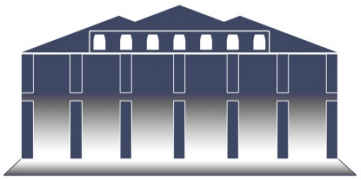
Evaluation of Efficiency and Effectiveness of State Ports at Wilmington and Morehead City

Final Report to the Joint Legislative Program Evaluation Oversight Committee

Report Number 2019-07

October 21, 2019



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John W. Turcotte
Director

October 21, 2019

Senator Brent Jackson, Co-Chair, Joint Legislative Program Evaluation Oversight Committee
Representative Craig Horn, Co-Chair, Joint Legislative Program Evaluation Oversight Committee

North Carolina General Assembly
Legislative Building
16 West Jones Street
Raleigh, NC 27601

Honorable Co-Chairs:

The 2018–19 Work Plan of the Joint Legislative Program Evaluation Oversight Committee directed the Program Evaluation Division to examine the efficiency and effectiveness of the North Carolina State Ports Authority and its operation of the Wilmington and Morehead City ports.

I am pleased to report that the North Carolina State Ports Authority cooperated with us fully and was at all times courteous to our evaluators during the evaluation.

Sincerely,

John W. Turcotte
Director

AN EQUAL OPPORTUNITY/AFFIRMATIVE ACTION EMPLOYER

Mandatory Evaluation Components

Report 2019-07: Evaluation of Efficiency and Effectiveness of State Ports at Wilmington and Morehead City

N.C. Gen. § 120-36.14 requires the Program Evaluation Division to include certain components in each of its evaluation reports, unless exempted by the Joint Legislative Program Evaluation Oversight Committee. The table below fulfills this requirement and, when applicable, provides a reference to the page numbers(s) where the component is discussed in the report.

N.C. Gen. § 120-36.14 Specific Provision	Component	Program Evaluation Division Determination	Report Page
(b)(1)	Findings concerning the merits of the program or activity based on whether the program or activity		
(b)(1)(a)	Is efficient	Overall, operations of the North Carolina State Ports Authority **are efficient because of improvements in productivity performance measures and declining unit costs**, all of which are consistent with improved efficiency. However, increased efficiencies are entirely attributable to operations in Wilmington and not Morehead City.	Page 19
(b)(1)(b)	Is effective	Analysis of these performance measures indicates the North Carolina State Ports Authority is **effectively managing the state ports—the ports as a whole have increased throughput both in terms of tonnage and containerized cargo, and the quality of cargo handling also has improved.** However, improved effectiveness has been driven by operations at the Port of Wilmington.	Pages 19
(b)(1)(c)	Aligns with entity mission	The mission of the North Carolina State Ports Authority is to provide a gateway to global markets and enhance the economy of North Carolina by supporting and improving the State's logistical network. This mission aligns with the Department of Transportation's mission to connect people, products and places safely and efficiently with customer focus, accountability, and environmental sensitivity in order to enhance the economy and vitality of North Carolina.	Page 6
(b)(1)(d)	Operates in accordance with law	The North Carolina State Ports Authority **does not operate in accordance with all state law.** Statute requires the Authority to maintain container shipping operations at both ports, yet the Port of Morehead City does not conduct container operations nor is it situated to develop such operations without investments in improved truck mobility.	Page 30-31
(b)(1)(e)	Does not duplicate another program or activity	The Program Evaluation Division found that **no duplication exists** as a result of the North Carolina State Ports Authority operating two coastal ports at Wilmington and Morehead City because each port processes different cargo and commodities. Furthermore, although overlap of certain positions at both port locations does exist, the overlap is necessary.	Page 27-29
(b)(1a)	Quantitative indicators used to determine whether the program or activity		
(b)(1a)(a)	Is efficient	The Program Evaluation Division determined **efficiency of the North Carolina State Ports Authority and the individual operations of the Ports of Wilmington and Morehead City based on measures of productivity and unit costing that demonstrate operational efficiency.** The following performance measures were collected from Fiscal Year 2013–14 to Fiscal Year 2017–18:	Page 13

		• ship turnaround time, • dwell time, • container moves per hour, • truck turn and gate times, and • unit costing.	
(b)(1a)(b)	Is effective	The Program Evaluation Division determined **effectiveness of the North Carolina State Ports Authority and the individual operations of the Ports of Wilmington and Morehead City based on measures that examined utilization of resources, throughput, and quality of cargo handling.** The following performance measures were collected from Fiscal Year 2013–14 to Fiscal Year 2017–18: • ship calls, • berth occupancy rate, • crane hours, • container moves, • tonnage, and • claims value.	Page 13
(b)(1b)	Cost of the program or activity broken out by activities performed	In Fiscal Year 2017–18, total operating costs of the North Carolina State Ports Authority were $48.6 million. Activities at the ports support the mission of stimulating import and export commerce throughout the state. Commerce is measured in terms of tons of cargo for general cargo and container moves for containerized cargo. From Fiscal Years 2013–14 to 2017–18 the cost of general cargo fluctuated between $6.26 and $7.57 per ton, falling by 5% from the beginning to the end of that timeframe. Costs per container move fell 12% from $51.17 to $44.96 per container move in that span.	Page 13
(b)(2)	Recommendations for making the program or activity more efficient or effective	To improve the administration of North Carolina's ports, the report's Recommendations advise the General Assembly to direct the Authority to do the following: • establish strategies to address deficiencies at the Port of Morehead City, • more comprehensively measure service quality, and • report on the implementation of an environmental management system.	Page 40-41
(b)(2a)	Recommendations for eliminating any duplication	The Program Evaluation Division **did not find evidence of duplication** in the operations of the North Carolina State Ports Authority.	Page 27-29
(b)(4)	Estimated costs or savings from implementing recommendations	There are no costs or savings from implementing this report's recommendations.	

PROGRAM EVALUATION DIVISION
NORTH CAROLINA GENERAL ASSEMBLY

October 2019 Report No. 2019-07

Evaluation of Efficiency and Effectiveness of State Ports at Wilmington and Morehead City

Summary

The Joint Legislative Program Evaluation Oversight Committee's 2018–19 Work Plan directed the Program Evaluation Division to examine the efficiency and effectiveness of the North Carolina State Ports Authority (the Authority) and its operation of the Wilmington and Morehead City ports. Ports are an important component of the statewide and regional economy; in Fiscal Year 2017–18, North Carolina ports contributed $15.4 billion to the state economy and indirectly supported more than 87,000 jobs that collectively provided $4.3 billion in compensation to employees. In that same year, the ports processed more than four million tons of cargo and performed over 320,000 container moves.

Operations at the ports are generally effective and efficient, due largely to the performance of the Port of Wilmington and recent implementation of capital projects. Multiple measures of performance that address asset utilization, cargo throughput, quality, terminal productivity, and unit cost show the Port of Wilmington is largely responsible for performance indicator gains made by the Authority as a whole during the last five fiscal years. A significant factor in these gains is the General Assembly's investment in capital projects at the ports between Fiscal Years 2015–16 and 2018–19. Although many of the projects are not yet complete, throughput and other performance measures have improved at the Port of Wilmington following the installation of new cranes.

Operations at the ports are not duplicative. Although some activities and positions overlap, the Authority's administrative decision to operate two ports is prudent, in part because the two ports service different types of cargo.

The Authority is not in compliance with statute requiring that containerized cargo shipping operations be conducted at both ports, has not implemented an environmental management system (EMS), and does not adequately assess service quality from its customers.

To address these deficiencies the General Assembly should

- direct the Authority to establish strategies to address deficiencies at the Port of Morehead City, more comprehensively measure service quality, and report on the implementation of an EMS and
- align the containerized cargo statute with operations at the ports.

Purpose and Scope

The Joint Legislative Program Evaluation Oversight Committee's 2018–19 Work Plan directed the Program Evaluation Division to examine the efficiency and effectiveness of the North Carolina State Ports Authority (the Authority) and its operation of the Wilmington and Morehead City ports. The Authority is charged with promoting, developing, constructing, equipping, maintaining, and operating the harbors and seaports within the state. A 2017 financial audit of the Authority showed that its profitability had decreased compared to the previous year despite the General Assembly appropriating state funds for capital investments beginning in Fiscal Year 2015–16. Because the Authority is subject to the oversight of the State Auditor, this evaluation did not focus on financial performance. Instead, the Program Evaluation Division applied a series of industry-accepted metrics for assessing maritime port operations to determine efficiency and effectiveness at both port locations.

Four research questions guided this evaluation.

1. Are operations of the North Carolina State Ports Authority effective?
2. Are operations of the North Carolina State Ports Authority efficient?
3. How have the State's recent capital investments in the port affected operations?
4. Are operations of the Port of Wilmington and Port of Morehead City duplicative?

The Program Evaluation Division collected and analyzed data from several sources including

- statutes and regulations,
- strategic plans,
- audited financial statements,
- review of port operations in other states,
- minutes from North Carolina State Ports Authority Board of Directors meetings,
- interviews with North Carolina State Ports Authority staff and executive leadership,
- analysis of terminal operations to include
  - shipping demand,
  - cargo throughput,
  - yard productivity, and
  - gate turn time, and
- site visits to the Ports of Wilmington and Morehead City.

Background

Ports are publicly owned or commercial facilities comprised of one or more wharves where ships dock to load and discharge passengers and cargo. Although usually situated on a sea coast or estuary, some ports are located many miles inland and accessible from the sea via river or canal. Whereas early ports tended to be simple harbors, modern ports often are multimodal distribution hubs with transportation links using sea, river, canal, road, rail, and air routes.

Today, ports are a primary component of the general transportation sector and are linked to the expanding global economy by serving as a centralized hub for the arrival and departure of imports and exports. Ports provide access to the global supply chain, increasing both the customer base for state-produced exports and the number of sellers accessing the state marketplace, thereby stimulating commerce within the state. North Carolina maritime ports—with locations in Morehead City and Wilmington—help connect North Carolinians to the global market.

Ports are a critical component of statewide and regional economies. Measures of economic impact are employment, wages, output or revenue, and tax revenues. A 2014 report from the American Association of Ports Authority estimated the total economic value of US coastal ports (in terms of revenue to businesses, personal income, and economic output by importers and exporters) at $4.6 trillion. A 2018 economic impact analysis showed North Carolina ports contributed $15.4 billion dollars to the state economy and indirectly supported more than 87,000 jobs. Employee compensation for these jobs was estimated at $4.3 billion.[1]

Access to ports can affect the cost of goods for buyers and sellers. Landed costs include the original price of the product, transportation fees (both inland and ocean), customs, duties, taxes, tariffs, insurance, currency conversion, crating, and handling and payment fees. All of these individual costs are part of the value of goods received and help sellers determine margin per item, which is reflected in the price of goods. The further away ports are from importers and exporters, the greater the landed costs.

Greater transport costs lead to less foreign investment, lower savings, reduced exports, and a decline in employment. It is estimated that doubling transport costs can lead to a drop in the rate of economic growth of more than half a percentage point. Lower growth over the long term results in sizeable variation in per capita income.[2] When they are functioning effectively and efficiently, North Carolina ports help keep the prices of imports low and help keep the State's exports competitive in the global market.

Ports handle many types of cargo. To understand the operation of various port components and their connection to port performance, it is necessary to have a basic understanding of the various types of cargo that are shipped and transported. The amount of cargo that passes through a port

[1] Head, W., Bert, S., & Findley, D. (2018). North Carolina Ports 2018 Economic Contribution Study. A Report by the Institute for Transportation Research and Education at North Carolina State University for the North Carolina State Ports Authority. Raleigh, NC: Institute for Transportation Research and Education.

[2] Dwarakish, G.S., & Salim, A.M. (2015). Review on the Role of Ports in the Development of a Nation. Aquatic Procedia, 4, 295-301.

is part of a port's throughput. This evaluation focused on containerized cargo and general cargo because these are the primary types of cargo handled at state ports.

Containerized cargo throughput is measured in the number of container moves standardized in 20-foot equivalent units (TEU), where TEU is the uniform measure of container capacity and moves represent loading a container from the dock onto a vessel or discharging a container from a vessel onto a dock.[3] As an operating metric, customers are invoiced by terminal operators for the number of moves performed.

General cargo, by contrast, consists of the following types of bulk materials with throughput volume measured in tons.

- **Dry Bulk** are unpacked and homogenous commodities (i.e., grain, iron ore, or coal). Dry bulk terminals usually handle either imports or exports. The size of the terminal is dependent upon the cargo volume, the number of commodity types, and vessel call frequency. Terminals are unloaded by a combination of fixed and mobile equipment.
- **Liquid Bulk** includes products such as crude oil, gasoline, diesel, fuel oil, and chemicals transported in a variety of tankers. To unload and load these materials, pipes and hoses connect to the vessel to allow the liquid cargo to be transferred to or from vessel tanks.
- **Break Bulk** materials are generally packed on pallets or in bags. These commodities are loaded and unloaded by cranes and straps (for boxes) or slings (for bags).

Ports are complex and made up of numerous components that require large capital investment to acquire and maintain. The physical and institutional components of ports differ by function, cargo type, and geographic location. The characteristics of the components, interactions, and management of a port will determine its capacity and throughput. Exhibit 1 provides a list of common port components, a description of each component, and its relation to capacity and throughput.

[3] Twenty-foot equivalent units are used worldwide as the uniform measure of container capacity; a TEU is 20 feet (6.06 meters) long and 8 feet (2.44 meters) wide and tall. A 20-foot container represents one TEU; a 40-foot container represents two TEU.

Exhibit 1: Various Port Components Can Restrict Capacity and Throughput

Component	Description	Relation to Throughput and Capacity
Terminal	A terminal is a port facility where vessels are discharged or loaded. Terminals can be defined by their facilities, equipment, the type of cargo handled, physical barriers or boundaries, ownership or operating structure, and other characteristics.	Many ports contain several terminals, each with their own berths, equipment, and land-side storage space, and which may be adjacent to each other or separated by many miles. Terminals vary widely in configuration and infrastructure, and therefore the number and size of terminals alone are not consistent indicators of port throughput and capacity.
Berths	A berth is a place to stop and secure a vessel for cargo transfer or other purposes. Berth locations are often determined by the availability of securement points on the wharf and may not have fixed sizes or boundaries.	Berth length is significant for container and break bulk terminals, where the full length of the vessel must be accessed, but is less significant for bulk and roll-on/roll-off (RORO) terminals, where unloading and loading operations use conveyors, ramps, or other means that do not require accessing the full vessel length. Insufficient berth availability can result in inefficiencies.
Loading and Unloading Equipment	Loading and unloading equipment are terminal equipment used to load and unload different cargo types. These equipment are fixed or mobile and will vary based on the cargo handled and the types of vessels serviced by the port.	Most container vessels are loaded and unloaded with shore-side gantry cranes. Smaller vessels and barges may be handled with on-board equipment or with mobile harbor cranes. RORO cargo and vessels are serviced with ramps. Bulk and break bulk terminals use a combination of fixed and mobile equipment that typically allow for faster loading and unloading of cargo. Operations are limited by infrastructure and operational efficiency.
Waterside Access	Waterside access refers to the waterways, channels, reaches, and anchorages that enable vessels to reach a port.	Limited waterside access can constrain the number and size of vessels that can call at a terminal.
Channel	A channel is a navigable waterway leading from open water to port terminals. Many channels are dredged to accommodate larger vessels and require periodic maintenance.	The shallowest point of a channel can be a limiting factor on the size of ships that can access a terminal. Channel access also may be limited by air draft restrictions imposed by overhead features such as bridges or power lines.
Modal Connections	Modal connections are the connections for moving cargo between vessels and surface transportation modes, including road, rail, and pipeline.	Road access is used for containers, bulk, break bulk, and RORO cargo. Highway capacity and congestion can constrain throughput. Rail is the primary mode of moving dry bulk export commodities such as coal and grain to port terminals and connects coastal container ports to inland import and export markets. For container terminals, rail intermodal connections are described as on-dock, near-dock, or off-dock. More efficient cargo handling is possible when rail facilities exist on dock.
Cargo/container storage and chassis depots	Cargo/container storage and chassis depots are places to store cargo, shipping containers, or container chassis outside of port terminals.	Off-terminal storage can include space for cargo before and after it is transferred to or from vessels. A lack of storage space may constrain the overall capacity of a terminal, as cargo cannot be stored prior to loading or while it awaits pickup after unloading.

Source: U.S. Department of Transportation, Bureau of Transportation Statistics, Port Performance Freight Statistics 2018 Annual Report to Congress.

The North Carolina State Ports Authority is responsible for promoting, developing, constructing, equipping, maintaining, and operating North Carolina's ports. In 1945, the North Carolina General Assembly created the North Carolina State Ports Authority (the Authority). A political subdivision of the State, the Authority has no stock or equity shareholders but rather is governed by an 11-member Board of Directors appointed by the Governor, Speaker of the House, and President Pro Tempore of the Senate on staggered terms. Administratively, the Authority resides within the Department of Transportation. Operations are subject to oversight from the State Auditor, who conducts an annual audit of the Authority.

The Authority's mission is to provide a gateway to global markets and enhance the economy of North Carolina by supporting and improving the State's logistics network. The Authority is responsible for port operations at two maritime ports and one inland port. An inland port (sometimes referred to as a dry port) is an inland intermodal terminal directly connected by road or rail to a seaport that operates as a center for the transshipment of sea cargo to inland destinations. The Authority is responsible for operating the inland port in Charlotte, which is not included in the scope of this evaluation because the work plan specifically directed an evaluation of operations at the Ports of Wilmington and Morehead City. Exhibit 2 displays a map of the state maritime and inland port terminals.

Exhibit 2: North Carolina State Ports Authority Operates Two Maritime Ports and One Inland Port

Source: Program Evaluation Division based on information provided by the Authority.

The Port of Morehead City and Port of Wilmington are operating ports, meaning the Authority is responsible for operating the cranes, truck gate, and yard; stevedoring companies are responsible for transferring cargo to and from vessels and the place of rest on the port.

