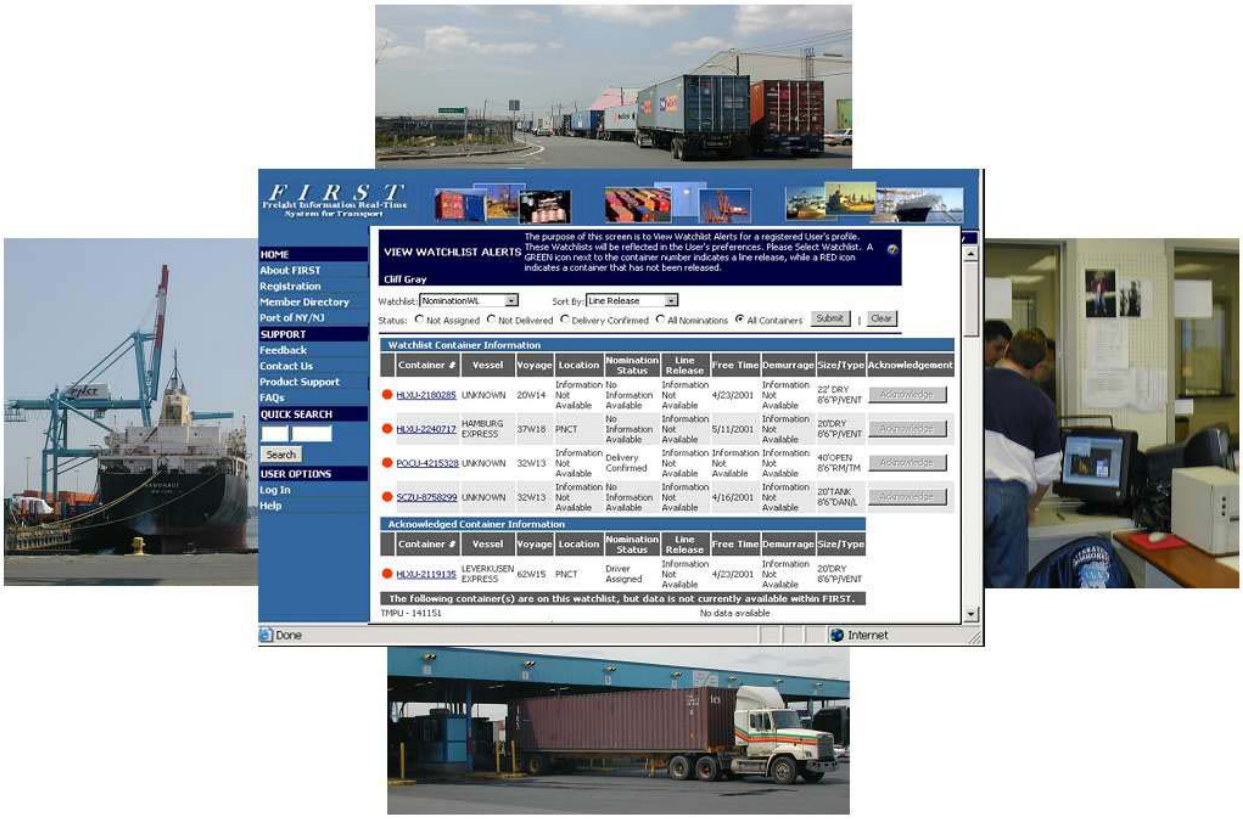
October 2003

Freight Information Real-Time System for Transport (FIRST)



Evaluation Final Report

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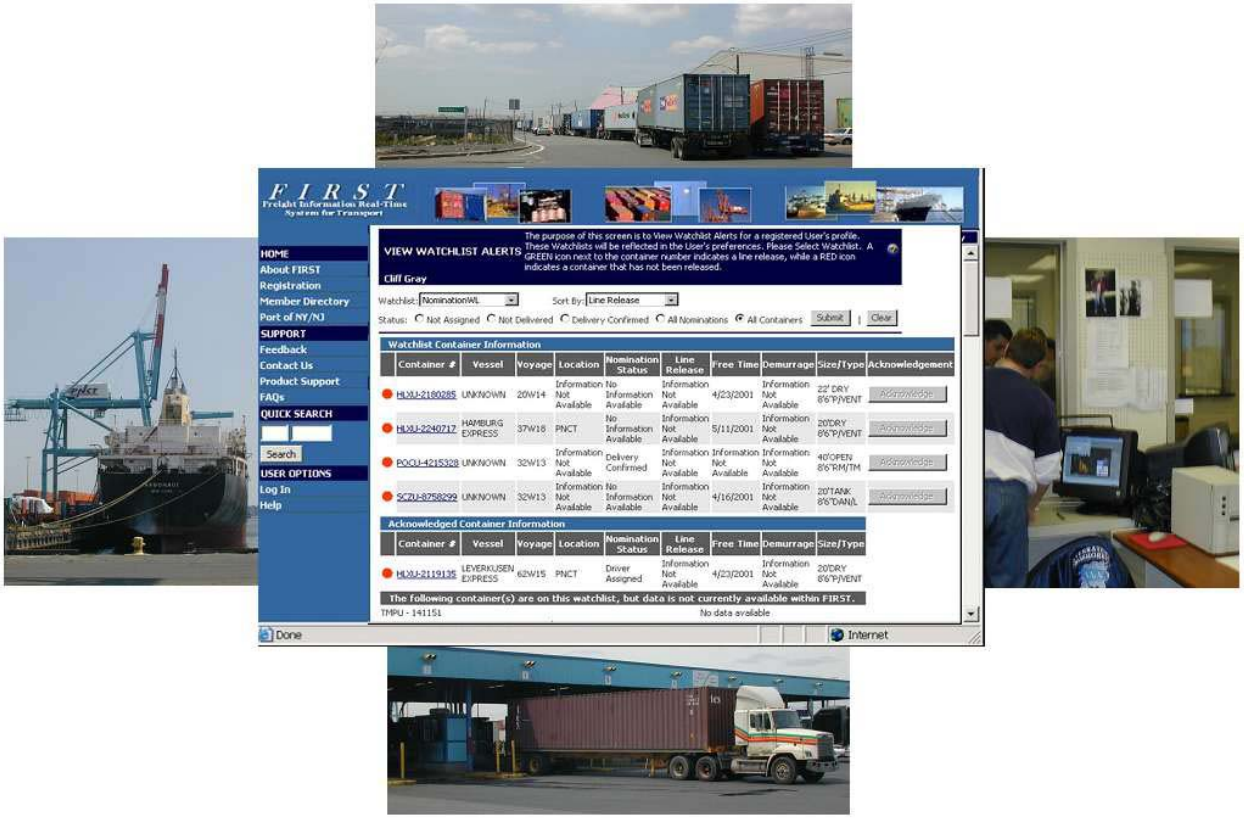

Evaluation Final Report

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FREIGHT & ITS WEB RESOURCES

USDOT ITS Joint Program Office:
http://www.its.dot.gov

FHWA Office of Freight Management
http://ops.fhwa.dot.gov/freight/

USDOT Office of Intermodalism
http://www.dot.gov/intermodal/freight.html

ITS Cooperative Deployment Network (ICDN):
http://www.nawgits.com/jpo/icdn.html

ITS Electronic Document Library (EDL):
http://www.its.fhwa.dot.gov/cyberdocs/welcome.htm

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FHWA Office of Freight Management and Operations

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16. Abstract

This report presents the findings of an independent evaluation of the Freight Information Real-time System for Transport (FIRST) intermodal freight ITS prototype system. FIRST is an Internet-based, real-time network that integrates numerous sources of freight location and status into a single, easily navigated Web portal to allow port users to access cargo and Port information to facilitate planning and logistics. This system was designed by the Port Authority of New York and New Jersey, in cooperation with members of the private sector intermodal industry, to meet the operational needs of regional intermodal freight service providers and their customers. FIRST makes information from ocean carriers, terminal operators, rail lines, and trucking companies available to port users. These stakeholders envisioned the FIRST system would help to reduce the truck queues at terminal gates, reduce unnecessary trips by trucks to the port, reduce truck emissions, increase terminal operation efficiencies, and improve the freight transportation system at the Port of New York/New Jersey overall. However, due to a variety of internal and external factors, the FIRST system did not gain a significant level of usage over the course of the evaluation period. For this reason the aforementioned benefits did not occur. This evaluation presents some of the factors contributing to the low usage, compares FIRST to similar, yet successful systems, and demonstrates via simulation the benefits that might be realized should the FIRST system incorporate a truck appointment system.

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ABBREVIATIONS

AMS	Automated Manifest System
ASI	American Systems, Inc.
ATIS	Advanced Traveler Information Systems
CBP	Customs and Border Patrol
CMAQ	Congestion Mitigation and Air Quality Improvement Program
CO	Carbon Monoxide
DSRC	Dedicated Short Range Communications
EDI	Electronic Data Interchange
eDO™	Electronic Delivery Order
eModal	A private company information portal
ETA	Estimated Time of Arrival
ETD	Estimated Time of Departure
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FIH	Freight Information Highway
FIRST	Freight Information Real-Time System for Transport
FOT	Field Operational Test
FTP	File Transfer Protocol
GPS	Global Positioning Systems
IT	Information Technology
ITS	Intelligent Transportation Systems
JPO	Joint Program Office
NAAQS	National Ambient Air Quality Standards
N2O	Nitrous Oxide
PANY/NJ	Port Authority of New York/New Jersey
PGP	Pacific Gateway Portal
PM	Particulate Matter
PoV	Port of Vancouver
PNCT	Port of Newark Container Terminal
SAIC	Science Applications International Corporation
SCAC	Standard Carrier Alpha Code
SEA LINK®	PANY/NJ truck identification system
TCOS	Trade Corridor Operating System
USDA	United States Department of Agriculture
USDOT	United States Department of Transportation
VPA	Vancouver Port Authority

EXECUTIVE SUMMARY

Industry and government are concerned about the existing capacity at ports and terminals – including the associated highways, rail lines, and waterways that serve them – to handle steadily increasing volumes of intermodal traffic, especially containerized freight.

Specifically, at the facilities under the jurisdiction of the Port Authority of New York/New Jersey (PANY/NJ), the most acute problem occurs on landside access to terminals. With very little room for land and facility expansion, the private terminals at the Port Authority's Marine Terminals are struggling with the ever-increasing flow of trucks into their terminals to unload and load container ships.

As a result, this has led to multiple problems with costly outcomes, including:

- Increased port congestion.
- Increased delays at terminals.
- Increased air pollution.
- Decreased asset and personnel utilization.
- Overall decrease in operational efficiency.
- Overall increased costs relating to general and security operations.

To respond to this situation, the PANY/NJ, supported by a large set of public and private stakeholders, looked at the possibility of leveraging information technologies to improve the efficiency of Port operations.

In 2001, the Federal Highway Administration's (FHWA's) Office of Freight Management and Operations, the I-95 Corridor Coalition, and the PANY/NJ moved forward with a freight project utilizing Intelligent Transportation Systems (ITS) to provide real-time information to the Port of NY/NJ freight community members. This demonstration project, the Freight Information Real-Time System for Transport (FIRST), was established to help solve the previously identified problems of limited landside access and increasing levels of truck traffic at and around PoNY/NJ.

FIRST is an Internet-based, real-time network that integrates numerous sources of freight location and status into a single, easily navigated Web portal to allow port users to access cargo and Port information to facilitate planning and logistics. This system was designed by members of the private sector intermodal industry, in cooperation with public sector partners, to meet the operational needs of regional intermodal freight service providers and their customers. Using File Transfer Protocol (FTP), FIRST was designed to compile information from ocean carriers, terminal operators, rail lines, and trucking companies. FIRST makes this information available to the port users to facilitate the safe, efficient, and seamless movement of freight through the Port of New York/New Jersey. Stakeholders envisioned the FIRST system would help to reduce the truck queues at terminal gates, reduce unnecessary trips by trucks to the port, reduce truck emissions, increase terminal operation efficiencies, and improve the freight transportation system at the Port of New York/New Jersey overall.

In terms of functionality, the FIRST system was designed to provide freight and port information via an easy to use Web portal that all port community members with Internet access could use. Types of features and information that is readily available on the FIRST portal include:

- Real-Time Container Status
- Vessel Schedules
- Web-Cameras
- Port Traffic Conditions
- Other Port and Freight Information

Additional features such as a truck appointment system; the Customs and Border Patrol's (CBP) Automated Manifest System (AMS); and the U.S. Coast Guard's Vessel Traffic Service were supposed to be available through the FIRST portal but were not available at the time of this writing.

In terms of systems users, stakeholders intended the FIRST Web portal to become a "one-stop shop" for all port community members. The members of the port community that were thought to have interest in accessing the FIRST Web portal include ocean carriers, freight forwarders, motor carriers, marine terminal operators, and other companies and organizations that have business in and around the Port of New York/New Jersey.

The FIRST system functioned successfully on a technological level. Unfortunately, the FIRST system did not gain measurable levels of use over the course of the deployment. While there was a high level of interest (almost 4500 homepage viewings) just after the launch of the FIRST site in 2001 (in part due to 9/11 interest), this level dropped to under 1000 in March of 2003. Similarly, use of the container-tracking feature dropped from over 1000 web hits per month to just over 100 month. Finally, as of March of 2003 only 1% of the known motor carriers in the Port of New York and New Jersey were registered with the system.

FIRST data users, the trucking companies, and freight forwarders noted the major concerns with FIRST are that it has limited data and when the data is available, it is not always accurate and timely. As a result, this causes:

- Terminal operators have to answer additional inquiries via the Internet from trucking companies about data, which causes unnecessary work
- Truckers have to visit multiple Websites to find all the information they need – which also causes additional effort that they are not likely to do on a regular basis;

Additionally, terminal operators and ocean carriers have begun to start their own Websites for their customers and are not going to send data to an outside source if they can do it in house. Furthermore, ocean carriers believe that they are not getting anything in return for providing FIRST with their data. Although data is transmitted via the Internet at no cost, the ocean carriers don't feel there is enough incentive to keep providing the data and some have partially or completely stopped sending data to the system administrator.

As a result of these low levels of usage and lackluster customer acceptance, it was reasonably assumed that FIRST did not have any appreciable impacts on Port efficiency, congestion, or emissions during the evaluation period. However, it also raised the questions – Can a FIRST type system be successful, and if so, then how?

To investigate these questions, the scope of the evaluation was expanded to identify projects that are similar to FIRST, but that have proven successful and to compare these successful systems to FIRST. Specifically, the Evaluation Team examined two other port community systems, the Pacific Gateway Portal of the Port of Vancouver, and eModal, a private company portal. This enabled the Evaluation Team to gain a different perspective from other systems, and determine the differences in features and characteristics that may have a role in system success.

The results of these case studies suggested that with the addition of an appointment system, the FIRST system could be a successful tool. Thus as a final step in the analysis, the evaluation team used simulation modeling to assess what the system impacts of FIRST might be if an appointment system was added and used. The prominent benefit that was explored is the potential environmental improvements associated with an integrated truck appointment system.

The port community systems such as the Pacific Gateway Portal and eModal have successful features that could be applied to FIRST. PGP's success is the result of careful planning up front by the stakeholder group at the Port of Vancouver and surrounding business community. The truck appointment system, firmly in place at the Port of Vancouver, has helped reduce congestion and wait times at terminal gates at the port. eModal, is succeeding at many ports around the country, and is continuing to grow by offering features that are truly beneficial to the customer using a fee payment structure by registered users. eModal provides efficiency-enhancing tools, such as the Folder Manager, eDO™, and Scheduler features that address participants' needs.

These PGP and eModal systems provide many similar features to FIRST, though the community support and financial philosophies are different. If these items are addressed at the PANY/NJ, FIRST could be sustained and operate as originally envisioned by its champions.

Moreover, in reviewing these alternative port community systems, the Evaluation Team identified that an appointment system may serve to benefit users of the FIRST system. Hence, an appointment system was designed and the benefits modeled using a model of terminal operations calibrated for a terminal handling a weekly average of approximately 1400 total vehicles per day. Based on this modeling effort, the Evaluation Team estimated a health cost savings of $93,107/year assuming that all vehicles calling at the terminal had made appointments prior to arrival. It should be noted that this figure is highly dependent on the baseline queuing system configuration. Hence, in periods of peak terminal use (i.e., during elevated holiday freight levels) these benefits may be significantly larger. Additionally, it should be taken into consideration that the modeled terminal is located in the Greater New York Metropolitan area – a notorious emissions non-attainment zone. Hence, any savings in air quality warrant consideration. Finally, this is only one terminal in the New York/New Jersey region: if it can be assumed that 10 terminals of a similar size to that modeled adopt such a program, it is possible that a savings of nearly $1 Million per year would

be realized. This level of public benefit from a new technology deployment may serve to leverage public funding of FIRST.

It is important to try to put the findings of this evaluation into perspective when comparing the other systems covered in the Case Studies section of this report. The FIRST system operates without any outside funding from the members or users. The other systems, the Pacific Gateway Portal and eModal, have external funding sources to sustain operations. Participation in the FIRST system might have been higher had the incentive for ocean carriers and terminals to provide data been more lucrative if PANY/NJ had more financial power to offer more services up front. The lesson learned here is that funding and financial incentives are important concerns for operations such as these port community systems, especially in a typically cash-strapped industry as freight transportation.

Another lesson learned involves the identification of all port community groups and the specific benefits to groups. A primary focus area of the FIRST project was on the motor carrier and truck driver. However, the steamship lines have a significant amount of the critical data that is necessary to populate the system. The port community has many different kinds of commercial enterprises with their own objectives. A system will be more successful if each group of users is considered independently from one another in terms of benefit-cost as well as the whole well-being of the port community.

A third lesson learned is related to readily available services and features that have an immediate impact. Features such as the truck appointment system should have been integrated in the beginning so that the benefits that project champions had hoped to see, i.e., reduction in terminal gate queues and related reduction in diesel emissions, had a better chance of being realized. When rolling out a new product there must be an immediate, obvious, and tested offering that will draw people to the system. Such an offering must be carefully marketed because low levels of use may be worse for the system as identified in the truck assignment model results.

The FIRST Web portal is a tool that if used as intended, has promise to address the problems that have been identified at the Port of NY/NJ. Future funding, quality control of data, and overall willingness of the port community to actively participate are the main issues that have to be addressed before some of the problems can finally be resolved. After these hurdles are overcome, the FIRST system has the opportunity to provide the Port of New York/New Jersey with solutions that meet the needs of the entire port community.

Based on the findings developed and the lessons learned in conducting this Evaluation, the Evaluation Team has developed the following four primary recommendations for the USDOT, the PANY/NJ, the I-95 Corridor Coalition, and others in government and industry to consider:

- **Data quality control.** The PANY/NJ, as landlord of the port, is neither the originator of record nor the primary user of the data. Additionally, with the small technical staff and limited resources, the PANY/NJ is not able to directly address concerns of data quality and customer satisfaction. Registered users accessing this system are concerned that there is not enough data, that the data that is there isn't always accurate, and sometimes the data are not timely. As stated before, one of the concerns with the port community is the accuracy and timeliness of the data on

the Website. The PANY/NJ should continue to address the quality control issues regarding the data that is broadcasted on the FIRST system. Even though the ocean carriers and terminal operators are responsible for submitting accurate and timely information, there is no incentive to ensure this happens. Additionally the lack of complete data results in inaccuracies. This can only be corrected by the participation of more terminals and steamship lines. While, the PANY/NJ encourages data providers to provide the data at no cost via FTP transmissions, this doesn't guarantee its accuracy.

- **Consideration of Local, state, or Federal regulations.** Recent truck idling legislation in California is has preliminarily shown positive results at terminal gates.[1] The trucking associations support this type of legislation and it may be a good example to model similar legislation in the Port of New York/New Jersey area to address the lengthy delays at the Port's terminal gates. The FIRST system could then facilitate the use of the appointment system because truckers and trucking companies could search and make appointments through one Web portal for all participating terminals without having to search multiple terminal sites.

- **Funding.** Although the spirit of FIRST's free services in an excellent idea, there may be a shortfall of funding in the immediate future unless outside financial resources are established. Once the PANY/NJ's funding ends in December of 2003, a decision will need to have been made by upper management and other stakeholders on the future funding of the FIRST system. The PANY/NJ may want to consider establishing a fee structure similar to that of the Port of Vancouver or eModal to help recoup the operating costs that are associated with the FIRST system. The PANY/NJ may want to consider establishing a fee structure similar to that of the Port of Vancouver or eModal to help recoup the operating costs that are associated with the FIRST system.

- **Increased outreach and marketing.** The PANY/NJ did get extensive input from the port community as to the design and functionality of the system in the beginning. However, the unfortunate timing of the 9/11 attacks may have disrupted the efforts and resources that the PANY/NJ would have liked to have had at its disposal to market and reach out to the port community as the system was being deployed. A survey or interviews with non-registered users as well as part-time users may be of benefit to the Port Authority to reconnect with the entire port community regarding their unwillingness to register with the system or use it full time. Additionally, the Port of Vancouver is interested in sharing their story with other ports, especially on the East Coast of the United States. PANY/NJ may want to consider meeting with FHWA and the Vancouver Port Authority to discuss various features of each others' systems and how the FIRST and Pacific Gateway Portal systems could enhance one another.

[1] Mongelluzzo, Bill. "Smooth Start for Lowenthal Law," Journal of Commerce. July 14-20, 2003.

1. INTRODUCTION

1.1 CURRENT CHALLENGES

Many ports today in are increasingly congested and crowded. Land is not always available for expansions of port facilities so existing property continues to receive increased truck and other port traffic without room to grow. This issue is especially of concern at the Port of New York/New Jersey located on the already congested North East Coast of the United States. Increased truck traffic in and around the Port of New York/New Jersey leads to delays, increased air pollution, overall congestion, and loss of operational efficiency.

In an effort to combat this problem, the Federal Highway Administration's (FHWA's) Office of Freight Management and Operations, the FHWA's Congestion Mitigation and Air Quality Improvement Program (CMAQ), and the I-95 Corridor Coalition's Intermodal Transfer of People and Goods Program, recently developed the Freight Information Real-time System for Transport (FIRST) Demonstration Project. FIRST is an information and technology based solution designed to:

- Enhance port throughput and efficiency of operations.
- Reduce congestion and delays at the port facilities.
- Reduce the associated air pollution from vehicle emissions.
- Improve Port of New York/New Jersey customer satisfaction.

Science Applications International Corporation (SAIC) was selected to conduct an independent evaluation of this FIRST system. The primary goals of the evaluation were to identify any benefits in operational efficiency, air quality, and customer satisfaction. In addition, the SAIC evaluation team also performed case studies comparing the FIRST system to other similar port community information an technology based systems, developed a queuing model to determine potential air quality health cost savings, and offered lessons learned on behalf of the participants.

Deploying the FIRST system provided an excellent opportunity to evaluate a new intermodal information-based Intelligent Transportation System (ITS) technology not addressed in the other ITS intermodal freight field operational tests (FOTs). Table 1-1 provides a comparison of the technologies and functions between FIRST and the other five intermodal ITS operational tests, completed or in the final stages of evaluation as of October, 2003[2]. The FIRST system evaluation added to this body of work valuable new information regarding port terminal information system deployments. In particular, an online system for freight arrival status on dock (i.e., ship arrival), chassis status and location information, and container availability information was tested. In addition, the technologies implemented in the FIRST project complement the technologies

[2] By the end of 2003, all of the evaluation final reports for these FOT's, excluding Cargo*Mate (which is ongoing through June 2004), should be available for download from the ITS Joint Program Office's Electronic Documents Library (EDL), which is accessible to the public at: http://www.its.dot.gov/welcome.htm.

implemented in the other intermodal freight ITS projects – in particular, the Freight Information Highway (FIH), which was similarly designed to provide greater freight information visibility. The difference between the FIH and the FIRST system, however, is that the FIRST system is based around a distinct geographical region and a distinct location where modal traffic interchanges (i.e. the port), whereas the FIH is designed to accommodate a nationwide level of users in a variety of roles.

