsx, and pdf format.	Optional	UN1, UN2	Demonstration
1.7.3	Parking Information	The integration of Parking Information into the PCS Core Platform interface and data exchange may:	Optional	UN1, UN4	Demonstration
1.7.3.a	Parking Information	Provide information regarding availability and location of short and long-term parking stalls.	Optional	UN1, UN4	Demonstration
1.7.3.b	Parking Information	Provide ability to reserve available stalls in advance.	Optional	UN1, UN4	Demonstration
1.7.3.c	Parking Information	Provide ability to pay for reservations in advance.	Optional	UN1, UN4	Demonstration
1.7.3.d	Parking Information	Allow users to query available parking stalls and generate reports that are customizable by user, and able to be exported in csv, xlsx, and pdf format.	Optional	UN1, UN4	Demonstration
1.7.4	Real-Time Chassis Tracking Information	The integration of Real-Time Chassis Tracking Information into the PCS Core Platform interface and data exchange may:	Optional	UN1, UN2, UN18	Demonstration
1.7.4.a	Real-Time Chassis Tracking Information	Provide information regarding size, condition, location and availability of all chassis.	Optional	UN1, UN2, UN18	Demonstration

1.7.4.b	Real-Time Chassis Tracking Information	Allow PCS users to report equipment status when they pick up or drop off chassis.	Optional	UN1, UN2, UN18	Demonstration
1.7.4.c	Real-Time Chassis Tracking Information	Designate drop-off locations for broken or poorly placed chassis.	Optional	UN1, UN2, UN18	Demonstration
1.7.4.d	Real-Time Chassis Tracking Information	Allow users to query archived chassis information and generate reports that are customizable by user, and able to be exported in csv, xlsx, and pdf format.	Optional	UN1, UN2, UN18	Demonstration
1.7.5	WIM Information	The integration of Weigh-in-Motion (WIM) Information into the PCS Core Platform may:	Optional	UN1, UN2, UN12	Demonstration
1.7.5.a	WIM Information	Collect data from the WIM scales to display real-time scale information on mobile application and archive data for report generation.	Optional	UN1, UN2, UN12	Demonstration
1.7.5.b	WIM Information	Be able to report on axle and total vehicle weight.	Optional	UN1, UN2, UN12	Demonstration
1.7.5.c	WIM Information	Provide real-time alerts when user-configurable thresholds have been exceeded.	Optional	UN1, UN2, UN12	Demonstration
1.7.5.d	WIM Information	Allow users to query archived weight information and generate reports that are customizable by user, and able to be exported in csv, xlsx, and pdf format.	Optional	UN1, UN2, UN12	Demonstration
1.7.6	Truck Location Information	The integration of Truck Location Information into the PCS Core Platform interface and data exchange may provide truck origin and destination information from on-board vehicle systems such smartphones with the PCS mobile app installed.	Optional	UN1, UN2	Demonstration
1.7.7	Common Appointment System	The PCS Core Platform may support a common appointment system platform across all marine terminals.	Optional	UN1, UN14	Demonstration
1.7.8	Real-time Billing System	The PCS Core Platform may support the integration of a real-time billing system interface.	Optional	UN17	Demonstration
1.7.9	Tenant Asset Information	The PCS Core Platform may support the integration of tenant asset information such as, but not limited to equipment utilization, available inventory, and condition.	Optional	UN18	Demonstration
1.7.10	Tenant Utility Usage Information	The PCS Core Platform may support the integration of Port and tenant utility usage.	Optional	UN8	Demonstration

1.7.11	Connected Vehicles	The PCS Core Platform may support adaptability to advanced communications, such as Dedicated Short-Range Communications (DSRC) and 5G devices.	Optional	UN13, UN28	Demonstration
1.7.12	Autonomous Equipment	The PCS Core Platform may support adaptability to emerging technologies, such as integration with autonomous equipment.	Optional	UN28	Demonstration

3.2 Performance Requirements

Table 2. PCS Communications Requirements

ID	Category	Description	Element Group	User Need	Verification Method
2.1	**Communications – Reliability and Availability**				
2.1.1	Reliability and Availability	The PCS Core Platform shall be available for use 24 hours a day, 365 days per year.	Initial	UN2, UN8, UN29	Analysis
2.1.2	Reliability and Availability	The PCS Core Platform shall be fully operational 99.5% of the time.	Initial	UN2, UN8, UN29	Analysis
2.1.3	Reliability and Availability	The PCS Core Platform shall be reliable to industry standards and minimize system freezes, crashes and failures.	Initial	UN2, UN8, UN29	Analysis
2.1.4	Reliability and Availability	The PCS Core Platform shall isolate safety-critical operations into manageable modules that have adequate safety features to minimize the probability and impact of safety-related failures.	Initial	UN2, UN8, UN29	Analysis
2.1.5	Reliability and Availability	The PCS Core Platform shall provide continual information as to the status of the system's operations.	Initial	UN2, UN8, UN29	Analysis
2.1.6	Reliability and Availability	The PCS Core Platform shall create automated, periodical back-ups of PCS data that aligns with user needs.	Initial	UN2, UN8, UN29	Analysis
2.1.7	Reliability and Availability	The PCS Core Platform shall not be impacted adversely in terms of performance and operation by the malfunction, removal, or addition of interfaces.	Initial	UN2, UN8, UN29	Analysis
2.1.8	Reliability and Availability	The PCS Core Platform shall make use of existing communications infrastructure and standards.	Initial	UN2, UN8, UN29	Analysis
2.2	**Communications – Response Time**				
2.2.1	Response Time	The PCS Core Platform shall update at a 1 to 30 second poll rate for data collection, depending on subsystem operational requirements.	Initial	UN29	Test
2.2.2	Response Time	The PCS Core Platform shall have a configurable poll rate.	Initial	UN29	Demonstration