- **Port of Wilmington.** The Port of Wilmington is located approximately 26 miles from the open sea on the Cape Fear River. Currently it has a channel depth of 42 feet Mean Lower Low Water (MLLW).[4] The port has nine berths with approximately 6,800 linear feet of wharf and provides cargo storage space for container, bulk, and break bulk

[4] MLLW is defined as the average of the lower low water height of each tidal day observed over the 19-year recording period known as the National Tidal Datum Epoch.

operations. Examples of Wilmington's major import commodities include fruit, grain, cement, and steel. Among the largest facilities at the Port of Wilmington is its container terminal, which has a gross area of approximately 85 acres including 6,000 20-foot ground slots for container storage and space for chassis storage. Container operations are served by three berths totaling 2,650 feet. Approximately 1,950 feet is in operation while 700 feet remains under construction. The berths were rebuilt to accommodate larger dock cranes and vessels. Appendix A shows a satellite photograph of the Port of Wilmington and its terminal features.

- **Port of Morehead City**. The Port of Morehead City is located four miles from the Atlantic Ocean and has a 45-foot MLLW-deep channel from the sea buoy. It has nine berths with approximately 5,500 feet of wharf and handles both break bulk and bulk cargo at its existing facilities. A major import commodity of the port is natural raw rubber. The port also serves as a major exporter of phosphates. Radio Island, which is part of the Port of Morehead City, is located across the Newport River from the port and includes approximately 150 acres of land suitable for port industrial development. Appendix A shows a satellite photograph of the Port of Morehead City and Radio Island and its terminal features.

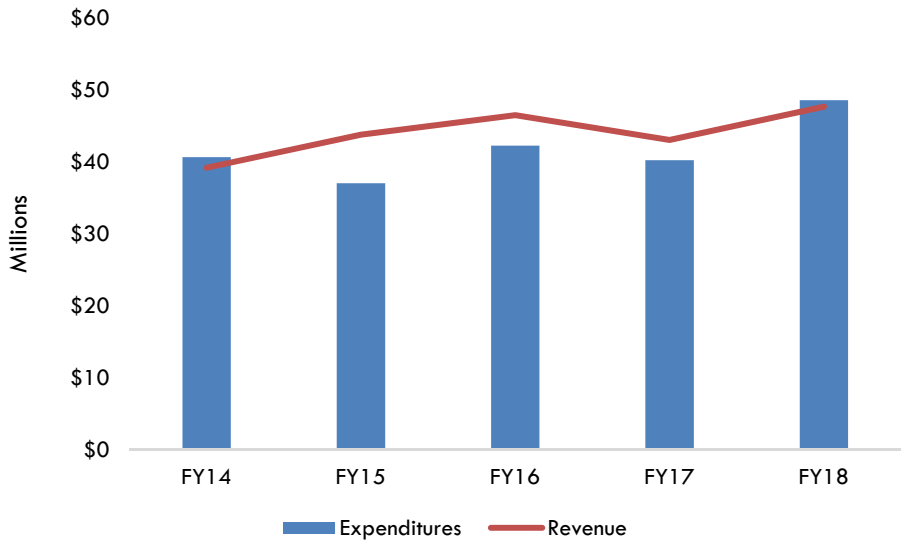
Operations at the ports generate revenue that is intended to cover operating costs. Exhibit 3 shows that revenue from operations has exceeded annual expenditures in three of the past five fiscal years. The dip in revenue in 2016–17 was cited in a 2017 financial audit of the Authority and raises concerns given the State's recent investment in port infrastructure.[5] However, the decline in port activity in Fiscal Year 2016–17 can be largely attributed to the bankruptcy of one of the ports' largest customers, Hanjin, a Korean-based shipping company that transported furniture and homeware goods. North Carolina ports relied on Hanjin for approximately 7.5% of annual revenue; correspondingly, from Fiscal Year 2015–16 to 2016–17, Authority revenues dropped by 7%.

Despite the 2017 dip, the ports have generally experienced revenue growth in recent years. Between Fiscal Years 2013–14 and 2017–18, the ports experienced an overall growth in revenues of 22% whereas growth of expenditures was 19%. In Fiscal Year 2017–18, expenditures increased significantly compared to the previous year due to the State's contribution of $6.5 million to the Army Corps of Engineers for dredging projects, resulting in a small operating loss. However, over the course of these five fiscal years, the ports achieved more than $11.4 million in operating profits.

[5] Office of the State Auditor. (2018, October). *North Carolina State Ports Authority Wilmington, North Carolina Financial Statement Audit Report for the Year Ended June 30, 2018*. Raleigh, NC: General Assembly.

Exhibit 3

Port Revenues Have Exceeded Expenditures in Three of the Last Five Fiscal Years



Note: Fiscal Year 2017–18 expenditures include $6.5 million in state contributions to the Army Corps of Engineers for dredging projects.

Source: Program Evaluation Division based on annual financial audits.

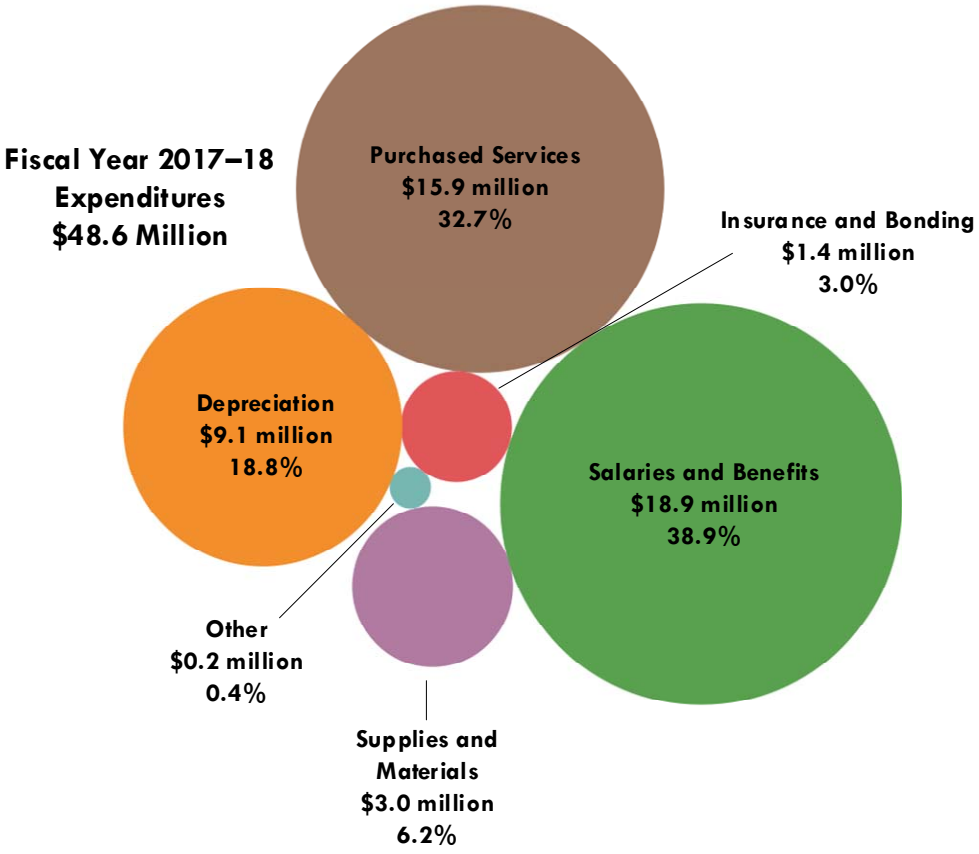
Operating revenues come from two sources: facility leases and cargo charges. Importers and exporters lease land and facility space at the terminals. However, leases accounted for less than 10% of all port operating revenue in Fiscal Year 2017–18. The majority of port revenue comes from cargo charges. The Authority uses a process for setting rates that is based on a combination of published port tariff charges and negotiated rates that use the tariff as the baseline. Both tariffs and negotiated rate setting are driven by market-based, industry standard cost elements (including items such as crane and equipment rental, gate processing, throughput, wharfage, dockage, demurrage, and storage), and in some cases rates are set in conjunction with minimum annual guarantees. Container business and general cargo rates are set based on their unique and required cost elements. Existing agreements and legacy business relationships also are considered in setting rates for either renewals or new business.

Expenditures are largely driven by salaries and purchased services. The Authority employs 214 staff, responsible for administrative, equipment operations, engineering and maintenance, and security functions. [6] Another primary source of expenditures are purchased services. Contracts for purchased services are competitively bid through a formal Request for Qualifications/Request for Proposals process. The value of purchased services grew by 100% between Fiscal Years 2013–14 and 2017–18 due in part to large capital investments that require contracted engineering services and state contributions to the Army Corps of Engineers for dredging projects. Expenditures on salaries and benefits and purchased services accounted for 72% of total expenditures in Fiscal Year 2017–18. Exhibit 4 shows all expenditures by category for the Authority for Fiscal Year 2017–18.

[6] This position count reflects Fiscal Year 2017–18 staffing levels and does not include vacant or unfilled positions or board members.

Exhibit 4

Salaries and Benefits and Purchased Services Accounted for 72% of Expenditures in Fiscal Year 2017–18



Note: Purchased Services includes $6.5 million in state contributions to the Army Corps of Engineers for dredging projects.

Source: Program Evaluation Division based on annual financial audits.

North Carolina's ports are in the process of implementing major capital improvements. In 2015, the Authority developed a five-year strategic plan that set forth a number of ambitious objectives including increasing the volume of containerized cargo and general cargo. The strategic plan outlined several necessary capital investment initiatives including

- terminal infrastructure,
- channel enhancements,
- improved truck mobility, and
- rail competition.

To meet these needs, the General Assembly appropriated $160 million from Fiscal Year 2015–16 through 2018–19 to the Authority to implement several capital infrastructure projects. Many of the projects are underway but have yet to be fully implemented.

In summary, North Carolina's ports play an important role in the State's economy by connecting its citizens with imports and connecting its exports to the global economy. However, a simple recognition of the significance of the economic impact of the ports—$15.4 billion to the state economy and direct support for more than 87,000 jobs—does not represent an assessment of

port operations. Furthermore, a 2017 audit identified a dip in revenue. As a result, the Joint Legislative Program Evaluation Oversight Committee directed this evaluation to examine the North Carolina State Ports Authority and its administration of the Wilmington and Morehead City ports to determine if operations are both efficient and effective.

Findings

Finding 1 shows that, as a whole, North Carolina ports are effective and efficient. However, aggregating both port locations in a single performance review is not the best means for evaluating the ports because the North Carolina State Ports Authority (the Authority) operates two ports with distinct cargo operations. Findings 2 and 3 provide greater detail regarding the individual performance of the Port of Wilmington and the Port of Morehead City, respectively. Taken together, Findings 2 and 3 show that recent port performance gains are attributable largely to the Port of Wilmington. The remainder of the report's findings address the question of potential duplication of effort at the two port locations, statutory compliance of port operations, and other administrative practices that require action to ensure continuous improvement.

Finding 1. Taken together, North Carolina ports are effective and efficient as demonstrated by increased throughput and decreased unit costs; however, examining port performance at the enterprise level obscures a determination of whether the two port locations are individually effective and efficient.

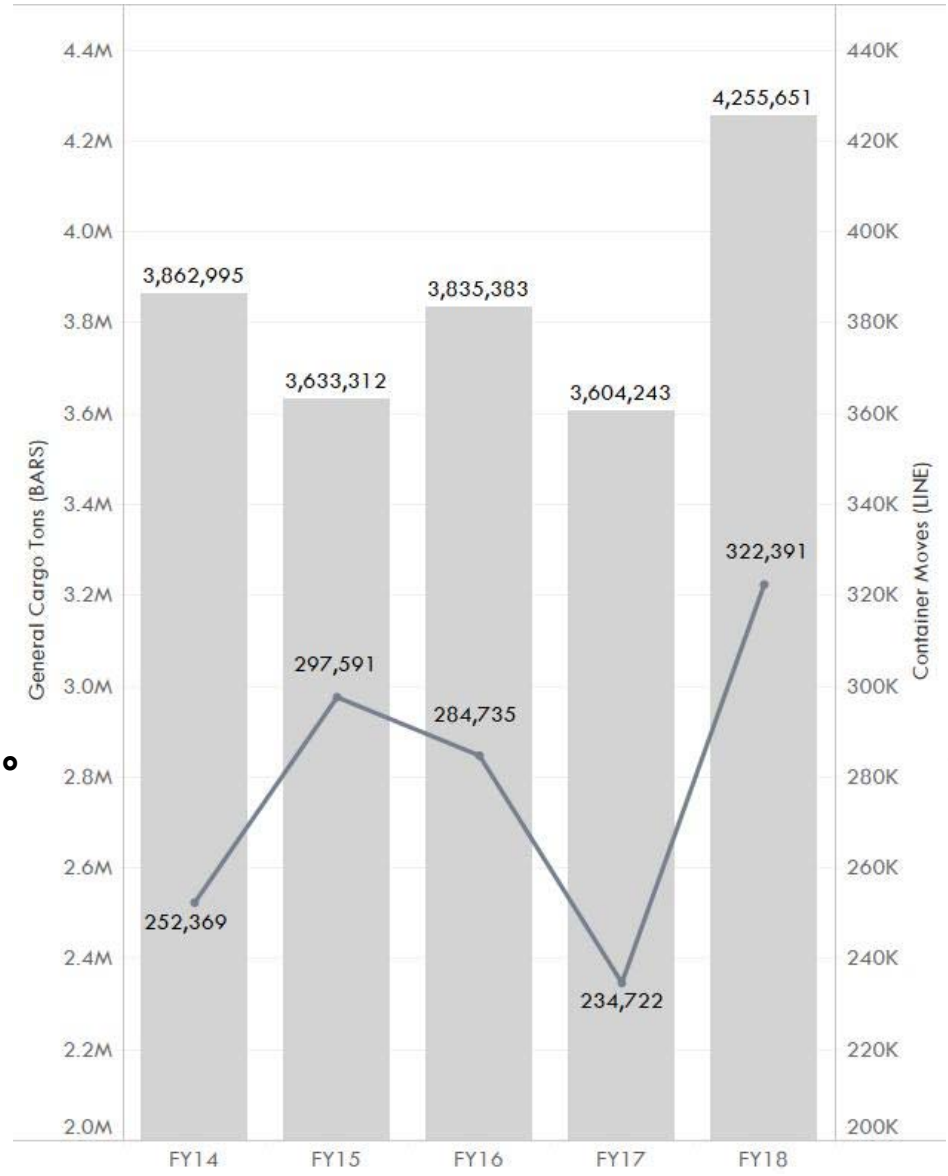
Ports seek to enhance the effectiveness of operations by maximizing throughput. Throughput is the general term for port output and can be measured in tons (for general cargo) and in container moves (for containerized cargo). Maximizing throughput for a given set of resources enhances the efficiency of port operations. Efficiency can be measured in cost per ton of cargo and cost per container move. Analysis of these measures for the Authority as a whole shows throughput has increased and processing costs have declined in recent years. However, these high-level performance indicators fail to address how operations at each of the two ports distinctly contribute to overall performance. In-depth analysis of the individual ports that considers the nature of operations is necessary to determine individual port efficiency and effectiveness.

Throughput has grown during the last five fiscal years, demonstrating overall port effectiveness. Throughput is the general term for port output and can be measured in tons for general cargo and in container moves for containerized cargo. Both measures indicate the volume of imports and exports processed through a port. As Exhibit 5 shows, North Carolina's ports have demonstrated growth in both throughput measures during the last five fiscal years. During that period, the volume of general cargo collectively processed at both ports has grown by 10%, from 3.9 million tons to 4.3 million tons. Similarly, but to a greater degree, the volume of container operations has grown by 28%, from 252,369 to 322,391 container moves.

Both of these throughput indicators reveal overall growth in port effectiveness during the last five fiscal years.