Table 1-1. Comparison of the Six Intermodal Freight ITS Operational Tests

IMTC Pacific NW ITS Border Crossing	WSDOT E-Seal & Container Tracking	O'Hare Electronic Supply Chain Manifest	ITFWG Asset Tracking & Info Highway	Cargo*Mate Chassis Tracking Demo	FIRST
▪ DSRC Transponder Tractor Tracking ▪ Trade Corridor Operating System (TCOS) ▪ Bi-national Electronic Customs Clearance	▪ Container Electronic Seals with Periodic Monitoring ▪ Wireless GPS Tractor Tracking ▪ Terminal Gate Cameras ▪ MPO Truck Movement Data Collection	▪ Biometric Fingerprint Identification ▪ Smart Cards with Commercial Drivers License ▪ Electronic Shipment Manifest for Cargo Tracking ▪ Air/Port/FAA Security Monitoring System	▪ Wireless GPS Chassis Tracking ▪ In-transit Visibility between Modes ▪ Communi-cation through FIH between Modal Carriers	▪ Container Electronic Seals with Continual Monitoring ▪ DSRC Transponder Tractor Tracking ▪ Wireless GPS Chassis Tracking ▪ Logistics Management System	▪ Dray Trucking Dispatch and Driver Assignment ▪ Ship/Rail Arrival and Departure Information ▪ Cargo Status ▪ Real-Time Traffic and Incident Information

FIRST provides real-time container, chassis, and vessel status information as well as trucker nomination capabilities, It is assumed that FIRST could, with sufficient levels of use, increase freight movement productivity and mitigate Port congestion. Moreover, at the outset of the deployment, it was expected that use of the FIRST system would significantly reduce truck congestion and idling times at the Port gate, and unnecessary truck trips, thereby producing measurable air quality improvements contributing to the attainment of National Ambient Air Quality Standards (NAAQS).

Unfortunately, the FIRST system did not gain measurable levels of use over the course of the deployment. While there was a high level of interest (almost 4500 homepage viewings) just after the launch of the FIRST site in 2001 (in part due to 9/11 interest), this level dropped to under 1000 in March of 2003. Similarly, use of the container-tracking feature dropped from over 1000 web hits per month to just over 100 month. Finally, as of March of 2003 only 1% of the known motor carriers in the Port of New York and New Jersey were registered with the system.

As a result of these low levels of usage and customer acceptance, it was reasonably assumed that FIRST did not have any appreciable impacts on Port efficiency, congestion, or emissions during the evaluation period. However, it also raised the question – Can a FIRST type system be successful, and if so, then how?

To investigate these questions, the scope of the evaluation was expanded to identify projects that are similar to FIRST, but that have proven successful and to compare these successful systems to FIRST. Specifically, the Evaluation Team examined two other port community systems, the Pacific Gateway Portal of the Port of Vancouver, and eModal, a private company portal. This enabled the Evaluation Team to gain a different perspective from other systems, and determine the differences in features and characteristics that may have a role in system success.

The results of these case studies suggested that with the addition of an appointment system, the FIRST system could be a successful tool. Thus as a final step in the analysis, the evaluation team used simulation modeling to assess what the system impacts of FIRST might be if an appointment system was added and used. The prominent benefit that was explored is the potential environmental improvements associated with an integrated truck appointment system.

This draft final report is organized as follows:

- **Section 2 – Deployment Overview and Impact.** This section provides a comprehensive overview of the problem this demonstration project sought to solve, a description of the stakeholders participating in this study, and a summary of the impact of the system as deployed.

- **Section 3 – Case Studies.** This section presents the description of the technologies deployed in this demonstration test, the issues behind the low levels of participation in FIRST, and case studies on two additional port community systems.

- **Section 4 – Terminal Operations Model: Air Quality and Truck Appointment System Modeling.** This section uses modeling to examine the potential benefits that could be realized through an increased and more efficient use of the FIRST system.

- **Section 5 – Conclusions and Recommendations.** This section provides a review of lessons learned through this demonstration project. In addition, also included is a discussion of “next steps” for the future to ensure the continued development of the FIRST system, and recommendations for current considerations now to increase participation in FIRST or possibly other systems in the future.

2. DEPLOYMENT OVERVIEW AND IMPACT

2.1 INTRODUCTION

The Freight Information Real-Time System for Transport (FIRST) was conceived prior to September 11, 2001.The Website itself came online just days before the terrorist attacks on New York, which resulted in the project being put on hold for about 6 months although the system and Website were operational throughout. The project resumed its operation and is now nearing the end of its preliminary funding through the Port Authority of New York/New Jersey (PANY/NJ). This document examines what can be gained from the demonstration project and presents the results so that they may assist stakeholders to eventually reach the goals and objectives that FIRST was originally designed to meet.

The remainder of this section is organized as follows:

- 2.1 Introduction
- 2.2 Problem Statement – The FIRST Demonstration Project
- 2.3 System Overview – The FIRST System
- 2.4 Participants and Stakeholders
- 2.5 Evaluation Hypotheses and Objectives

2.2 PROBLEM STATEMENT – THE FIRST DEMONSTRATION PROJECT

Industry and government are concerned about the capacity of existing ports and terminals – and the associated highways, rail lines, and waterways that serve them – to handle steadily increasing volumes of intermodal traffic, especially containerized freight. Over the last decade, the volume of intermodal containers moving through ports worldwide has doubled. Correspondingly, the volume of intermodal airfreight, intermodal traffic on U.S. railroads, and intermodal freight moved by truck grew apace. These volumes are expected to double again over the next two decades.

Today's intermodal freight system is not equipped to handle this growth. Ineffective links among modes – particularly in terms of landside access to ports and terminals – degrade the reliability and performance of carriers, shippers, and terminal operators. Moreover, the lack of an effective information-sharing network among stakeholders creates deficiencies, bottlenecks, and unnecessary delays, which adversely impact efficient freight movement. These deficiencies result in increased operating costs and congestion, and decreased safety, economic competitiveness, and air quality.

For the PANY/NJ, the most acute problem occurs on landside access to terminals. With very little room for land and facility expansion, the private terminals at the Port Authority's Marine Terminals are struggling with the ever-increasing flow of trucks into their terminals to unload and load container ships. This problem is expected to worsen in the coming decade as the number of containers entering the Port increases by 4.2

percent annually.[3] Figure 2-1 shows a lengthy truck queue outside a terminal at the Port of New York/New Jersey. To respond to this situation, the Port Authority, supported by a large set of public and private stakeholders, looked at the possibility of leveraging information technologies to improve the efficiency of Port operations.

Figure 2-1. Four-Block Long Truck Line at a Port of NY/NJ Terminal.

With real-time information available at the click of a button, the FIRST system was conceptually designed to provide truckers and other data users with information that would help reduce the time at terminal gates, reduce unnecessary truck trips, minimize the inefficiencies in operation, increase safety and security, and improve mobility within the port.

2.3 SYSTEM OVERVIEW – THE FIRST SYSTEM

FIRST is an Internet-based, real-time network that integrates numerous resources into a single, easy-to-use Website for access to cargo and Port information. This system was designed by members of the private sector intermodal industry, in cooperation with public sector partners, to meet the operational needs of regional intermodal freight service providers and their customers. Using a variety of standard data transmissions, including Electronic Data Interchange (EDI) and File Transfer Protocol (FTP), FIRST is intended to facilitate the safe, efficient, and seamless movement of freight through the Port of New York/New Jersey.

Information on the FIRST Website – www.firstnynj.com – is drawn from various sources in various formats to provide real-time information on cargo status to ocean carriers, exporters, importers, foreign freight forwarders, customs brokers, terminal

[3] A Combined Report for Freight Information Real-Time System for Transport (FIRST), SAIC, May 2002.

operators, and rail and truck providers. Figure 2-2 provides an overview of the FIRST system.

Figure 2-2. FIRST Information Sources, Types, and Users.

Specifically, information comes from the following sources in a variety of formats consistent with those depicted in Figure 2-3.

- Real-time cargo information – including customs status, hazardous cargo information, vessel or carrier, date in, services required and completed.
- Real-time booking status – including types of containers booked, number of containers by type, and information on containers delivered full and empty.
- Container tracking – container history including all movement for the past 90 days, gate transactions, inspections, trucker SCAC, weights, destination and proof of delivery, with date and time for relevant transactions.
- Container monitoring – alerts users when containers are available for pick-up.
- Trucking company status – will interface with SEA LINK® system to provide information on drivers.
- Trucker nomination – list of containers for a nominated trucker.
- Driver assignment – will transmit and confirm with terminal operator the container number, bill of lading, and SCAC code of authorized trucker.
- Delivery confirmation entry – information received from the driver including container number, date and time of delivery, and name of receiving party.

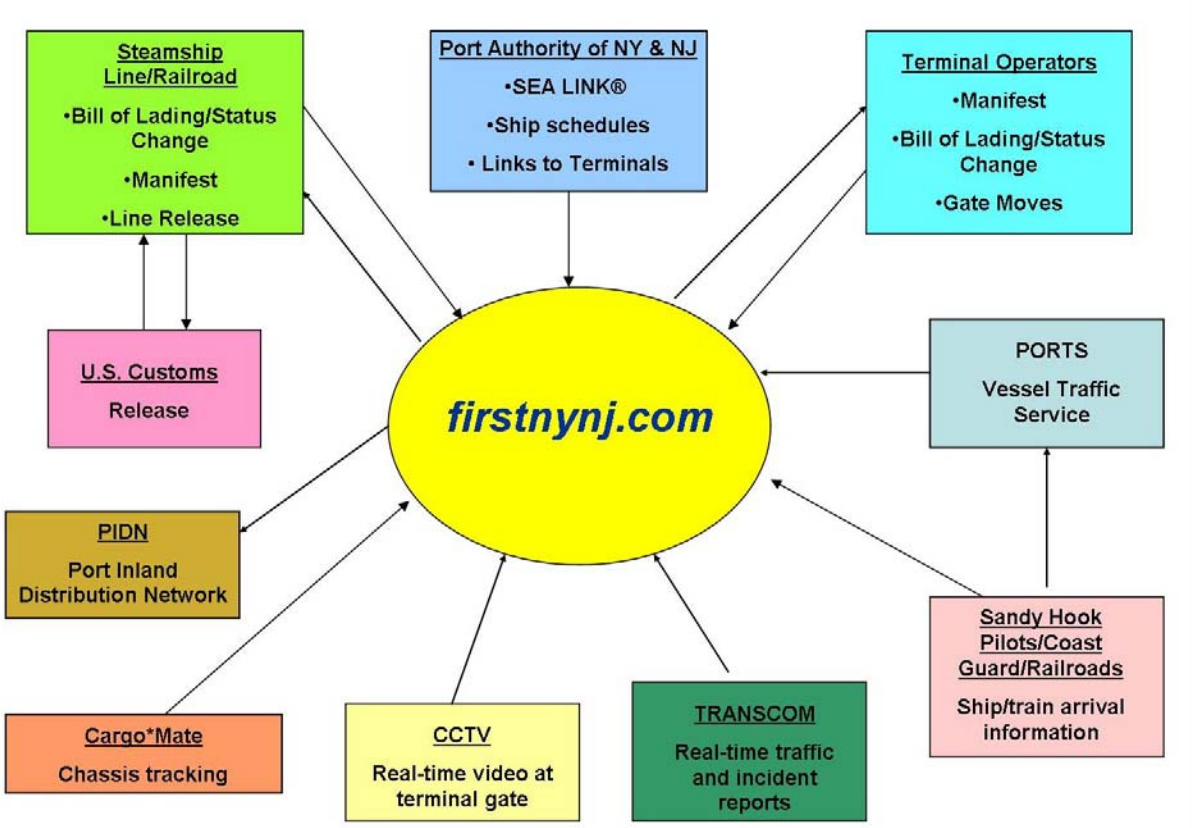


Figure 2-3. FIRST System Overview.

In its full manifestation, FIRST is intended to serve six classes of user. These classes are Anonymous Users, Registered Users, Administrative Users, Super Users, Developers, and System Administrators. These classes are detailed in Table 2-1. Of these classes only Anonymous and Registered Users are logging on to the system to obtain port related information. Of those users, the Anonymous class of users is difficult to track; hence, this evaluation focused on registered users.

Table 2-1. 6 Classes of User

User Group	Definition
Anonymous Users	Anybody reaching the FIRST Web site who will be allowed to view/query container/event, trip/leg, traffic and schedule data.
Registered Users	Users from companies participating in FIRST who will be allowed to view/query booking and bill of lading data, driver/SCAC relationships, driver assignments, trucker nominations, and trip/leg data.
Administrative Users	A participating company's designated user who can set up and authenticate other users for their company.
Super Users	Selected PANYNJ/ASI personnel who will be allowed to perform all FIRST application functions and view data for all Parties and Sites.
Developers	ASI developers who will have all Super User access and site data view access, but not necessarily the ability to create/update data. They will also have access to some FIRST system tables.
System Administrators	ASI personnel who will have total access to all FIRST tables, application functions, Party and Site data including the ability to create, update, and delete data.

Within these classes of user, registered users include trucking/drayage companies in the port vicinity seeking to improve operations. For example, in a typical scenario, a trucking company can use the FIRST system to determine the status of a cargo container scheduled for pickup up at the Port. The assigned truck driver can reduce delay time, avoid numerous telephone calls to the terminal, and prevent unnecessary trips to the Port by verifying that the container is at the terminal and has been released for pickup. It was expected that FIRST would significantly reduce the number of trouble tickets and increase the container movement throughput. When this scenario is multiplied by numerous drivers and cargo containers per day, it was expected that a significant reduction in operating costs, time delays, and congestion could be realized, as well as increased safety and security, economic competitiveness, and enhanced air quality.

Of the information sources and points of connectivity listed above, nearly all were successfully integrated with FIRST. In particular, SEA LINK®, which provides a central database of registered trucking companies and their associated truck drivers doing business at the Port, was integrated with FIRST. Additionally, registered FIRST members can access Cargo*Mate® chassis tracking data through the Website to obtain real-time chassis status information. As part of separate U.S. Department of Transportation (USDOT) Demonstration Test, there are over 600 chassis equipped with the Cargo*Mate® DataGates in the NY/NJ area that are accessible to Cargo*Mate® registered users through the FIRST Website. Other systems that are expected to be integrated into FIRST in the future include the United States Coast Guard's Vessel Traffic Service, the U.S. Customs' Automated Manifest System (AMS), and a truck appointment system.

The FIRST system is administered by Americas Systems, Inc. (ASI), from Murray Hill, New Jersey. FIRST will operate off of one primary server located at the ISP offices and will also operate one "load" server if needed. A disaster recovery server is currently located at ASI's offices, but will be moved to an off-site location. Information (previously described) will come into the FIRST system from several sources which include SEA LINK®, TRANSCOM's "Trips 1, 2, 3", the U.S. Coast Guard's Vessel Traffic Service, and U.S. Custom's AMS. Video images from the Port and from TRANSCOM will be fed into the system.

2.4 PARTICIPANTS AND STAKEHOLDERS

Following is a brief description of the participants and stakeholders involved in the FIRST Demonstration Project evaluation.

Port Authority of New York/New Jersey

PANY/NJ sponsored this project and has provided funding to support its operation. PANY/NJ operates some of the busiest and most important transportation links in the region. These links include the John F. Kennedy International, Newark Liberty International, LaGuardia and Teterboro airports; the George Washington Bridge; the Lincoln and Holland tunnels; the three bridges between Staten Island and New Jersey; the PATH rapid-transit system; the Downtown Manhattan Heliport; Port Newark; the Elizabeth-Port Authority Marine Terminal; the Howland Hook Marine Terminal on Staten Island; the Brooklyn Piers/Red Hook Container Terminal; and the Port Authority Bus Terminal in midtown Manhattan. The agency also owns the 16-acre World Trade Center site in Lower Manhattan. The Port Authority is financially self-supporting and receives no tax revenue from either state.

Americas Systems, Inc.

In this demonstration project, Americas Systems, Inc. (ASI) designed and maintains the FIRST Website and server and processes the data received via FTP from ocean carriers and other data providers. ASI also provides product and technical support for those in the Port community who use the FIRST system.

ASI is an information technology firm that specializes in providing innovative solutions to the transportation field. With two offices located in New Jersey, ASI provides its clients (retailers, manufacturers, exporters, global ocean carriers, third-party logistics providers, terminal operators, port authorities, IT service providers and others) with business and IT solutions to transportation management issues.

I-95 Corridor Coalition

The I-95 Corridor Coalition, the organization supporting this demonstration project, is driven by the goal to improve intermodal truck access to and from the ports of New York and New Jersey.

The I-95 Corridor Coalition is an alliance of transportation agencies, toll authorities, and related organizations. These organizations include law enforcement, from the State of Maine to the State of Florida, with an affiliate member in Canada, which provides a forum for key decision and policy makers to address transportation management and operations issues of common interest.

USDOT, FHWA, Office of Freight Management and Operations

As the United States government's lead agency responsible for the safe, efficient transportation issues on federal highways, the FHWA realizes the need for increased mobility, improved air quality, increased security, and improvement in efficiency at the Port of New York/New Jersey. Based on this need, FHWA/USDOT sponsored the Freight Information Real-Time for Transport demonstration test.

Other Stakeholders

In addition to the previously identified project sponsors, a number of other organizations served as active and enthusiastic participants including: The New York Department of Transportation, The New Jersey Department of Transportation, The New York City Department of Transportation, NY and NJ Metropolitan Planning Organizations, Academia, New York/New Jersey Foreign Freight Forwarders and Brokers Association, Bi-State Harbor Motor Carriers, and other members of the Port Community.

2.5 EVALUATION HYPOTHESIS AND OBJECTIVES

This section describes the original evaluation hypotheses and the results pertaining to them. Based on the outcomes related to these hypotheses the Evaluation Team appended this study with an additional case study analysis comparing two other port community information systems and a queuing model based around a proposed truck appointment system. The objectives for these two new main components of this report are also summarized below.

2.5.1 Original Hypotheses and Outcomes

The FIRST evaluation was initially based around three areas of study:

- Intermodal Freight Operations Study
- Air Quality Study

- Customer Satisfaction Study

The original proposed study approach, hypotheses, and outcomes are presented in the following three sub-sections.

2.5.1.1 Intermodal Freight Operations Study

The Intermodal Freight Operations study was designed to focus on the effects the FIRST system has on the operational efficiency of the terminal gate. Specifically, this portion of the original study was to analyze how information received from and exchanged through FIRST could increase the efficiency of trucks moving through the pre-gate, gate, and complete processing steps.

The following goals of the FIRST project were established for the Intermodal Freight Operations Study:

- Reduce the amount of time that trucks spend in queues waiting to enter the terminal
- Reduce the number of trips taken to the help desk
- Reduce the number of unnecessary trips taken by truck drivers
- Increase the number of double moves made by truck drivers

Given the extremely low level of system use the bulk of these hypotheses can be reasonably rejected – that is there was no appreciable improvement in these metrics.

Table 2-2 summarizes the original hypotheses for each study goal, providing detail on the outcome and project redesign based on the Evaluation Team's preliminary findings.

Table 2-2. Intermodal Freight System Operations Evaluation Technical Approach

Original Hypothesis	Outcome
Using the FIRST system will reduce truck wait times at the terminal gate	This hypothesis is rejected. As deployed, the FIRST system did not appreciably reduce truck wait times. Nonetheless, if the usage were to increase, benefits may be achievable – see modeled results in section 4.0.
Using the FIRST system will assist in the exchange of more accurate information and payment of fees before a truck arrives at a gate	Fee payment options were not incorporated into the FIRST system in the course of the deployment period. In addition the low system use numbers rendered this hypothesis infeasible for measure at this time.
Using the FIRST system will reduce the number of unnecessary trips made by trucks when trucker verifies that cargo container(s) are available for pickup and delivery prior to trip to Port	Due to the low numbers of truckers actively using the FIRST system to verify load availability, no appreciable changes in this metric occurred. However, while this hypothesis must be rejected on the aggregate, it is still possible that some individual users experienced a reduction in unnecessary trips. However, the numbers of users are too low to reliably measure this sub-hypothesis.
Using the FIRST system will cause an increase in the number of double moves within the terminals.	No appreciable changes in this metric occurred. However, while this hypothesis must be rejected on the aggregate, it is still possible that some individual users experienced a decrease in double moves. However, the numbers of users are too low to reliably measure this sub-hypothesis.

2.5.1.2 Air Quality Study

The air quality study was closely linked to the Intermodal Freight Operations Study since improvement in air quality is a direct benefit of reducing truck idling times and trips. The Air Quality Study was to measure improvements in air quality by measuring current emissions from trucks entering the terminals and comparing the levels with trucks entering the terminals after implementing the FIRST system. As previously mentioned, it is expected that using the FIRST system will result in lower wait times for trucks trying to enter the terminal, and reduce unnecessary truck trips – all factors that are expected to result in reduced truck emissions at the Port.

The following is the initial goal of the Air Quality Study:

- Reduce the amounts of emissions caused by the trucks that utilize the Port of NY/NJ

As noted in the original evaluation plan, the degree to which the identified goal is realized depends on the operational efficiency improvements made on the part of truck drivers and terminal operators at the Port of NY/NJ. Unfortunately the level of use required to measure intermodal operational efficiency changes was not reached during the deployment period. Hence, many of these hypotheses were rejected and this portion of the study was given over to a modeling effort.

Table 2-3 summarizes the original hypotheses for each study goal, providing detail on the outcome and project redesign based on the Evaluation Team's preliminary findings.

Table 2-3. Improvements in Air Quality Evaluation Technical Approach

Original Hypothesis	Outcome
Using the FIRST system will lead to a more efficient use of the Port facilities by trucks which will result in measurable air quality improvements	Due to low use of the FIRST system there was no noticeable change in Port Facility use. Therefore, this hypothesis is rejected. If system usage does increase, however, appreciable benefits may be achieved - see modeling results in section 4.0.

2.5.1.3 Customer Satisfaction Study

The Customer Satisfaction Study was initially designed to focus on the perceived level of satisfaction by trucking companies and terminal operators based on how the FIRST system meets their information needs. One of the expected outcomes of FIRST implementation and use was improved customer satisfaction with the Port of NY/NJ because of the anticipated increase in efficiency at the terminal gates. It was also expected that the level of market penetration to Port customers would increase as FIRST became better known in the region as a provider of useful and timely Port related information.

The following two goals of the FIRST project were to be evaluated for the Customer Satisfaction Study:

- Improve customer satisfaction with the Port of NY/NJ by using the FIRST system
- Reach a significant level of market penetration for the FIRST system

These hypotheses were studied through a limited survey of registered users and in-depth interviews with key members of the port community. The result of this work led the Evaluation team to reject both hypotheses. It was the rejection of these hypotheses that inspired the Evaluation Team to study alternative, but comparable, port community systems to understand what made them successful.

Table 2-3 summarizes the original hypotheses for each study goal, providing detail on the outcome and project redesign based on the Evaluation Team's preliminary findings.

Table 2-3. Customer Satisfaction Evaluation Approach

Original Hypothesis	Outcome
Over time a significant and increasing number of trucking companies will be using the FIRST system	This hypothesis was rejected. As indicated by web activity statistics, there was a high level of interest (almost 4500 homepage viewings) just after the launch of the FIRST site in 2001 (in part due to 9/11 interest). This level dropped to under 1000 in March of 2003. Furthermore, use of the container-tracking feature dropped from over 1000 web hits to just over 100. Finally, in March of 2003 only 1% of the known motor carriers in the Port of New York and New Jersey were registered with the FIRST system. As a result of this low measure of customer satisfaction the Evaluation Team took the initiative to compare the FIRST system with alternative, but similar successful port community information technology systems.
Customers will use the ITS data as part of their decision-making processes. Users will find the ITS data to be accessible, accurate, and secure.	This hypothesis was rejected as many port community members interviewed expressed concern about FIRST posting incorrect information – generating more work and requiring dedicated staff at the terminals to answer additional inquires from truckers. In most cases the erroneous data is a result of errors in EDI transmission to the FIRST system. Additional details on this study may be found in Section 3.2.4.

Additional information on the original customer satisfaction study and outcomes can be found in section 3.2.4.

2.5.2 New Areas of Study

All of the truck drivers that use PANY/NJ must register with SEA LINK®. There are 536 users in total registered with FIRST compared to the 48,894 registered SEA LINK® truck drivers; the percentage of FIRST use is extremely low (~1%). Consequently, many of the hypotheses associated with the FIRST system were rejected – as detailed in section 2.5.1. This raised the questions of why the usage rates were so low, if such a system could succeed, and what the impacts might be if usage increased. To investigate these questions, a number of additional areas of study were pursued.

These additional studies uncovered the reasons why the FIRST system is not being used and then compared the offerings to two other Port Community systems. Based on the comparisons, it was decided that an appointment system could serve as an additional FIRST system offering, thus promoting greater FIRST system use. To understand the benefits of an appointment system, terminal operations with and without an appointment system were studied and modeled using queuing systems at the Howland Hook terminal.

The following two subsections highlight the focus and hypotheses of the new areas of study.