ID	Category	Description	Element Group	User Need	Verification Method
2.2.3	Response Time	The PCS Core Platform shall meet or exceed the performance measures including, but not limited to:	Initial	UN29	Test
2.2.3.a	Response Time	Data latency – 2 seconds maximum.	Initial	UN29	Test
2.2.3.b	Response Time	Time for user to monitor, display, and access any control interface – 2 seconds maximum.	Initial	UN29	Test
2.2.3.c	Response Time	User commands to be enacted – 2 seconds maximum.	Initial	UN29	Test
2.2.4	Response Time	The FRATIS subsystem home page shall be accessed within 3 seconds of entering URL. This threshold criteria is required to hold true 90% of the time.	Initial	UN29	Test
2.2.5	Response Time	The FRATIS subsystem login shall not exceed 10 seconds. This threshold criteria is required to hold true 90% of the time.	Initial	UN29	Test
2.2.6	Response Time	The FRATIS subsystem shall meet or exceed the performance measures including a maximum 2 second refresh rate for all displays.	Initial	UN29	Test
2.2.7	Response Time	The FRATIS subsystem shall provide current information in near real-time (i.e., data is no more than 10 minutes old), or as available from integrated data sources. This threshold criteria is required to hold true 90% of the time.	Initial	UN29	Test
2.2.8	Response Time	The FRATIS subsystem time for a user to load any view (except a map or camera view) shall not exceed 3 seconds. This threshold criteria is required to hold true 90% of the time.	Initial	UN29	Test
2.2.9	Response Time	The FRATIS subsystem view or refresh rate for the largest map shall not exceed 15 seconds. This threshold criteria is required to hold true 90% of the time.	Initial	UN29	Test
2.2.10	Response Time	The FRATIS subsystem view or refresh rate for a camera feed shall not exceed 15 seconds. This threshold criteria is required to hold true 90% of the time.	Initial	UN29	Test
2.2.11	Response Time	The FRATIS subsystem shall provide streams motion JPEG camera images. This threshold criteria is required to hold true 90% of the time.	Initial	UN29	Demonstration
2.2.12	Response Time	The FRATIS subsystem shall generate a user defined performance report within 15 seconds of request. This threshold criteria is required to hold true 90% of the time.	Initial	UN29	Test

3.3 Interface Requirements

Table 3. PCS Interface Requirements

ID	Category	Description	Element Group	User Need	Verification Method
3.1	**Interfaces –System Integration**				
3.1.1	Existing NWSA Systems	The PCS Core Platform may integrate with existing NWSA systems, including but not limited to:	Initial	UN2, UN6	Demonstration
3.1.1.a	Existing NWSA Systems	Bellerophon.	Initial	UN2, UN6	Demonstration
3.1.1.b	Existing NWSA Systems	RFID System	Initial	UN2, UN6	Demonstration
3.1.1.c	Existing NWSA Systems	PierTrucker	Initial	UN2, UN6	Demonstration
3.1.1.d	Existing NWSA Systems	Video Management System	Intermediate	UN2, UN6	Demonstration
3.1.1.e	Existing NWSA Systems	GIS	Intermediate	UN2, UN6	Demonstration
3.1.1.f	Existing NWSA Systems	Intermodal Pro (iPro).	Intermediate	UN2, UN6	Demonstration
3.1.1.g	Existing NWSA Systems	Maximo	Intermediate	UN2, UN6	Demonstration
3.1.2	PCS User System Integration	The PCS Core Platform may be capable of interfacing and obtaining data from PCS User systems including, but not limited to:	Intermediate	UN2, UN6	Demonstration
3.1.2.a	PCS User System Integration	Transportation Partner Agency (e.g., WSDOT, SDOT) real-time transportation data	Intermediate	UN2, UN6	Demonstration
3.1.2.b	PCS User System Integration	Marine terminal operating systems	Long Term	UN2, UN6	Demonstration
3.1.2.c	PCS User System Integration	Ocean carrier manifests	Long Term	UN2, UN6	Demonstration
3.1.2.d	PCS User System Integration	Rail detection systems	Optional	UN2, UN6	Demonstration
3.1.2.e	PCS User System Integration	Chassis vendor inventory	Optional	UN2, UN6	Demonstration
3.1.2.f	PCS User System Integration	Trucking company vehicle locations	Optional	UN2, UN6	Demonstration
3.1.3	Future Integration Considerations	The PCS Core Platform may be capable of interfacing and obtaining data from future technologies including, but not limited to:	Optional	UN2, UN6, UN13, UN28	Demonstration
3.1.3.a	Future Integration Considerations	Internet of Things-based ITS systems.	Optional	UN2, UN6,	Demonstration

ID	Category	Description	Element Group	User Need	Verification Method
				UN13, UN28	
3.1.3.b	Future Integration Considerations	Digital supply chain platforms.	Optional	UN2, UN6, UN13, UN28	Demonstration

3.4 Non-Functional Requirements

Table 4. PCS Non-Functional Requirements

ID	Category	Description	Element Group	User Need	Verification Method
4.1	**Non-Functional – Presentation Requirements**				
4.1.1	Presentation Requirements	The FRATIS subsystem shall have a consistent look and feel with other NWSA apps and website.	Initial	UN2	Inspection
4.1.2	Presentation Requirements	The FRATIS subsystem shall be branded with the NWSA name and logo.	Initial	UN2	Inspection
4.1.3	Presentation Requirements	The FRATIS subsystem shall use terminology commonly utilized by the drayage community.	Initial	UN2	Inspection
4.1.4	Presentation Requirements	The FRATIS subsystem shall be displayed in English as the default language across all functionalities.	Initial	UN2	Inspection
4.1.5	Presentation Requirements	The FRATIS subsystem shall display the user name for the user currently logged into the system.	Initial	UN2	Inspection
4.1.6	Presentation Requirements	The FRATIS subsystem shall display maps that:	Initial	UN1, UN2	Inspection
4.1.6.a	Presentation Requirements	Are GIS based, using standard GIS files (e.g., shape files or other equivalent) to render a geographically accurate, to-scale map.	Initial	UN1, UN2	Inspection
4.1.6.b	Presentation Requirements	Display all major interstates and arterials with appropriate classification identified (i.e., interstate shield, state route shield).	Initial	UN1, UN2	Inspection
4.1.6.c	Presentation Requirements	Include the capability to zoom in and out with multiple zoom levels.	Initial	UN1, UN2	Inspection
4.1.6.d	Presentation Requirements	Include pre-defined regional zoomed areas, as defined by NWSA.	Initial	UN1, UN2	Inspection