Exhibit 5: Overall Port Throughput Shows Positive Growth

Change in General Cargo Volume +10%



Change in Container Move Volume +28%

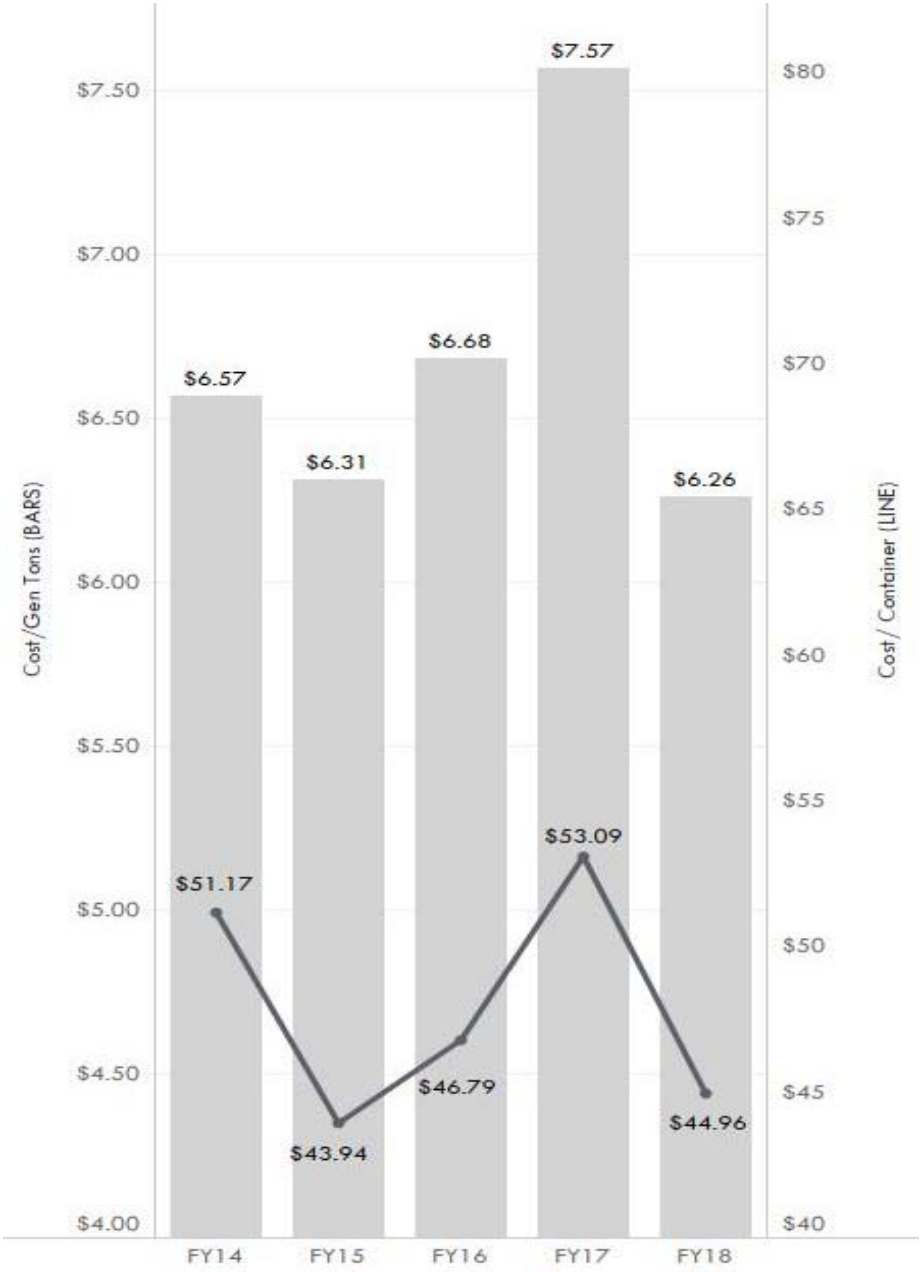
Note: BARS represent tons of general cargo. LINE represents the number of container moves performed.

Source: Program Evaluation Division based on information provided by the Authority.

The cost to process cargo has decreased during the last five fiscal years, demonstrating overall port efficiency. Efficiency can be measured by looking at the resources it takes to produce a given output, where cost is measured in operating expenditures and outputs are measured in tonnage and container moves. Overall, port efficiency has improved in recent years. During the last five fiscal years, costs per ton for general cargo have fallen by 5% and the cost to process containerized cargo has decreased by 12%. Exhibit 6 illustrates these trends related to port efficiency.

Exhibit 6: Costs to Process Containerized and General Cargo Have Decreased

Cost/Ton General Cargo -5%



Cost/Container Move -12%

Note: BARS represents cost per ton of general cargo. LINE represents cost per container move in TEU.

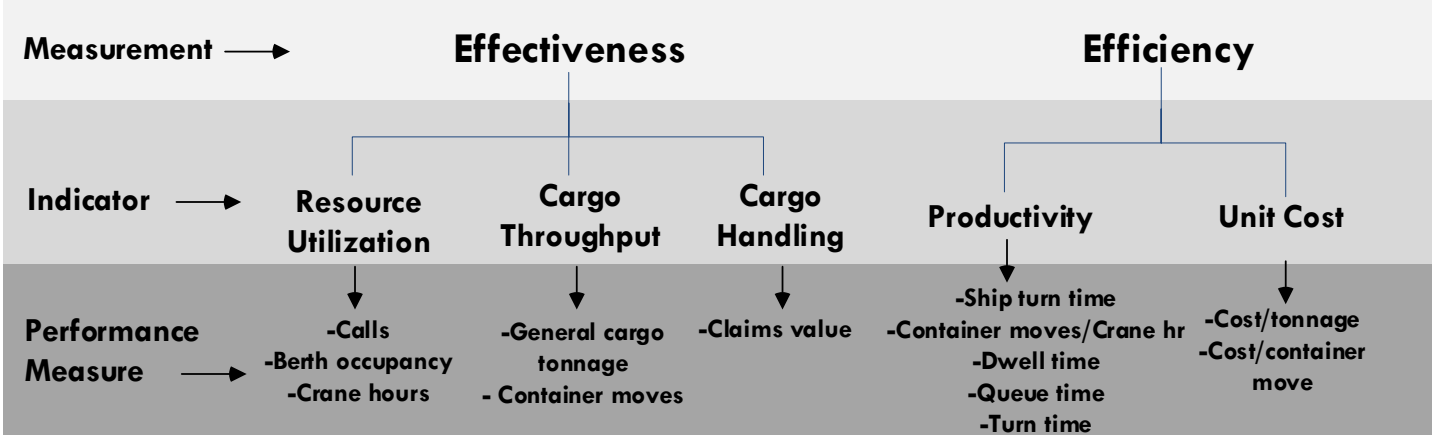
Source: Program Evaluation Division based on information provided by the Authority.

Solely examining throughput and cargo processing costs fails to provide the level of detail necessary to measure the individual effectiveness and efficiency of operations at the two North Carolina ports. Although operations at both the Ports of Wilmington and Morehead City are the administrative responsibility of the North Carolina State Ports Authority (the Authority), performance of North Carolina's ports cannot be accurately assessed at the enterprise level because the two ports maintain unique operations. For example, the Port of Wilmington services general cargo and containerized cargo but Morehead City only services the former.

Accordingly, the data pertaining to container moves shown in Exhibits 5 and 6 only reflects operations in Wilmington, whereas the measures related to general cargo encompass both ports. This operational difference alone merits the use of additional performance measures.

As a result, the Program Evaluation Division relied on several industry standard measures of maritime port operational effectiveness and efficiency that span general cargo and containerized cargo operations. The Program Evaluation Division reviewed logistics and shipping literature from academia, industry trade groups, and the United Nations on Trade and Development to develop a matrix of performance measures relevant to port operations at Wilmington and Morehead City. Exhibit 7 displays the matrix and shows the elements used to evaluate port efficiency and effectiveness across both ports. In most cases, the Program Evaluation Division selected multiple performance measures for each operational indicator.

Exhibit 7: Evaluation Performance Measures for Port Effectiveness and Efficiency



Source: Program Evaluation Division based on a review of literature.

Port effectiveness is comprised of three indicators.

- **Utilization of resources.** Utilization of resources demonstrates how assets are being deployed to meet demand. It can be used as a proxy performance indicator to illustrate how well the Authority is generating commerce at the ports through its marketing and sales efforts and the implementation of its capital plan. The number of **calls, berth occupancy rate, and crane hours** are the three performance measures used to evaluate the utilization of resources at each port.
- **Throughput.** Throughput is an essential indicator that measures the total cargo being serviced at the ports. The performance measures for throughput are standardized **container moves** for containerized cargo and **tonnage** for bulk, break bulk, and liquid bulk cargo.
- **Quality of cargo handling.** Cargo handling demonstrates how effectively ports service their cargo without damage or liability. The **value of claims per call** for damaged or insured goods paid out by the Authority is the performance measure for cargo handling.

Port efficiency is determined by terminal productivity and unit costing.

- **Port productivity.** Measuring port productivity provides a view into how efficiently the ports are using available resources per a given output. Port productivity is broken into the three performance measures that indicate the amount of time it takes to perform various operations
  - at the dock via **ship turnaround time and container moves per crane hour,**
  - in the yard via **dwell time,** and
  - through the gate via **queue and turn times**.
- **Unit cost.** Because productivity measures can be affected by operations, unit costing provides a measurement of changes in operating costs per output, reflecting any improvements or gains in efficiency in overall port operations. **Cost per container move** and **cost per tonnage** are the performance measures for unit costing.

The applicability of each of these performance measures is dependent on the nature of operations at each individual port. Exhibit 8 illustrates how the performance indicators and measures respectively apply to the two ports. Although many of the measures apply to both locations, several others apply only to the Port of Wilmington because it is the only one of the two ports that handles containerized cargo.

Exhibit 8

Operational Differences Between the Ports Require the Use of Different Performance Measures

Indicator	Performance Measure	Applicability	
		Wilmington	Morehead City
Utilization	Calls	✓	✓
	Berth Occupancy Rate	✓	
	Crane Hours	✓	✓
Throughput	Container Moves	✓	
	General Cargo Tonnage	✓	✓
Handling	Claims Value Per Call	✓	✓
Productivity	Ship Turn Time	✓	✓
	Container moves/hour	✓	
	Dwell Time	✓	
	Queue Time	✓	
	Turn Time	✓	✓
Unit Costing	Cost/Tonnage	✓	✓
	Cost/container move	✓	

Source: Program Evaluation Division based on a review of literature and information provided by the Authority.

In summary, throughput gains and decreased costs to process cargo are positive indicators that port operations are effective and efficient. However, looking at port operations at the enterprise level alone is insufficient because of differences in the types of cargo handled at the two ports. Additional performance measures are needed to examine the effectiveness and efficiency of the ports at an individual level. Furthermore, this evaluation's directive required analysis of the individual Ports of Wilmington and

Morehead City. To evaluate effectiveness and efficiency at the individual port level, the Program Evaluation Division collected data for a five-year period for the various performance measures identified in Exhibits 7 and 8 where applicable. Findings 2 and 3 summarize each port's performance.

Finding 2. Operations at the Port of Wilmington are effective and efficient based on growth in port utilization and throughput, improved cargo handling and productivity, and reduced unit costs over time.

Effective operations indicate a port is meeting its intended mission and objectives. Efficient operations involve maximizing resources for a given output or activity. Using the framework identified in Exhibit 7, the Program Evaluation Division collected available year-by-year data for each of the identified performance measures. Appendix B provides details on specific performance trends for each measure. As Exhibit 10 shows, the Port of Wilmington has made improvements on nearly every performance measure in recent years.

Exhibit 10: Port of Wilmington Operations are Effective and Efficient

Indicator	Performance Measure	Definition & Performance Interpretation	Trend Over Time	Outcome
Effectiveness				
Utilization	Calls	Calls refers to the number of ships entering a port and using its berths to process cargo. The number of calls represents the customer volume of a port and reflects the port's ability to attract new business and maintain previous customers. **Increased** numbers of calls represent improved levels of volume at ports.	⬆	+
	Crane Hours	Crane hours demonstrate how ports use equipment to process cargo. As throughput changes, corresponding changes in crane hours reflect how ports use employee and equipment hours to process cargo. **Increased** crane hours reflect greater utilization.	⟷	NA
	Berth Occupancy Rate	Berth occupancy rate (BOR) is a measure of a port's utilization of capacity. **Increased** BOR represents improved usage of port facilities.	⬆	+
Throughput	Container Moves	Container moves is a measurement of the container volume serviced at a port. **Increased** container moves are an indicator that throughput is improving.	⬆	+
	General Cargo Tonnage	General cargo being processed at a port is captured through tonnage. **Increased** tonnage is an indicator that throughput is improving.	⬆	+
Cargo Handling	Value of Claims Per Call	Claims amounts paid per call for damaged or lost goods can serve as a measure of the quality of the handling of cargo at ports. **Decreased** claims value per call represents improved cargo handling quality.	⟷	NA
Efficiency				
Productivity	Ship Turn Time	Ship turn time shows the time it takes for a ship to be serviced at call. **Decreasing** values are associated with an increase in efficiency.	↘	+
	Container Moves/Hour	Container moves per hour is the best measure of port call productivity. **Increasing** values are associated with greater efficiency. The industry standard strives for 40 moves per hour.	↘	-
	Dwell Time	Dwell time measures yard productivity and is the length of time a port takes to hold and ultimately process containerized goods. **Decreasing** dwell time represents more efficient use of the yard.	⬆	-
	Queue Time	Queue time is the length of time a truck waits to enter port. **Decreasing** gate time is an operational objective.	⬇	+
	Turn Time	Turn time refers to the total time elapsed between when a truck enters and exits the port. **Reducing** gate time is an operational objective.	↘	+
Unit Costing	Cost/Tonnage	Cost per tonnage measures the cost for a port to process a standardized unit of cargo. Gains in efficiency are realized in **decreased** unit costs.	⟷	NA
	Cost/Container Move	Cost per container move measures the cost for a port to move containerized cargo. Gains in efficiency are realized in **decreased** unit costs.	↘	+

⬆= Increase greater than 25% ⬇= Decrease greater than 25% ↗= Increase of 5% to 25% ↘= Decrease of 5% to 25% ⟷=Less than 5% increase or decrease

Note: (+) represents a positive performance outcome. (-) indicates a negative performance outcome. (NA) indicates the performance measure remained stable.

Source: Program Evaluation Division based on a review of literature information provided by the Authority.

Utilization of the Port of Wilmington has increased, demonstrating improved effectiveness, but capacity still exists. Utilization is important because it reflects the extent to which port capital infrastructure is being used. It is also a proxy for the Authority's effectiveness at generating commerce at the ports through its marketing and sales efforts. The Port of Wilmington is demonstrating improvement in terms of calls, crane hours, and berth occupancy rate (BOR); however, the port's BOR still falls short of optimum levels, signaling that additional capacity still exists.

- **Calls** overall at the Port of Wilmington increased 37% between Fiscal Years 2013–14 and 2017–18. This overall increase is due in large part to the increase in container calls, which have grown 91% over the five-fiscal-year period.
- **Crane Hours** declined at the Port of Wilmington by 1.3%. However, given the increased number of calls at the Port of Wilmington and, as will be demonstrated, the increased number of container moves serviced, the relatively small decline in crane hours is better understood as a reflection of the port utilizing overall resources more efficiently.
- **Berth Occupancy Rate (BOR**) is a measure of a port's utilization of capacity that captures the ratio of calls to operating hours. Literature on container operations supports a general optimum range for BOR between 50% and 70%. Anything above 70% suggests the port may be at risk of congestion, whereas a BOR below 50% suggests underutilization. BOR has increased annually in each of the last four years, demonstrating the port is improving its utilization of resources and increasing its effectiveness, reaching a high of 29% in Fiscal Year 2017–18. However, despite achieving positive trends in recent years, the Port of Wilmington's BOR still falls well short of the optimum range, suggesting the port possesses excessive capacity and that current resources are not being fully utilized. This conclusion is shared and supported by the Authority.

Overall throughput in cargo tons and container moves at the Port of Wilmington has increased by 25% or more; at the same time, quality of cargo handling has also improved. The throughput processed by a port is linked to the port's effectiveness—the more throughput handled at the port, the greater volume of goods and materials it is processing. Containerized cargo throughput is measured in container moves and general cargo is measured in tons. Fees, tariffs, and efforts to grow and/or retain business are all reflected in throughput, along with process improvements and technological advances.

- **Container Moves** is a throughput performance measure standardized in 20-foot equivalent units (TEU), wherein TEU is the uniform measure of container capacity and moves represent loading a container from the dock onto a vessel or discharging a container from a vessel onto a dock. Customers are invoiced by terminal operators for the number of moves performed. In its 2015 strategic plan, the Authority set a goal of annually servicing 530,000 TEU by 2020. Although this goal has not been reached, the Authority is demonstrating progress. In the

past five fiscal years, total TEU have increased at the Port of Wilmington by 28%, from 252,369 to 322,391.

- **General Cargo Tonnage** captures the throughput for general cargo operations. General cargo at the Port of Wilmington includes liquid, dry, and break bulk items. Total tons of general cargo processed by the Port of Wilmington increased 25% during the five-fiscal-year period.
- **Value of Claims Per Call** paid out to customers for damaged or lost goods serves as a measure of the quality of the handling of cargo at ports. The value of claims paid out per call has decreased at the Port of Wilmington during the past five years. These data are especially notable because throughput has grown at the ports, and therefore the lack of associated growth in damaged or lost goods indicates an increase in effectiveness.

Improved productivity demonstrates efficient operations. The Port of Wilmington has made improvements in nearly all measures of port productivity.

- **Ship Turnaround Time (STT)** is a performance measure for berth productivity that captures the average number of hours it takes for a ship to be serviced at call. Lower STT is associated with an increase in efficiency, whereas higher STT is associated with a decrease in efficiency. Ship turnaround time at the Port of Wilmington has fallen by 11% over the last five fiscal years.
- **Container Moves per Hour** is a measure of port call productivity. Higher values are associated with greater efficiency. Although aveage container moves per hour has fallen slightly, the Port of Wilmington's four-year average number of container moves per crane hour (41.8) still exceeds the industry benchmark of 40 moves per hour.
- **Dwell Time** assesses yard productivity by measuring the length of time a port takes to hold and ultimately process containerized goods. Average dwell time increased at the Port of Wilmington by 110% from an average of 27 hours in Fiscal Year 2014–15 to 57 hours in Fiscal Year 2017–18. In other words, trends reveal that yard productivity decreased while berth productivity (as previously shown) increased. Although this trend may signify decreased efficiency, dwell time is a performance measure that tracks both loaded and unloaded containers; dwell time for loaded containers has remained stable while dwell times for exports have grown. Furthermore, cargo owners dictate delivery patterns for imported cargo, and as a result the Authority does not control cargo delivery. Regardless of the source of increasing dwell times, the Authority reports that increased dwell times have not affected its abilty to handle additional cargo.
- **Queue Time** captures the length of time a container truck waits to enter port. Measured in minutes, queue time reflects how efficiently ports are operating lanes of transportation into their facilities. Longer

queue times lead to delays in processing cargo into the supply chain, jeopardizing customer satisfaction and reducing overall port productivity. Queue time for single container trucks decreased by 72% from an average of 41 minutes in Fiscal Year 2014–15 to 12 minutes in Fiscal Year 2017–18. Likewise, queue time for double container trucks decreased by 64% from an average of 45 minutes in Fiscal Year 2014–15 to 16 minutes in Fiscal Year 2017–18.