2.5.2.1 Case Studies

The primary focus of this section is the features and characteristics of three port community systems. Three case studies were developed from the information gathered on FIRST, the Pacific Gateway Portal, and eModal. In addition to the features of each system, the case studies section presents reasons why the FIRST system did not achieve the usage rates originally expected and what could the features and characteristics of the other two systems provide in the way of improvements if applied to FIRST.

Although this section is not a quantitative analysis of the three systems, there are assumptions, in the way of hypothesis that were derived for this portion of the evaluation. The hypotheses are as follows:

- **Hypothesis 1:** The FIRST system was not used by port community members at the level expected because of data availability, data accuracy, and data timeliness issues.

- **Hypothesis 2:** The Pacific Gateway Portal and the eModal port community systems are successful because of community member support and financial stability.

2.5.2.2 Modeling

The primary focus of this section is the modeling of a potential appointment system offering of the FIRST system. The appointment mechanism is aimed at trucks entering the terminals of the Ports of New York and New Jersey. Additionally the benefits of such a system are modeled – not only in terms of cost and timesavings, but also from the perspective of air quality. The evaluation tactic pursued in this section is to develop a model of the potential appointment system based on observed data measured in June of 2002 at the Howland Hook terminal, and on widely accepted principles in transportation based queuing theory. The output of the model (vehicle time spent in queue and terminal processes) enables a study of benefits at varying levels of appointment system use.

In an effort to quantify the benefits of an appointment system, the daily timesavings were factored to annual benefits, and converted to a monetary value using assumed values of time and an air quality value using assumed values of idling emissions. Additionally, the sensitivity of the commercial vehicle operations benefits to realistic system use scenarios was of interest hence, a study presenting a range of estimated benefits dependent on system success was performed.

Two hypotheses were derived for this investigation:

- **Hypothesis 1:** The daily operations of a terminal within the Port of New York and New Jersey may be modeled using basic transportation queuing theory principles to gain insight into expected levels of benefits associated with use of an appointment system.

- **Hypothesis 2:** An appointment system, if used by terminals at the Port of New York and New Jersey, has the potential to reduce time in queue and at the terminal translating into improved air quality and a reduction in air quality related health costs.

3. CASE STUDIES

This section describes the three port community systems, the FIRST system, the Pacific Gateway Portal, and eModal. Concluding this section is a summary of findings that briefly reiterates the reasons why PANY/NJ's port community members did not use the FIRST system at the levels stakeholders had originally hoped, and compares the characteristics, features, and environmental circumstances of the other two systems to provide insight into modifications that could allow FIRST to realize greater benefits.

The remainder of this section is organized as follows:

- 3.1 Overview
- 3.2 Freight Information Real-time System for Transport (PANY/NJ)
- 3.3 Pacific Gateway Portal (PoV)
- 3.4 eModal
- 3.5 Summary of Findings

3.1 OVERVIEW

The correlation between the hypotheses presented in Section 2 of this document and the analysis performed and described in depth here is made explicit in the bulleted list below.

- **Hypothesis 1:** The FIRST system was not used by port community members at the level expected because of data availability, data accuracy, and data timeliness issues.

  Analysis: This hypothesis was measured via a review of the PONY/NJ operating environment as well as in-depth interviews with key members of the port community. Furthermore system use was measured via FIRST website activity data.

- **Hypothesis 2:** The Pacific Gateway Portal and the eModal port community systems are successful because of community member support and financial stability.

  Analysis: This hypothesis was tested via a review of the PGP and eModal systems as well as through interviews with the primary managers of each service.

3.2 FREIGHT INFORMATION REAL-TIME SYSTEM FOR TRANSPORT (PANY/NJ)

This section is designed to provide a review of the operating environment, financial conditions, and technical capabilities of the FIRST website. Additionally, this section

concludes with a subsection further detailing the customer satisfaction study and outcomes undertaken as part of this evaluation.

3.2.1 Background on PANY/NJ

As the largest port on the East Coast of North America in total volume handled, the Port Authority of New York/New Jersey plays an important role in the freight community and has a strong impact on the United States' overall domestic and international trade economy. The PANY/NJ accounted for more than 59 percent and 13 percent of the containerized cargo handled by all North Atlantic ports and all U.S. ports, respectively, in 2002.[4] As the East Coast's leading destination for shippers from around the globe in 2002, the PANY/NJ generated over $25 billion in economic activity for the region as a result of the work done by over 228,000 full-time jobs at the port.[5] These statistics, as well as the fact that the total loaded and empty container volumes handled rose 13 percent in 2002, demonstrates not only the important role the PANY/NJ has in the region, but also that there is no obvious sign of major reduction of activity or economic growth at the port.

As growth continues at PANY/NJ, available waterfront property is becoming scarcer, which makes it difficult to expand terminal space to handle the increased truck and other surface traffic in and around the port. In an attempt to try to reduce the lengthy truck queues at terminal gates and improve the overall traffic in and around the port, the PANY/NJ, in collaboration with FHWA, the I-95 Corridor Coalition, the local port community and regional transportation agencies, created and developed a demonstration project that utilizes integrates ITS components. The Freight Information for Real-Time Transport system is the PANY/NJ's port community system designed to consolidate the various existing sources of critical cargo transfer and carrier information, and integrate available, real-time information on truck, ship, or train arrivals.

3.2.2 Funding and Community Support for the FIRST System

The FIRST system will operate until December of 2003 with the PANY/NJ's funding. This is an important fact to note because the system has components that are still in the plans to be integrated, such as the truck appointment system, access to the U.S. Coast Guard's Vessel Traffic Service, and the Customs and Border Protection's (CBP) Automated Manifest System (AMS).

As a part of its decision-making process, PANY/NJ needs to consider the level of use and support the port community has for the system. As of July 2003, there are 362 companies and 536 users registered with FIRST. Not all of these registered companies and users are truckers, but when compared to the number of SEA LINK® companies and truck drivers (2,905 and 48,894 respectively), it is obvious that many truckers who are using the Port of New York/New Jersey are not registered with FIRST.[6] SEA LINK®

[4] Port Authority of NY/NJ Press Release. March 27, 2003. Accessed from www.portnynj.com/pr/prframe.htm on July 27, 2003.

[5] Port Authority of NY/NJ Press Release. March 27, 2003. Accessed from www.portnynj.com/pr/prframe.htm on July 27, 2003.

[6] Statistics from the Port Authority of NY/NJ.

is PANY/NJ's Trucker Identification System, which provides drivers with a single identification card that accesses all terminals at the port. Additionally, some of FIRST's registered users and companies are the data providers. Ocean carriers and terminal operators are the data providers; however, according to FIRST's main Website, there are only two steamship companies and three marine terminals that are providing data directly to the FIRST system. The Port Newark Container Terminal also provides data on behalf of their steamship lines.

FIRST stores all of its information on a central database populated by port community participants (steamship lines, terminals, freight forwarders, brokers, truckers, maritime authorities, etc.) via FTP, as well as direct data input. It operates through a central server, designed and hosted by ASI, and is delivered through the Internet. Registration with FIRST allows the client access to this information at no cost.

3.2.3 Description of the FIRST System

The FIRST system provides a centralized, online application that consolidates existing sources of critical cargo transfer and carrier information to the PANY/NJ. FIRST, which came online in September of 2001, is a Web-based application integrating available, real-time information on truck and ship arrivals. As this system relies on data to be useful for port community members, the shipping lines and other data providers send their data to Americas Systems, Inc, (ASI) via File Transfer Protocol (FTP). To encourage the data providers to provide their data to the FIRST system, FIRST provides the platform for trading partners to move their data through the FIRST system via FTP at no cost, thereby eliminating EDI-related charges.

The primary features of FIRST are centered around seven areas of cargo information and terminal conditions. Those seven areas are: Containers, Bookings, Nominations, Traffic, Port Community, Vessel Activity, and Rail Activity.

The area devoted to Containers allows a general user to perform a container trace as long as they have the container number. A registered user, however, can use the container information page to establish a container watch list, update and edit watch lists, perform an USDA search, and search for chassis using the chassis number. The Bookings portion of the FIRST site allows both general and registered users the ability to search for booking information with a booking number and SCAC code for the appropriate Ocean Carrier. The Nominations portion of the website allows only registered users with special permissions to establish and monitor freight forwarder and customs broker trucker nominations. The FIRST trucker nomination feature provides a unique number that can be used as part of an electronic delivery order. The Traffic section of the site is a location that all users can visit in order to view useful port and terminal traffic updates in addition to viewing Port web cams posted on external sites. The Port Community segment provides an alphabetical list of FIRST members grouped by company type. The Vessel Activity page on the FIRST website allows both registered and non-registered users to view and search vessel activity schedules for the terminals at the PoNY/NJ. The Rail Activity portion of the website is still under construction.

Table 3-1 provides a list of the features of FIRST and whether they are accessible via public access, registered user login, or on a case-by-case basis depending on the type of company or specific need.

Table 3-1. Levels of Access to FIRST System Features

Feature	Public Access	Basic Registered User Access	Specific/ Special Business Access
Container Trace	•	•	•
Booking Inquiry	•	•	•
Port Traffic Alerts	•	•	•
Port Directory (including SEA LINK® Inquiry)	•	•	•
Vessel Activity Inquiry	•	•	•
Waterway Activity	•	•	•
Web Cameras (PNCT, Global, Interport Gates)	•	•	•
Watchlist Menu (monitor, create, edit)		•	•
USDA Search		•	•
Cargo*Mate® Chassis Search		•	•
Truck Nominations			•
Truck Appointment System (FUTURE)			•
U.S. Coast Guard Vessel Traffic Service (FUTURE)			•
Customs Border Patrol Automated Manifest System (FUTURE)			•

Sample FIRST System Web Pages

The primary interface for the FIRST system is via the Internet located at www.firstnynj.com. A sample home page for the FIRST system is displayed in Figure 3-1. Although the public can access the FIRST Website, only registered users with an authorized login and password can gain access to available and specific information in subsequent Web pages. Other sample FIRST system Web pages include information regarding “Nominations,” “Booking Detail,” “Container Information,” and “Watchlists.” These Web pages are authorized for registered users only and are displayed as Figures 3-2, 3-3, 3-4, 3-5, and 3-6, respectively.

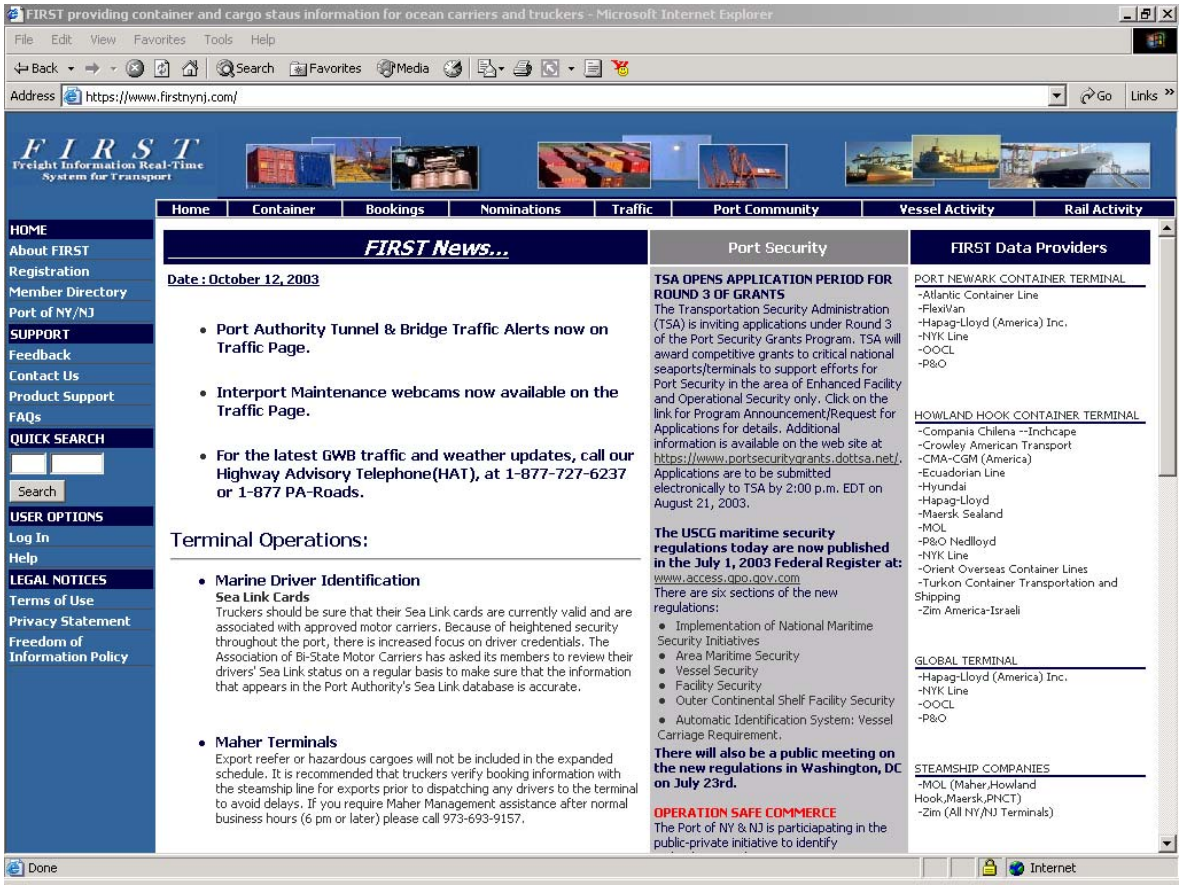


Figure 3-1. FIRST "Home Page" Web Page.

Figure 3-2 depicts the Container Trace feature available on FIRST. This feature is accessible within one click of the home page and does not require the user to login. Users interested in getting details on container status can type in a container number and press ”Submit” and they will get information on the size/type, whether or not it has been nominated for a pick-up by a certain trucker, and the last event that it experienced. eModal has a feature similar to the Container Trace; however, it is only accessible through user login. The Pacific Gateway Portal does not have the capability at this time to access container information through a basic login, though it is possible to acquire general information on steamship lines based on the type of containers they carry through a link to the *Journal of Commerce* without having to login.

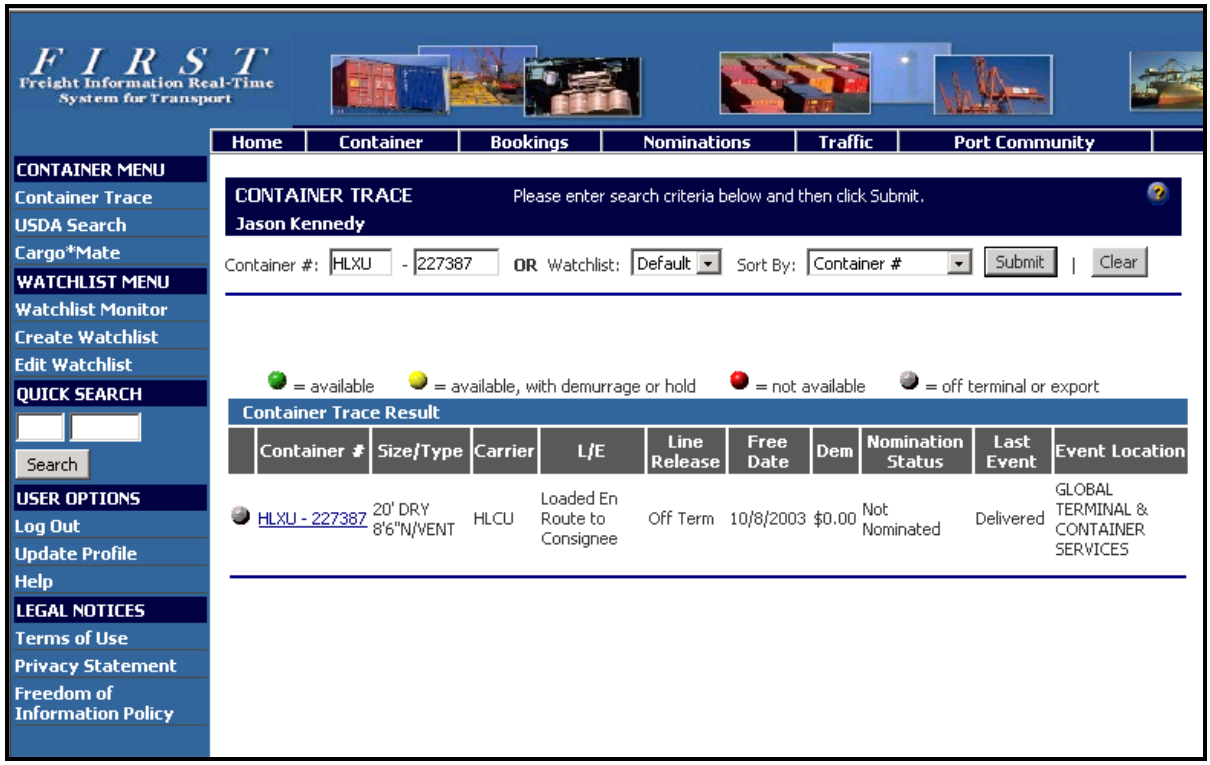


Figure 3-2. FIRST “Container Trace” Web Page.

If a user is registered with the FIRST system, it is possible to perform a chassis trace from the same FIRST interface. The data is supplied to the FIRST system by the Cargo*Mate® system free of charge to registered users. Figure 3-3 depicts the results of a chassis trace performed as a registered user.

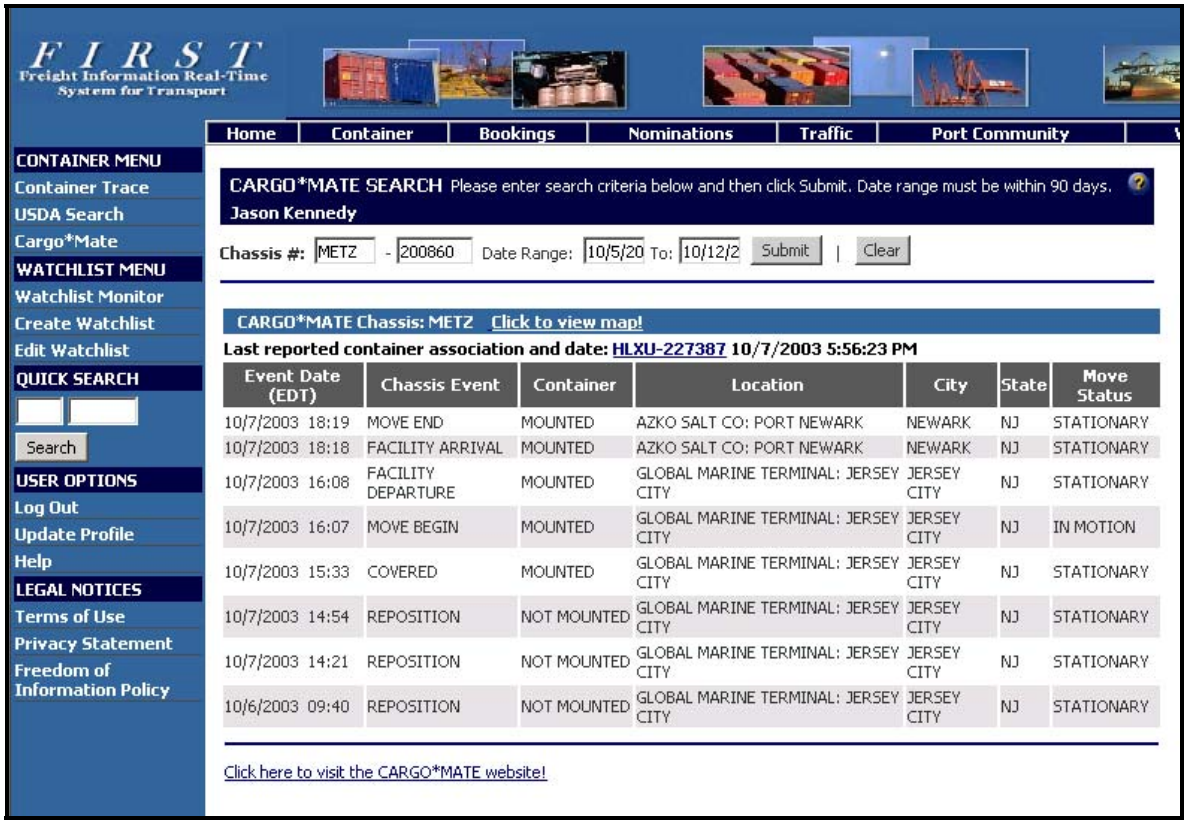


Figure 3-3. Chassis Trace Results

Figure 3-4 depicts the Booking Detail feature available on FIRST. Users can access this feature without logging on to FIRST and are able to obtain information regarding the details of a booking, including the carrier and the vessel the container is booked with. To access this information, a user just needs to have the booking number and the Standard Carrier Alpha Code (SCAC) for the particular ocean carrier that the container is booked on. eModal does have a similar feature accessible via user login. Booking details are available through eModal's Activity Folder feature, which allows members to store lists of their bookings and containers to keep track of the activities. The Pacific Gateway Portal does not have this feature currently available via general login.

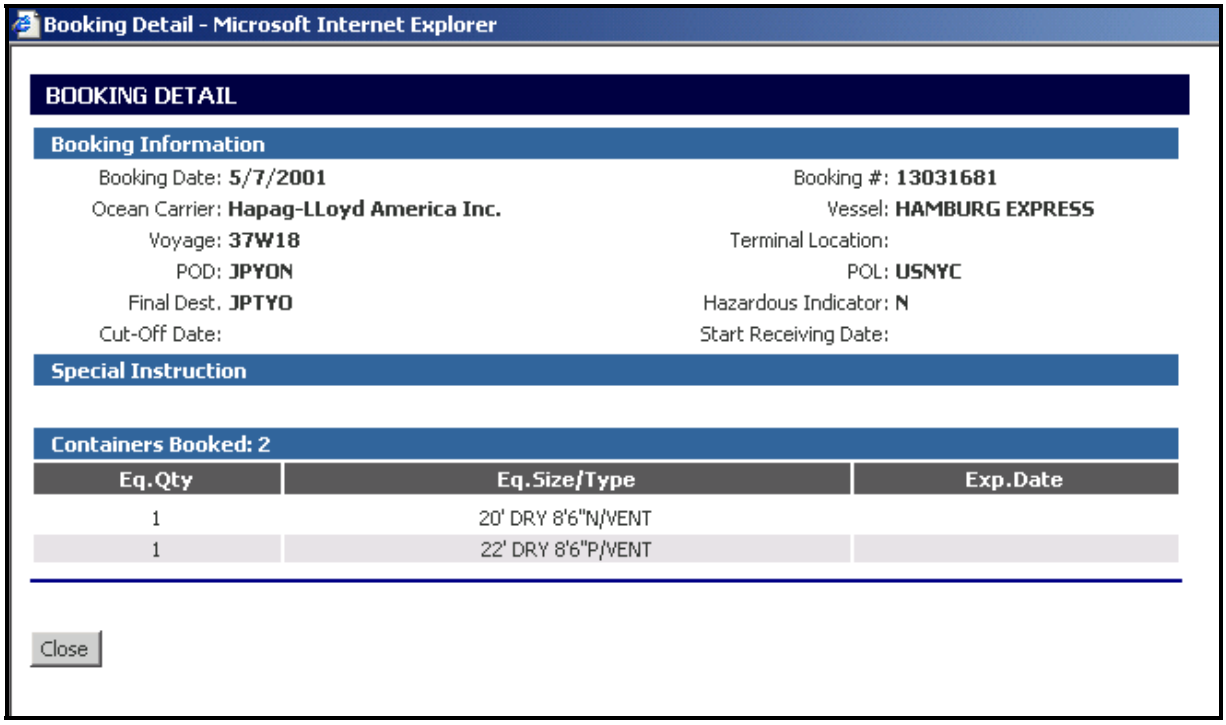
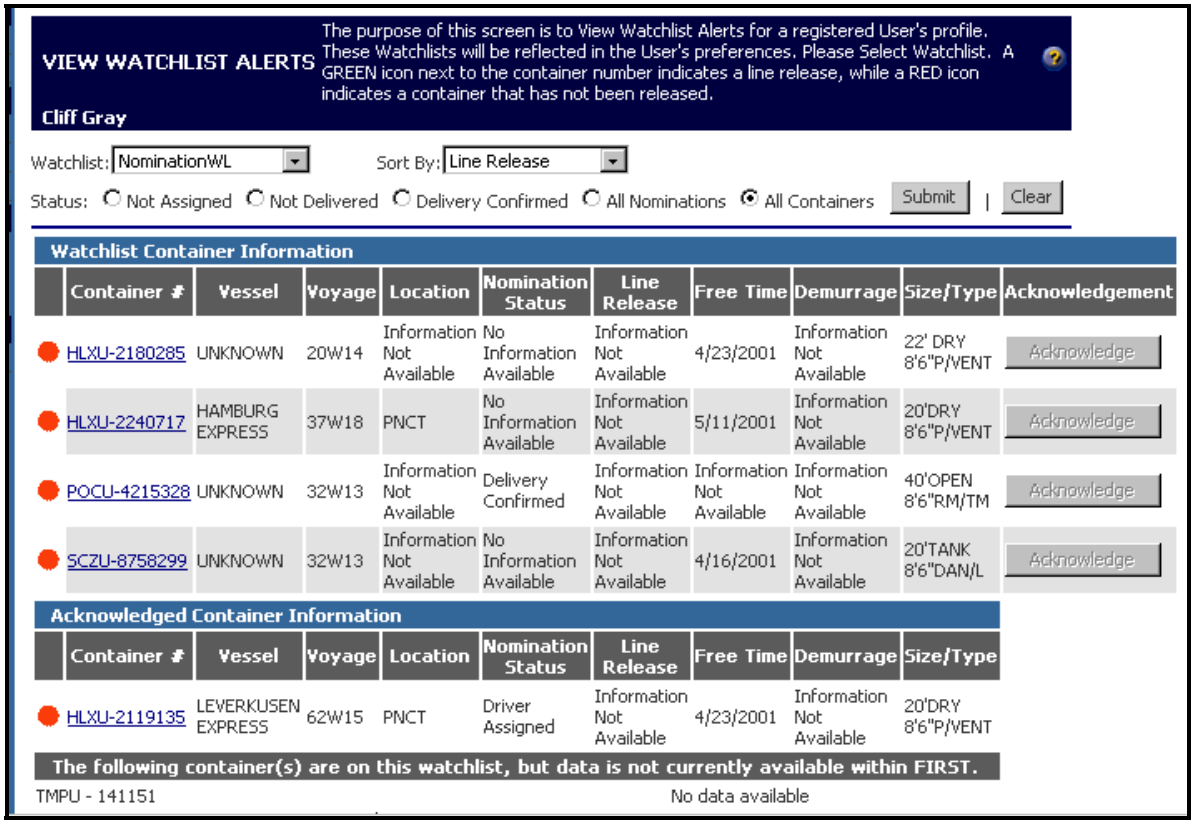


Figure 3-4. FIRST "Booking Detail" Web Page.

igure 3-5 depicts the Watchlist Alert feature on the FIRST Website. This feature is available via user login and takes two clicks to reach the particular page. Once this Web page is accessed, a user can choose between viewing, editing, or creating watchlists of containers that are of interest to them. eModal has a feature similar to this and is accessible through the Activity Folder Web page via secured login to the system. The Pacific Gateway Portal does not have this feature available at this time. Although this feature is useful, it is only of benefit to users if there is data in the columns. This example shows may cells with "No Information Available," which does not help a potential port member trying to access this watchlist.