ID	Category	Description	Element Group	User Need	Verification Method
4.1.6.e	Presentation Requirements	Include a user-defined default map view (initial view when map first opened) based on user name and password.	Initial	UN1, UN2	Inspection
4.1.6.f	Presentation Requirements	Have map icons that are proportional to the zoom reference of the map.	Initial	UN1, UN2	Inspection
4.1.6.g	Presentation Requirements	Include the capability to pan in any direction with a smooth transition.	Initial	UN1, UN2	Inspection
4.2	**Non-Functional – Usability**				
4.2.1	Usability	The FRATIS subsystem shall be capable of being used within a common standard Internet browser, tablet, or smartphone device, and not specific to any one browser or device.	Initial	UN29	Demonstration
4.2.2	Usability	The FRATIS subsystem shall have a straightforward and intuitive design that enables PCS Users to make effective use of the app and website with no training.	Initial	UN24, UN29	Inspection
4.2.3	Usability	The FRATIS subsystem shall utilize commonly understood icons and objects instead of text where feasible.	Initial	UN29	Inspection
4.2.4	Usability	The FRATIS subsystem shall be offered in multiple languages, configurable by user.	Initial	UN5, UN29	Demonstration
4.2.5	Usability	The FRATIS subsystem mobile application shall be developed for both iOS and Android operating systems.	Initial	UN29	Demonstration
4.2.6	Usability	The FRATIS subsystem mobile application orientation shall automatically adjust if the User rotates from portrait (vertical) or landscape (horizontal). This is contingent upon the User's smartphone auto-rotate setting being enabled.	Initial	UN29	Demonstration
4.2.7	Usability	The PCS Core Platform shall save all user preferences by user login so that users may access their saved preferences from any device.	Initial	UN29	Demonstration
4.2.8	Usability	The FRATIS subsystem shall be ADA compliant to the extent practical within the confines of the development	Initial	UN29	Inspection

ID	Category	Description	Element Group	User Need	Verification Method
		and deployment environment, though not all application elements can be made accessible to all individuals (e.g., interactive maps cannot be made accessible to the visually impaired).			
4.3	**Non-Functional – Capacity**				
4.3.1	Capacity	The PCS Core Platform shall provide the ability to dynamically increase the storage capacity as needed.	Initial	UN26, UN30	Demonstration
4.3.2	Capacity	The PCS Core Platform shall serve a minimum of 10,000 users.	Initial	UN26, UN30	Inspection
4.3.3	Capacity	The PCS Core Platform shall support expandability for more users via hardware upgrades.	Initial	UN26, UN30	Inspection
4.4	**Non-Functional – System Administration**				
4.4.1	System Administration	The PCS Core Platform shall be able to receive firmware updates that support changes or improvements to the software baseline, either through an ongoing maintenance service period or as part of a one-time NWSA purchase.	Initial	UN26	Test
4.4.1.a	System Administration	Updates shall be version-controlled with unique release/version numbers and have a version library with notes of improvements.	Initial	UN26	Test
4.4.1.b	System Administration	Updates shall be tested by the Vendor with certified documentation provided to the NWSA prior to implementation.	Initial	UN26	Test
4.4.1.c	System Administration	Updates to the PCS Core Platform or subsystems shall be uniformly applied, so that all components continue functioning properly together.	Initial	UN26	Test
4.4.1.d	System Administration	New versions of software shall be installed as a separate version in the Configuration Management (CM) Library that holds the software, with changes to code identified in relevant code headers.	Initial	UN26	Test
4.4.1.e	System Administration	Upon implementation, all updates shall be reviewed and approved by the System	Initial	UN26	Test

ID	Category	Description	Element Group	User Need	Verification Method
		Administrator prior to being considered complete.			
4.4.2	System Administration	The PCS Core Platform shall include automatic procedures for startup of subsystems.	Initial	UN26	Test
4.4.3	System Administration	The PCS Core Platform shall provide the capability to start or stop a single subsystem without affecting any of the other subsystems.	Initial	UN26	Test
4.4.4	System Administration	The PCS Core Platform shall require a reboot only when Operating System upgrades or modifications are created, or upgrades to executable applications are installed.	Initial	UN26	Test
4.4.5	System Administration	The PCS Core Platform shall include configurable procedures for creating backups.	Initial	UN26	Test
4.4.6	System Administration	The PCS Core Platform shall include configurable procedures for restoring from a backup.	Initial	UN26	Test
4.4.7	System Administration	The PCS Core Platform shall provide system updates at one location to be propagated to all other locations.	Initial	UN26	Test
4.4.8	System Administration	The PCS Core Platform shall provide for the capability to create templates for commonly used process scripts.	Initial	UN26	Test
4.4.9	System Administration	The PCS Core Platform shall allow updates to the database without affecting the current users' session with the PCS.	Initial	UN26	Test
4.4.10	System Administration	The PCS Core Platform shall allow only authorized and validated users into the system.	Initial	UN19, UN20, UN26	Test
4.4.11	System Administration	The PCS Core Platform shall allow the System Administrator the ability to add, modify, and delete user accounts while maintaining historical information.	Initial	UN19, UN20, UN26	Test
4.4.12	System Administration	The PCS Core Platform shall allow the System Administrator the ability to add, modify, and delete user passwords and privileges	Initial	UN19, UN20, UN26	Test

ID	Category	Description	Element Group	User Need	Verification Method
		while maintaining historical information.			
4.4.13	System Administration	The PCS Core Platform shall allow the System Administrator the ability to assign unique user accounts and passwords to each individual user.	Initial	UN19, UN20, UN26	Test
4.4.14	System Administration	The PCS Core Platform shall allow the System Administrator the ability to determine which users are currently logged onto the system and where they are located.	Initial	UN19, UN20, UN26	Test
4.4.15	System Administration	The PCS Core Platform shall prioritize users by providing different privileges on a per-subsystem level.	Initial	UN19, UN20, UN26	Test
4.4.16	System Administration	The PCS Core Platform shall validate each command from a user for the proper privileges.	Initial	UN19, UN20, UN26	Test
4.4.17	System Administration	The PCS Core Platform shall allow the System Administrator the ability to add, modify, and delete group privileges.	Initial	UN19, UN20, UN26	Test
4.4.18	System Administration	The PCS Core Platform shall allow the System Administrator the ability to add or delete a user from one or more group while maintaining historical information.	Initial	UN19, UN20, UN26	Test
4.4.19	System Administration	The PCS Core Platform shall log an event message to the alarm and event logger whenever a user logs in. The event shall contain the date, time, user name, and log in location.	Initial	UN21, UN26	Test
4.4.20	System Administration	The PCS Core Platform shall not require a user to log off and back on to view data from external sources that were added, modified, or deleted.	Initial	UN26	Test
4.4.21	System Administration	The PCS Core Platform shall not require a subsystem reboot when an external data sources are added, modified, or deleted.	Initial	UN26	Test
4.5	**Non-Functional – Security**				
4.5.1	Security	PCS Core Platform elements shall be developed, procured,	Initial	UN20	Demonstration