- **Turn Time** refers to the total time elapsed between when a truck enters the port to be loaded with cargo and when it exits the port facility. Like queue time, turn time affects customer satisfaction and environmental hazards. Additionally, gate time is an indicator of how efficiently a port is handling vehicular and transportation traffic. Turn time for the Port of Wilmington is tracked by container type. Turn time for single container trucks decreased by 19% from an average of 27 minutes in Fiscal Year 2014–15 to 22 minutes in Fiscal Year 2017–18. Turn time for double container trucks decreased by 27% from an average of 42 minutes in Fiscal Year 2014–15 to 31 minutes in Fiscal Year 2017–18.

Falling unit costs reflect productivity gains and growing throughput at the Port of Wilmington. Gains in efficiency, be they achieved at any step along the workflow of a terminal or elsewhere within the port system, should be realized in decreased costs per unit produced. The more efficient an agency is at producing a particular output, the less expensive it is to produce the output. Unit costing is available by the type of cargo serviced. At the Port of Wilmington, cost per ton of general cargo and cost per container move are the performance measures related to unit costing that are used to determine efficiency.

- **Cost per ton** at the Port of Wilmington decreased by 4% from $6.04/ton to $5.83/ton during the five-fiscal-year period.
- **Cost per container move** at the Port of Wilmington also decreased by 12% during the past five fiscal years. This increased efficiency is due to operating costs growing at a much slower rate than the number of container moves. Estimated container operating costs grew by only 12% over the five fiscal years, whereas container moves grew by 28%, resulting in decreased unit costs.

In summary, the Program Evaluation Division applied 13 performance measures to the Port of Wilmington spanning five operational indicators. The port demonstrated improved performance on nearly every performance measure over the five-fiscal-year period. As a result, the Program Evaluation Division concludes that operations at the Port of Wilmington are effective and efficient.

Finding 3. Despite falling utilization rates, decreased throughput, and diminished productivity, the Port of Morehead City has made bottom-line efficiency gains.

The Program Evaluation Division collected available data for each performance measure identified in Exhibits 7 and 8 that was applicable to the Port of Morehead City. Appendix C provides details on specific performance trends for each measure. As Exhibit 11 shows, the Port of Morehead City has demonstrated diminishing effectiveness and efficiency in recent years.

Exhibit 11: Operations at the Port of Morehead City Exhibit Diminished Effectiveness and Efficiency

Indicator	Performance Measure	Definition & Performance Interpretation	Trend Over Time	Outcome
Effectiveness				
Utilization	Calls	Calls refers to the number of ships entering a port and using its berths to process cargo. The number of calls represents the customer volume of a port and reflects the port's ability to attract new business and maintain previous customers. **Increased** numbers of calls represent improved levels of volume at ports.	⬇	-
	Crane Hours	Crane hours demonstrate how ports use equipment to process cargo. As throughput changes, corresponding crane hour changes reflect how ports use employee and equipment hours to process cargo. **Increased** crane hours reflect greater utilization.	↘	-
Throughput	General Cargo Tonnage	General cargo being processed at a port is captured through tonnage. **Increased** tonnage is an indicator that throughput is improving.	↘	-
Cargo Handling	Value of Claims Per Call	Claims amounts paid per call for damaged or lost goods can serve as a measure of the quality of the handling of cargo at ports. **Decreased** claims value per call represents improved cargo handling quality.	⬇	+
Efficiency				
Productivity	Ship Turn Time	Ship turn time shows the time it takes for a ship to be serviced at call. **Decreasing** values are associated with an increase in efficiency.	↗	-
	Turn Time	Gate time refers to the total time elapsed between when a truck enters and exits the port. **Decreasing** gate time is an operational objective.	⬆	-
Unit Costing	Cost/Tonnage	Cost per tonnage measures the cost for a port to process a standardized unit of cargo. Gains in efficiency are realized in **decreased** unit costs.	↔	NA

⬆= Increase greater than 25% or more ⬇= Decrease greater than 25% or more ↗= Increase of 5% to 25% ↘= Decrease of 5% to 25% ↔=Less than 5% increase or decrease

Note: (+) represents a positive performance outcome. (-) indicates a negative performance outcome. (NA) indicates the performance measure remained stable.

Source: Program Evaluation Division based on a review of literature and information provided by the Authority.

Utilization is declining at the Port of Morehead City, suggesting diminishing effectiveness.

- **Calls** at the Port of Morehead City have declined over the last five fiscal years from 606 in Fiscal Year 2013–14 to 444 in Fiscal Year 2017–18. The number of ships entering the Port of Morehead City declined by 27%, a trend driven by a decline in barge calls.

Whereas general cargo calls actually increased by 33% during the period, barge calls fell by 45%.

- **Crane Hours** reflect the decline in calls. As fewer ships enter the port, demand for crane operations also declines. Overall crane hours decreased 13% from 1,664 hours in Fiscal Year 2013–14 to 1,451 in Fiscal Year 2017–18.

Overall throughput has declined slightly due to reductions in liquid bulk cargo yet the falling value of claims paid for damaged cargo shows improved effectiveness.

- **General Cargo Tonnage** at the Port of Morehead City is made up of liquid, dry, and break bulk cargo items. Overall, general cargo tonnage declined by 7% during the examined timeframe, but this decline is not indicative of a decrease in tonnage for each type of general cargo. The volume of dry and break bulk cargo actually experienced modest increases during the period, as the overall tonnage decline at Morehead City was driven entirely by a reduction in liquid bulk tonnage, which fell 37%, from 1 million to 683 thousand tons.

  The decrease in barge calls and liquid bulk cargo at the Port of Morehead City can be attributed to changes in the shipping volumes of one of its largest lease holders, PCS/Nutrien. This company has recently changed business models, moving from a reliance on domestic bulk materials to international sources. This shift has precipitated the drop in calls and volume at the Port of Morehead City. The Authority contends that the shipping activity and volume of PCS/Nutrien pose little concern to the health of operations at Morehead City as the Authority receives revenue from the lease regardless of volume serviced through the port. Further, the Authority is working with the company to utilize leased property to the Authority's commercial interests. Nonetheless, falling utilization and throughput—whatever the cause—represents a potential threat to the Authority's effectiveness that will need to be addressed.

- **Value of Claims Per Call** serves as a measure of the quality of the handling of cargo at ports. The value of claims paid per call at the Port of Morehead City decreased by 76% from the beginning to the end of the five-fiscal-year period, specifically from $51 per vessel call in Fiscal Years 2013–14 to $12 in Fiscal Year 2017–18. Morehead City did experience a one-year spike in the value of claims per vessel call during this period, which jumped to $167 during Fiscal Year 2016–17.

Productivity measures tracked at the Port of Morehead City indicate decreased efficiency.

- **Ship Turnaround Time** measures productivity at the dock by quantifying how quickly ships are loaded and unloaded. Measured in hours, average ship turnaround time increased by 16% at the Port of Morehead City over the five fiscal years, from 52 hours in Fiscal Year 2013–14 to 60 hours in Fiscal Year 2017–18.

- **Turn Time** is tracked in minutes and measures how quickly goods and commodities are loaded and unloaded from trucks. Turn time is tracked for specific commodities (rubber and lumber) at the Port of Morehead City because the Authority uses these as key performance indicators; however, these indicators have only been tracked since the first quarter of Fiscal Year 2017–18. Nevertheless, turn times for both commodities have increased on a quarter-by-quarter basis since 2017–18. Specifically, gate times for rubber trucks increased by 24% and gate times for lumber increased by 40%. Increased gate times for both commodities indicates it is taking longer to process goods out of the gate, representing decreased efficiency.

Unit costs have fallen over the last five years, signaling bottom-line efficiency gains at the Port of Morehead City.

- **Cost per ton** captures the operating cost to process one ton of liquid, dry, and break bulk commodities. A decline in calls is reflected in throughput, which subsequently affects unit costs. Overall, the cost per ton to process general cargo at the Port of Morehead City decreased 3% over five fiscal years, from $7.19/ton to $6.94/ton.

To summarize Findings 1, 2, and 3, examining North Carolina's ports as a whole reveals throughput has increased, with container operations increasing by 28% and general cargo increasing by 10%. Efficiency of operations has also increased, while the cost to process cargo decreased. However, these operational improvements are not shared across both port locations. Analysis of standard performance metrics at the individual port level shows the system's improved performance is largely attributable to gains made at the Port of Wilmington.

Finding 4. Improved performance at the Port of Wilmington is linked to early implementation of capital expansion projects.

This evaluation's scope included a charge to determine how the State's recent capital investment in the ports affected operations.

Port capital expansion is necessary for adapting to emerging technologies, developing mechanical and transportation systems, and building the capacity to handle increasingly larger cargo ships. Since 2016, capital investments by the Authority have increased significantly as new cranes have been purchased and projects related to berth enlargements, improvements, and modernization have been funded. Capital expansion is important not just for attracting new business to ports but for maintaining existing customers. As average container vessel size increases, the need for ports to adapt to changing market climates will become increasingly imperative.

The Authority identified four main areas of critical need for capital expansion in its strategic plan.

- **Terminal Infrastructure.** There are a myriad of infrastructure components and concerns that must be addressed when operating a maritime port terminal. Terminal features and equipment dictate a

port's capacity, thereby driving or limiting throughput. The Authority identified upgrading and addressing aging infrastructure as a primary capital need. Projects covered by this investment include replacing and enhancing ship-to-shore and other gantry cranes, expanding and improving docks and berth access, improving open storage and warehouses, and making enhancements to the gates.

All of these projects are designed to expand capacity, increase throughput and productivity, and preserve and expand business opportunities.

- **Channel Enhancements.** Due to shoaling and other natural occurrences, shipping channels require ongoing maintenance to preserve adequate depths to accommodate vessels of different sizes. Additionally, as the size of container vessels grows, so does the need to accommodate larger vessels. As a result, the Authority included in its capital investment plan a need to deepen channels and perform channel maintenance. To specifically accommodate larger container vessels, the Authority plans to widen its turning basin at the Port of Wilmington.[7]

- **Improved Truck Mobility.** Better interstate and land-side transportation was another important component of the logistics puzzle discussed by the Authority's strategic plan. Land-side transportation refers to the network of roads and interstates that allow trucks to get to and from the terminal gate. Land-side improvements are important because these costs can account for an estimated 50% of total overseas delivery costs. The ports—especially the Port of Morehead City—are at a disadvantage compared to peer ports in terms of land-side highway access. The strategic plan therefore identified needed improvements to US 70, I-40, I73/74, and US 74/76.

- **Rail Competition.** Rail is an important component of the intermodal network connecting port commodities to inland destinations because it optimizes shipment of containerized cargo at distances greater than one day of travel time. Although the state is served by an extensive rail network, freight rail service to and from the ports is limited and each terminal is served by a single rail carrier, meaning rail services lack the competition necessary to keep pricing competitive. As a result, some port customers have repositioned cargo needing extensive intermodal rail transports through other state terminals. However, the strategic plan offered no solution for this infrastructure challenge.

Appropriations from the General Assembly have been used to fund capital expansion projects at the Authority in recent years. Between Fiscal Years 2015–16 and 2018–19, the General Assembly appropriated $160 million to the Authority to fund capital expansion projects. Projects addressing terminal infrastructure and channel enhancements were funded

[7] A turning basin or swinging basin is a wider body of water located either at the end of a ship canal or in a port. It allows cargo ships to turn and reverse their direction of travel, and it allows long narrow barges to turn a sharp corner in a canal.

using state appropriations. Enhancing truck mobility and rail competition includes improvements that are outside the purview of the Authority and therefore would have required collaboration with other relevant state and federal agencies.

The funded capital expansion projects were first identified as a priority through the Authority's strategic plan. Subsequently, the Authority submitted these projects to the State through its annual budget request process. The capital expansion plan requests $261 million in state appropriations to execute 17 major projects between Fiscal Years 2015–16 and 2020–21. Exhibit 23 shows the list of capital expansion projects funded through state appropriations. The majority of the projects are located in Wilmington with the exception of new cranes being purchased with state appropriations at Morehead City. Additionally, state appropriations funded information technology improvements intended to bolster operations throughout the Authority, including both ports and inland facilities.

Exhibit 23: Capital Expansion Projects Undertaken at North Carolina Ports

Project	Status	Estimated Cost June 30, 2019	Description
Berth 7 Structural Improvements	In-Progress	$31,068,925	Expansion of existing berth space, allowing for the eventual access to Berths 7/8/9 by the 100-ft gauge ship-to-shore cranes and for operations to be able to accommodate two neo-Panamax vessels simultaneously. Price includes design and planning components.
Berth 8 Reconstruction	Complete	29,292,454	Replacing the dock structure, replacing crane rail and railroad track, providing new 100-foot gauge crane rail, and increasing the operating area for container vessels.
Turning Basin Expansion - Phase 1	Complete	28,242,613	Expanding the turning basin to service larger vessels and improving land-based items related to liquid bulk handling structures and control systems.
Two 100-ft Gauge Ship-to-Shore Cranes	Complete	25,381,588	Purchase of two new ship-to-shore container cranes capable of handling vessels in the +14,000 TEU class.
Turning Basin Expansion - Phase 2	In-Progress	20,972,071	Further expansion on east side to increase basin to 1,524 feet.
Container Gate & Interchange	Planning	20,000,405	Construction of new, modern, and efficient gate facility to improve capacity.
Reefer Yard - Phase 1	In-Progress	14,170,000	Relocation of reefer yard and allowance for vertical stacking racks in order to double current capacity.
System Upgrades	In-Progress	13,014,756	New and improved Information Technology features for container and cargo operations.
One 100-ft Gauge Ship-to-Shore Crane	In-Progress	12,200,304	Purchase of one additional ship-to-shore container crane.
Air Draft	In-Progress	11,000,000	Raising transmission lines over Cape Fear River.
New Crane Design and Procurement	In-Progress	6,645,264	Procurement of portal-mounted gantry crane at Port of Morehead City.
Dredging Contributions	Complete	6,500,000	Supplementing funding to Corps of Engineers work plans to increase operational capabilities.
Pave Area of Building No.8	In-Progress	5,740,684	Repaving and repurposing of additional container space yards.
Operating Equipment - Toplifts	Complete	1,873,347	Purchase and update of equipment used to handle containers within the container yard; toplifts are used to handle containers in the yard.
Berth 7 - Extend 50' Gauge Crane Rail	Complete	1,265,639	Extending 50' crane rail to increase operating area for cranes and facilitate future berth reconstruction.
North Property Permitting Planning	In-Progress	586,257	Extending property of the Authority to allow for the turning basin to be enlarged in future endeavors.
Container Yard Planning & Improvements	In-Progress	454,457	Completion of an engineering study for both short-term and long-range planning for improvements and expansion of container yard facilities.
Total		**$228,408,765**	

Notes: TEU stands for 20-Foot Equivalent Unit.

Source: Program Evaluation Division based on information provided by the Authority.

Following the implementation of capital investment projects, throughput at the ports has increased, suggesting state appropriations are succeeding in their intended mission of increasing cargo movement thereby inducing economic activity. As previously mentioned, some of the projects listed in Exhibit 23 are still in progress. Additionally, future capital expansion projects may be started with remaining state appropriations. A complete evaluation of the effect of these state appropriations on port performance will need to wait until all projects are fully complete. However, some of the most significant projects are already complete, including the delivery of new cranes to the Port of Wilmington in March 2017 and Phase 1 of the turning basin expansion. The Authority procured new cranes and pursued turning basin expansion with the goals of increasing capacity, replacing aging infrastructure, and handling larger ships, hence inducing more ships to call at the port. Improvements to throughput and utilization would be expected after the cranes had been delivered.

The Program Evaluation Division analyzed data on specific throughput and utilization measures both before and after implementation of the new cranes. As Exhibit 24 illustrates, the Program Evaluation Division found statistically significant improvements across three important performance measures.

Exhibit 24

Key Performance Measures Have Improved Since Completion of Important Capital Projects

	Quantity Change	Percentage Change
Berth Occupancy Rate	+10.3 percentage points	+53%
Container Moves	+4,400 per month	+19%
Ship Calls	+6 per month	+16%

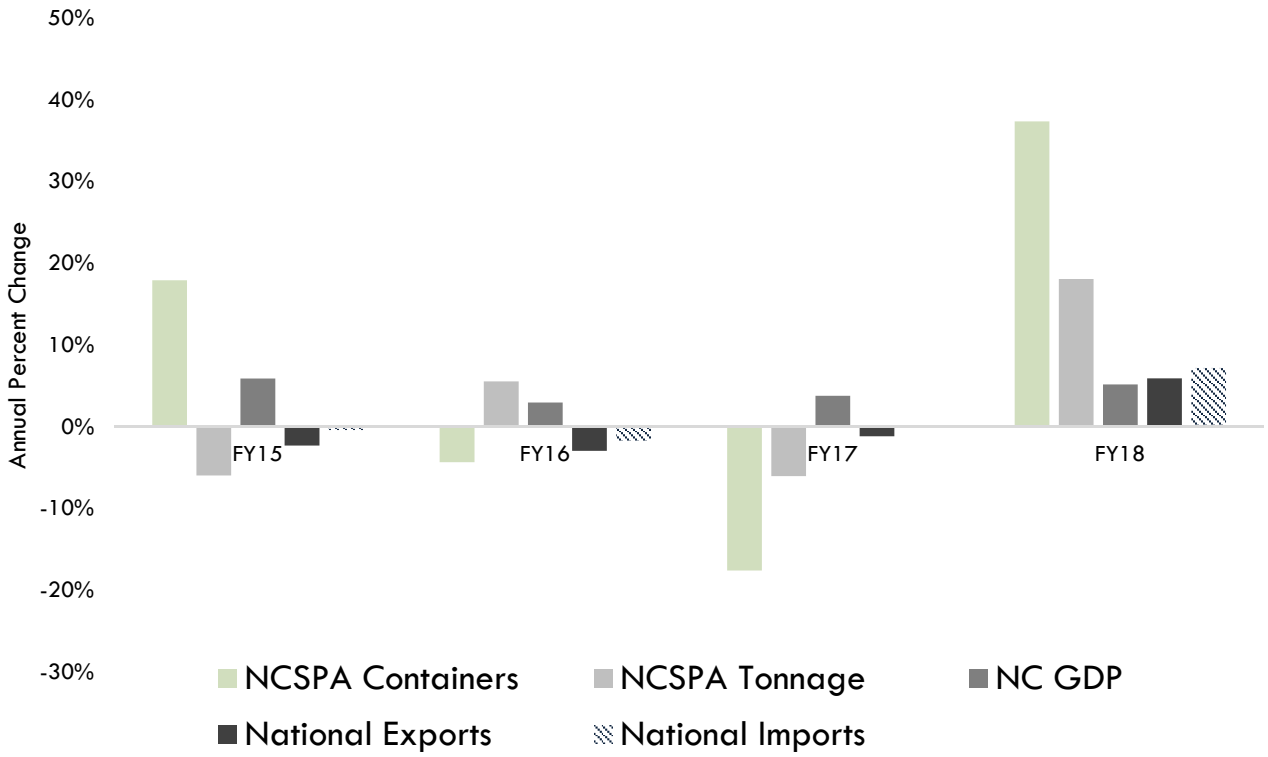
Note: Statistically significant differences were found at p <0.000.