VIEW WATCHLIST ALERTS

The purpose of this screen is to View Watchlist Alerts for a registered User's profile. These Watchlists will be reflected in the User's preferences. Please Select Watchlist. A GREEN icon next to the container number indicates a line release, while a RED icon indicates a container that has not been released.

Cliff Gray

Watchlist: NominationWL Sort By: Line Release

Status: Not Assigned Not Delivered Delivery Confirmed All Nominations All Containers Submit | Clear

Watchlist Container Information

Container #	Vessel	Voyage	Location	Nomination Status	Line Release	Free Time	Demurrage	Size/Type	Acknowledgement
HLXU-2180285	UNKNOWN	20W14	Information Not Available	No Information Available	Information Not Available	4/23/2001	Information Not Available	22' DRY 8'6"P/VENT	Acknowledge
HLXU-2240717	HAMBURG EXPRESS	37W18	PNCT	No Information Available	Information Not Available	5/11/2001	Information Not Available	20'DRY 8'6"P/VENT	Acknowledge
POCU-4215328	UNKNOWN	32W13	Information Not Available	Delivery Confirmed	Information Not Available	Information Not Available	Information Not Available	40'OPEN 8'6"RM/TM	Acknowledge
SCZU-8758299	UNKNOWN	32W13	Information Not Available	No Information Available	Information Not Available	4/16/2001	Information Not Available	20'TANK 8'6"DAN/L	Acknowledge

Acknowledged Container Information

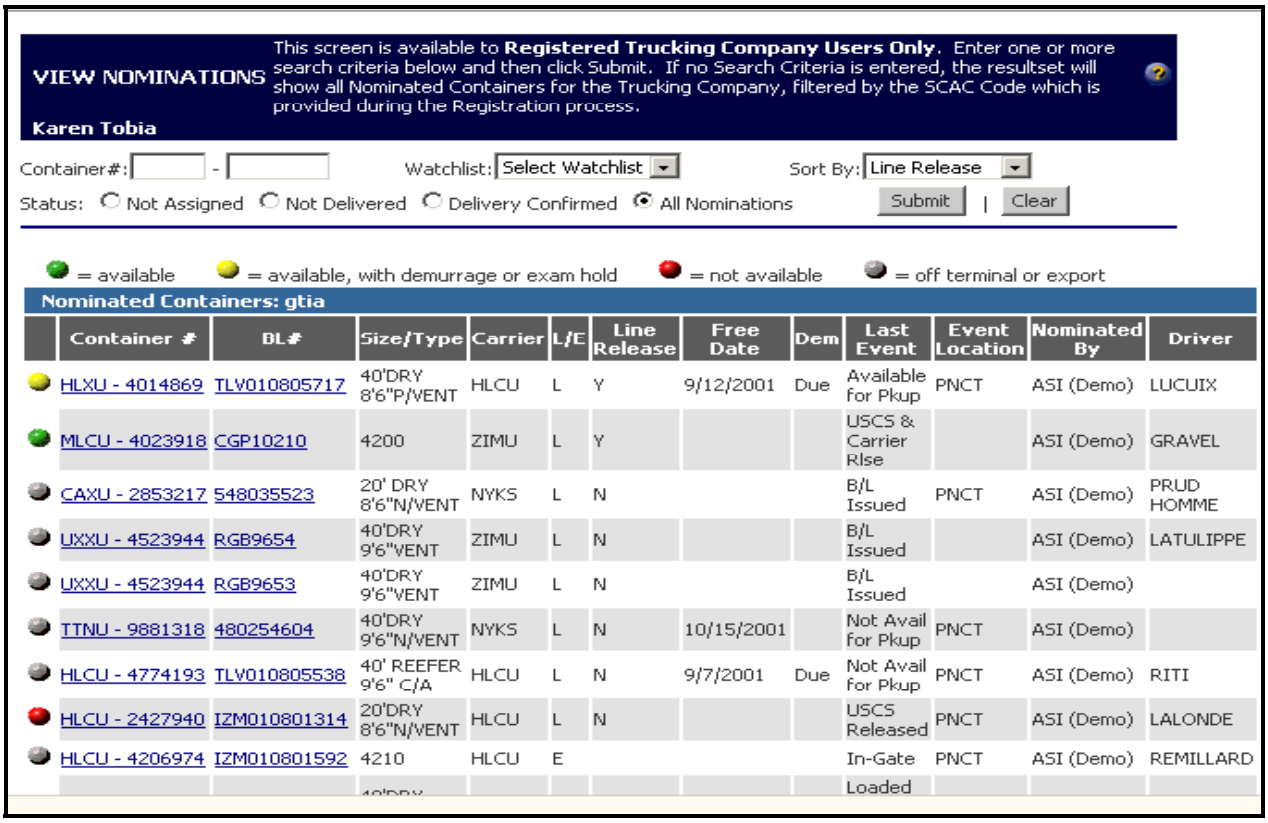
Container #	Vessel	Voyage	Location	Nomination Status	Line Release	Free Time	Demurrage	Size/Type
HLXU-2119135	LEVERKUSEN EXPRESS	62W15	PNCT	Driver Assigned	Information Not Available	4/23/2001	Information Not Available	20'DRY 8'6"P/VENT

The following container(s) are on this watchlist, but data is not currently available within FIRST.

TMPU - 141151 No data available

Figure 3-5. FIRST "View Watchlist Alerts" Web Page.

This feature is available to registered trucking company users only via their secured login. Trucking company users are able to search for container nominations using various search criteria or all the containers for that particular company. An ocean carrier or freight forwarder or broker can assign a truck driver to a particular container so that it speeds up the pick-up process at the terminal. eModal's Activity Folder shows container nominations via the secured login. The Pacific Gateway Portal does not have this feature available with a basic login. Figure 3-6 depicts the View Nominations feature of the FIRST system.



VIEW NOMINATIONS

This screen is available to **Registered Trucking Company Users Only**. Enter one or more search criteria below and then click Submit. If no Search Criteria is entered, the resultset will show all Nominated Containers for the Trucking Company, filtered by the SCAC Code which is provided during the Registration process.

Karen Tobia

Container#: - Watchlist: Select Watchlist Sort By: Line Release

Status: Not Assigned Not Delivered Delivery Confirmed All Nominations Submit | Clear

= available = available, with demurrage or exam hold = not available = off terminal or export

Nominated Containers: gtia

Container #	BL#	Size/Type	Carrier	L/E	Line Release	Free Date	Dem	Last Event	Event Location	Nominated By	Driver
HLXU - 4014869	TLV010805717	40'DRY 8'6"P/VENT	HLCU	L	Y	9/12/2001	Due	Available for Pkup	PNCT	ASI (Demo)	LUCUIX
MLCU - 4023918	CGP10210	4200	ZIMU	L	Y			USCS & Carrier Rlse		ASI (Demo)	GRAVEL
CAXU - 2853217	548035523	20' DRY 8'6"N/VENT	NYKS	L	N			B/L Issued	PNCT	ASI (Demo)	PRUD HOMME
UXXU - 4523944	RGB9654	40'DRY 9'6"VENT	ZIMU	L	N			B/L Issued		ASI (Demo)	LATULIPPE
UXXU - 4523944	RGB9653	40'DRY 9'6"VENT	ZIMU	L	N			B/L Issued		ASI (Demo)	
TTNU - 9881318	480254604	40'DRY 9'6"N/VENT	NYKS	L	N	10/15/2001		Not Avail for Pkup	PNCT	ASI (Demo)	
HLCU - 4774193	TLV010805538	40' REEFER 9'6" C/A	HLCU	L	N	9/7/2001	Due	Not Avail for Pkup	PNCT	ASI (Demo)	RITI
HLCU - 2427940	IZM010801314	20'DRY 8'6"N/VENT	HLCU	L	N			USCS Released	PNCT	ASI (Demo)	LALONDE
HLCU - 4206974	IZM010801592	4210	HLCU	E				In-Gate	PNCT	ASI (Demo)	REMILLARD
								Loaded			

Figure 3-6. Sample "View Nominations" Web Page.

3.2.4 Customer Satisfaction Findings

As part of the analysis of FIRST, the Evaluation team worked with ASI to conduct customer satisfaction surveys. The ASI Product Support Team conducted approximately 40 phone surveys over a 30 day period and received consistent results; the users liked the site but needed to see additional container data. Based on these preliminary findings, the Port Authority Team made the decision to postpone any additional surveys until more trading partners were brought on line who could provide that data that the users were looking for within the site. Unfortunately, that level was never reached and the surveys were not re-administered. The outcome of those limited surveys in conjunction with statements made in in-depth interviews and website based statistics form the basis for this sub-section.

According to conversations with FIRST data users and PANY/NJ officials, the trucking companies and freight forwarders do not believe there is enough data on the site and when there is data available, there may be inaccuracies and time delays associated with the information. As a result, terminal operators have to answer additional inquiries via the Internet from trucking companies about data; and truckers have to visit multiple Websites to find all the information they need. In addition, due to the rapid changes in technology, terminal operators and ocean carriers have started their own Websites for their customers and are less willing to spend time to send data to multiple locations.

The perception of time delays in the data is justified. The delay, estimated to be up to 60 minutes in some instances, is based on the timeliness of ocean carriers and terminal operators providing data to the FIRST system. The inaccuracies perceived in the site stem in part from the delay. Specifically, ocean carriers and terminals may have received updated data several times in the time the FIRST system took to receive and post one set of data. This then creates conflicts in what is posted on terminal websites and what is being shown on the FIRST website.

Additionally, ocean carriers believe that they are not getting anything in return for providing FIRST with their data. Although data transfer occurs at no cost via FTP, the ocean carriers don't feel there is enough incentive to keep providing the data and some have partially or completely stopped sending data to ASI. Recently, the FIRST site launched the ability to search for chassis at no cost via the FIRST website. This feature would definitely be a useful element to Steamship Lines and others leasing chassis from large pools in the PoNY/NJ vicinity (currently, TRAC Lease is successfully charging Steamship Lines for this service). It seems, however, that this feature was launched after opinions were already formed.

While incentive is a large part of the reason for the low Ocean Carrier participation, there is also the complexity associated with proprietary data. In particular, most ocean carriers were unwilling to post data to a platform where proprietary information could be shared. Furthermore, ASI was purchased by Maersk Data – a move that created a conflict of interest in the minds of some carriers.

These perceptions of inaccuracy, delay, and conflict of interest led to a measurable drop-off in visitors to the FIRST website. In the first month after launching the site there were almost 4500 page views of the FIRST home page, over 1000 visits to the Container tracking portions of the website, and almost 1500 visits to the vessel schedule portion of the site. By March 2003, less than 1000 views of the homepage were made in that month, just over 100 views of the Container tracking page, and slightly less than 500 views of the vessel schedule site. The significant drop off in numbers is a reflection of user perceptions of the FIRST site and its ability to benefit port-based operations in the New York/New Jersey region.

3.3 PACIFIC GATEWAY PORTAL (POV)

This section is designed to provide a review of the operating environment, financial conditions, and technical capabilities of the PGP website. Additionally, this section concludes with a subsection summarizing the key features of the PGP that have the potential of benefiting the FIRST system.

3.3.1 Background on Port of Vancouver and Vancouver Port Authority

The Port of Vancouver (PoV), located near the United States and Canadian border in the province of British Columbia, Canada, is a key port along the West Coast of North America. As of 2002, the PoV ranks number 2 in total foreign exports in all of North America, and ranks number 2 in total cargo volume on the entire West Coast.[7]

[7] Port of Vancouver Website, www.portvancouver.com, accessed July 2003.

Additionally, the PoV had the highest total cargo handled and container throughput in 2002 in Canada.

The Vancouver Port Authority (VPA), which controls 14,826 acres of water and 1,137 acres of land, is the agency responsible for business and operational decisions at the PoV, in addition to the land owned by industry, provinces, and municipalities, which are a part of the 233 kilometers of shoreline that the PoV covers. Although not a large container port, the PoV does handle an extensive amount of bulk cargo. Over 76 percent of the 62.8 million tons of cargo handled in 2002 were of the bulk variety such as coal, grain, sulphur, and petro-chemicals.[8] To demonstrate the amount of commitment VPA has to the bulk cargo trade, there are 17 out of a total 25 terminals that process the millions of tons of bulk Canadian exports that are headed to destinations such as Asia, Europe, and Latin/South America.

3.3.2 Pacific Gateway Portal Funding and Community Support

The PGP is a non-profit organization and aims to off-set operational costs with the fees collected from paying customers. At the same time, the PGP does not want to slow down its progress while ongoing revenue sources are established. Currently, the PGP receives bridge financing by private and government stakeholders while the needed revenue sources are found. Additional support for the Web portal is provided by members through substantial "in-kind" assistance. Current members of the port community allow the PGP access to the existing relevant system assets they own. This includes domain expertise, source code, data, and intellectual property. Specific examples include the existing PGP hardware and network infrastructure, EDI partnerships with shipping lines, and the terminal systems themselves.

Revenue sources that are in place now or are being pursued by PGP include advertising fees, annual membership fees for defined services, and transaction fees for defined services. The PGP does not charge port community members for data/information that it receives for free, unless approved by the owner of the data/information. Additionally, the PGP only charges a price that reflects the cost of obtaining the same data somewhere else. Members that have provided in-kind contributions through source data or other resources are given free data in return and/or a discount on PGP services they use.[9]

3.3.3 The Pacific Gateway Portal System

The Port of Vancouver's Pacific Gateway Portal (PGP) is a Web-based port community site that serves stakeholders and customers in the Vancouver area and elsewhere who have business in the port. The initial strategic planning of the concept of the PGP began as early as 1999, by some members of the PoV community. In 2000, the first community Web application for Dangerous Goods came online. Following further development, the main Website that exists today was online in January of 2002. Vessel information such as Estimated Time of Arrival (ETA) and Estimated Time of Departure (ETD) made its debut on the PGP first. Following these marine features, some of the landside features such as Web-cameras for real-time video feed from the Port were next to be included on PGP. Currently, many of the new applications and features that

[8] Port of Vancouver Website, www.portvancouver.com, accessed July 2003.
[9] Telephone interview with Director of IT at the Port of Vancouver, July 21, 2003.

will be included on the PGP are security-related due to an increased concern over freight and port security.

The PGP allows all 500+ registered users to access basic features contained on the public site, as well as limited selection of additional features. Further applications and features are available to those who have special privileges and pay for access to applications such as the truck appointment system and the dangerous goods features. Table 3-2 shows the types of features available to the public, those available with access via a basic login, and a few examples of the many other applications and features that are available to those who require and pay for access to through the PGP.

Table 3-2. Levels of Access to the Pacific Gateway Portal Features

Feature	Public Access	Basic Registered User Access	Paid Access/ Specific Business Access
News	●	●	●
Web Cams	●	●	●
Service Directory	●	●	●
Soundings	●	●	●
Dangerous Goods Demo Site	●	●	●
JOC Cargo Arrival and Departure Search	●	●	●
Vessel Information		●	●
Tide Report		●	●
Statistics		●	●
Media		●	●
Events		●	●
Survey		●	●
Harbour Operations		●	●
Safety and Pollution Prevention		●	●
VPA Anchorages		●	●
Ships in Harbour		●	●
Dangerous Goods Application			●
Truck Appointment System			●

Sample Pacific Gateway Portal System Web Pages

The primary interface for the Pacific Gateway Portal system is via the Internet located at www.pacificgatewayportal.com. A sample home page for the Pacific Gateway Portal system is displayed in Figure 3-7. Although the public can access limited areas of the PGP Website, only registered users with an authorized login and password can gain access to available and specific information via subsequent Web pages. Other sample PGP system Web pages include information regarding "Vessel Activity," "Webcams," and "Safety and Pollution Prevention." These Web pages are authorized for registered users only and are displayed as Figures 3-8, 3-9, and 3-10, respectively.

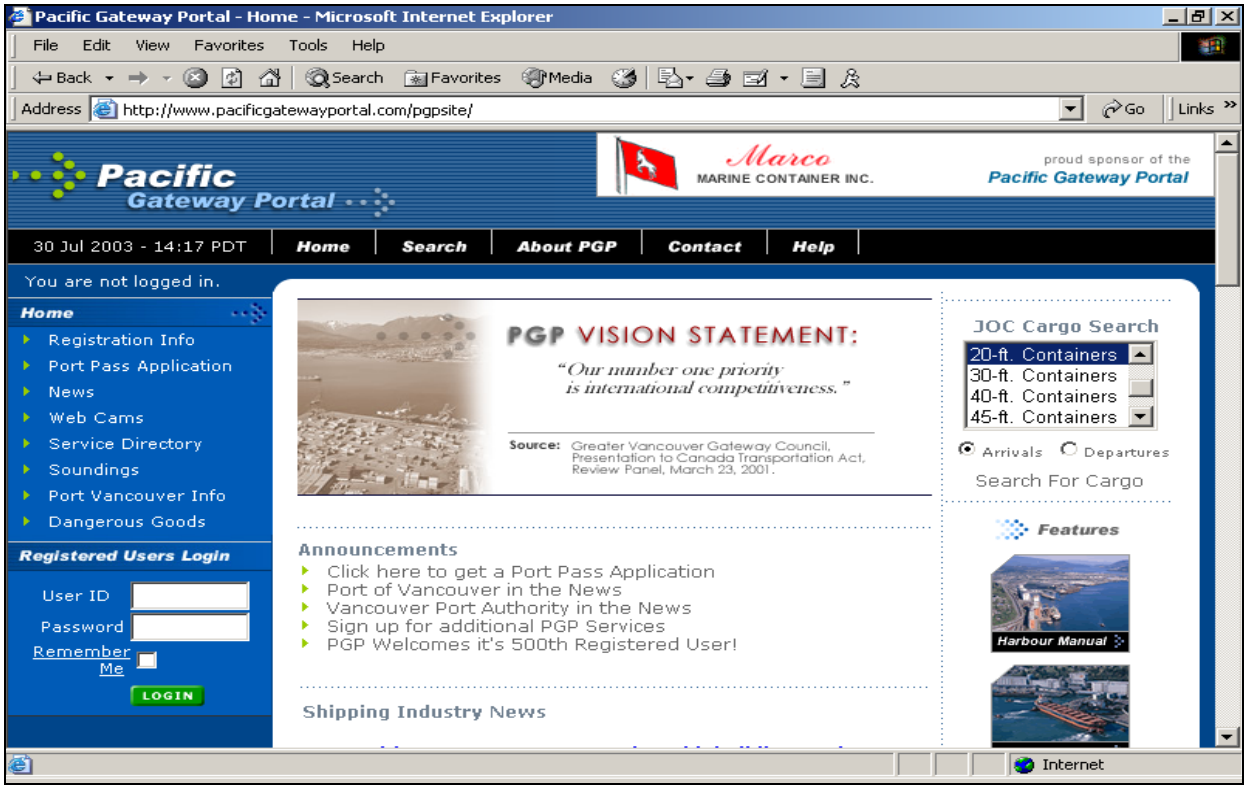


Figure 3-7. "Home Page" Web Page.

Figure 3-8 depicts the Vessel Activity feature on the Pacific Gateway Portal. This feature is accessible through the secure login and provides information on the status of vessels in the port, as well as expected arrivals of ships calling the Port of Vancouver. Users can find out when a particular ship is arriving, departing, and its current location. Users can also sign up to receive emails when an arrival or departure occurs. FIRST has a similar feature, although it does not have as many options and there is no email alert for a departure or arrival at the Port of New York/New Jersey. eModal does not have a feature like this via the basic login.

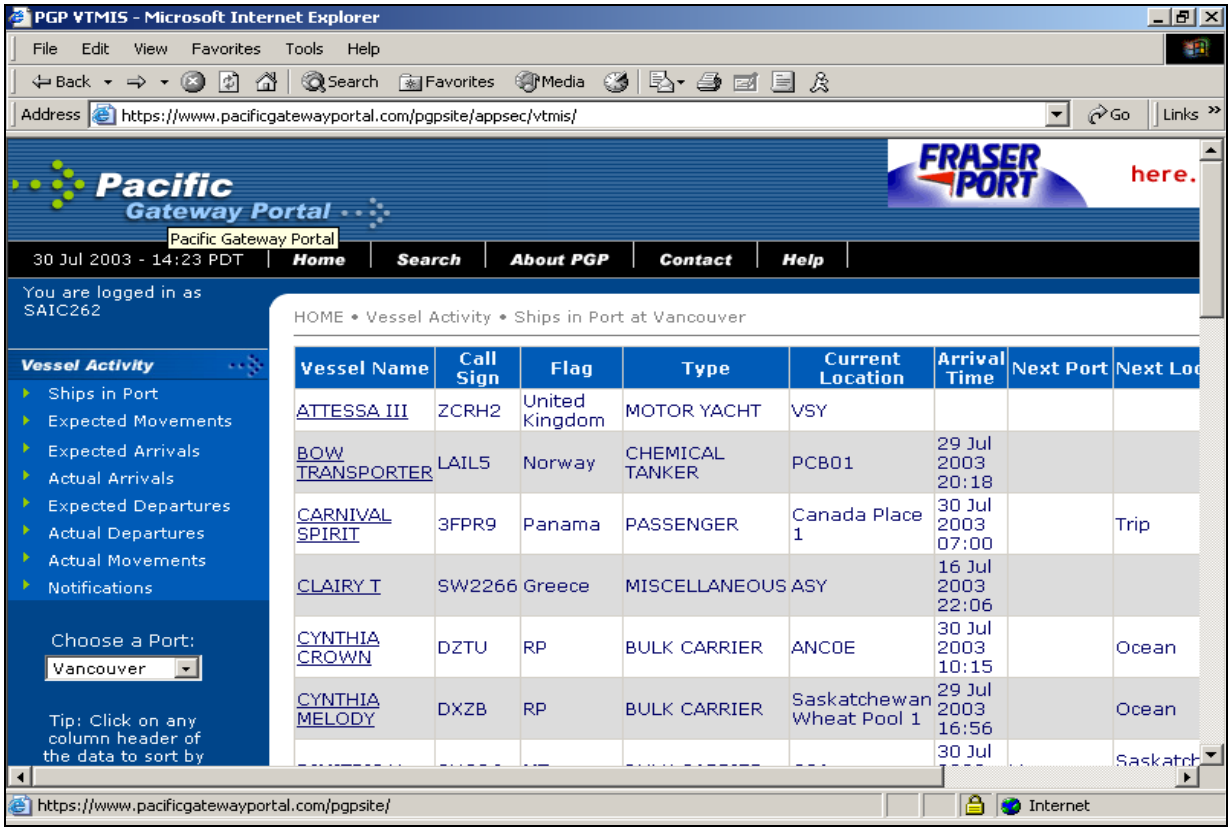


Figure 3-8. PGP "Vessel Activity" Web Page.