ID	Category	Description	Element Group	User Need	Verification Method
		and managed using cybersecurity best practices.			
4.5.2	Security	PCS Core Platform data shall reside in the continental U.S.	Initial	UN20	Inspection
4.5.3	Security	The PCS Core Platform shall have a security management and administrative system that allows access and operational privileges to be assigned, monitored and controlled by an administrator, and conform to the agency's access and network infrastructure security policies.	Initial	UN19, UN20	Demonstration
4.5.4	Security	The PCS Core Platform shall conform to the user's rule-based administration for access and security at all levels of system use.	Initial	UN19, UN20	Demonstration
4.5.5	Security	The PCS Core Platform shall encode/encrypt the user's password.	Initial	UN20	Inspection
4.5.6	Security	The PCS Core Platform shall allow a user to modify their password.	Initial	UN19, UN20, UN21	Test
4.5.7	Security	The PCS Core Platform shall provide a method to log system, device, and security activity for online reporting and archival storage to the alarm and event logger.	Initial	UN21	Test
4.5.8	Security	The PCS Core Platform shall alert the System Administrator automatically of unusual activity and security breaches.	Initial	UN19, UN20, UN21	Demonstration
4.5.9	Security	The PCS Core Platform shall protect personal data from unauthorized access.	Initial	UN19, UN20, UN21	Demonstration
4.5.10	Security	The PCS Core Platform shall protect proprietary information from unauthorized use.	Initial	UN19, UN20, UN21	Demonstration
4.5.11	Security	The PCS Core Platform shall protect proprietary systems from unauthorized access.	Initial	UN19, UN20, UN21	Demonstration
4.5.12	Security	The PCS Core Platform shall provide the capability for a System Administrator to manage user accounts.	Initial	UN19, UN20, UN21	Demonstration
4.5.13	Security	The PCS Core Platform shall protect against unauthorized access through user roles. Refer to **Table 7** for user roles and permissions.	Initial	UN19, UN20, UN21	Demonstration

ID	Category	Description	Element Group	User Need	Verification Method
4.5.14	Security	The PCS Core Platform shall adhere to NWSA specific policies.	Initial	UN19, UN20, UN21	Demonstration
4.5.15	Security	Data contributed by PCS users to the PCS Core Platform shall not be under the control of NWSA.	Initial	UN19, UN20, UN21	Demonstration
4.6	**Non-Functional – Documentation**				
4.6.1	Documentation	The PCS Core Platform shall include a user manual for NWSA Staff and System Administrators which shall include information required to use, maintain, and update the PCS Core Platform over time..	Initial	UN26	Demonstration
4.6.2	Documentation	The FRATIS subsystem shall include a User's Guide for PCS users which shall include an overview of the mobile application and website contents, its capabilities, and troubleshooting guidance.	Initial	UN26	Demonstration
4.7	**Non-Functional – System Training**				
4.7.1	Training	The Vendor shall provide training and documentation to support Client use of the system.	Initial	UN26	Inspection
4.7.2	Training	The Vendor shall provide on-site training with a webinar option for community member access.	Initial	UN26	Inspection
4.7.3	Training	The training shall include System Administrator training.	Initial	UN26	Inspection
4.7.4	Training	The Vendor shall supply User's Manuals, which shall be aligned with the training.	Initial	UN26	Inspection
4.7.5	Training	Multiple sessions of each type of training shall be provided to accommodate those with schedule conflicts (e.g., shift workers).	Initial	UN26	Inspection
4.7.6	Training	At the request of the Port, the Contractor shall provide additional training sessions at the contract price per session.	Initial	UN26	Inspection
4.8	**Non-Functional – Reporting**				
4.8.1	Reporting	The PCS Core Platform shall prepare monthly mobile application and website statistics reports including:	Initial	UN2, UN23	Demonstration
4.8.1.a	Reporting	Unique visits to the website per day	Initial	UN2, UN23	Demonstration
4.8.1.b	Reporting	Website page views per day	Initial	UN2, UN23	Demonstration

ID	Category	Description	Element Group	User Need	Verification Method
4.8.1.c	Reporting	Concurrent users of the website at any time	Initial	UN2, UN23	Demonstration
4.8.1.d	Reporting	Unique visits to the mobile application per day	Initial	UN2, UN23	Demonstration
4.8.1.e	Reporting	Concurrent users of the mobile application at any time	Initial	UN2, UN23	Demonstration
4.8.2	Reporting	The PCS Core Platform shall prepare monthly performance reports based on operational performance measures obtained from the PCS subsystems that includes, at a minimum:	Initial	UN2, UN23	Demonstration
4.8.2.a	Reporting	Vessel on-time performance	Initial	UN2, UN23	Demonstration
4.8.2.b	Reporting	Average turn times at each marine terminal gate	Initial	UN2, UN23	Demonstration
4.8.2.c	Reporting	Average queue lengths at each marine terminal gate	Initial	UN2, UN23	Demonstration
4.8.3	Reporting	Monthly performance reports shall be archived and available for review.	Initial	UN2, UN23	Demonstration
4.8.4	Reporting	Monthly performance reports shall be provided in a printable format.	Initial	UN2, UN23	Demonstration
4.8.5	Reporting	The FRATIS subsystem shall be configurable to develop other type of reports from the data collected (e.g., late vessel arrivals, turn times greater than 2 hours, etc.).	Initial	UN2, UN23	Demonstration
4.8.6	Reporting	The FRATIS subsystem shall be configurable to change the level of detail of each report in a customizable manner (e.g., date range, time of day, marine terminal, etc.).	Initial	UN2, UN23	Demonstration

4.0 Supporting Documentation

4.1 User Needs

PCS User Needs are grouped into specific functional areas, as shown in **Table 5** and ranked according to the following priority levels:

- **High –** The need is a “must-have” and should be considered essential to the initial PCS development, that is, the PCTS.
- **Medium –** The need is a “should-have” or desirable capability for which there is considerable interest, but is not necessarily critical to the initial PCS (PCTS) development.