Source: Program Evaluation Division based on information provided by the Authority.

Following the turning basin expansion and delivery and installation of the new cranes at the Port of Wilmington, berth occupancy rate (BOR) increased by 53% and calls increased by eight additional ships, or 19%, per month. Additionally, throughput at the Port of Wilmington increased as the cranes were able to handle larger vessels. The Port of Wilmington performed an additional 4,400 container moves monthly following the delivery of the new cranes.

Although general economic indices share similar growth trends with port performance metrics, the rate of port performance improvement outpaces economic indicators. To ensure these improvements are not exclusively due to broader trends in economic activity, the Program Evaluation Division compared the Port of Wilmington's performance measure growth to regional and national economic indices. Exhibit 25 shows annual growth in selected indicators. Following a downturn in Fiscal Year 2016–17, the tonnage serviced by the Authority increased by 25% in Fiscal Year 2017–18, far outpacing national and state-level indicators. The statistically significant improvements shown in Exhibit 24 are therefore not likely to be solely due to economic trends.

Exhibit 25: Growth in North Carolina Ports Outpaces General Economic Indices



Note: NC GDP is a general measure of North Carolina's economic condition through its gross domestic product.

Source: Program Evaluation Division based on information provided by the Authority, Federal Reserve Bank of St. Louis, and the U.S. Census Bureau.

Fiscal Year 2016–17 saw a downturn in economic activity for North Carolina's ports. Container moves and tonnage decreased 18% and 6%, respectively. However, the rebound in Fiscal Year 2017–18 throughput is an indication that the ports were able to generate new business opportunities. The Authority's revenues experienced a similar rebound of 11% from 2017 to 2018. The fact that the rate of change in throughput for North Carolina ports exceeded general economic indicators in Fiscal Year 2017–18 suggests the initial implementation of capital expansion projects are positively affecting port performance independent of overall gains from an improving general economic climate.

In summary, port performance, particularly at the Port of Wilmington, has improved following implementation of state-funded capital expansion projects. Statistically significant differences in key performance indicators suggest the expansion projects led to better port performance and greater volume serviced. Further, comparison with macroeconomic trends indicates that these improvements in state port performance can be at least partly attributed to capital investment and are not solely the function of market fluctuations.

Finding 5. The Authority operates two distinct maritime port terminals that are not duplicative.

Program Evaluation Division statute requires each evaluation to identify potential duplication of the services provided by the governmental or quasi-governmental entity being examined. Duplication exists when one entity performs operational activities or completes a tasks unnecessarily because that task or activity has already been completed or is executed by another governmental or quasi-governmental entity. Duplication is generally viewed as negative because it represents an inefficient and wasteful use of resources. Questions of potential duplication on the part of the Authority arise from the operation of two distinct maritime ports.

Operating multiple ports or terminals is not an administrative or organizational feature unique to North Carolina's ports. Port terminals require significant investment in specialized capital equipment. As a result, terminal build-out tends to reflect the cargo it intends to accommodate, and port authorities often develop terminals at multiple sites to attract and accommodate different types of cargo. The comparison of the North Carolina State Ports Authority's maritime terminals to other south Atlantic states depicted in Exhibit 26 shows that operating multiple terminals is not unique to North Carolina.

Exhibit 26

Neighboring States Operate Multiple Ports and/or Terminals

State Authority	Number of Ports and Terminals	Names and Locations
Georgia Ports Authority	2 Ports with a Combined 5 Terminals	Two terminals at Port of Savannah • Garden City Terminal • Ocean Terminal Three terminals at Port of Brunswick • Colonel's Island Terminal • Mayor's Point Terminal • Marine Point Terminals
South Carolina Ports Authority	2 Ports with a Combined 6 Terminals	Five terminals at Port of Charleston • North Charleston Terminal • Wando Welch Terminal • Columbus Street Terminal • Union Pier Terminal • Veterans Terminal One terminal at Port of Georgetown • Port of Georgetown
Virginia Port Authority	1 Port with 4 Terminals	Four terminals at Port of Virginia • Norfolk International Terminals • Portsmouth Marine Terminal • Newport News Marine Terminal • Virginia International Gateway

Source: Program Evaluation Division based on review of port authorities in neighboring states.

Analysis of the Authority's operations shows that although there is some overlap of activities performed at the two port locations, the overlap is reasonable and terminal operations at each port are justified. Because the existence of multiple terminals alone is not by itself sufficient to demonstrate duplication, the Program Evaluation Division considered the specific activities performed at each terminal. Operations carried out by the Authority can be categorized into three tasks.

- **Port Promotions.** Port promotions activities are largely carried out by two staff at the Authority. As a result, this activity is consolidated and centralized within the main office in Wilmington through the executive affairs department. Activities include development and implementation of the print and digital media marketing plan; website maintenance and development; event planning; community outreach; tradeshow support; and communications.

  Because these activities are performed centrally for both port locations, promotions activities are not duplicative.

- **Port Development, Construction, Equipping, and Maintenance.** These activities are carried out by a centralized executive staff, equipment engineers, and maintenance staff. Port development is carried out in combination with the Ports Authority Board and the executive leadership team. Development is reflected in the annual operating budget capital development plan that addresses capital infrastructure investments needed at both port locations to develop and maintain market competitiveness. Construction is carried out through contracting. However, each location has personnel and staff that are responsible for port facility and equipment maintenance. Although this arrangement may appear duplicative, staffing at each of the ports for equipment maintenance is justified due to the proximity and nature of the equipment at each of the ports. Having a centralized maintenance staff could create greater inefficiencies due to travel time. The Ports of Wilmington and Morehead City are located nearly 100 miles apart. Nearly four hours round trip would be needed to travel between ports if the Authority consolidated maintenance within a centralized location. Therefore, having maintenance staff at each maritime terminal is reasonable.

- **Terminal Operations.** The Authority maintains terminal operations at two maritime locations, the Ports of Wilmington and Morehead City. Terminal operations activities include handling cargo discharged from vessels; performing inventory control for imported cargo; handling cargo for exports arriving by truck and rail; and stripping cargo from containers for delivery.

Absent context, the State operating multiple terminals might appear duplicative. However, a closer look at terminal throughput data demonstrates unique operations at the Wilmington and Morehead City locations. Specifically, as shown in Exhibit 27, the ports of Wilmington and Morehead City handle different types of cargo. Of the two maritime ports, the Port of Wilmington is the only terminal that maintains container operations. Both terminals process bulk and break bulk cargo, but as the

exhibit shows, the types of cargo handed at each terminal are different and are more diverse at the Port of Morehead City.

Exhibit 27

Authority's Two Port Terminals Process Different Types of Cargo

Cargo Type	Port of Wilmington	Port of Morehead City
Container	Yes	No
Bulk and Break Bulk	Yes	Yes
Description of Bulk Cargo Materials	Forest Products Metal Products Grain Chemicals Fertilizer Woodchips Wood Pellets	Forest Products Phosphate Sulphur Metal Products Scrap Metal Paper Asphalt Rubber Woodchips Aircraft Parts Grain

Source: Program Evaluation Division based on information and data provided by the Authority.

In summary, operating multiple port terminals may benefit efforts to attract and accommodate different cargo materials. Nonetheless, an examination of operations is necessary to determine where inefficiencies exist as a result of operating multiple sites. A review of the Authority shows that although there is some overlap in positions and operations at the two port terminals, the position duplication is reasonable and differences between the cargo and commodities that move in and out of each port justify the operation of both locations.

Finding 6. Statute requires the Authority to conduct containerized cargo shipping operations at both ports, yet the Port of Morehead City does not perform this function.

In accordance with statute, all evaluations completed by the Program Evaluation Division are required to identify how current operations comply with statutory and regulatory requirements. This requirement presents the opportunity to examine the intended purpose of existing statute to improve current and future oversight.

N.C. Gen. Stat. § 136-260, ratified in 1945, established the North Carolina State Ports Authority and set guidelines for the governance structure of the ports including composition of the Board of Directors, mission of the organization, and oversight and governance responsibilities. In order to advance the economic activity of the State through the ports, the General Assembly granted the Authority the power to

- make all necessary contracts;
- rent, lease, buy, mortgage, and otherwise encumber property;
- apply for and accept loans and grants from federal or state agencies; and
- establish its own rules and governing regulations.

The Authority therefore operates as a semi-autonomous body.

Statute requires the Authority to maintain container shipping at both the Wilmington and Morehead City ports. Among the Authority's statutory charges is a requirement to develop container shipment operations at both the Port of Wilmington and the Port of Morehead City. Specifically, statute states that the Authority shall

> provide at the ports of Morehead City and Wilmington adequate equipment and facilities including container cranes at each port as needed, in order to maintain existing and future levels of containerized cargo shipping at both ports and provide and encourage growth in handling of containerized cargoes at both ports.

The General Assembly introduced this charge via legislation passed in 1979. When Session Law 2011-145 transferred the Authority from the Department of Commerce to the Department of Transportation, the charge was modified yet preserved. Hence, this provision to provide container shipping at both ports has been reviewed and remains an explicit statutory goal of the Authority.

The Port of Morehead City does not have container operations nor is it situated to develop container operations without investments in improved truck mobility. The Authority has been operating for four decades under the explicit statutory requirement to maintain container operations at both the Ports of Wilmington and Morehead City. However, at no point in its existence has the Port of Morehead City been equipped to handle containerized cargo.

Further, in the strategic plan developed by the Authority, there is no mention of future plans to develop container operations at the Port of Morehead City. Even if such plans did exist, challenges to truck mobility pose barriers to developing containerized cargo operations at Morehead City. Sufficient roadways are a necessary intermodal component of moving containerized cargo. In its 2015 strategic plan, the Authority did in fact identify the need to improve truck mobility and land-side transportation to provide better access to interstates. Specifically, the plan cited improvements to US 70, which services the Port of Morehead City. During site visits to the port, the Program Evaluation Division observed a lack of viable roadways to accommodate the volume of containerized cargo necessary to justify operations. Given the long-term nature of interstate projects, it would be premature to focus on development of containerized cargo operations prior to ensuring adequate land-side transportation. In summary, although statute requires the Authority to conduct dual containerized cargo operations, the Port of Morehead City does not maintain containerized cargo operations and may not be poised to develop this capability until other capital needs have been addressed.

Finding 7. The Authority does not adequately monitor perceptions of service quality on the part of its customers.

Customer perception of service quality is integral to continuous improvement. There has been particular recognition in recent decades from transport operators that improvement in transport service quality is critical to achieving a differential advantage in competition. Quality of service also can be established as a demonstrable program outcome. A common way for a service provider to ascertain the quality of the services and outcomes it provides is through customer satisfaction surveys.

As recently as 2015, the Authority administered a satisfaction survey to its customers. However, because of sampling errors and the insufficiency of the questions posed, the tool failed to collect generalizable results and adequately measure the various dimensions and attributes of maritime port service quality.

The number of responses to the 2015 survey fell short of a generalizable sample and as a result the Authority can infer little from the results. Sampling is an important consideration when administering a survey because the number of responses can affect the generalizability and therefore the reliability of the results. The Authority issued its 2015 customer satisfaction survey to 1,371 customers. The survey questions were administered to

- ocean carriers,
- beneficial cargo owners (importers and exporters), and
- truckers.

The Authority received a total of 168 responses, 134 of which were complete. This number represents the sample. If the 1,371 customers represent the population of the Authority's customers, the Authority would have needed at least 301 completed responses (a 22% response rate) as a sample size to derive generalizable results. Because the Authority received fewer than half the complete responses needed, it cannot draw reliable conclusions from the survey results.

Questions used in the survey failed to adequately address the full range of dimensions of maritime port service quality. Construct validity, in the case of the survey administered by the Authority, refers to whether the questions asked match or measure the concept of the construct—maritime port service quality. The Authority surveyed its customers with a range of questions that focused on service rating, factors to increase business utilization, and communication. Appendix D provides a list of the survey questions. The Program Evaluation Division found that the Authority's survey questions did not accurately track all dimensions of maritime service quality. Additionally, the Program Evaluation Division found that the questions are not as comprehensive as those identified in the logistics literature.

Although there are many ways to measure maritime port shipping quality, logistics research has led to the identification of specific dimensions and factors.

- **Resources** relate to the physical resources, financial resources, condition of facilities, equipment, location, infrastructure, etc.
- **Outcomes** involve the product or core services being received by customers, including service accomplishment, such as the on-time delivery of a shipment, or the price of a service offered.
- **Process** relates to the components of interactions between employees and customers such as how customers perceive the behavior of staff in dealing with customer requirements, staff knowledge of customer wants and needs, and the application of technology to better serve the customer.
- **Management** involves the selection and implementation of resources in the most efficient way so as to ensure meeting/exceeding customer expectations, as well as the knowledge, skills, and professionalism of employees and their understanding and responsiveness to customer needs and requirements. This dimension also relates to the feedback system from customers regarding new inputs for quality management practices, as well as continuous improvement as suggested by industry processionals.
- **Image/Reputation** relates to the overall perception of customers about the service organization as well as their ethical perceptions as to whether the organization's administration is engaging in socially responsible behavior.

Exhibit 28 compares the Authority's survey to dimensions and factors identified in the logistics literature.

Exhibit 28

Authority's Customer Satisfaction Survey Does Not Adequately Address Important Service Quality Dimensions

Service Quality Dimension	Measured by Survey?
Process	●
Components: professionalism, quick response, knowledge of customer needs and requirements	
Resources	○
Components: equipment and facilities are modern and functioning; strong financial stability; excellent shipment track and trace capability	
Outcome	◖
Components: fast, reliable, consistent service; ship/shipments are safe and secure; error-free invoices; competitive prices	
Management	◖
Components: comprehensive information and communication technologies; management is knowledgeable, competent, and responsive to needs; feedback is collected; processes are continuously improved	
Image and Social Responsibility	○
Components: good relationships with other service providers; record of reliability and safety; demonstrates social responsibility to employees and stakeholders; environmentally responsible	

● = Dimension Fully Addressed
◖ = Dimension Partially Addressed
○ = Dimension Not Addressed

Source: Program Evaluation Division based on An Analysis of Port Service Quality and Customer Satisfaction: The Case of Korean Container Ports *and the Authority's customer satisfaction survey.*

As the exhibit shows, the Authority's survey failed to fully address four of five service quality domains. The dimension related to process was the only domain fully covered by the survey. Although one or more survey questions addressed components of management and outcomes, not all of the factors that make up these domains were fully addressed. Questions that touch on port resource sufficiency and a port's image and social responsibility were entirely absent from the Authority's survey.

In summary, customer satisfaction measurement plays a critical role in informing service improvement. It allows an agency to understand what its customers value, how values vary between different types of customers, and where the agency can take action to improve service delivery. The Authority's customer satisfaction survey fails to accurately measure port performance or determine areas of improvement. The customer satisfaction survey did not obtain a valid response rate or follow established criteria for fully measuring port performance. It is essential for an organization to accurately measure its performance to ensure that services are continuously improved. When developed and disseminated correctly, customer service

questionnaires can provide feedback for a business to determine if the needs and requirements of customers are being met.

Finding 8. The Authority has not established an environmental management system, thereby jeopardizing sustainable operations.

Advancing sustainability is a critical function of all ports. Because port operations are highly reliant on environmental factors, sustainable ports have traditionally viewed themselves as stewards of coastal resources. One of the dimensions of service quality discussed in Finding 7 captures the importance of a port's image of environmental responsibility.

Managing environmental responsibility can be challenging because maritime ports must contend with numerous environmental challenges. Adverse environmental impacts may include

- coastal erosion due to development;
- disturbance of bottom surfaces due to dredging and dumping;
- hazardous oil spills from accidents;
- loss of natural habitat, such as marsh and mudflats;
- air pollution from bulk cargo operations and gaseous cargo;
- noise pollution;
- disposal of waste water; and
- increased rail and road activity in the vicinity.

Each of these environmental impacts poses risks to the operations and sustainability of maritime ports. As a result, maritime port operations must navigate a substantial number of environmental regulations. Appendix E shows the list of federal regulations that can apply to maritime port operations. One means of ensuring sustainability and navigating the complexity of environmental regulations is through the development and implementation of an Environmental Management System (EMS).

An EMS provides a structured framework designed to achieve continual environmental improvement beyond regulatory compliance. An EMS, like any other management system, consists of several elements (staff, documentation, procedures) that must be present for the system to function. The purpose of an EMS is to enable organizations to integrate environmental considerations into day-to-day decisions and operations in order to, at a minimum, maintain compliance with environmental regulations. Ideally, an EMS also allows an organization to continually improve its environmental performance by implementing pollution prevention and best management practices wherever feasible. In other words, an EMS is a formal system for proactively managing the environmental footprint of maritime port operations. Implementing an EMS has several benefits including

- improving environmental performance,
- enhancing compliance,
- developing new customer marketing options,
- increasing efficiency/reducing costs,
- enhancing employee morale,

- improving public image, and
- increasing employee environmental awareness.