Figure 3-9 depicts the Webcam feature on the Pacific Gateway Portal. Users can access this feature from the PGP home page without having to log onto the system. This feature allows users to see live video feeds from cameras around the Port of Vancouver. Users can determine if there are long lines at certain terminals or if an incident has occurred on one of the roads leading to a certain portion of the port. The FIRST system has a few Webcams that are accessible without logging into the Website and offer users live pictures of conditions at three terminal gates. eModal at this time does not offer Webcams to members via the Website.

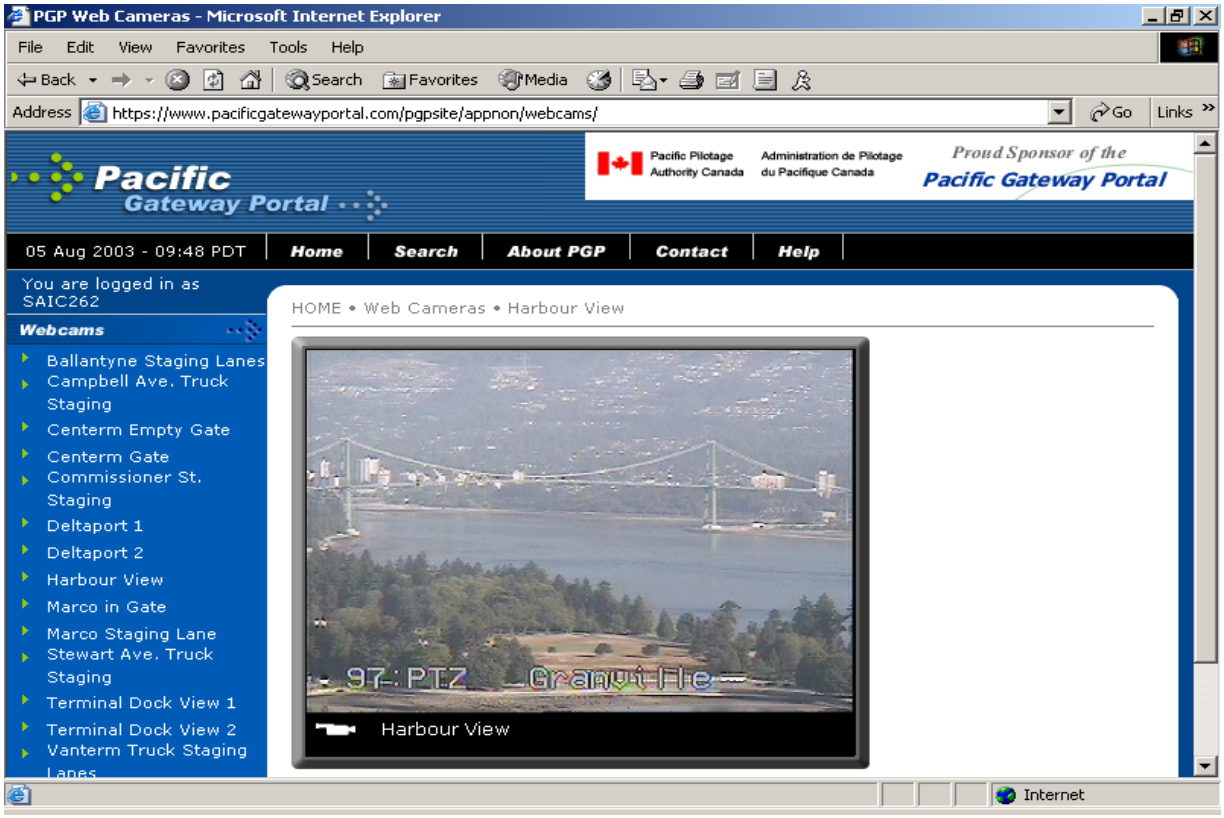


Figure 3-9. "Webcams" Web Page.

Figure 3-10 depicts the Safety and Pollution Prevention Web page on the Pacific Gateway Portal. Users can access this feature by logging into to PGP and are able to view requested vessel inspections as well as submit new service requests to the Port of Vancouver. FIRST and eModal do not have this feature accessible via basic login at this time.

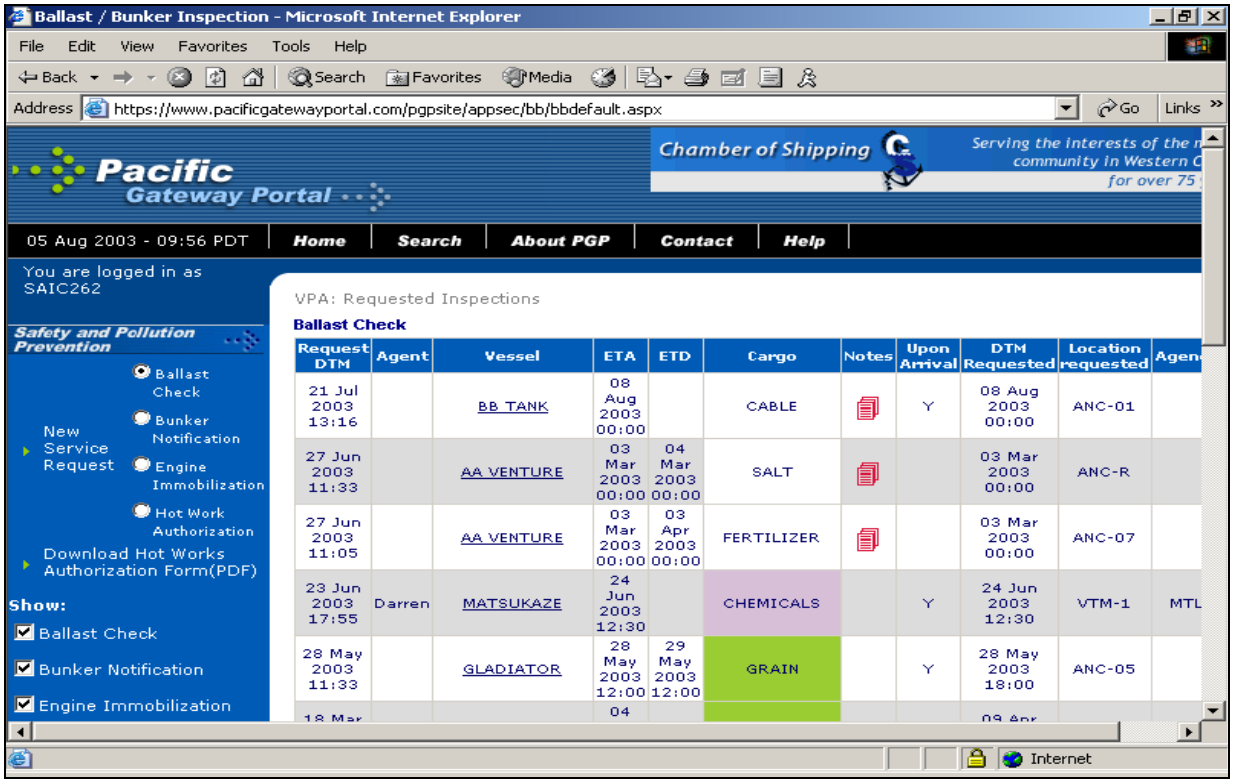


Figure 3-10. "Safety and Pollution Prevention" Web Page.

3.3.4 Summary of Pacific Gateway Portal's Success

According to officials with the Port of Vancouver, the participation of the stakeholder group and the freight and business community at-large in the creation and development of the system has led to the success of the Pacific Gateway Portal. Additionally, the truck appointment system, which has been in place at the port for several years, has helped reduce pollution and increase operation efficiency.

Truck Appointment System

Due to the explicit attribution of the PGP's success to the truck appointment capabilities, this brief subsection is dedicated to a more detailed review of that feature. The truck appointment system at the Port of Vancouver has been in place since March 2001 and is known as the Container Terminal Scheduling System (CTS). It is fully operational at three terminals within the port – Centerm, Vanterm, and Deltaport. In a joint partnership with the Vancouver Port Authority (VPA), Terminal Systems Inc. (TSI) developed CTS as a truck reservation system designed to provide a given number of time slots during gate hours when a carrier who holds a valid permit with the Vancouver Port Authority can reserve and be assured of being handled.

A reservation electronically through the terminal's web page is made against a time slot. Each time slot has a dedicated number of reservable transactions. These transactions are determined by the terminals and reflect the capacity that can be catered for. Dependent on the number of reservations a specified number of dedicated lanes are available for processing the trucks with reserved appointments.

Reservations are given in hourly time slots. All trucks with reservations must be in line at least 15 minutes prior to the expiration of their reserved time slot. Should they arrive later, they must use the non-reservation lines or reschedule in the case of import containers – as it is a requirement that all import containers utilize the reservation system. If, on the other hand, a truck is early to its appointment it is served as soon as all other reservations are served or at the time of its reservation – whichever comes first.

While the system provides great benefits if used properly, there are penalties if the system is abused. Carriers that over-book reservations or fail to show for their assigned time period or attempt to use the reservation line without a bonafide reservation, risk restriction or loss of access to the reservation system. Companies that persistently abuse the system risk having their licenses revoked.

There is no cost for using the appointment system and the hardware requirements are minimal. Any licensed truck driver expected to call at the Port of Vancouver may access the system with any computer having a Pentium processor of 200mhz or greater, a windows 95, 98, 2000, NT 4.0, or XP operating system, 64 MB of RAM, and at least a 56k modem (although cable internet is preferred).

3.4 EMODAL, INC.

This section is designed to provide a review of the operating environment, financial conditions, and technical capabilities eModal, Inc. Additionally, this section concludes with a subsection summarizing the key elements that set eModal apart from both the PGP and FIRST systems.

3.4.1 Background on eModal

In 1999, eModal, Inc. began its operations out of Irvine, California. By February 2000, eModal.com, the company's Port Community Website came online to the public. eModal.com is a private company that now has the largest membership of all Port Community Websites in the United States. The company has signed up 14 ports in the United States, with 36 marine terminals providing data to the system.[10] There are over 6,400 registered companies signed up with eModal.com representing all areas of the freight and port community. Registered members include:

- Brokers
- Consignees

[10] Telephone interview with eModal. July 2, 2003.

- Distribution Centers
- Freight Forwarders
- Marine Terminals
- Port Authorities
- Rail Terminals
- Shippers
- Steamship Lines
- Stevedore Companies
- Trucking/Drayage Companies

Designed to improve efficiency and decrease congestion at container terminals, eModal is a single point of contact for multiple container terminals. eModal works with the marine terminals to consolidate their information into the eModal system and make it available to the trucking community, as well as for developing future business applications to serve all aspects of the transportation chain. As an information and data service provider to the transportation industry, eModal acts as a data warehouse to the port and freight communities to provide "one-stop shopping" and grouping of data, through the use of its Website, www.emodal.com.

3.4.2 eModal Portal Funding and Community Support

As a private, for-profit company, eModal charges a fee for most of its features available to its members depending on the level of service desired. Table 3-3 depicts the types of features available on eModal and the associated fee description.

Table 3-3. List of eModal Services and Associated Fee Types

Service	Fee Type
Trucker Check	Terminal Monthly Fee
EDO	Broker Transactional Fee
Depot Manager	Transactional
Scheduler	Terminal Monthly fee
On-Line Fee Payment	Transactional Per Cent
Notifier	Transactional Fee
eModal Pro	Monthly Fee

There are a few features on eModal that are accessible for free through a secured login that is obtained at registration. Features such as weather conditions at terminals/ports as well as the online membership directory are two examples accessible for free to registered users. Data provided to eModal from the ocean carriers and marine terminals are transmitted mostly via FTP to keep transmission costs to a minimum. There are no advertisement fees collected because eModal provides free advertising to all registered users by including members in the online directory.

3.4.3 eModal.com Port Community System

eModal.com (eModal) came online in 2000, and has become a single point of contact for multiple container terminals. Currently, eModal offers registered users some basic information for free. Features such as container information, marine terminal weather conditions, and members' contact information are available to all registered users at no charge. For members that desire access to premium features, eModal will provide enhanced services for a fee.

One of the capabilities highlighted with registering on eModal is gaining access to an Activity Folder, which helps the registered company track containers or bookings, sort container information in a customized fashion, keep container information in one place, and receive instant updates. In addition, eModal allows for access to a Scheduler, which gives the member admission to valuable marine and trucking scheduling information. The marine terminals and trucking companies work on a specific schedule and sometimes do not communicate with outside parties. However, as a registered user of eModal, access to this information is guaranteed.

Another feature, the Ticker Tape, is an asset that may be utilized to gain information on the marine and trucking industry. With eModal's Ticker Tape, news related to the port and freight community is easily accessible once a member logs onto the site. If the member has paid for access, the Ticker Tape scrolls across the top of the eModal Website for instant news and information on the freight industry.

Sample eModal Port Community System Web Pages

eModal system is accessed via the Internet at www.emodal.com. A sample home page for the eModal system is displayed in Figure 3-11. The public can access limited areas of the eModal Website. However, only registered users can access features such as "Folder Manager" and "eDO™". These Web pages are displayed as Figures 3-12 and 3-13, respectively.

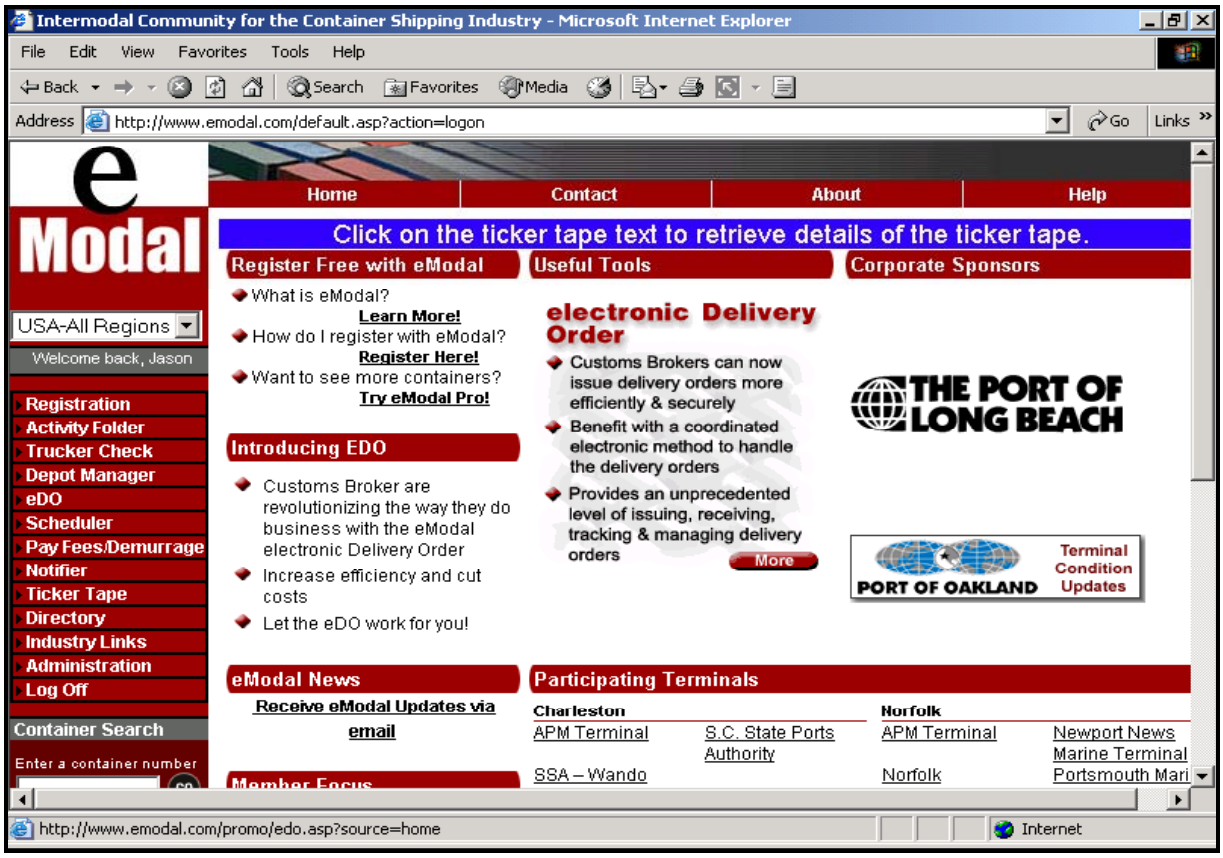


Figure 3-11. eModal Home Page.

Figure 3-12 depicts the Folder Manager feature available on eModal's Website. The Folder Manager feature is accessible through regular login and is free to registered users by clicking on the Activity Folders link on eModal's home page. Users are able to create, edit, customize, and view Activity Folders that hold information on containers as well booking number. The Pacific Gateway Portal does not have a feature similar to this one that is accessible via a regular login. As mentioned in the section regarding FIRST's Web pages, there is a feature similar to the Activity Folder available through FIRST.

Figure 3-12. eModal "Folder Manager" Web Page.

Figure 3-13 depicts the electronic delivery order system available through eModal. This feature, which is accessible through a fee-based subscription, allows user to issue, receive, track and manage delivery orders electronically. The eModal electronic deliver order (eDO™) system is not available on other port community systems. FIRST and the PGP do not have features similar to this available at this time.

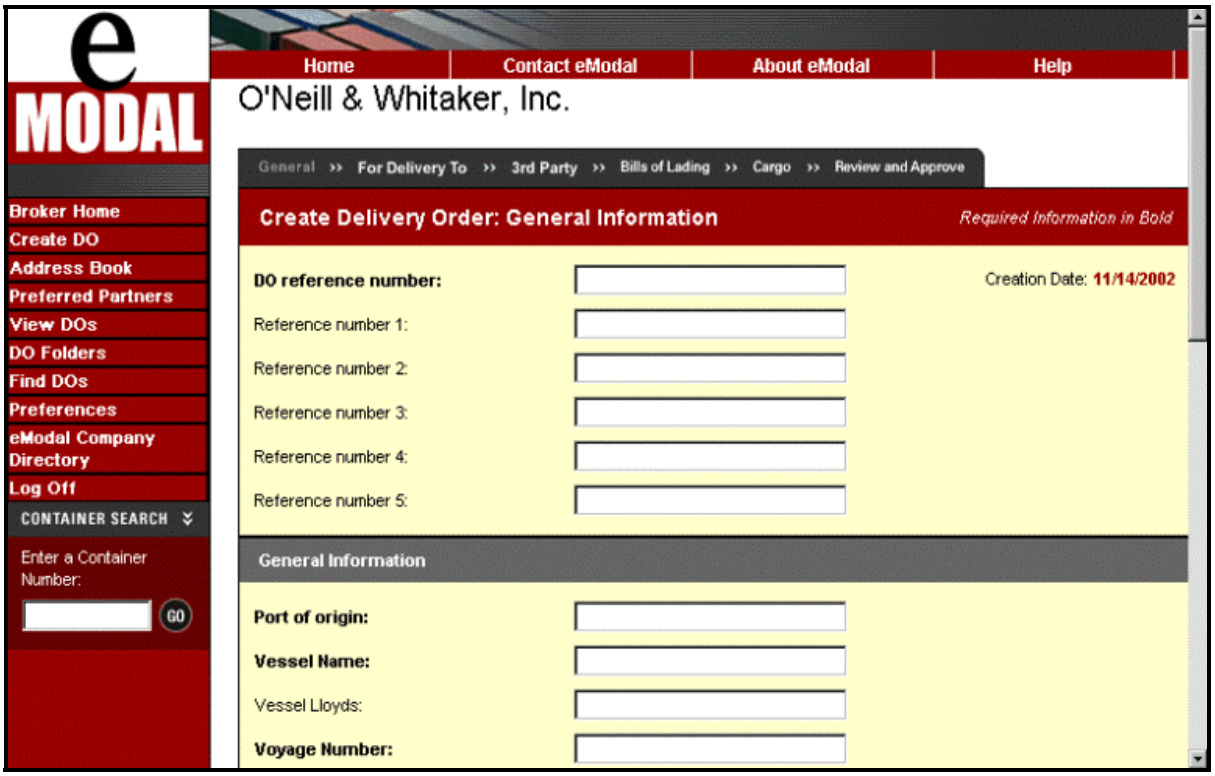


Figure 3-13. eModal "eDO™" Web Page.

3.4.4 Summary of eModal's Success

According to eModal, the success of their port community system has been a result of careful business planning and consideration for the customer. Efficiency-enhancing tools and customer satisfaction in conjunction with an user-accepted fee structure, has helped eModal reach out to ports and other freight community members on the West Coast and other portions of the United States and North America.

3.5 SUMMARY OF FINDINGS

The three port community systems discussed in this document have different operating philosophies and procedures but have some similar features and offerings available to their respective port community members. Table 3-4 provides a comparison of the three system's features.

FIRST did not have any major technological issues or problems. However, the FIRST system suffers from a significant lack of commitment from industry. According to conversations with FIRST data users and PANY/NJ officials, the trucking companies and freight forwarders do not believe there is enough data on the site and when there

is data available, there may be inaccuracies and time delays associated with the information. Additionally, ocean carriers believe that they are not getting anything in return for providing FIRST with their data. Although data is transmitted at no cost via FTP, the ocean carriers don't feel there is enough incentive to keep providing the data and some have partially or completely stopped sending data to ASI.

The findings of this section of the report are primarily based around the hypotheses presented at the outset of section 3. The following bullets present some of the key findings from each area of study.

- **Hypothesis 1:** The FIRST system was not used by port community members at the level expected because of data availability, data accuracy, and data timeliness issues.

Based on the following findings, this hypothesis was confirmed.

  - Participants noted the major concerns with FIRST are that it has limited data and when the data is available, it is not always accurate and timely.
  - Terminal operators have to answer additional inquiries via the Internet from trucking companies about data, which causes unnecessary work.
  - Truckers have to visit multiple Websites to find all the information they need – which also causes additional effort that they are not likely to do on a regular basis.
  - Additionally, since FIRST was developed, terminal operators and ocean carriers have begun to start their own Websites for their customers and are not going to send data to an outside source if they can do it in house.

- **Hypothesis 2:** The Pacific Gateway Portal and the eModal port community systems are successful because of community member support and financial stability.

For the most part this hypothesis was confirmed. Although as noted by the following bullets this community support and financial stability was gained for reasons related to consistent data and additional offerings – such as, a truck appointment system.

  - When comparing the three port community systems, access privileges and any costs associated with them are important to keep in mind. The PGP was easy to navigate. However, there are not a lot of features available to a user with basic access privileges. FIRST does have the broadest offerings of the three port community systems that are accessible by the public or basic login; however, eModal does have many useful features that are accessible for a premium.
  - PGP's success is the result of careful planning up front by the stakeholder group at the Port of Vancouver and surrounding business community. The truck appointment system, firmly in place at the Port of

Vancouver, has helped reduce congestion and wait times at terminal gates at the port.

- eModal, is succeeding at many ports around the country, and is continuing to grow by offering features that are truly beneficial to the customer using a fee payment structure by registered users. eModal provides efficiency-enhancing tools, such as the Folder Manager, eDO™, and Scheduler features that address participants' needs.

To shed more light on the differences between the various systems, Table 3-4 on the succeeding page compares system offerings across the three information technology based port community sites.