- **Low –** The need is a “nice-to-have” or not viable in the near-term and may provide extra desirable functionality (these could potentially become add-on features in future releases).

Table 5. PCS User Needs and Functional Areas

ID	User Need	Functional Areas	Priority
UN1	Need to compile and provide high-quality and relevant, static, real-time, and historic Port community information, data, and performance indicators that are map based when appropriate.	Port Community Information; Data Management	High
UN2	Need PCS information, data, and performance indicators to be accurate, searchable, consistent, consolidated, based on defined standards, and compatible with a variety of existing and proposed internal and external systems. Create application programming interfaces (APIs) to connect user data.	Port Community Information; Data Management; System Operations and Other	High
UN3	Need to send out alerts/notifications on recurring and non-recurring basis regarding traveler information, port activities (import/export), and special events (disaster evacuation).	Port Community Information	High
UN4	Need to provide short- and long-term truck parking information.	Port Community Information	Low
UN5	Need to provide traveler information in multiple languages.	Port Community Information; System Operations and Other	Medium
UN6	Need to improve coordination between the NWSA and public sector agencies for planning efforts, information and data sharing, and communications (e.g., center-to-center [C2C], API availability and sharing, etc.).	Mobility and Safety; System Operations and Other	High
UN7	Need ability to create custom dashboards.	Port Community Information; System Operations and Other	High
UN8	Need to improve real-time situational awareness of NWSA and regional operations and trends to improve freight movement efficiency (e.g., regional weigh-in-motion [WIM] systems, street turn opportunities, pre-gate truck queues, gate activity, on-terminal turn times, Port travel times, equipment status, container location, Last Free Day, trouble transactions, vessel movements, traffic conditions, yard utilization, rail car movements, extra gates, etc.).	Mobility and Safety	High
UN9	Need ability to detect, monitor, and manage traffic congestion, modal conflict issues, queues and blockages in and around the NWSA areas, including potential secondary traffic safety issues.	Mobility and Safety	High
UN10	Need to provide at-grade crossing information to help reduce delay, environmental, and safety impacts.	Mobility and Safety	Medium
UN11	Need to establish coordinated, enhanced incident and evacuation management programs for NWSA and parties accessing the NWSA terminals.	Mobility and Safety	High
UN12	Need WIM systems on-site at the Alliance.	Mobility and Safety	Medium

ID	User Need	Functional Areas	Priority
UN13	Need to incorporate ITS, Smart City, Smart Street and Smart Port opportunities to improve access to/from and circulation within the Alliance.	Mobility and Safety	Medium
UN14	Need to provide an equitable and incentivized real-time appointment system for all transactions/activities.	Port Productivity	Medium
UN15	Need predictive analytics for data, information, and systems, where possible, to allow for more proactive port operations forecasts, planning, and actions.	Port Productivity; Port Community Information	High
UN16	Need to track freight delivery status (per diem and demurrage) and vessel information (arrival/departures).	Port Productivity	High
UN17	Need to provide real-time billing capabilities.	Port Productivity	Medium
UN18	Need to perform real-time and customizable asset and yard management capabilities - equipment utilization, available inventory, and condition.	Port Productivity	Low
UN19	Need privilege-based user roles and system logs for security and maintenance management.	Security	High
UN20	Need to utilize cybersecurity best practices and to provide access to data and information through safe and secure methods that are unique to user types.	Security	High
UN21	Need to track user modifications by user name, modification made, and time stamp.	Security	High
UN22	Need to maintain an up-to-date database of registered trucks and drivers to track compliance regulations.	Data Management	High
UN23	Need to access archived data, automated reports, and ad hoc reports (e.g., trend analysis, data to support grant applications, etc.).	Data Management	High
UN24	Need a user-friendly platform for configuration of system parameters, uploading/downloading documents and reports, and monitoring system operation in real-time.	Data Management; System Operations and Other	High
UN25	Need to automate data collection methods, data processing for consistency, user data sharing, system functions, and information dissemination processes (e.g., eliminate manual interaction such as activating mobile app when entering NWSA facilities).	Data Management; System Operations and Other	High
UN26	Need to automate and minimize maintenance costs and activities with clearly defined maintenance and operations requirements (e.g., monitor field devices remotely, redundancy, ability to report NWSA facility maintenance issues, etc.).	System Operations and Other	High
UN27	Need to accommodate non-disclosure agreement considerations.	System Operations and Other	High
UN28	Need to consider integration of new technologies and advanced methods (e.g., connected and automated vehicles [C/AV], dedicated short-range communications [DSRC], machine learning, artificial intelligence [AI] capability, block chain, etc.).	System Operations and Other; Data Management	High
UN29	Need PCS to be available via a mobile app and website that are fast and reliable.	System Operations and Other	High

ID	User Need	Functional Areas	Priority
UN30	Need PCS requirements to be non-vendor specific, open standard/open API, flexible, and scalable to allow for creative solutions.	System Operations and Other	High

4.2 PCS Elements

The following subsections list potential PCS architecture elements according to the following phases, each with increasing system sophistication:

- Initial Elements
  - Highest priority and need
  - Foundational to subsequent features/deployments
  - Funding for improvements have already been acquired
- Intermediate Elements
  - Priority level is high, but may be dependent upon implementation of Initial Elements
  - Implementation is deemed feasible, but may be dependent on additional hardware/software elements and future data integration
  - Funding for improvements may be dependent on new grant developments
- Long Term Elements
  - Features build upon the previous two PCS phases
  - Feasibility of implementation may be dependent upon additional hardware/software elements and/or data acquisition and/or data sharing agreements with public sector partners
  - Important to have but not essential, or cannot be completed in the immediate-term
- Optional Elements
  - “Nice-to-have” features
  - Elements of implementation may be out of the NWSA’s control, requires a very high level of confidence in data security on the part of private sector partners, or not technically feasible at this time
  - PCS elements were not identified by many stakeholders through user needs process
  - “Future-proof” to be opportunistic (e.g. ability to leverage developments with “Smart Cities” and Truck Automation)

Table 6. Categorization of PCS Elements

ID	System	Port Community System Element	Owner/Operator	User Need(s)
1. Initial Elements				
1.1	PCTS	PCS Core Platform hardware/cloud services	NWSA	UN1, UN2, UN20, UN30

ID	System	Port Community System Element	Owner/Operator	User Need(s)
1.2	PCTS	PCS Core Platform data management functions, repository and archive	NWSA	UN1, UN2, UN20, UN23
1.3	PCTS	PCS Core Platform data exchange interfaces	NWSA	UN1, UN2, UN3, UN20
1.4	PCTS	PCS Core Platform initial analytics (data sets to create basic reports)	NWSA	UN1, UN2, UN21, UN23, UN24
1.5	PCTS	PCS Core Platform Graphical User Interface (GUI)	NWSA	UN1, UN2, UN5, UN7
1.6	PCTS	Integration of vessel scheduling and berthing data into Core Platform data management function.	NWSA through Bellerophon	UN1, UN2, UN16
1.7	PCTS	Integration of RFID data into Core Platform data management function.	NWSA	UN1, UN2
1.8	PCTS	Integration of registered truck and driver database into Core Platform data management function.	NWSA	UN22
1.9	PCTS	NWSA Website Interface for data delivery and information exchange	NWSA	UN1, UN2, UN5, UN8, UN20, UN24, UN27
1.10	PCTS	Mobile Application Interface for data delivery and information exchange	NWSA	UN1, UN2, UN5, UN8, UN20, UN24, UN27, UN29
1.11	PCTS	Automated notifications (terminal wait times, street queue waiting times, closures)	NWSA	UN1, UN2, UN3, UN25
1.12	PCTS	King County expansion of RFID system	NWSA/WSDOT	UN8, UN9
2. Intermediate Elements				
2.1	PCS	Emergency/incident alerts and routing information (manual upload/static information)	NWSA	UN1, UN3, UN9, UN11
2.2	PCS	Integration (and video analytics) of MTO and Port area camera feeds into Core Platform data management function.	NWSA/MTOs	UN1
2.3	PCS	Integration of WSDOT, SDOT and other local transportation agency traffic data (congestion information, closures) into Core Platform data management function.	Transportation Agencies	UN1, UN2, UN6, UN9, UN11
2.4	PCS	Integration of NWSA GIS information (asset management, Port maps) into Core Platform data management function.	NWSA	UN1, UN2
2.5	PCS	Integration of rail scheduling interface and data exchange into Core Platform data management function.	NWSA through iPro	UN1, UN2

ID	System	Port Community System Element	Owner/Operator	User Need(s)
2.6	PCS	Integration of inventory and maintenance scheduling information into Core Platform data management function.	NWSA through Maximo	UN1, UN2
2.7	PCS	FRATIS incident, emergency, and rail crossing blockage alerts and notifications	NWSA	UN1, UN3, UN9, UN10, UN11
2.8	PCS	FRATIS emergency/incident alerts [VCC] and routing information (automated/dynamic information).	NWSA/Partner Agencies	UN1, UN2, UN3, UN9, UN11
2.9	PCS	PCS advanced system-wide analytics, utilizing integrated data sets in Core Platform data management function.	NWSA	UN2, UN15
3. Long Term Elements				
3.1	PCS	Ability for truckers or other Port users to enter service requests for security or maintenance needs	NWSA	UN19, UN26
3.2	PCS	Integration of Port-wide basic container availability information (including real-time alerts) and 48 hour predicted container availability information	Ocean Carriers	UN1, UN2, UN18
3.3	PCS	Integration of third-party data sets with internal data sets driving increased analytics into Core Platform data management function.	Third-Party	UN1
3.4	PCS	Integration with terminal appointment system interface and data exchange.	MTOs	UN1, UN14
3.5	PCS	Integration of third-party global shipping platform interface and data exchange.	Third-Party	UN1
3.6	PCS	FRATIS directional/route guidance for incidents or emergency situations with truck prohibited route considerations	NWSA/Partner Agencies	UN1, UN2, UN3, UN9
3.7	PCS	Develop advanced analytics capabilities, including functions such as predictive analytics, behavior analytics and machine learning	NWSA	UN28
4. Optional Elements				
4.1	PCS	Real-time container tracking system (origin/destination) interface and data exchange.	MTOs	UN1, UN2, UN18
4.2	PCS	Rail dwell time system interface and data exchange.	Rail Companies	UN1, UN2
4.3	PCS	Integration of short and long-term parking management system interface and data exchange.	NWSA	UN1, UN4
4.4	PCS	Real-time chassis tracking system interface and data exchange.	Chassis Vendors	UN1, UN2, UN18
4.5	PCS	WIM interface	NWSA	UN1, UN2, UN12
4.6	PCS	Truck location (origin/destination) interface and data exchange.	Trucking Companies	UN1, UN2

ID	System	Port Community System Element	Owner/Operator	User Need(s)
4.7	PCS	Common appointment system platform	MTOs	UN1, UN14
4.8	PCS	Real-time billing system interface.	MTOs	UN17
4.9	PCS	Tenant asset information (equipment utilization, available inventory, condition, etc.)	MTOs	UN18
4.10	PCS	Port and tenant utility usage	NWSA/MTOs	UN8
4.11	PCS	Integration with connected vehicles and data exchange	NWSA	UN13, UN28
4.12	PCS	Integration with autonomous equipment	NWSA	UN28

4.3 Diagrams

Figure 2 presents an overview of the relationship between the Users, the Data Sources, the System Concept and the Dissemination Methods. **Figure 3** presents a high-level concept for the architecture of the PCS.