A formalized EMS system is developed and implemented based on a framework of 13 elements. Exhibit 29 lists and describes each element.

Exhibit 29: Establishing and Implementing a Formalized Environmental Management System Requires a 13-Step Process

Note: BMP refer to best management practices.

Source: Program Evaluation Division based on a review of federal guidance provided by the U.S. Environmental Protection Agency.

As the exhibit shows, several elements must be considered and a host of actions must be taken in developing and implementing a formalized EMS. A formalized EMS requires the following documentation:

- an environmental policy statement,
- organizational charts with personnel duties and responsibilities related to the EMS,
- a description of how the port fulfills EMS requirements,
- procedures for preventative and corrective action,
- standard operating procedures, and
- emergency preparedness plans, response plans, and training plans.

The Authority has not developed and implemented a formalized EMS. The Program Evaluation Division requested that the Authority provide a description and documentation of its EMS. The Authority responded by stating that the ports do not currently have a formalized EMS but insisted the ports work across departments to maintain environmental compliance. The Authority employs one Senior Environmental analyst to ensure regulatory compliance across both the Ports of Wilmington and Morehead City. In addition, staff from the Safety Department assist with compliance. However, without an established EMS, the Authority runs the risk of missing out on the benefits of a formalized system and are only positioned to meet the minimal operating standards of environmental compliance.

The Authority is currently working to build upon environmental compliance activities by establishing a formal EMS based on the EPA framework.[8] Specifically, the Authority's EMS will address

- dredging operations,
- water quality,
- waste disposal,
- recycling,
- noise,
- air quality,
- collaboration with local community groups,
- hazardous material transportation, and
- energy conservation.

In summary, viable port operations must strive for sustainability. The complex environmental regulations that the Authority must navigate challenge and threaten operational sustainability and growth. A formalized EMS provides a framework to implement environmental considerations into day-to-day decisions and operations in order to maintain compliance with environmental regulations and ideally to continually improve the organization's environmental performance. The Authority has not implemented an EMS and, as a result, runs the risk of diminished environmental performance and compliance as well as missed opportunities for expanding its market share and bolstering operational efficiency and effectiveness.

[8] The Program Evaluation Division requested information about the Authority's EMS on April 12, 2019. The Authority proposed an initiative to develop and implement a formalized EMS to its board on April 25, 2019.

Recommendations

Recommendation 1. The General Assembly should direct the North Carolina State Ports Authority to establish operational objectives, including modifying its strategic plan, in order to improve performance at the Port of Morehead City.

As discussed in Findings 1, 2, and 3, North Carolina's ports are, on the whole, effective and efficient. However, recent operational improvements have been entirely driven by the performance of the Port of Wilmington, whereas the Port of Morehead City has experienced declining performance in recent years according to nearly every metric of effectiveness and efficiency examined by the Program Evaluation Division.

As the Authority moves through its five-year strategic planning process, the General Assembly should direct it to establish objectives to address reduced operational effectiveness and efficiency at the Port of Morehead City. At a minimum, the objectives should address ways to increase port utilization and throughput and decrease gate times and ship turnaround times. These strategies should be included as part of the Authority's 2021–2025 strategic plan, and they should be reported to the Authority's board and the House and Senate Transportation Committees.

Recommendation 2. The General Assembly should modify the statute pertaining to containerized shipping to align with current practice.

According to Gen. Stat. § 136-260, the Authority is required to dually develop container shipping operations at both the Ports of Wilmington and Morehead City. However, as Finding 6 demonstrates, the Port of Morehead City does not currently conduct nor plans to develop such operations. Furthermore, the Authority is not positioned to develop container operations at Morehead City until investments in improved truck mobility have been committed.

To ensure the law provides greater discretion to the Authority to decide where to conduct container shipping operations, the General Assembly should modify statute to remove language that makes maintaining container operations an explicit expectation of both port locations in favor of language that establishes container operations as a part of maritime shipping services provided by the Authority at the ports.

Recommendation 3. The General Assembly should direct the North Carolina State Ports Authority to improve its service quality measurement.

Shipping and transport service quality is critical to achieving competitive business advantage. Customer satisfaction is one measure of service quality and is integral to continuous improvement. Quality of service is also a program outcome. One way of assessing service quality is through a customer satisfaction survey. Finding 7 shows that although the Authority does measure service quality by distributing a customer satisfaction survey, the survey's questions do not adequately address the various dimensions of

maritime port service quality. Furthermore, the Authority failed to achieve a response rate sufficient to ensure the survey results are generalizable.

The General Assembly should direct the Authority, as part of its strategic planning process, to assess the quality of services it provides to its customers. The Authority's construction of its service quality measurement tool should ensure each of the dimensions and factors of service quality described in Exhibit 28 are adequately addressed. Furthermore, measurement of service quality should be conducted in a manner that ensures the sampling method and size allow the Authority to generalize results to inform strategic planning and overall operations.

Recommendation 4. The General Assembly should direct the Authority to periodically update the House and Senate Transportation Committees and its board on the development and implementation of its environmental management system (EMS).

Ports, whose operations are highly reliant on environmental factors, have traditionally viewed themselves as stewards of coastal resources. Sustainability is a critical function of all ports and remains a high priority of the Authority's executive management team. One method of achieving environmental sustainability is by developing and implementing an EMS. However, as Finding 8 demonstrates, the Authority is currently only in the beginning stages of developing and implementing such a system.

To ensure the Authority follows through on its commitment to developing and implementing a formalized EMS, it should be directed to provide periodic updates to the General Assembly's House and Senate Committees on Transportation and the Authority's own board. Updates should include the status of each of the components listed in Exhibit 29 of this report. The legislative committees should receive their status report annually beginning on June 30, 2020 and the Authority's board should be updated annually and complete any necessary board action regarding development and implementation during board meetings.

Appendices

Appendix A: Port of Wilmington and Morehead City Map

Appendix B: Operations at the Port of Wilmington Have Improved in Nearly Every Performance Measure

Appendix C: Operations at the Port of Morehead City Have Decreased Over Most Performance Measures Appendix

Appendix D: Questions Used in the 2015 North Carolina Port Authority Survey

Appendix E: Maritime Ports Must Navigate a Myriad of Federal Environmental Regulations

Appendix F: Summary Statistics About the Ports

Appendix G: Financial Statement of Net Position from the 2018 Comprehensive Annual Financial Report

Agency Response

A draft of this report was submitted to the North Carolina State Ports Authority to review. Its response is provided following the appendices.

Program Evaluation Division Contact and Acknowledgments

For more information on this report, please contact the lead evaluator, Sean Hamel at Sean.Hamel@ncleg.net.

Staff members who made key contributions to this report include Jacob Ford and Sidney Thomas. John W. Turcotte is the director of the Program Evaluation Division.

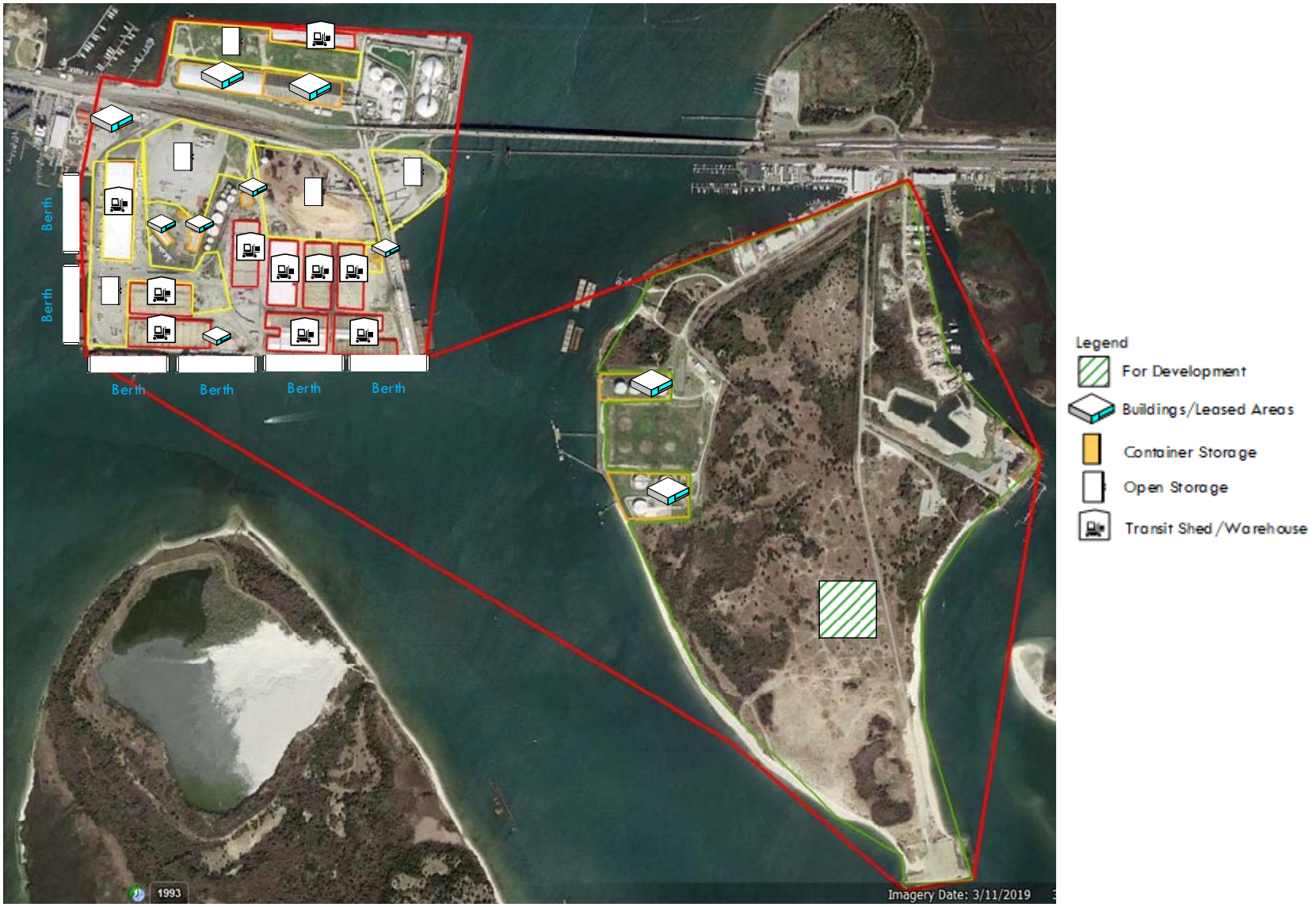
Appendix A: Port of Wilmington

Legend

- For Development
- Buildings/Leased Areas
- Container Storage
- Open Storage
- Transit Shed/Warehouse

Source: Program Evaluation Division based on information provided by the Authority.

Appendix A: Morehead City (with Radio Island)

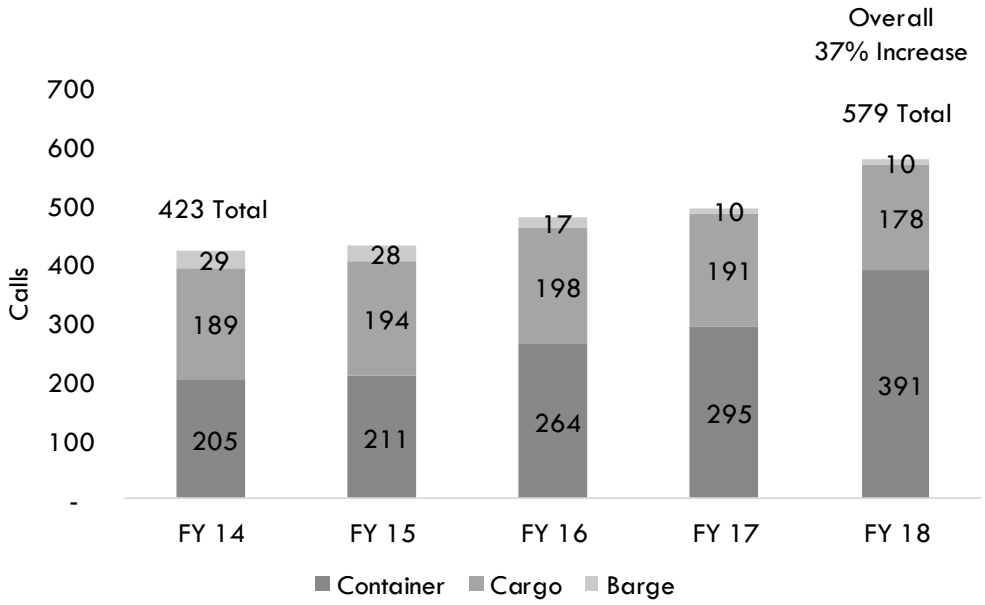


Source: Program Evaluation Division based on information provided by the Authority.

Appendix B: Operations at the Port of Wilmington Have Improved in Nearly Every Performance Measure

Performance Measures for Port Effectiveness
Port of Wilmington

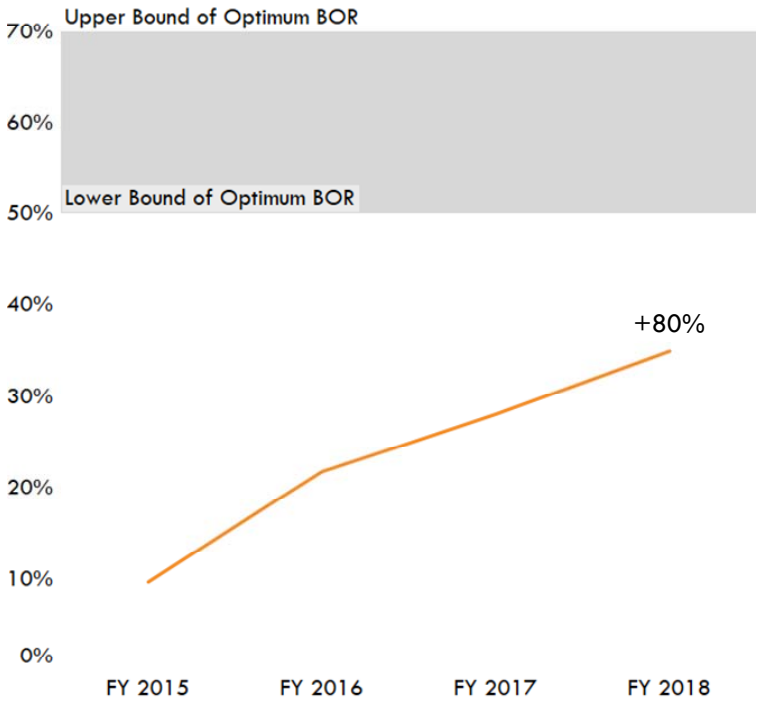
Ship Calls Have Increased by 37%



Note: Calls refers to the number of ships entering a port and using its berths to process cargo.

Source: Program Evaluation Division based on information provided by the Authority.

Berth Occupancy Rate Has Increased But Capacity Still Exists

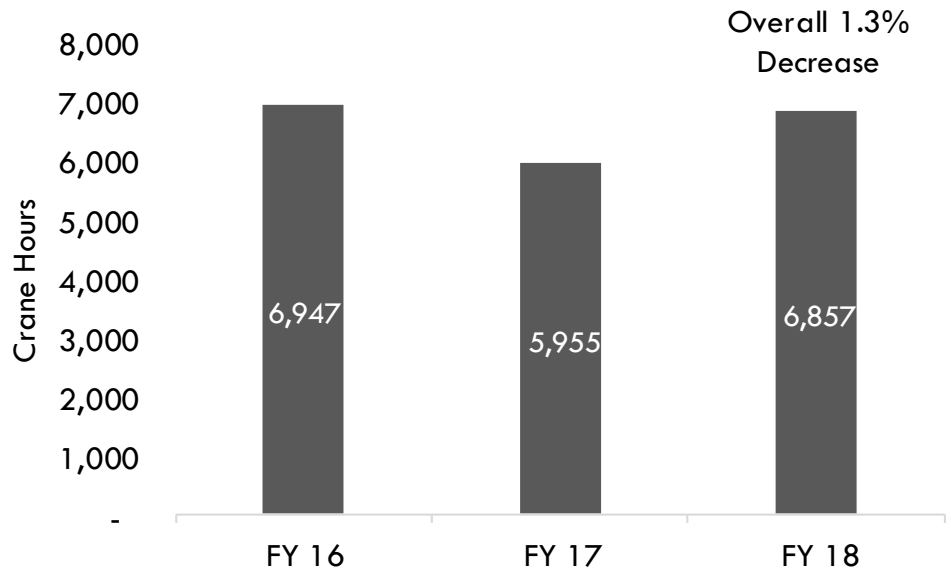


Note: Berth occupancy rate (BOR) is a measure of a port's utilization of capacity.

Source: Program Evaluation Division based on information provided by the Authority.