Based on this review of the FIRST system it is apparent that there are a myriad of reasons, both external and internal, for the low usage of the FIRST system. External reasons include the timing of the site launch and the poor economy; internal reasons include poor data quality and the lack of certain features such as an appointment system (the only feature offered by both the case study systems, but not the FIRST system). While there is little that can be done regarding the external reasons for low usage, based on the case studies it appears that remedying the internal factors would lead to a viable port community system. A viable system would promote a larger use rbase and possibly render the original rejected hypotheses positive. To verify this conjecture, a simulation of a terminal at PoNY/NJ was generated to model the effect of a truck appointment system. The following section, Section 4.0, presents this model and the corresponding results

Table 3-4. Features of Three Comparable Port Community Systems

Feature	PANY/NJ's FIRST System	Port of Vancouver's Pacific Gateway Portal	eModal
Non-Proprietary System	●	●	
Free Usage/Data Transfer	●	●[11]	●[12]
Truck Appointment System		●[13]	●
Real-Time Video Feeds via Web Cameras	●	●	
Direct Access to Cargo*Mate® Chassis Data	●		
Real-Time Traffic Information Around Port	●		
Pay Demurrage/Other Fees			●
Electronic Delivery Order (eDO™) System			●
Depot Manager™ – depot inventory and management tool to monitor and track their gate and yard activity.			●
Real-time cargo information – includes Customs status, hazardous cargo information, vessel or carrier identification, services required, and demurrage, with date in/date completed time-stamp capabilities.	●	●	●
Real-time booking status – includes types of containers booked, number of containers by type, and information on containers delivered full and empty.	●	●	
Container tracking – provides container history including all movement for the past 90 days, gate transactions, inspections, trucker SCAC, weights, destination, and proof of delivery, with a date and timestamp for relevant transactions.	●	●	●
Container monitoring – alerts users when containers are available for pick-up.	●		●
Trucker nomination – provides individual lists of containers for nominated truck drivers.	●		●
Driver assignment – transmits and confirms with terminal operator the container number, bill of lading, and SCAC code of authorized trucker.	●		●

[11] Fees charged for certain features.
[12] Ibid.
[13] Existing PoV Appointment System being integrated into Pacific Gateway Portal.

4. TERMINAL OPERATIONS MODEL: APPOINTMENT SYSTEM POTENTIAL AND AIR QUALITY BENEFITS

4.1 INTRODUCTION

Based on the review of comparable systems, it is apparent that the only element offered by both rival systems, but lacking in the FIRST system is a truck appointment system. Hence, the primary focus of this section is the modeling of a potential appointment system offering of the FIRST system. The appointment mechanism is aimed at trucks entering the terminals of the Ports of New York and New Jersey. Additionally the benefits of such a system are modeled – not only in terms of cost and timesavings, but also from the perspective of air quality.

The evaluation approach described in this section was to develop an analytical demand model to predict the potential of a FIRST-supported appointment system to relieve port congestion. The model was developed using observed queuing data and terminal gate records, measured in June 2002 at the Howland Hook terminal, and the application of widely accepted principles in transportation based queuing theory. The output of the model (vehicle time spent in queue and terminal processes) enabled a study of benefits at varying levels of appointment system use.

The correlation between the hypotheses presented in Section 2 of this document and the analysis performed and described in depth here is made explicit in the bulleted list below.

- **Hypothesis 1:** The daily operations of a terminal within the Port of New York and New Jersey may be modeled using basic transportation queuing theory principles to gain insight into expected levels of benefits associated with use of an appointment system.

  Analysis: Howland Hook Terminal on Staten Island was chosen as the terminal for modeling. A data collection effort aimed at obtaining queue related data was performed. The results of the field collected data and the gate records of Howland Hook Terminal allowed for a comprehensive analysis of daily terminal operations for one full week in June 2002. Based on the consistency of terminal operations from day to day and from year to year (based on a preliminary review of June 2003 data) it was determined that the operations of the terminal were sufficiently regular to warrant use of queuing theory techniques to model terminal operations.

- **Hypothesis 2:** An appointment system, if used by terminals at the Port of New York and New Jersey, has the potential to reduce time in queue and at the terminal translating into improved air quality and a reduction in air quality related health costs.

  Analysis: Using the model of terminal operations, five different scenarios were developed to test the time in terminal results associated with each level of appointment system use. Based on the average total time spent in the terminal by all vehicles as derived from the terminal model, a difference in the scenarios with substantial appointment system use and without any system use (baseline) will indicate the level of time reduction. Based on this time differential and tables of

hourly truck emissions in concert with associated health cost benefits will allow for the quantification of time and air quality savings.

This section is organized as follows:

- 4.2 Terminal Operations
- 4.3 Description of Data and Preliminary Results
- 4.4 Development of The Model
- 4.5 Description of Appointment System and Results at Varying Levels of Use
- 4.6 Potential Air Quality Benefits
- 4.7 Summary of Findings

The terminal entry time benefits of an appointment system deployment were estimated using the developed model. The model was developed to isolate the following three primary components of terminal operations travel time benefits: the time in queue in approaching the gate; gate processing time (including time spent handling a trouble ticket); and in terminal time. The model was designed such that benefits of an appointment system deployment and a dedicated appointment lane can be assessed at varying levels of system acceptance.

Daily benefits were estimated through application of the model, factored to annual benefits, and converted to a monetary value using assumed values of time and an air quality value using assumed values of idling emissions. Additionally, the sensitivity of the commercial vehicle operations benefits to realistic system use scenarios was evaluated, thus presenting a range of estimated benefits dependent on system success.

4.2 TERMINAL OPERATIONS

For the purpose of this evaluation, one terminal within the jurisdiction of the Port Authority of New York and New Jersey was chosen for study. The terminal chosen was that leased by Howland Hook Container Terminal, Inc. Howland Hook is located near the Goethals Bridge in Staten Island. The terminal occupies a 187-acre tract on upland area. It is readily accessible to major truck routes, and has the capability for on-dock rail service connecting to the North American intermodal rail network. The terminal was built by American Export Lines and purchased by the City of New York (the City) for $47.5 million in 1973. The Port Authority of New York and New Jersey leased Howland Hook from the City in April 1985. In 1995, the terminal was leased on a long-term basis to Howland Hook Container Terminal, Inc., which reactivated the terminal for container operations in September 1996.The facility consists of 2,500 linear feet (760 meters) of berth, capable of handling three vessels simultaneously; 147 acres of open area for container storage; seven container cranes; 200,000 square feet of shedded area for stuffing and stripping and for dry reefer and hazardous cargoes. The terminal has the capacity to handle 425,000 containers annually.

A survey of terminal operations at Howland Hook Terminal was conducted in June 2002. The primary purposes of the survey was to acquire an understanding of operating conditions, and to gather data required to perform a substantial review of metrics from before and after the deployment of the FIRST system. Unfortunately, the insufficient use of the FIRST system has negated both the need and the opportunity for the after deployment data collection. Thus, the understanding of operations and data gained from the survey has instead been used to build and calibrate the model. This section presents the salient features of port terminal truck entry operations and summarizes relevant survey results.

The existing operations for entry to the Howland Hook Terminal are illustrated in Figure 4-1 on the next page. Additionally, Figure 4-2 shows a satellite overview of the terminal gate. Unfortunately, however, this image taken in 1995 shows the facilities prior to reconstruction. The Howland Hook Terminal was remodeled and open for container services in1996. The reconstruction did not significantly change the gate configuration.

Facility Traffic Flow

Upon entering the terminal area, bobtails are separated from the main queue for tractor/chassis combinations entering the yard. The bobtail queue was significantly shorter than that of the main gate and hence was not studied in the survey of terminal operations. Tractor/chassis combination vehicles enter the yard using the truck entrance at Goethals Road and Western Avenue. It is along the entrance road that the queues form on the approach to the gatehouse located within the terminal. At the gatehouse the trucks pass through an in-gate process. If the documentation is in order, the vehicles proceed into the terminal as directed to complete the transaction. If improper information is supplied, the driver is issued a “trouble ticket” that must be resolved at the customer service window. As this process occurred within the terminal the survey did not include this process – rather, this data was supplied through terminal gate records.

The vehicles entering the terminal may be entering with the purpose of performing six different actions as follows:

- Dropping Off
  - A chassis (*chassis in*)
  - An Empty Container (*empty in*)
  - A Loaded Container (*load in*)
- Picking Up
  - A chassis (*chassis out*)
  - An Empty Container (*empty out*)
  - A Loaded Container (*load out*)
- Dropping Off and Picking Up (*double move*)

The survey methodology was primarily developed to capture travel time by major segment from the moment a commercial vehicle entered the study area to the completion of gate processing and entrance to the terminal. (The survey station locations are identified as red circles in Figure 4-2). Surveyors used watches and "walkie-talkies" (see Figure 4-3) to collect data on time in the queue by tracking the vehicle at the end of the queue by container number through to the gate. The surveyor at the gate not only monitored the time a specific vehicle spent in queue but also made a random sampling of processing times at the gate.

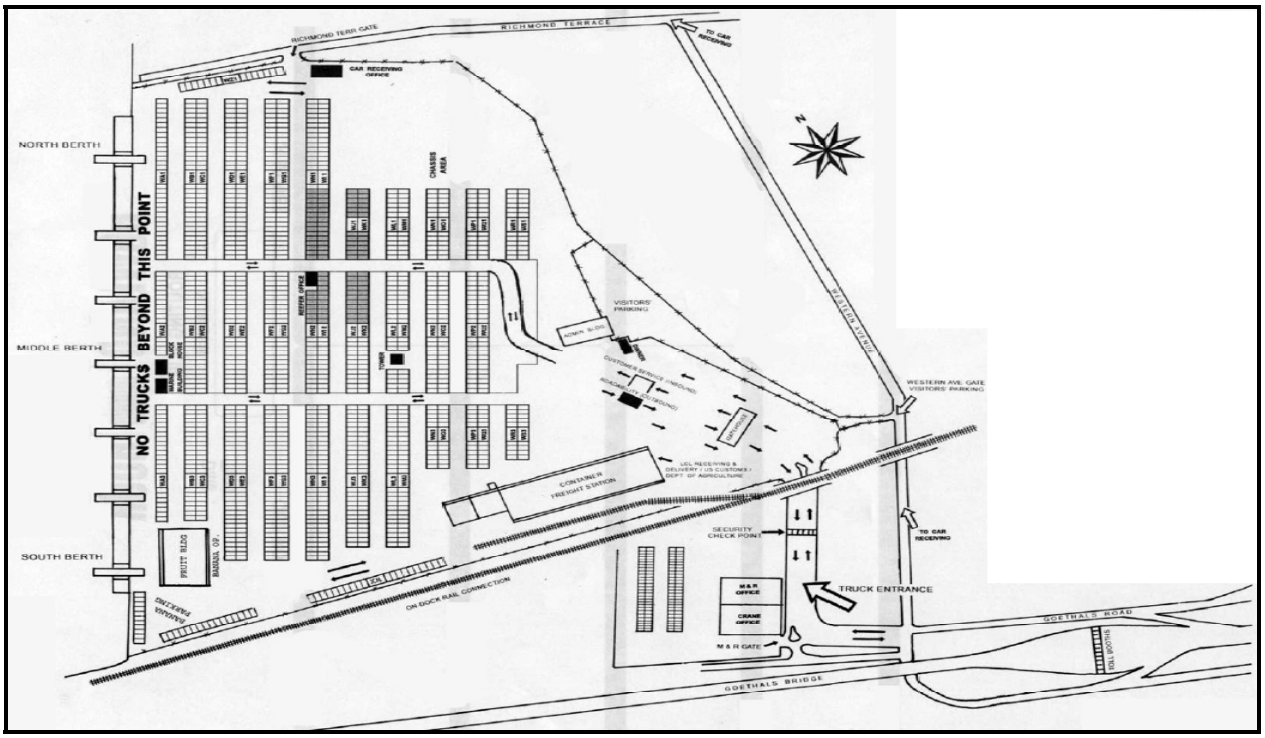


Figure 4-1. Layout of the Howland Hook Terminal.

1. A surveyor was located near the security booth, but moved dependent on the end of the queue. The responsibility of this surveyor was to mark down a container number and the time it passed then radio that information to surveyor #2.
2. A surveyor was located near the gatehouse. This surveyor was responsible for watching for and marking down the time the identified unit arrived at the gate for processing.

   Additionally this surveyor monitored a random sampling of vehicles in process at the gate.

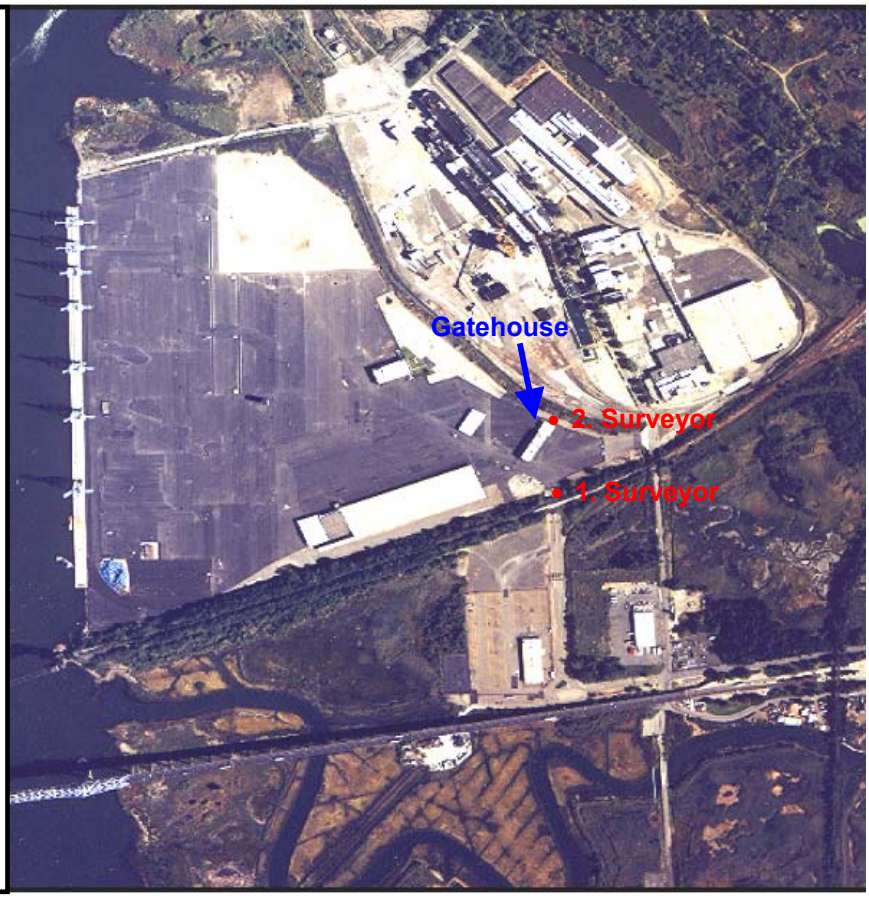


Figure 4-2. Aerial image of Howland Hook Terminal with Overlay of Survey Layout.

Figure 4-3. Picture of Data Collection Activity at Howland Hook Terminal.

4.3 DESCRIPTION OF DATA AND PRELIMINARY RESULTS

The Howland Hook Container Terminal was surveyed between Monday and Friday, June 24 through June 28, 2002. Supplemental information was provided by Howland Hookfrom their June 24 – 28 gate records.. These gate records include a count of all vehicles entering the yard per hour, the transactions of the entering vehicles, and the average time required per vehicle. This section, in an effort to fully expose all aspects of terminal operations, presents a combination of results from both the data survey and the Howland Hook Gate records.

Vehicle entrance rates observed during the survey are illustrated in Figure 4-4. The number of vehicles entering the terminal per hour was supplied from the Howland Hook gate records – these measures include all vehicles (bobtail and truck) entering the terminal. The average demand during the survey period was 1,452 vehicles per day. The mix of transactions is important to the modeling process as it can be noted that time in terminal corresponds to the type of transaction.

During the survey period approximately 52 percent of the vehicles were entering the yard to pick up an empty container, loaded container, or chassis, and approximately 48 percent were entering to drop off a chassis, loaded container, or empty container. Of all these moves on average 55 percent of demand was attributable to those doing double moves. On average, 14 percent of incoming vehicles had improper paper and were issued trouble tickets.

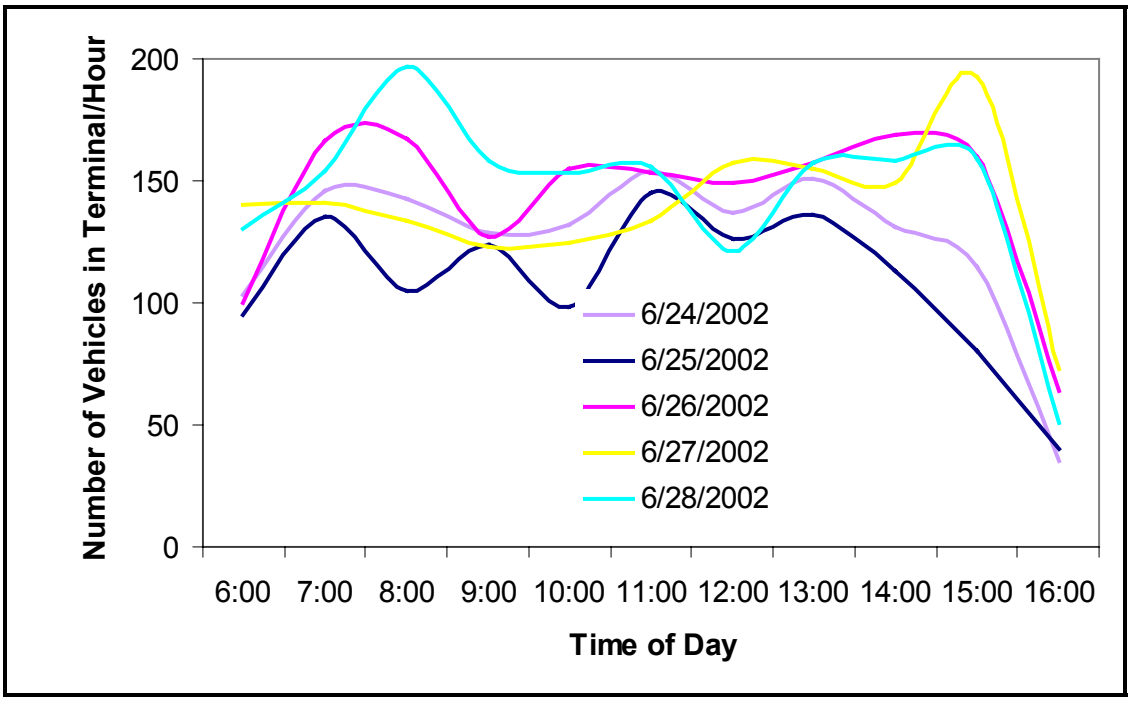


Figure 4-4. Number of Vehicles in the Terminal by Hour of the Day.

Once at the gate, drivers are required to present a valid SEA LINK® ID as well as additional information pertaining to the transaction they wish to undertake. The time in queue approaching the gate was measured by following a specific vehicle through the approach. The average *time in queue* over the 5 survey days was 25 minutes. It should be noted that this figure ranged significantly over each day and over the 5 days of the survey. The range seen was from 3 minutes up to 56 minutes; with a standard deviation of 14.2 around the mean.

The time that it took individual drivers to conduct business at the gate was randomly sampled during the survey. The average *gate processing time* over the 5 days was 7 minutes.

Time in the terminal consists of handling a trouble ticket and/or the physical process of picking up or dropping off a container (loaded or empty) or chassis. The total average time in terminal during the survey period was 33 minutes for a single transaction to 64 minutes per vehicle performing a double move. However, it should be noted that there was significant variation in this number. In particular, the time for dropping off a load, empty, or chassis in the terminal varied from 8 minutes to 30 minutes. Additionally, it should be noted that those needing to resolve a trouble ticket took on average 21 minutes longer (50 minutes versus 29 minutes) in the terminal than those with proper paperwork. This variation based on proper information can have a significant influence on terminal operations. Furthermore, trouble tickets, as a percentage of all transactions are strongly correlated to the type of transaction being performed. Interestingly, (with the exception of improper information pertaining to a load out move) there is a negative correlation between the percent of trouble tickets and the time required to resolve them. That is, the more trouble tickets in a class of transactions, the less time required to resolve them. Table 4-1 reveals the data pertaining to these measures.

Table 4-1. Percent Trouble Tickets and Associated Terminal Time with Transaction

Transaction Type	Total Number of Vehicles	Percent Trouble	Average Time in Terminal (Minutes)
Empty In	2,187	6.5%	25.5
Empty Out	589	15.0%	47.8
Load In	915	31.5%	37.9
Load Out	3,045	14.3%	69.0
Chassis In	395	6.3%	26.1
Chassis Out	131	5.43%	57.8

As an absolute value, the gate processing time is a small proportion of overall terminal operations time. The gate processing time does not have a significant influence upon queue time or time in the terminal. The bulk of the total time spent at the terminal comes from the actual transaction time within the terminal yard. This is somewhat variable depending on the transaction. It is primarily yard capacity restrictions that influence the presence of a queue and the time spent in queue.

A summary of average daily total truck time (queue time + processing time + terminal time) is provided in Table 4-2. Note, however, that as bobtails entering the terminal were diverted to another entrance, these numbers are only relevant to those vehicles using the main gate. Over the 5 survey days, the average time from the moment a truck entered the survey area to clearance of the terminal was approximately 64 minutes per vehicle. It is notable that the average time ranged between 44 to 77 minutes among the 5 days.

Table 4-2. Average Number of Vehicles and Time Spent in Terminal for Trouble and Non-Trouble Transactions

Date (2002)	Total Number of Trucks Using the Main Gate	Total Average Time (Minutes)	Average Trouble Time (Minutes)	Average Non-Trouble Time (Minutes)
June 24	1,018.0	58.2	78.2	51.5
June 25	924.0	44.4	70.9	42.5
June 26	1,101.0	73.8	95.2	74.7
June 27	1,145.0	61.7	80.6	62.1
June 28	1,245.0	76.9	91.6	78.4
Average per Truck	1,086.6	64.03	84.3	63.0

The total time in the system for the average truck with proper information was approximately 64 minutes, or roughly 21 minutes less than the average truck receiving a trouble ticket. The total time (queue, processing, and terminal times combined) distribution during each hour period for each of the survey days is provided in Figure 4-5. Figure 4-5 also shows the number of vehicles requesting service for each hour period throughout the day.

Of note:

- The total time spent in queuing, processing, and in the terminal is strongly correlated to the number of vehicles calling at the terminal.

- The total time spent in the system is also strongly correlated to the type of transaction being performed.

- The percent of trouble tickets is also strongly correlated to the varying types of transactions being performed.

- Processing time is relatively constant throughout the day and across the days. Hence, technology aimed at reducing processing time is not likely to have an impact on terminal operations.

- Also interesting is the relationship between queue time and processing time. From June 26 – 28, the queue time exceeded the total time in the terminal. This is consistent with the common practice of forcing vehicles to wait in queue outside the terminal when time in the terminal reaches a critical threshold.

- Interestingly, there is little variation from day to day in the pattern of trucks calling at the terminal. The queue builds in the morning, remains steady through the afternoon, and then subsides to the point of closing.

Table 4-2 and Figure 4-5 demonstrate the variability of operating conditions from day to day. Additionally, this table and figure demonstrate the impact of trouble tickets on overall terminal operations. It can be seen that on June 26 and 28, when trouble ticket resolution times were at a peak, so was overall time spent in the terminal by all vehicles. The resolution of trouble tickets may have been high as a result of the high number of vehicles in the yard as a whole. It is this complex relationship between total terminal volume, trouble ticket volume, and time in terminal that the model seeks to exploit. Additionally, the relationship between terminal times and queue times are important to the model.