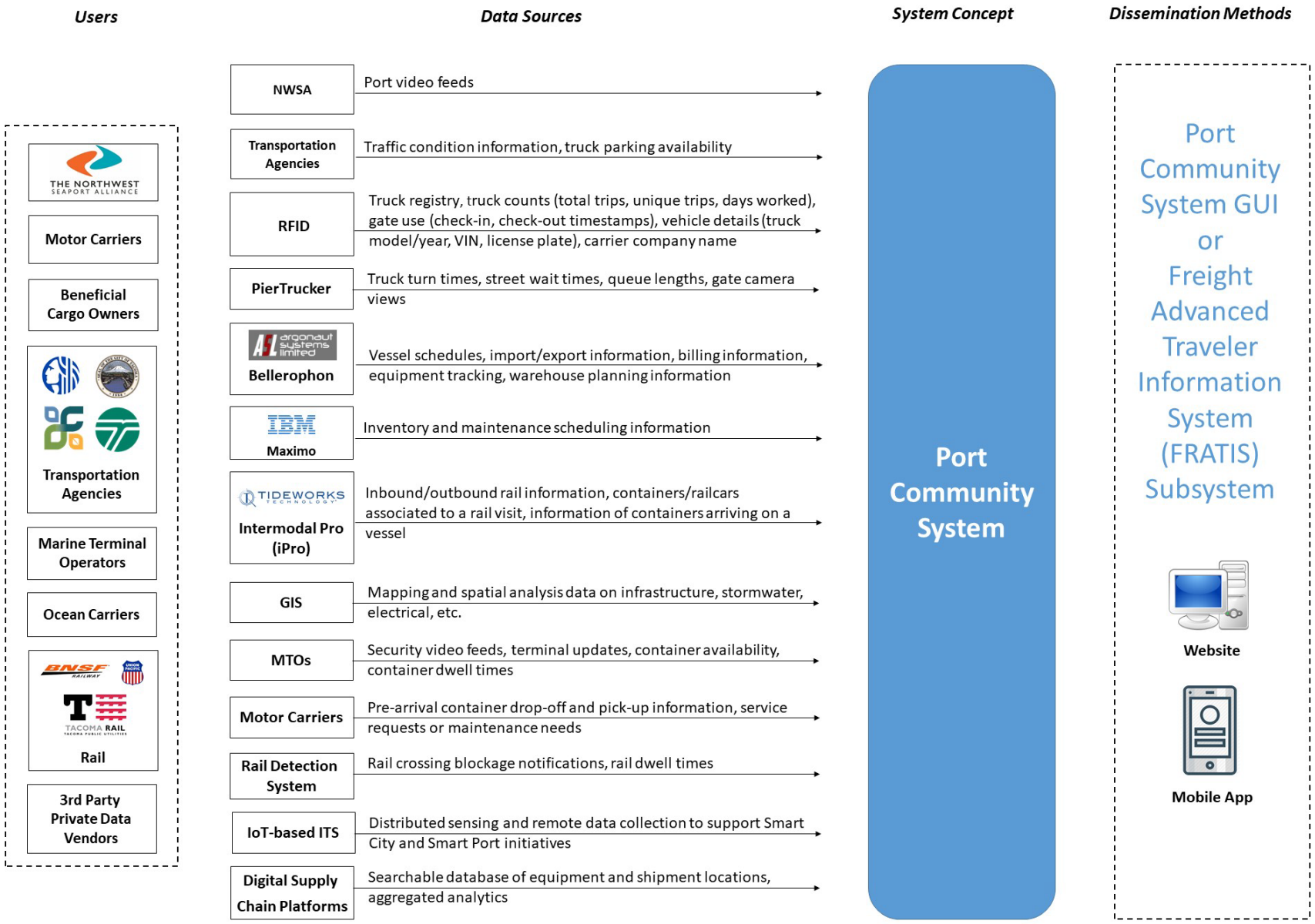


Figure 2. Elements of an NWSA PCS

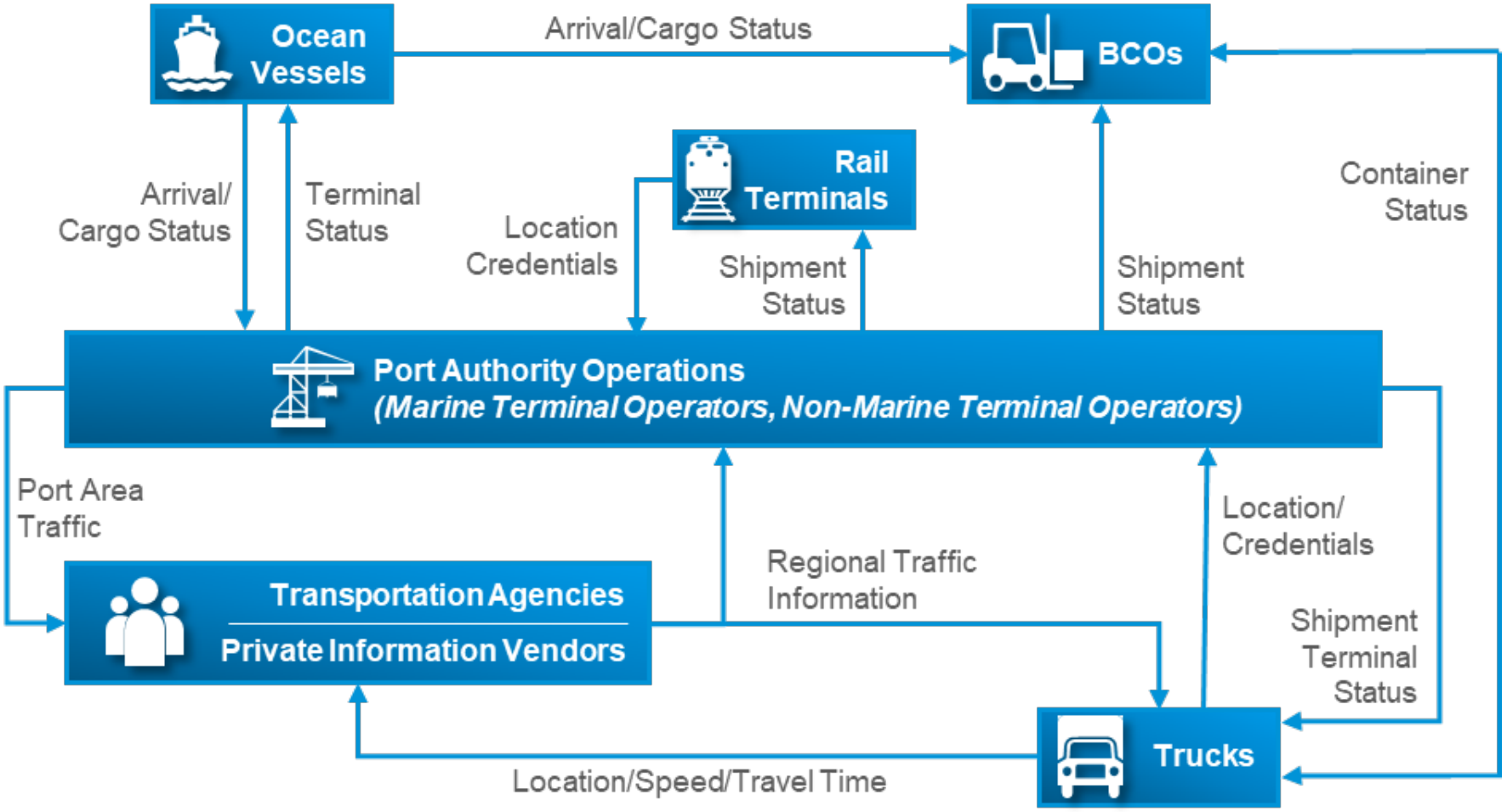


Figure 3. High-Level PCS Architecture Concept

4.4 User Permissions

Table 7 specifies the PCS functionality each PCS user type is permitted to access.

Table 7. PCS User Types and Permissions

Function	Guest User	Registered Users						System Administrator
		Drivers	Licensed Motor Carriers	Ocean Carriers	Marine Terminal Operators	Rail Companies	NWSA Staff	
1. Initial Elements								
Register for PCS account	X							
Change PCS password		X	X	X	X	X	X	X
Customize language settings		X	X	X	X	X	X	X
Set Up, Maintain User Accounts								X
Assign User Role								X
Edit Configurable Parameters, Lists								X
Customize dashboard information		X	X	X	X	X	X	X
View vessel schedules and berthing information	X	X	X	X	X	X	X	X
View marine terminal turn times	X	X	X	X	X	X	X	X
View registered trucks			X		X		X	X
Receive In-App notifications (terminal wait times, street queue waiting times, closures, incident, emergency, rail crossing blockages)	X	X	X	X	X	X	X	X
Receive SMS, email, audible alerts		X	X	X	X	X	X	X
Customize notifications (filter for notifications of interest)		X	X	X	X	X	X	X
Delete notifications		X	X	X	X	X	X	X
Push notifications			X	X	X	X	X	X
Edit notification details			X	X	X	X	X	X
View documents reports (turn time, vessel schedules, etc.)	X	X	X	X	X	X	X	X
Download documents and reports	X	X	X	X	X	X	X	X
Upload documents and reports		X	X	X	X	X	X	X
View system logs, user modification logs, ITS equipment logs, exception reports								X
Download system logs, user modification logs, ITS equipment logs, exception reports								X
2. Intermediate Elements								
View MTO and NWSA camera feeds, locations	X	X	X	X	X	X	X	X
View Port and regional traffic condition, closure information	X	X	X	X	X	X	X	X
View Port GIS maps	X	X	X	X	X	X	X	X
View NWSA asset management							X	X
View rail schedules	X	X	X	X	X	X	X	X

Function	Guest User	Registered Users						System Administrator
		Drivers	Licensed Motor Carriers	Ocean Carriers	Marine Terminal Operators	Rail Companies	NWSA Staff	
View inventory and maintenance schedules	X	X	X	X	X	X	X	X