Performance Measures for Port Effectiveness
Port of Wilmington

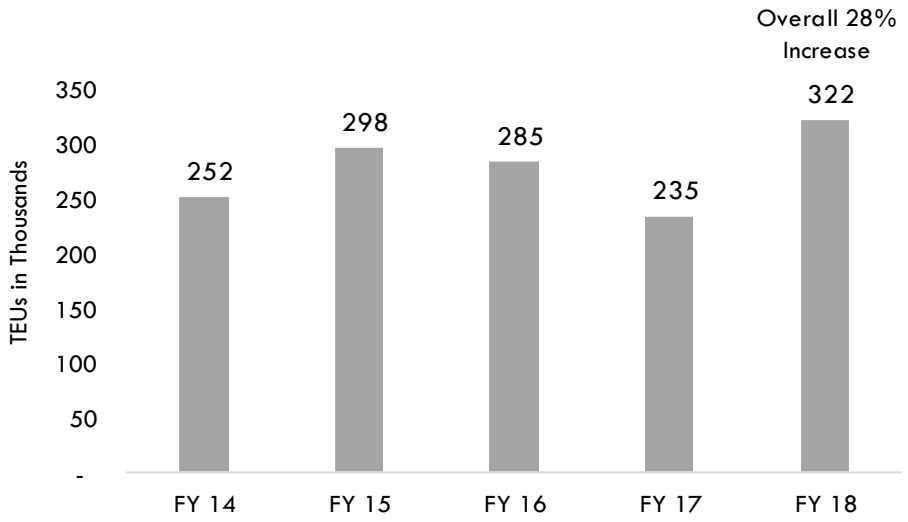
Crane Hours Have Decreased Slightly



Note: Crane hours demonstrate how ports use equipment to process cargo.

Source: Program Evaluation Division based on information provided by the Authority

Number of Container Moves Has Grown by 28%

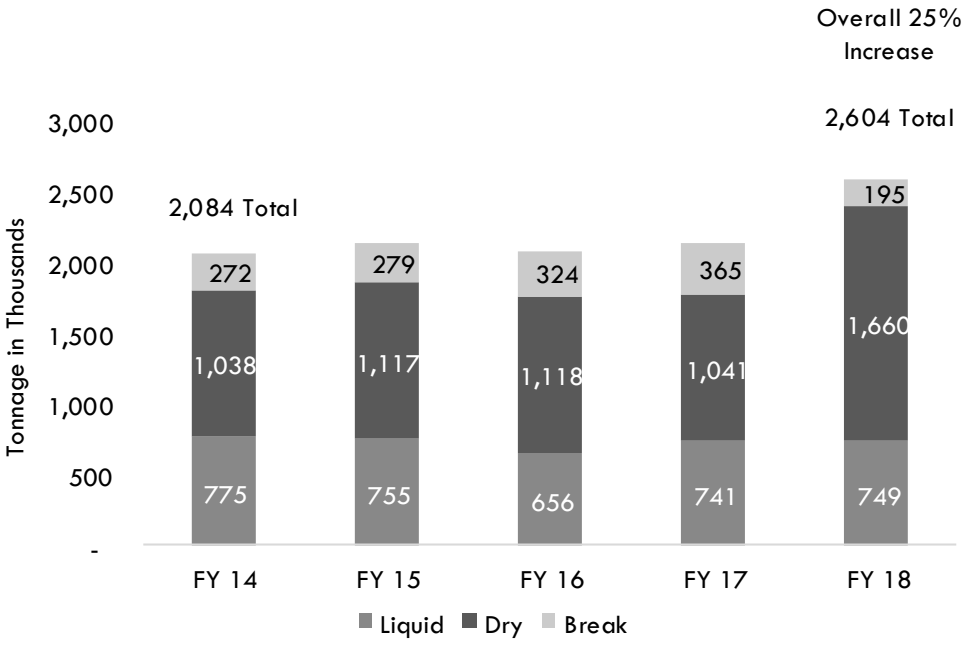


Note: Container moves is a measurement of the container volume serviced at a port and is standardized in 20-Foot Equivalent Units (TEUs).

Source: Program Evaluation Division based on information provided by the Authority.

Performance Measures for Port Effectiveness
Port of Wilmington

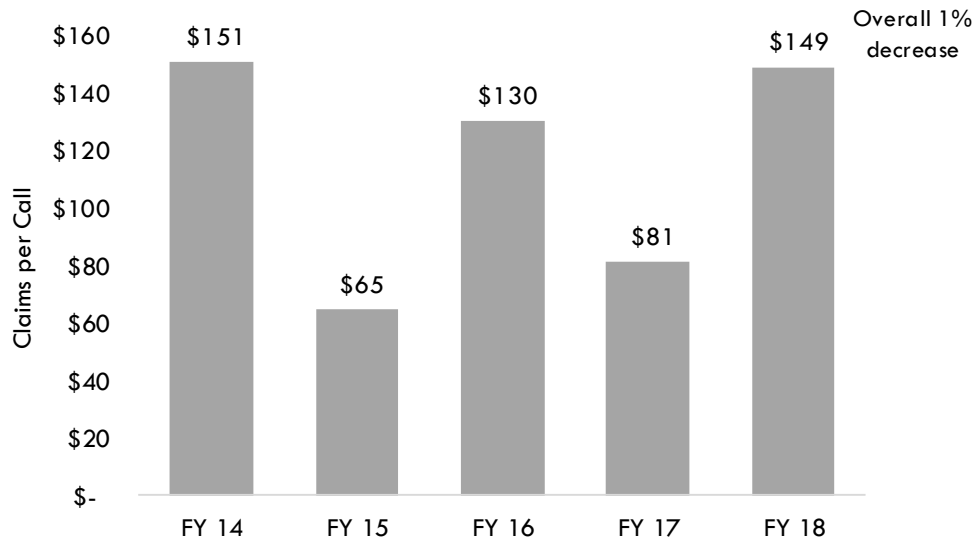
Tons of General Cargo Processed at the Port of Wilmington Has Increased by 25% Due to Growth in Dry Bulk Cargo



Note: General cargo being processed at a port is captured through tonnage.

Source: Program Evaluation Division based on information provided by the Authority.

Value of Claims Per Call Has Decreased by 1% at the Port of Wilmington

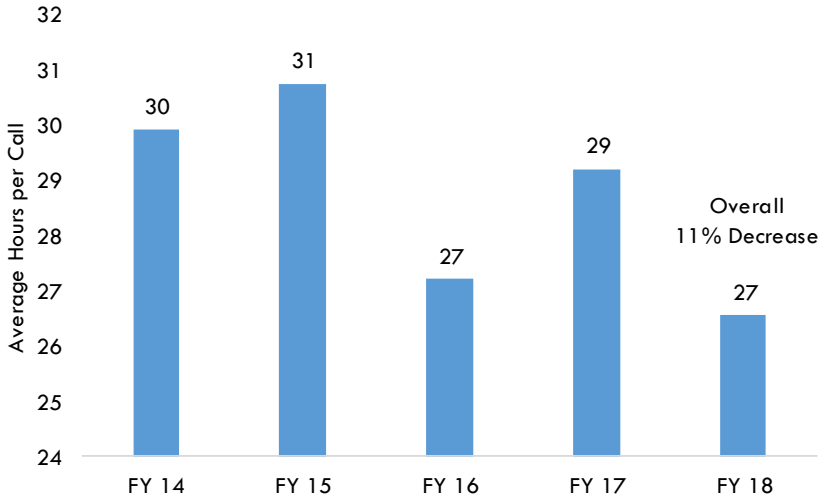


Note: Claims amounts paid per call for damaged or lost goods can serve as a measure of the quality of the handling of cargo at ports.

Source: Program Evaluation Division based on information provided by the Authority.

Performance Measures for Port Efficiency
Port of Wilmington

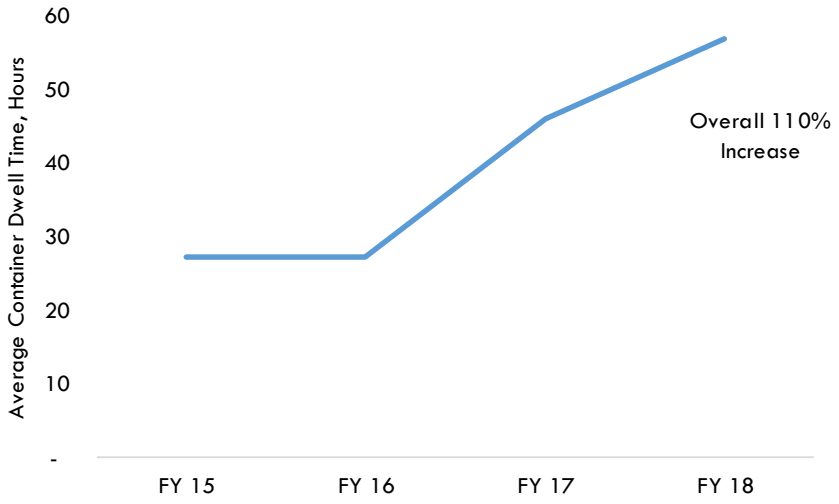
Decrease in Ship Turn Time Means Ships Are Being Serviced and Processed Faster at the Port of Wilmington



Note: Ship turn time shows the time it takes for a ship to be serviced at call.

Source: Program Evaluation Division based on information provided by the Authority.

Container Dwell Time Has More Than Doubled

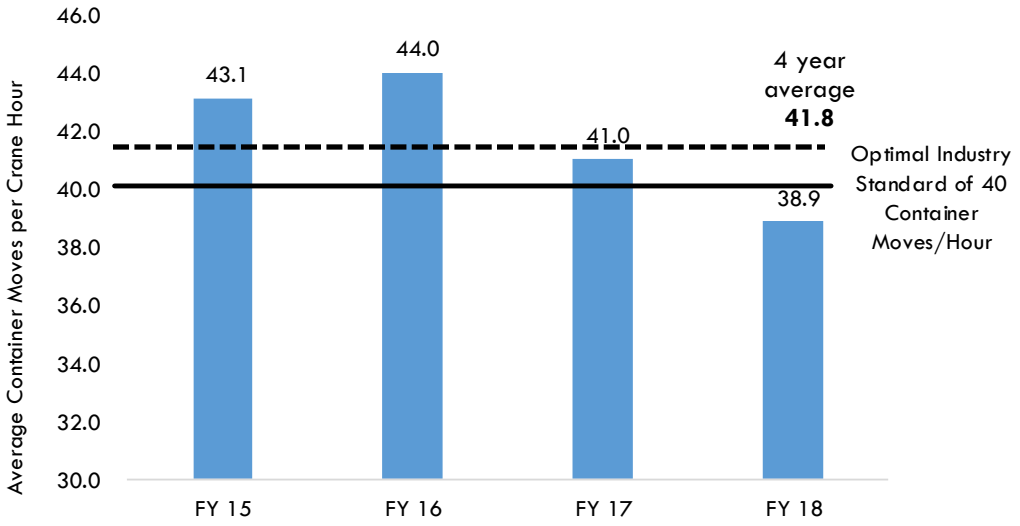


Note: Dwell time measures yard productivity and is the length of time a port takes to hold and ultimately process containerized goods.

Source: Program Evaluation Division based on information provided by the Authority.

Performance Measures for Port Efficiency
Port of Wilmington

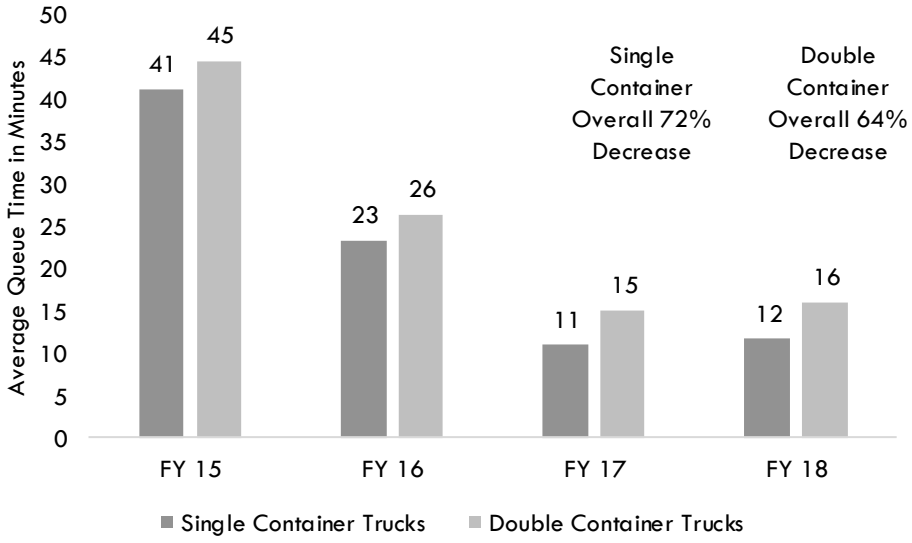
Average Container Moves Per Crane Hour Remain Above Optimal Industry Standard



Note: Container moves per hour is the best measure of container operations productivity and is not standardized for container size.

Source: Program Evaluation Division based on information provided by the Authority.

Queue Time Decreased for Both Single and Double Container Trucks

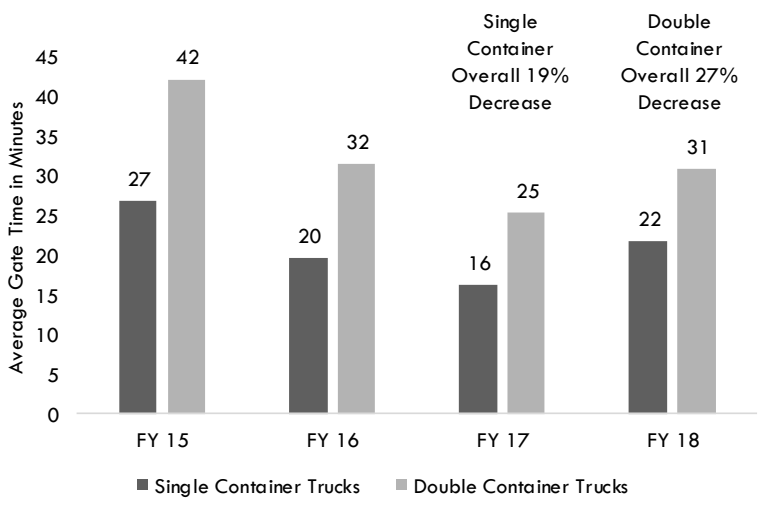


Note: Queue time is the length of time a truck waits to enter port.

Source: Program Evaluation Division based on information provided by the Authority.

Performance Measures for Port Efficiency
Port of Wilmington

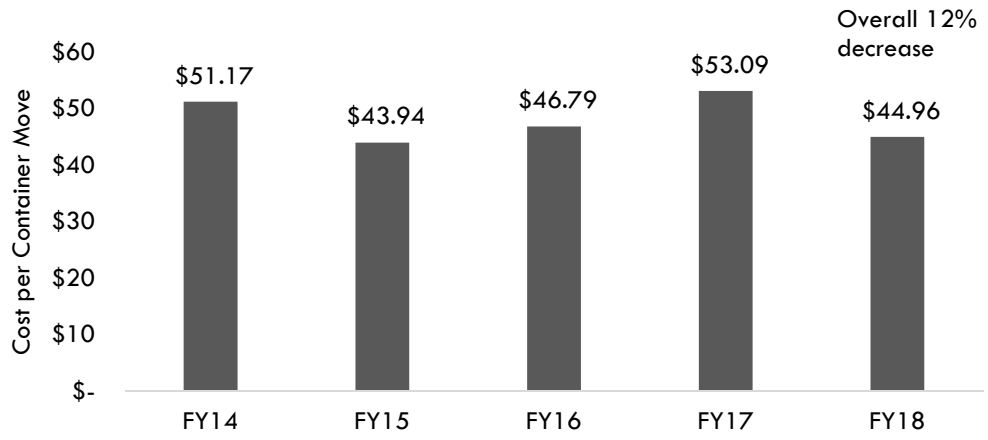
Gate Time for Both Single and Double Container Trucks Have Decreased



Note: Gate time refers to the total time elapsed between when a truck enters and exits the port.

Source: Program Evaluation Division based on information provided by the Authority.

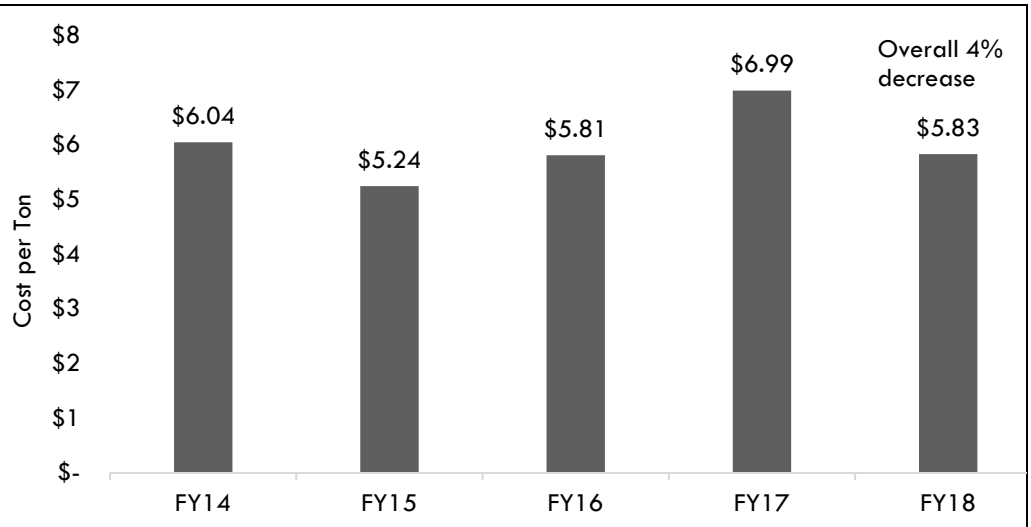
Cost Per Container Move Improved, Reflecting Improvements in Efficiency at Wilmington



Note: Cost per container move measures the cost for a port to move cargo in a standardized container size.

Source: Program Evaluation Division based on information provided by the Authority.