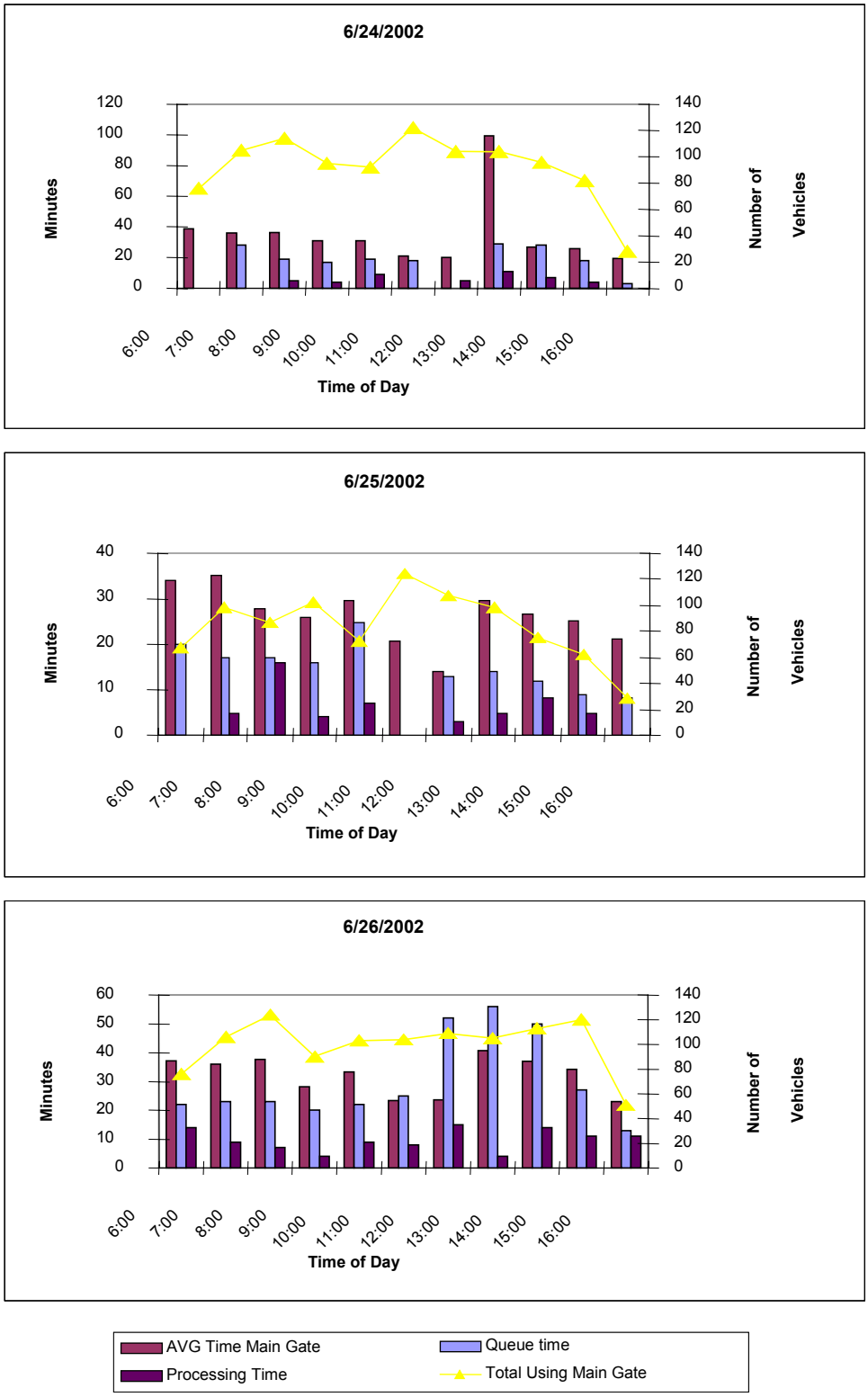


Figure 4-5. Daily Operating Conditions at Howland Hook Terminal, Staten Island.

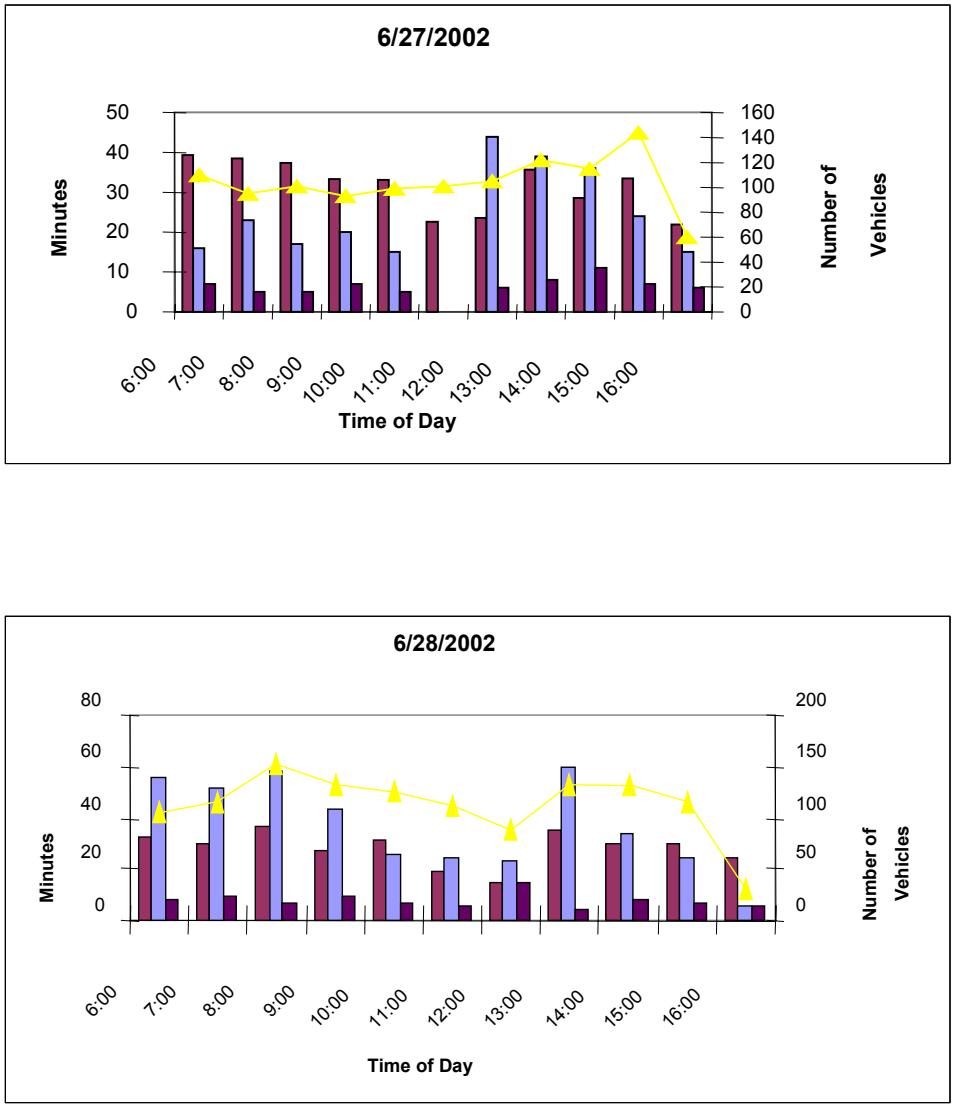


Figure 4-5 (continued). Daily Operating Conditions at Howland Hook Terminal

4.4 DEVELOPMENT OF THE MODEL

For the purpose of this evaluation, the Howland Hook Terminal was modeled using principles from general queuing theory. All trucks calling on the terminal are considered system users. The service process is comprised of gate processing and terminal activities. Note, that this indicates that all vehicles in the yard influence yard capacity – not just those vehicle entering through the main gate. Thus, the model is premised on total vehicles in the yard (entering via both main and bobtail gates). Once the vehicle has fulfilled its task at the terminal it leaves and is considered discharged from the system.

For a more detailed description of general queuing theory the reader is directed to Appendix A. For a more detailed view of the application of queuing theory in modeling the Howland Hook Terminal, the reader is directed to Appendix B.

4.5 DESCRIPTION OF APPOINTMENT SYSTEM AND RESULTS AT VARYING LEVELS OF USE

The objective of developing an appointment system as an additional FIRST offering is not only to promote the FIRST site, but also to improve terminal management. An improvement in terminal management would impact the congestion experienced in the vicinity of the port and the air quality of the port region. This section examines the means by which a potential appointment system could operate. Subsequently, the benefits of varying levels of use of such a system in the context of the model presented in the previous section are exposed.

Currently, the numbers of vehicles calling at the Howland Hook terminal arrive clustered around the noon to early afternoon hours. This leads to increase in queuing and/or terminal times during this period. The objective of instating an appointment system is to more evenly distribute the queue through out the day. In this case appropriate levels of users calling at the terminal for each hour were determined based on each transaction. These specified levels were specified as the upper limit on the number of trucks able to call at the terminal in that specific hour. Thus, the trucks were forced to spread out across the day

From the perspective of the trucker, the system works as follows, including the following assumptions for this scenario:

- An appointment is defined as an hour-long slot in which a driver may show up at the terminal and receive expedited service.

- There is a dedicated lane for appointment vehicles.

- Using an appointment system requires secure identification and statement of intent at the terminal.

- All users arriving for an appointment have the proper information.

    Log on to the appointment system either the day before or the morning that a call to the terminal needs to be made. Based on the desired time of

> arrival at the terminal and the slots available for the transaction that must be performed, select an appointment. Show up to the terminal within the time slot for the appointment. Regardless of the queue outside the terminal, the driver holding an appointment may move to the front of the appointment queue.

A system of this nature not only makes it possible for drivers to serve more loads in one day, but it also makes it possible for the terminal to better manage queue length and terminal congestion. In modeling an appointment system all of the elements mentioned above were taken into consideration, and the following assumptions also were made:

- The number of vehicles entering the system is controlled by a preset capacity.
- The number of servers is based on the number of vehicles using the appointment system – that is, the vehicles using the appointment system use a dedicated lane.
- None of the vehicles using the appointment system have improper information – that is, the vehicles holding appointments have no chance of getting a trouble ticket.

Based on these assumptions, a separate queuing model was designed. This model, in conjunction with the no-appointment model, allows for a testing of timesavings at varying levels of appointment system use. The process for achieving this is outlined in Figure 4-6.

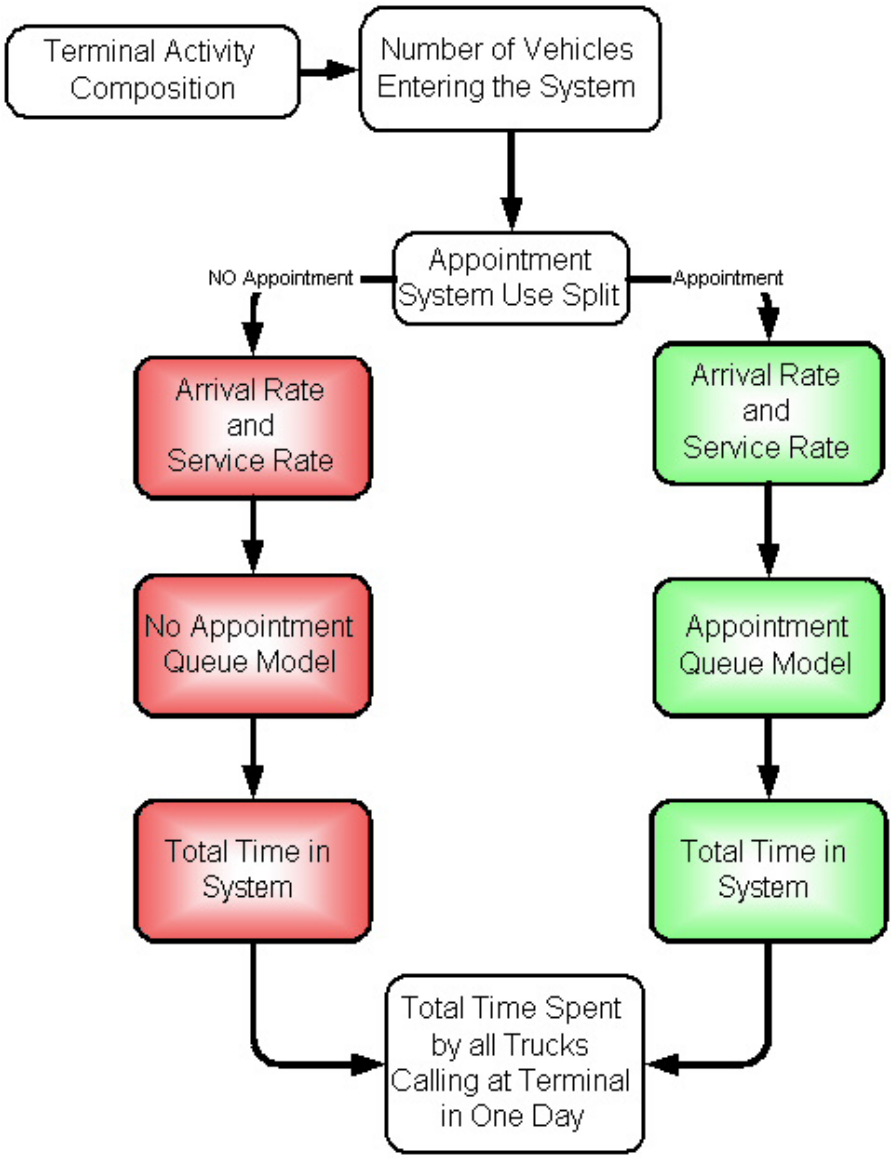


Figure 4-6. Appointment System Queuing Model Framework.

To illustrate the benefits of an appointment system at varying levels of deployment, several scenarios were tested using the same vehicle terminal activity and trouble ticket composition (controlling these features allows for a fair comparison of numbers). Table 4-3 presents these scenarios. Note that Scenario 0 presents the baseline or current situation – no vehicles using an appointment system.

Table 4-3. Table of Scenarios to Model Varying Levels of Appointment System Use

Scenario	Percentage With Appointments	Percentage without Appointments
0	0	100
1	5	95
2	25	75
3	50	50
4	75	25
5	95	5
6	100	0

The results of these scenarios in terms of total vehicle minutes per day spent in the terminal can be seen in Table 4-4. Note that these results are in terms of vehicles (some with and some without appointments) calling at one terminal over a five day operating period – for the purposes of this model it was assumed that all vehicles have free and available access to the appointment system, with only a percentage of vehicles actually taking advantage of the system. Of particular note in the results table is that benefits from use of the appointment system are only realized in scenarios 3, 5, and 6. The reason for this is due to the imbalance in server allocation that is created by the introduction of a priority queuing system. In particular, in scenario 1 and 2 there are too many servers allocated to the appointment system for the number of system users at such a low level of deployment. The allocation modeled however is necessary, as servers cannot be split in half. The allocation balances out in scenario 3 as the system is at a 50 percent level of deployment. In scenario four a dramatic spike is seen in the wait time of the non-appointment system users – again a result of server allocation and user demand levels. Significant savings, however, are realized at levels of 95 percent and 100 percent deployment.

This result should be properly noted as such a phenomenon may make system startup difficult. In particular, it may be difficult to promote system buy-in if benefits are not immediately seen. A possible way around such a situation may be to mandate use of the system; hence, achieving critical levels of use immediately. Another possible remedy is the dynamic allocation of terminal personnel. As modeled the number of servers was static, however, in practice as the appointment or non-appointment queues build past a critical level personnel could be reallocated to serve the users with the highest demand.

Table 4-4. Results of the Appointment System Queuing Model

Scenario	Number of Vehicles		Average Time in System		Vehicle Minutes		
	No Appointment	Appointment	No Appointment	Appointment	No Appointment	Appointment	Total
0	1,426	0	55	NA	78,486	NA	78,486
1	1,355	71	222	77	300,217	5,475	305,692
2	1,070	356	182	38	194,937	13,694	208,631
3	713	713	52	35	36,971	24,766	61,736
4	356	1,070	163	34	58,153	36,050	94,202
5	71	1,355	326	29	23,243	39,626	62,869
6	0	1,426	NA	28	NA	38,537	40,539

Important to note as well is the fact that at full deployment the vehicle time in terminal savings per day over the baseline level is 3,976 minutes. The following section explores the relationship of these savings to total air quality at the terminal.

4.6 POTENTIAL AIR QUALITY BENEFITS

Air quality benefits are expressed in terms of avoided heath costs associated with diesel truck exhaust. The benefits derive from reduced time spent idling at the port terminal. To derive the reduced health impacts, estimates of reduced truck (delay or idling) time developed in this analysis were combined with published estimates of truck diesel emission levels while at idle and published estimates of health costs related to the emissions. As a caveat, air quality impacts can be affected by a number of factors including the stop and go nature of the truck queues, composition of trucks in queue with regards to age and engine conditions, meteorological and climatologic variables, levels of other point and non-point sources of air pollution, and population demographics. Therefore, care is advised in interpreting these results.

Sources for truck idle emissions data include studies conducted by U.S. Environmental Protection Agency, the U.S. Department of Energy, academia, and private firms. Based on the literature, hourly truck idling emissions of VOCs, N2O, CO, and particulate matter (PM) were developed. Table 4-5 presents these ranges.

Table 4-5. Baseline Truck Idling Emissions (in Grams per Hour)

Study	VOC	N2O	CO	PM
NACEC 200114	12.6	46.8	105.6	2.16
NESCAUM15	36.4	122.0	118.0	2.19
Clean Air Technologies International 16	86.4	225.0	189.7	2.19

Published research that assigns actual dollar values to the health costs of emissions from trucks at idle is somewhat scarce. The CalTrans environmental impact assessment tool, Cal-B/C, uses cost factors developed by McCubbin and Delucchi[17] to assess the impacts of transportation projects[18]. McCubbin and Delucchi developed estimates of air pollutant costs for the Los Angeles area, urban areas as a whole, and for nationwide averages for the United States. The Cal-B/C model uses the Los Angeles costs for the Los Angeles, Urban area costs for all other urban areas – and

[14] North American Trade and Transportation Corridors: Environmental Impacts and Mitigation Strategies, August 2001-Figures presented are estimates of truck idling pollutants for United States – Canada border crossings in 1999. Prepared by ICF Consulting for the North American Commission for Environmental Cooperation.
[15] Northeast States for Coordinated Air Use Management GHG Case Study – The Hunts Point Truck/Trailer Electrification Pilot Project. The figures used were an un-weighted average of published emissions results from EPA-Mobile5, Colorado Institute for Fuels and Environmental Research, and the University of California Davis.
[16] Clean Air Technologies International – Extended Idling Emissions Study, conducted for IdleAir Technology Corporation, 2001.
[17] McCubbin, D. and M. Delucci. "The Social Cost of the Health Effects of Motor Vehicle Air Pollution." Report #11 in the series, "The Annualized Social Cost of Motor-Vehicle Use in the United States, based on 1990-1991 Data," Institute of Transportation Studies, University of California Davis, August 1994.
[18] California Life-Cycle Benefit/Cost Analysis Model (Cal-B/C) Technical Supplement to Users Guide, Booz Allen & Hamilton, 1999.

the nationwide costs for rural areas in California. This analysis assumes the pollution costs for the "urban" truck emissions per ton in 2003 dollars, which are presented in Table 4-6.

Table 4-6. Pollution Costs of Truck Emissions (in 2003 US Dollars)

Pollutant	Urban Cost/Ton	Rural Cost/Ton
VOC	$1,052	$826
N2O	$11,187	$15,059
CO	$66	$60
PM	$121,577	$86,737

These emission level and cost factors[19] and the expected time in terminal in each scenario studied in this evaluation, enabled the estimation of health impacts by the following formula:

(Level of air pollutants [in tons] produced per hour by trucks at idle)

x

(Hours spent in the terminal)

x

(Estimated health costs per ton for truck-generated pollutants)

=

(Health costs of truck generated pollutants as a result of terminal operations).

Based on the preceding formula, Table 4-7 presents the associated health costs for each scenario presented in the above queuing analysis.

[19] It is estimated that the hourly health costs associated with truck emissions during idling is $0.45 per hour. Truck emissions used in this analysis are: 44g/hr; 136g/hr; and 130g/hr and 2.18g/h for VOC, CO, N2O, and PM, respectively.

Table 4-7. Queue Model Results Converted to Air Quality Measures

Scenario	Time in Terminal		Emissions		Associated Health Cost	
	Vehicle Minutes/ Day	Vehicle Hours/ Day	Emissions/ Day	Emissions/ Year	Cost/ Day	Cost/ Year
0	78,486	1,308.1	408,468.4	149,193,078.7	$527	$192,573
1	305,692	5,094.9	1,590,927.3	581,086,189	$2,053	$750,047
2	208,631	3,477.2	1,085,788.1	396,584,119.6	$1,401	$511,897
3	61,736	1,028.9	321,295.6	117,353,208.3	$414	$151,475
4	94,202	1,570.0	490,259.9	179,067,431.2	$632	$231,134
5	62,869	1,047.8	327,192.1	119,506,914.2	$422	$154,255
6	40,539	675.7	210,979.0	77,060,089.9	$272	$99,466

Of particular interest is the fact that there is an associate health cost of $99,466/year at a level of full appointment system use. This represents health cost savings of $93,107 over the baseline scenario of no appointment system use. It should be noted that this figure is highly dependent on the baseline queuing system configuration. Hence, in periods of peak terminal use (i.e., during elevated holiday freight levels) these benefits may be significantly larger. Additionally, it should be taken into consideration that Howland Hook is located in the Greater New York Metropolitan area – a notorious non-attainment zone. Hence, any savings in air quality warrant consideration. Finally, this is only one terminal in the New York New Jersey region: if it can be assumed that 10 terminals with similar vehicle throughputs of 1,462/day adopt such a program, it is possible that a savings of $931,070/year will be realized. This level of public benefit from a new technology deployment may serve to leverage public funding.

4.7 SUMMARY OF FINDINGS

The primary purpose of this section was to model terminal operations at the Howland Hook terminal, design and test an appointment system as a potential additional offering for the FIRST system, and convert the benefits of such a system into terms of air quality and health costs. The findings of this section of the report are primarily based around the hypotheses presented at the outset of section 4. The following bullets present some of the key findings from each area of study.

- **Hypothesis 1:** The daily operations of a terminal within the Port of New York and New Jersey may be modeled using basic transportation queuing theory principles to gain insight into expected levels of benefits associated with use of an appointment system.

  Based on the following findings, this hypothesis was confirmed.

- The total time spent in queuing, processing, and in the terminal is strongly correlated to the number of vehicles calling at the terminal and their intent. Additionally, the percent of trouble tickets experienced by each type of terminal transaction is directly related to the total time spent in the terminal. Specifically, the lower the percent of trouble tickets for the activity the longer it took to be resolved.
- Overall however, over the 5 survey days, the average time from the moment a truck entered the survey area to clearance of the terminal was approximately 64 minutes per vehicle. It is notable that the average time ranged between 44 to 77 minutes among the 5 days.
- The average time spent in queue ranged widely from 3 minutes to 56 minutes with an average of 25 minutes.
- Processing time did not vary widely and averaged at 7 minutes per vehicle over the 5 survey days.
- Average overall time in terminal was obtained from the Howland Hook gate records and averaged about 33 minutes. However, vehicles needing to resolve improper information issues took on average 21minutes longer in the terminal – 29 minutes versus 50 minutes.
- The daily pattern of vehicles in the terminal per hour is consistent from day to day. The number of vehicles builds to t threshold level where it remains steady until it tapers in the afternoon. This pattern lends itself well to a steady state queuing model.
- The Howland Hook terminal can be modeled as an *M/M/m* queuing system.
- Arrival rate, vehicles per hour, is based on a randomized number of vehicles arriving to the terminal over the course of the day.
- The service rate is modeled as a calculated average of randomized service times associated with the varying types of transactions.
- The appointment system was modeled as a variation of the M/M/m queue model used to represent the baseline no-appointment system terminal.
- The appointment system relies on a dedicated lane and preset capacity levels.
- It is assumed that none of the vehicles using the appointment system suffer from improper information.
- The final model, incorporating both appointment and no-appointment system use, was run at varying levels of appointment system use. These scenarios ranged in use from 0 to 100 percent.

- **Hypothesis 2:** An appointment system, if used by terminals at the Port of New York and New Jersey, has the potential to reduce time in queue and at the terminal translating into improved air quality and a reduction in air quality related health costs.

  Based on the following findings, this hypothesis was confirmed.

  - At 0 percent use of the appointment system, the results demonstrated a total in system time across all vehicles of 78,486 minutes. The closeness of this

number to the observed data provides good indication that the model is well calibrated.

- Most notably, at 5 percent, use of the appointment system an increase in total vehicle minutes in the terminal is seen. There is a jump from 78,486 minutes to 305,692 minutes. This jump is most likely attributed to the lack of terminal ability to dedicate the necessary resources at such a low level of use. Hence, a queue develops thus elevating the overall time spent in the terminal per vehicle using the system.
- This increase in terminal time following initial system use should serve as a caveat to system administrators. In order to realize benefits from an appointment system, use of the system must be greater than 50 percent and preferably above 95 percent. This immediate level of system buy-in may be gain through legislation.
- At full appointment system use a total time savings of 37,947 minutes may be seen.
- This time savings translates in to a yearly savings of $93,107 per annum per terminal in air quality related health costs.
- If ten terminals in the New York New Jersey area adopt such technology, a total savings from air quality related health costs of $931,070 per year might be realized.

5. CONCLUSIONS AND RECOMMENDATIONS

This section presents conclusions with "lessons learned" and recommendations developed by the Evaluation Team based on the findings developed over the course of this evaluation effort. The conclusions highlight the "lessons learned" from input from stakeholders, and the recommendations provide suggestions to be considered in the current efforts of the FIRST system and other future related freight ITS projects.