3. Long Term Elements								
Submit service requests for security or maintenance needs		X	X	X	X	X	X	X
View Port-wide basic container availability information and 48-hour predicted container availability information	X	X	X	X	X	X	X	X
View terminal appointment availability	X	X	X		X		X	X
Reserve, manage terminal appointments		X	X		X		X	X
Search truck-specific route guidance	X	X	X				X	X
4. Optional Elements								
View real-time container status/location	X	X	X	X	X	X	X	X
View rail dwell times	X	X	X	X	X	X	X	X
View truck parking availability	X	X	X		X		X	X
Make, manage truck parking stall reservations		X	X		X		X	X
View real-time chassis status/location	X	X	X	X	X	X	X	X
View weigh-in-motion weight reading		X	X		X		X	X
View truck origins/destinations							X	X
View tenant asset information (equipment utilization, available inventory, condition, etc.)							X	X
View Port and tenant utility usage information							X	X

5.0 Acronyms and Abbreviations

Term	Definition
ADA	Americans with Disabilities Act
AI	Artificial Intelligence
API	Application Programming Interface
BCO	Beneficial Cargo Owner
Caltrans	California Department of Transportation
C/AV	Connected and Automated Vehicle
CM	Configuration Management
CMAQ	Congestion Mitigation and Air Quality
CSV	Comma-Separated Value
C2C	Center-to-Center

Term	Definition
DOT	Department of Transportation
DSRC	Dedicated Short-Range Communications
ERD	Earliest Receiving Date
ETA	Estimated Time of Arrival
ETD	Estimated Time of Departure
FRATIS	Freight Advanced Traveler Information System
GIS	Geographic Information System
GUI	Graphical User Interface
iPro	Intermodal Pro
IT	Information Technology
ITS	Intelligent Transportation System
JPEG	Joint Photographic Experts Group
MTO	Marine Terminal Operator
NWSA	Northwest Seaport Alliance
PCS	Port Community System
PCTS	Port Community Technology System
PDF	Portable Document Format
PSRC	Puget Sound Regional Council
RFID	Radio-Frequency Identification
SDOT	Seattle Department of Transportation
SMS	Short Message Service
TacSim	Tacoma South Intermodal Facility
UP	Union Pacific
URL	Uniform Resource Locator
WIM	Weigh-in-Motion
WSDOT	Washington State Department of Transportation