5.1 EVALUATION CONCLUSIONS

5.1.1 Findings on Deployed System

The FIRST evaluation was initially based around three areas of study:

- Intermodal Freight Operations Study
- Air Quality Study
- Customer Satisfaction Study

The Intermodal Freight Operations study was designed to focus on the effects the FIRST system has on the operational efficiency of the terminal gate. Specifically, this portion of the original study was to analyze how information received from and exchanged through FIRST could increase the efficiency of trucks moving through the pre-gate, gate, and complete processing steps.

The following original hypotheses and their outcomes are listed below for the Intermodal Freight Operations Study:

- **Using the FIRST system will reduce truck wait times at the terminal gate.** This hypothesis is rejected. As deployed, the FIRST system did not appreciably reduce truck wait times. Nonetheless, if the usage were to increase, benefits may be achievable – see modeled results in section 4.0.

- **Using the FIRST system will assist in the exchange of more accurate information and payment of fees before a truck arrives at a gate.** Fee payment options were not incorporated into the FIRST system in the course of the deployment period. In addition the low system use numbers rendered this hypothesis infeasible for measure at this time.

- **Using the FIRST system will reduce the number of unnecessary trips made by trucks when trucker verifies that cargo container(s) are available for pickup and delivery prior to trip to Port.** Due to the low numbers of truckers actively using the FIRST system to verify load availability, no appreciable changes in this metric occurred. However, while this hypothesis must be rejected on the aggregate, it is still possible that some individual users experienced a reduction in unnecessary trips. However, the numbers of users are too low to reliably measure this sub-hypothesis.

- **Using the FIRST system will cause an increase in the number of double moves within the terminals.** No appreciable changes in this metric occurred. However, while this hypothesis must be rejected on the aggregate, it is still possible that some individual users experienced a decrease in double moves. However, the numbers of users are too low to reliably measure this sub-hypothesis.

The air quality study was closely linked to the Intermodal Freight Operations Study since improvement in air quality is a direct benefit of reducing truck idling times and trips. The Air Quality Study was to measure improvements in air quality by measuring current emissions from trucks entering the terminals and comparing the levels with trucks entering the terminals after implementing the FIRST system. As previously mentioned, it is expected that using the FIRST system will result in lower wait times for trucks trying to enter the terminal, and reduce unnecessary truck trips – all factors that are expected to result in reduced truck emissions at the Port.

The following is the initial hypothesis and result of the Air Quality Study:

- **Using the FIRST system will lead to a more efficient use of the Port facilities by trucks which will result in measurable air quality improvements.** Due to low use of the FIRST system there was no noticeable change in Port Facility use. Therefore, this hypothesis is rejected.

As noted in the original evaluation plan, the degree to which the identified goal is realized depends on the operational efficiency improvements made on the part of truck drivers and terminal operators at the Port of NY/NJ. Unfortunately the level of use required to measure intermodal operational efficiency changes was not reached during the deployment period. Hence, many of these hypotheses were rejected and this portion of the study was given over to a modeling effort – the results of which are summarized below in section 5.1.3.

The Customer Satisfaction Study was initially designed to focus on the perceived level of satisfaction by trucking companies and terminal operators based on how the FIRST system meets their information needs. One of the expected outcomes of FIRST implementation and use was improved customer satisfaction with the Port of NY/NJ because of the anticipated increase in efficiency at the terminal gates. It was also expected that the level of market penetration to Port customers would increase as FIRST became better known in the region as a provider of useful and timely Port related information.

The following two hypotheses and the outcomes for the Customer Satisfaction Study are presented below:

- **Over time a significant and increasing number of trucking companies will be using the FIRST system.** This hypothesis was rejected. As indicated by web activity statistics, there was a high level of interest (almost 4500 homepage viewings) just after the launch of the FIRST site in 2001 (in part due to 9/11 interest). This level dropped to under 1000 in March of 2003. Furthermore, use of the container-tracking feature dropped from over 1000 web hits to just over 100. Finally, in March of 2003 only 1% of the known motor carriers in the Port of New York and New Jersey were registered with the FIRST system. As a result of this low measure of customer satisfaction the Evaluation Team took the initiative to

compare the FIRST system with alternative, but similar successful port community information technology systems.

- **Customers will use the ITS data as part of their decision-making processes and users will find the ITS data to be accessible, accurate, and secure.** This hypothesis was rejected as many port community members interviewed expressed concern about FIRST posting incorrect information – generating more work and requiring dedicated staff at the terminals to answer additional inquires from truckers. In most cases the erroneous data is a result of errors in EDI transmission to the FIRST system. Additional details on this study may be found in Section 3.2.4.

These hypotheses were studied through a limited survey of registered users and in-depth interviews with key members of the port community. The result of this work led the Evaluation team to reject both hypotheses. It was the rejection of these hypotheses that inspired the Evaluation Team to study alternative, but comparable, port community systems to understand what made them successful.

5.1.2 Conclusions from Case Studies

Based on the data and information collected from the PANY/NJ, stakeholders of the FIRST system, the champions for the Pacific Gateway Portal and eModal, and the Web portals through which these systems are accessed, three major conclusions are as follows:

- **The FIRST system did not function as intended due to low rates of data sharing and system use.** FIRST did not have any major technological issues or problems. The FIRST system did not completely succeed because of a lack of commitment from industry. According to conversations with FIRST data users and PANY/NJ officials, the trucking companies and freight forwarders do not believe there is enough data on the site and when there is data available, there may be inaccuracies and time delays associated with the information. Additionally, ocean carriers believe that they are not getting anything in return for providing FIRST with their data. Although data is transmitted at no cost via FTP, the ocean carriers don't feel there is enough incentive to keep providing the data and some have partially or completely stopped sending data to ASI.

- **Community members of the PANY/NJ had a few overriding concerns about data and its accuracy and timeliness.** Participants noted the major concerns with FIRST are that it has limited data and when the data is available, it is not always accurate and timely. As a result, this causes: (1) Terminal operators have to answer additional inquiries via the Internet from trucking companies about data, which causes unnecessary work; (2) Truckers have to visit multiple Websites to find all the information they need – which also causes additional effort that they are not likely to do on a regular basis; (3) additionally, terminal operators and ocean carriers have begun to start their own Websites for their customers and are not going to send data to an outside source if they can do it in house.

- **The port community systems such as the Pacific Gateway Portal and eModal have successful features that could be applied to FIRST.** PGP'ssuccess is the result of careful planning up front by the stakeholder group at the Port of Vancouver

and surrounding business community. The truck appointment system, firmly in place at the Port of Vancouver, has helped reduce congestion and wait times at terminal gates at the port. eModal, is succeeding at many ports around the country, and is continuing to grow by offering features that are truly beneficial to the customer using a fee payment structure by registered users. eModal provides efficiency-enhancing tools, such as the Folder Manager, eDO™, and Scheduler features that address participants' needs.

5.1.3 Model based Appointment System and Air Quality Conclusions

As previously mentioned, one of the main problems with the FIRST system was low user acceptance and buy-in. As a result, the Evaluation Team reviewed several alternative port community systems and identified that an appointment system may serve to benefit users of the FIRST system. Hence, an appointment system was designed and the benefits modeled using a calibrated model of terminal operations.

The results of the preliminary data exploration in an effort to model the terminal showed consistent daily demand hence indicating that a queuing model would adequately forecast terminal operations under various scenarios. The scenarios examined were based around varying levels of appointment system use. In particular, the scenarios focused on the following percentage of use: 5; 25; 50; 75; 95; and 100.

The results of these scenarios were compared against the baseline scenario (i.e., 0 percent system use) and a significant savings in total vehicle time in the terminal system (queue, processing, and terminal) was noted between the 100 and 0 percent scenarios. Specifically, a differential of 37,947 minutes was observed.

Most interesting, however, was the fact that savings from appointment system use did not appear until a level of 50 percent deployment was reached. After that the savings subsided again until a level of 95 percent was reached. This inconsistent correlation between percent of system use and benefits is attributable to the split in servers between the two levels of service.

In practice, if appointment system deployments were to occur, there are two design variables that may be altered to mitigate the chance of operating at a level of use in one of the failed scenarios. First, servers should be allocated dynamically. That is during periods in which one type of server (appointment or non-appointment) is idle, its resources should be transferred to the other level of service to alleviate the chance of long queues forming despite idle servers. Second, legislation may serve to promote the use of an air quality improvement system at the port. This legislation could mandate use of the system or provide incentives for use thus forcing a high level of deployment.

Of paramount interest here is the Evaluation Team's estimates of health cost savings of $93,107/year at a level of full appointment system use. It should be noted that this figure is highly dependent on the baseline queuing system configuration. Hence, in periods of peak terminal use (i.e., during elevated holiday freight levels) these benefits may be significantly larger. Additionally, it should be taken into consideration that Howland Hook is located in the Greater New York Metropolitan area – a notorious non-attainment zone. Hence, any savings in air quality warrant consideration. Finally, this is only one terminal in the New York New Jersey region: if it can be assumed that 10 terminals of similar operating size (i.e. a weekly average of ~1400 vehicles per day)

adopt such a program, it is possible that a savings of $931,070/year will be realized. This level of public benefit from a new technology deployment may serve to leverage public funding.

5.2 LESSONS LEARNED

It is important to try to put the findings of this evaluation into perspective when comparing the other systems covered in the Case Studies section of this report. The FIRST system operates without any outside funding from the members or users. The other systems, the Pacific Gateway Portal and eModal, have external funding sources to sustain operations. Participation in the FIRST system might have been higher had the incentive for ocean carriers and terminals to provide data was more lucrative and PANY/NJ had more financial power to offer more services up front. The lesson learned here is that funding and financial incentives are important concerns for operations such as these port community systems, especially in a typically cash-strapped industry as freight transportation.

Another lesson learned involves the identification of all port community groups and the specific benefits to groups. A primary focus area of the FIRST project was on the motor carrier and truck driver. However, the steamship lines have a significant amount of the critical data that is necessary to populate the system. The port community has many different kinds of commercial enterprises with their own objectives. A system will be more successful if each group of users is considered independently from one another in terms of benefit-cost as well as the whole well-being of the port community.

A third lesson learned is related to readily available services and features that have an immediate impact. Features such as the truck appointment system should have been integrated in the beginning so that the benefits that project champions had hoped to see, i.e., reduction in terminal gate queues and related reduction in diesel emissions, had a better chance of being realized. When rolling out a new product there must be an immediate, obvious, and tested offering that will draw people to the system. Such an offering must be carefully marketed because low levels of use may be worse for the system as identified in the truck assignment model results.

5.3 RECOMMENDATIONS

Shown below are the four primary recommendations that the SAIC Evaluation Team is offering to USDOT, the PANY/NJ, the I-95 Corridor Coalition, and others in government and industry to consider based on the conclusions obtained in conducting this evaluation.

- **Data quality control.** The PANY/NJ, as landlord of the port, is neither the originator of record nor the primary user of the data. Additionally, with the small technical staff and limited resources, the PANY/NJ is not able to directly address concerns of data quality and customer satisfaction. Registered users accessing this system are concerned that there is not enough data, that the data that is there isn't always accurate, and sometimes the data are not timely. As stated before, one of the concerns with the port community is the accuracy and timeliness of the data on the Website. The PANY/NJ should continue to address the quality control issues regarding the data that is broadcasted on the FIRST system. Even though the ocean carriers and terminal operators are responsible for submitting accurate and timely information, there is no incentive to ensure this happens. Additionally the

lack of complete data results in inaccuracies. This can only be corrected by the participation of more terminals and steamship lines. While, the PANY/NJ encourages data providers to provide the data at no cost via FTP transmissions, this doesn't guarantee its accuracy.

- **Consideration of Local, state, or Federal regulations.** Recent truck idling legislation in California is has preliminarily shown positive results at terminal gates.[20] The trucking associations support this type of legislation and it may be a good example to model similar legislation in the Port of New York/New Jersey area to address the lengthy delays at the Port's terminal gates. The FIRST system could then facilitate the use of the appointment system because truckers and trucking companies could search and make appointments through one Web portal for all participating terminals without having to search multiple terminal sites.

- **Funding.** Although the spirit of FIRST's free services in an excellent idea, there may be a shortfall of funding in the immediate future unless outside financial resources are established. Once the PANY/NJ's funding ends in December of 2003, a decision will need to have been made by upper management and other stakeholders on the future funding of the FIRST system. The PANY/NJ may want to consider establishing a fee structure similar to that of the Port of Vancouver or eModal to help recoup the operating costs that are associated with the FIRST system. The PANY/NJ may want to consider establishing a fee structure similar to that of the Port of Vancouver or eModal to help recoup the operating costs that are associated with the FIRST system.

- **Increased outreach and marketing.** The PANY/NJ did get extensive input from the port community as to the design and functionality of the system in the beginning. However, the unfortunate timing of the 9/11 attacks may have disrupted the efforts and resources that the PANY/NJ would have liked to have had at its disposal to market and reach out to the port community as the system was being deployed. A survey or interviews with non-registered users as well as part-time users may be of benefit to the Port Authority to reconnect with the entire port community regarding their unwillingness to register with the system or use it full time. Additionally, the Port of Vancouver is interested in sharing their story with other ports, especially on the East Coast of the United States. PANY/NJ may want to consider meeting with FHWA and the Vancouver Port Authority to discuss various features of each others' systems and how the FIRST and Pacific Gateway Portal systems could enhance one another.

[20] Mongelluzzo, Bill. "Smooth Start for Lowenthal Law," Journal of Commerce. July 14-20, 2003.

APPENDIX A: GENERAL QUEUEING THEORY

A queuing system in its most general lay out consists of a source of users, the queue, and servers. Figure A-1 provides a basic overview of this set up.

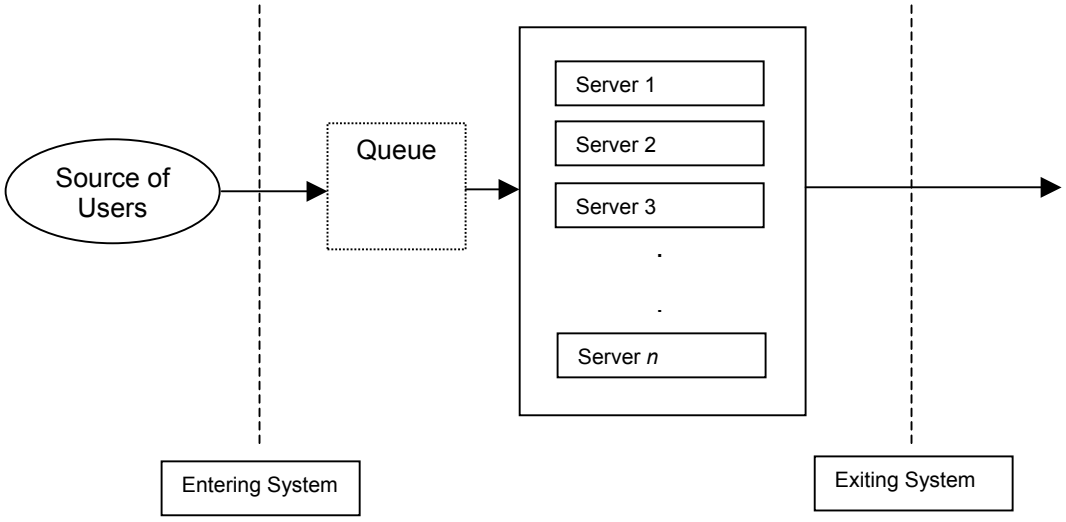


Figure A-1. Basic Queuing System.

To fully describe such a system additional information regarding arrivals to the system, service times for users, and the number of servers is required. The notation most common in the practice of queuing theory to denote the properties of specific queuing systems is *A/B/m*. In this notation, *A* represents the distribution of interarrival times. The most common include:

- M = Memoryless or a negative exponential pdf[21] for user inter arrivals.
- D = Deterministic or constant inter arrivals.
- G = General distribution or any distribution.

The *B* in the queuing notation denotes the distribution of user service times – the options for this distribution is the same as for *A*. Finally, *m* denotes an integer representing the number of servers. Hence, an *M/M/m* system is one with both Memoryless user interarrivals and service times and *m* servers.

In the study of queuing systems, there are several quantities of interest. The most significant are λ and μ, which represent (λ), the rate of user arrivals at the system per

[21] A detailed explanation of a negative exponential probability density function is outside the scope of this document. For a detailed review of this function in the context of queuing theory and transportation systems, the reader is directed to the book *Urban Operations Research* by Larson and Odoni.

unit time, and (μ), the expected number of service completions per unit time when a server is working continuously. As a queuing system operates over time, a system equilibrium or steady state will be reached, provided that $\lambda/\mu < 1$. At steady state, the measures of most interest are:

- W = Expected system occupancy time for a user.
- W_q= Expected waiting time in the queue.
- L = Total number of users in the system.
- L_q = Total number of users in the queue.

The relationship, known as *Little's Formula*, $L = \lambda W$ and $L_q = \lambda L_q$ relates the measures and makes it possible to calculate all four with only λ and μ. Additionally, it should be noted that $W = 1/\mu + W_q$.

Based on the behavior of a queue system at steady state and the probability that nobody is in the system, P_0, can be derived. Specifically, for an *M/M/m* system this probability is represented in terms of λ and μ as follows:

$$P_0 = \left[\sum_{n=0}^{m-1} \frac{\left(\frac{\lambda}{\mu}\right)^n}{n!} + \frac{\left(\frac{\lambda}{\mu}\right)^m}{m!} \left(\frac{1}{1 - \frac{\lambda}{m\mu}} \right) \right]^{-1}$$

Based on P_0, L_q can be derived resulting in the following:

$$L_q = \frac{P_0 \left(\frac{\lambda}{\mu}\right)^m \left(\frac{\lambda}{m\mu}\right)}{m! \left(1 - \frac{\lambda}{m\mu}\right)^2}$$

Using modeling techniques such as these are particularly useful for understanding the propagation of small changes in service times through out the queuing system. In particular the overall impact on *L* and *W* can be monitored. This allows for easy testing of such design variables as number of servers, new technology impacting service rates, or changes in the arrival rate.

APPENDIX B: MODELING THE HOWLAND HOOK TERMINAL

In the case of Howland Hook, the source of users is the trucks calling at the terminal; the queue is that which forms on the approach to the gate; and the entire process of passing through the gate and performing the appropriate transaction in the terminal represents the service. This entire queuing system can be seen in Figure B-1.

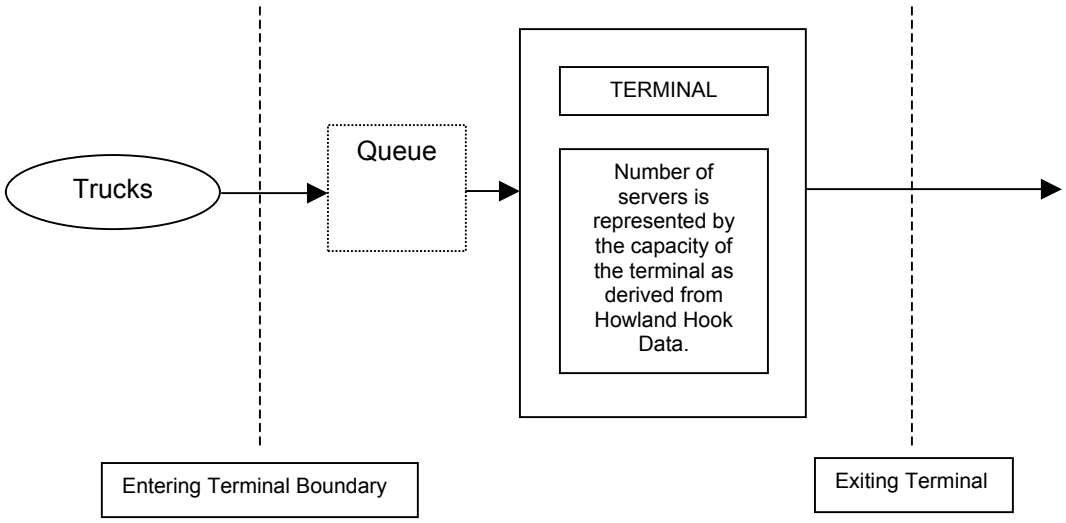


Figure B-1. Howland Hook Terminal Modeled as a Queuing System.

The arrival rate, λ, represents the number of vehicles arriving per hour to the terminal. For the purposes of the model, this is based on a randomized number (calibrated to the observed arrivals over the course of a day) of vehicles arriving to the terminal over the course of the day. The service rate, μ, represents the number of trucks that can pass through the gate and fulfill their business in the terminal per hour. For the purposes of this model, the service rate was an average calculated from a randomized service rate associated with and calibrated to the observed mix of vehicle transactions, trouble tickets, and the correlated service times. It is key to note that the service time is calibrated to reflect the observed mix of vehicle transactions and associated service times. This is important because this mix includes all vehicles – those entering through the bobtail gate and the main gate. This mix will be referred to as total vehicle volume. Based on the equations presented above total vehicle volume (i.e. throughput) and length of time spent in the terminal can be calculated.

It should be noted here that this model was calibrated to the 5 days worth of data at the Howland Hook Terminal. Those 5 days were consistent in demand patterns – building volume in the morning steady through the day and tapering in the afternoon. Hence, that pattern was used to design the arrival rates used in the model. In testing the model, 5 runs at baseline level (i.e., no appointment system use) were run to simulate 5 days of operation.

The average time spent at the terminal over these five simulations was then compared to the average found in the baseline data. This comparison yielded a difference in average vehicle volume of 21 (1,452 versus 1,431 [model]) and difference in average time at the terminal of 9 minutes (64 minutes versus 55 minutes [model]). Recall that 1,452 is the average of all vehicles utilizing the Howland Hook Terminal (entering via both the main and bobtail gates) over a five day period in June (i.e. the number referenced in table 4-2 represents only the vehicle using the maingate); similarly 64 minutes reflects the average time required by all vehicles (both bobtail gate and main gate users) to complete their transaction at the Howland Hook Terminal over 5 days in June. This difference is negligible as the comparison was performed over only 5 days' worth of data – it is expected that with a more robust testing dataset (i.e., more simulated days) a closer estimation of the observed would be seen. It should be cautioned, however, that this baseline calibration was done based on the 5 days of observed data in June 2002. Annual changes in throughput as well as trends toward greater terminal throughput may require that the model be re-calibrated.

In an effort to model an appointment system it was necessary to build two queuing systems – one modeling the terminal with an appointment system and the other modeling it sans appointment system. The following section provides background on the appointment system and the overall framework to model different levels of use.

REFERENCES

"A Combined Report for Freight Information Real-Time for Transport (FIRST)," prepared by Science Applications International Corporation for the United States Department of Transportation/Federal Highway Administration, May 2002.

California Life-Cycle Benefit/Cost Analysis Model (Cal-B/C) Technical Supplement to Users Guide, Booz Allen & Hamilton, 1999.

Clean Air Technologies International – Extended Idling Emissions Study, conducted for IdleAir Technology Corporation, 2001.

eModal Inc., interview conducted in July 2003.

eModal Website, www.emodal.com, accessed from May 2003 – August 2003.

FIRST Information Sources, Types, and Users, diagram courtesy of American Systems, Inc., 2002.

McCubbin, D. and M. Delucci. "The Social Cost of the Health Effects of Motor Vehicle Air Pollution." Report #11 in the series, "The Annualized Social Cost of Motor-Vehicle Use in the United States, based on 1990 –1991 Data," Institute of Transportation Studies, University of California Davis, August 1994.

Mongelluzzo, Bill. "Smooth Start for Lowenthal Law," *Journal of Commerce*, July 14 – 20, 2003.

North American Trade and Transportation Corridors: Environmental Impacts and Mitigation Strategies, August 2001. (Figures presented are estimates of truck idling pollutants for United States – Canada border crossings in 1999.) Prepared by ICF Consulting for the North American Commission for Environmental Cooperation.

Northeast States for Coordinated Air Use Management GHG Case Study – The Hunts Point Truck/Trailer Electrification Pilot Project, (The figures used were an un-weighted average of published emissions results from EPA-Mobile5, Colorado Institute for Fuels and Environmental Research, and the University of California Davis.)

Pacific Gateway Portal Website, www.pacificgatewayportal.com, accessed May – August 2003.

Port Authority of New York/New Jersey Website, www.panynj.com, accessed March – August 2003.

Telephone interview conducted in July 2003 with James Ireland, director of Information Technology, Port of Vancouver.

Vancouver Port Authority Website, www.portvancouver.com, accessed May – August 2003.