Cost Per Ton Has Decreased at the Port of Wilmington



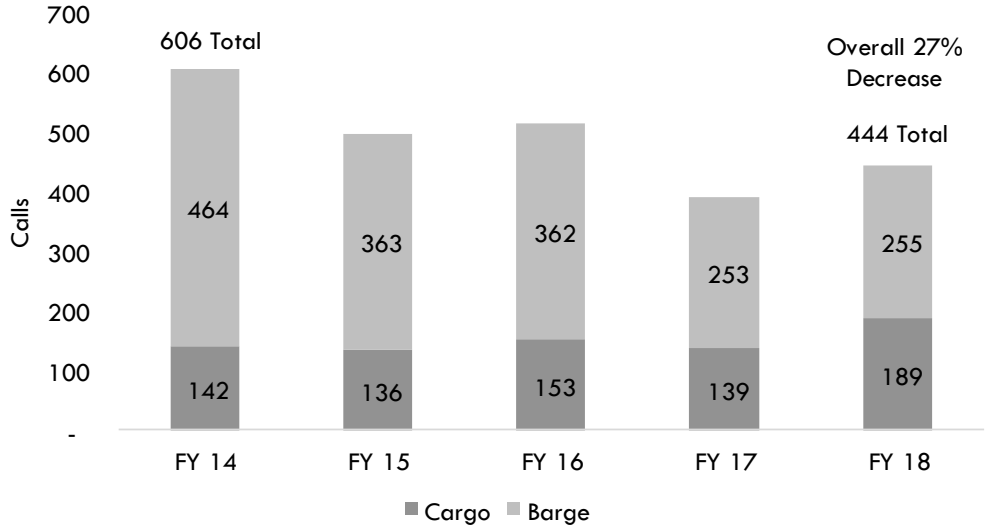
Note: Cost per tonnage measures the cost for a port to process a standardized unit of cargo.

Source: Program Evaluation Division based on information provided by the Authority.

Appendix C: Operations at the Port of Morehead City Have Decreased Over Most Performance Measures

Performance Measures for Port Effectiveness
Port of Morehead City

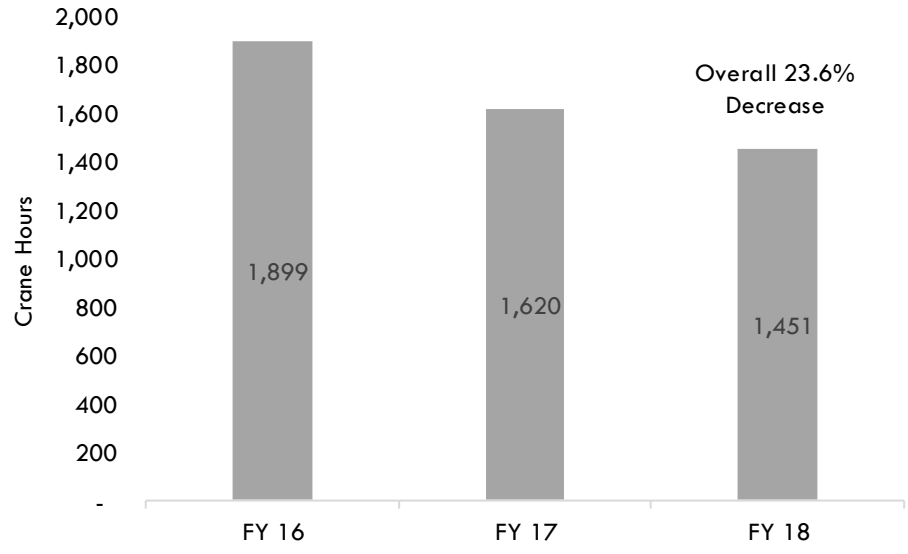
Calls Have Decreased by 27% at the Port of Morehead City



Note: Calls refers to the number of ships entering a port and using its berths to process cargo.

Source: Program Evaluation Division based on information provided by the Authority.

Port of Morehead City Crane Hours Have Decreased by 24%

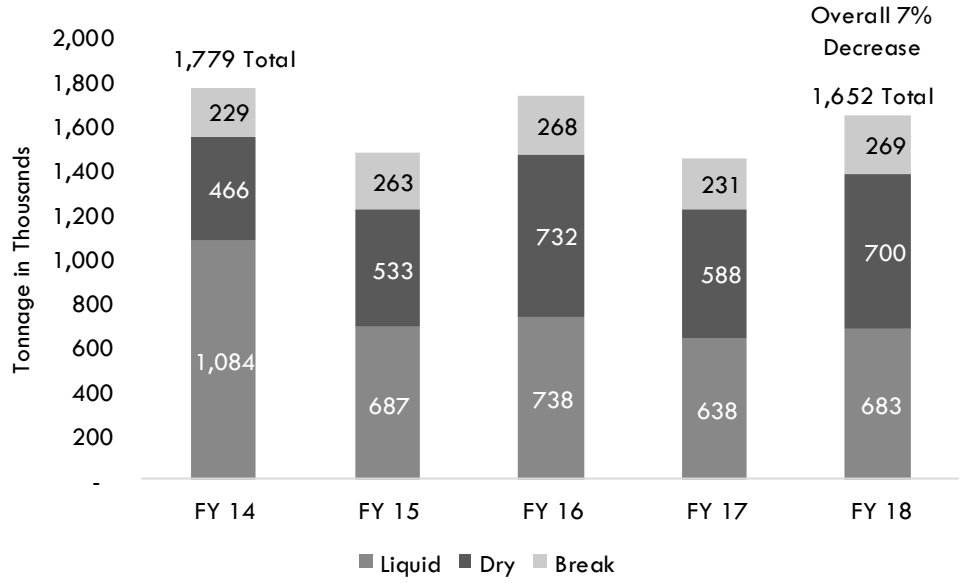


Note: Crane hours demonstrate how ports use equipment to process cargo.

Source: Program Evaluation Division based on information provided by the Authority.

Performance Measures for Port Effectiveness
Port of Morehead City

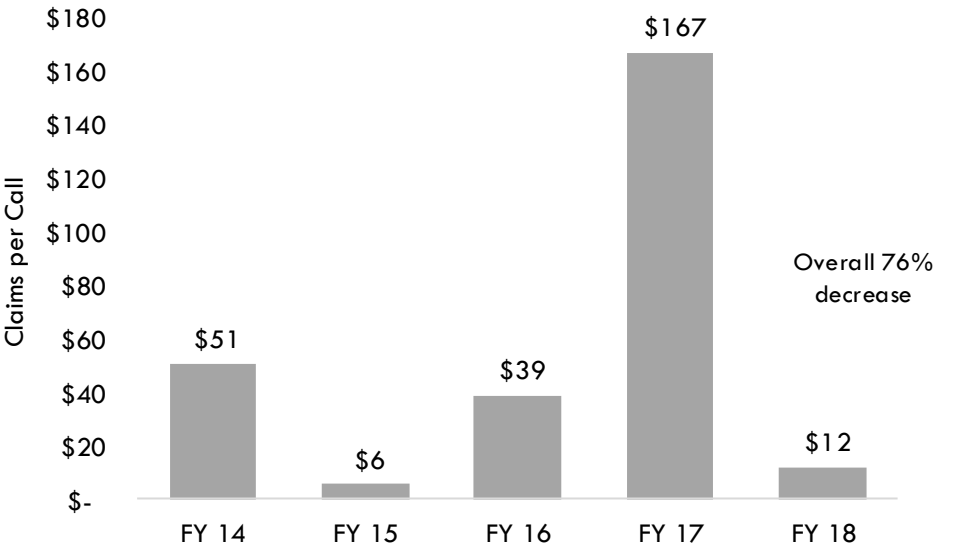
General Cargo Tonnage Has Declined by 7%, Driven by Losses in Liquid Cargo



Note: General cargo being processed at a port is captured through tonnage.

Source: Program Evaluation Division based on information provided by the Authority.

Claims Per Call Have Decreased by 76% at Morehead City

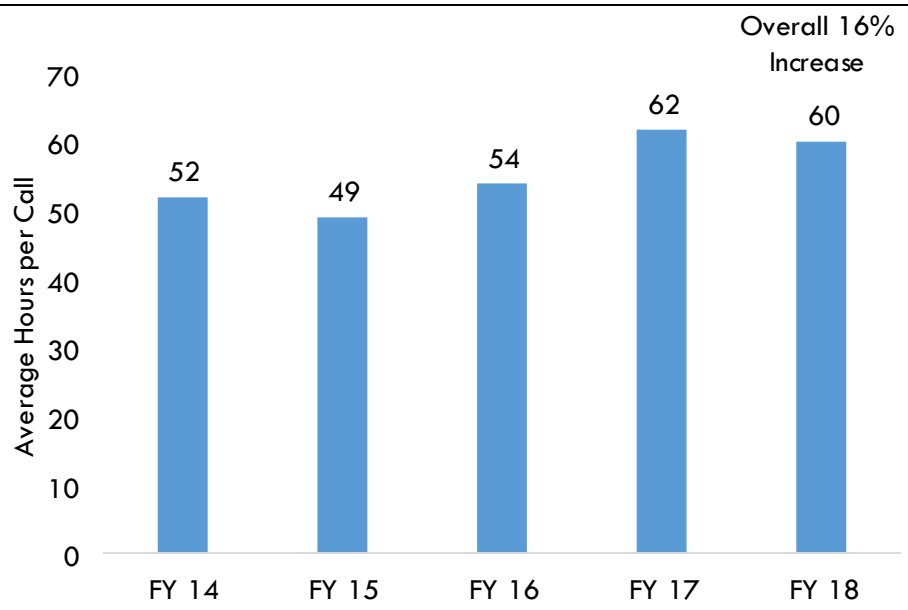


Note: Claims amounts paid per call for damaged or lost goods can serve as a measure of the quality of the handling of cargo at ports.

Source: Program Evaluation Division based on information provided by the Authority.

Performance Measures for Port Efficiency
Port of Morehead City

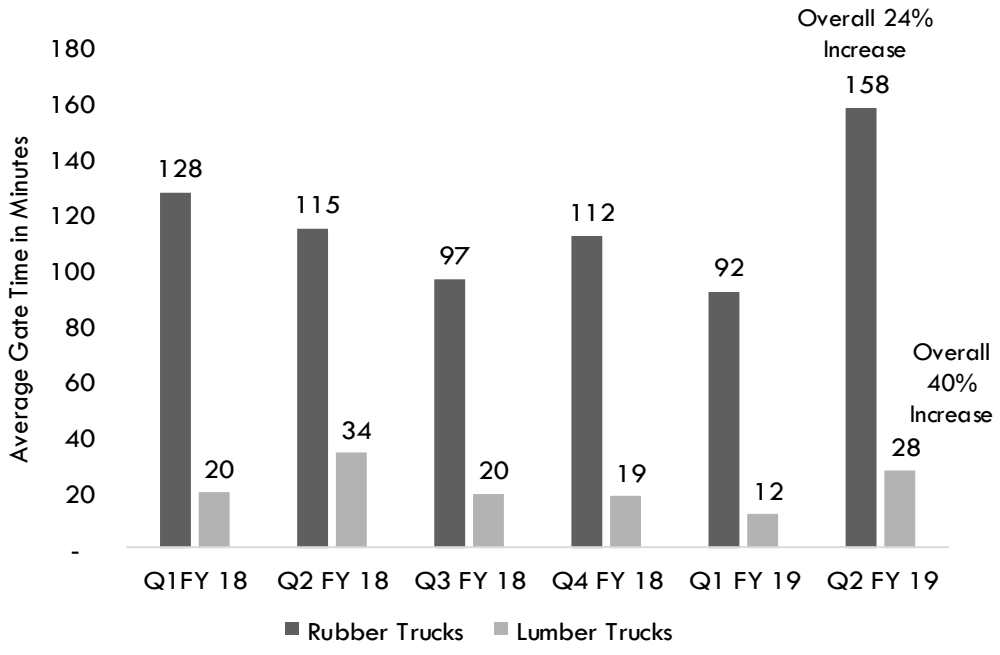
Ship Turnaround Time at Morehead City Has Increased



Note: Ship turn time shows the time it takes for a ship to be serviced at call.

Source: Program Evaluation Division based on information provided by the Authority.

Truck Gate Time at Morehead City Has Increased

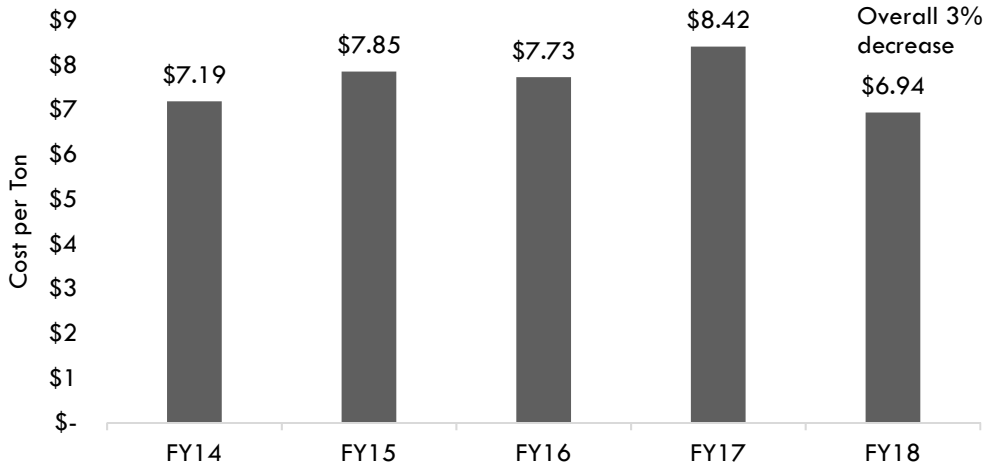


Note: Gate time refers to the total time elapsed between when a truck enters and exits the port.

Source: Program Evaluation Division based on information provided by the Authority

Performance Measures for Port Efficiency
Port of Morehead City

Unit Costing Reveals Bottom-Line Efficiency Gains at the Port of Morehead City



Note: Cost per tonnage measures the cost for a port to process a standardized unit of cargo.

Source: Program Evaluation Division based on information provided by the Authority.

Appendix D: Questions Used in the 2015 North Carolina Port Authority Survey

1. What type of customer are you?
    a. Ocean Carrier
    b. Importer or Exporter
    c. Trucker
2. Who do you most frequently communicate with at the Port?
3. What reasons prompt you to contact the Ports of Wilmington/Morehead City?
4. Please rate our current services.
    a. Overall I am satisfied with the way the Port of Wilmington/Morehead City handles my cargo
    b. NCSPA is polite, professional and courteous
    c. My cargo moves quicker than other ports
    d. The NCSPA is efficient and responsive
5. How would you rate the value of the port services that you receive for the rates you pay?
6. What would you say is the likelihood of increasing your shipments through the Ports of Wilmington or Morehead City?
7. What factors into your decision to select a port?
    a. Proximity to cargo/destination
    b. Pricing
    c. Terminal Productivity
    d. Flexibility
    e. Inland transport costs
    f. Carrier selection/trade lanes served
8. What would incentivize you to increase business with NCSPA? (Ocean Carriers)
9. What would encourage you to increase business with the North Carolina State Ports Authority? (Importers and Exporters)
10. What would incentivize you to increase business with NCSPA? (Truckers)

Appendix E: Maritime Ports Must Navigate a Myriad of Federal Environmental Regulations

Legislation	Description	Applicability to Maritime Port Operations
Clean Air Act (CAA)	The CAA was implemented to protect public health from different types of air pollution by regulating air quality standards.	The Act regulates the port industry through regulations on diesel engines, marine vessel loading operations, emissions, and other types of port equipment. These regulations establish timing and usage standards for vehicles and equipment referred to as covered fleets.
Clean Water Act (CWA)	The CWA was implemented to restore and maintain the chemical, physical, and biological integrity of the waters by regulating the discharge of point and non-point source pollutants into navigable waters.	The Act regulates the port industry by controlling the amount and type of discharge from vessels. There are several types of pollutants that can affect the quality of water. The EPA has established the areas in which discharge from vessels is not allowed and regulates the equipment that is used to treat or hold sewage. The CAA also extends the power to states to implement stricter standards to prohibit discharges from the normal operation of a vessel into the waters.
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)	CERCLA, also known as the Superfund, provides federal funding to clean uncontrolled or abandoned hazardous waste sites, spills, accidents, and other emergency releases of pollutants and contaminants into the environment.	The Act requires any individual that is in charge of an offshore or onshore facility to immediately notify the National Response Center, the appropriate government agency, and any affected state(s) of any hazardous substance that is equal to or exceeds the minimum reportable quantity discharged from its vessel(s) into the environment. The facility must also obtain a permit to dispose of, store, and transport hazardous waste.
Emergency Planning and Community Right-to-Know Act (EPCRA)	EPCRA was authorized under Title III of the Superfund Amendments and Reauthorization Act. It was enacted to help local communities protect public health, safety, and the environment from chemical hazards and to increase the public's knowledge and access to information.	The Act extends the requirements of the EPCRA by requiring onshore and offshore facilities to immediately notify the Local Emergency Planning Committee and the State Emergency Response Commission if there is a release of hazardous chemicals into the environment. The emergency notification must include information on the chemical substance and its effects on the environment.
Hazardous Materials Transportation Act (HMTA)	The HMTA regulates the intrastate, interstate, and foreign transportation of hazardous material to protect against risks to life, property, and the environment.	The Act applies to any operator of a vessel that is transporting hazardous material in commerce and directly affects the safe transportation of such material. It also regulates the packaging, registration, training and security, and other responsibilities that must be taken by vessel operators and facilities when transporting hazardous materials.

Legislation	Description	Applicability to Maritime Port Operations
Resource Conservation & Recovery Act (RCRA)	The RCRA gives the EPA the authority to regulate the generation, transportation, treatment, storage, and disposal of hazardous waste.	The Act requires any individual or entity that transports solid waste to keep a manifest that tracks the waste. The ports as storage and disposal facilities must obtain permits, which require inspections and monitoring in addition to compliance with the manifest.
Toxic Substance Control Act (TSCA)	The TSCA gives the EPA the authority to regulate reporting, record-keeping and testing, and restrictions related to chemical substances and mixtures that are transported through intrastate, interstate, or foreign commerce.	The Act requires the inspection of any facility or other premises in which chemical substances, mixtures, or products subject to Title IV are stored or held before or after their distribution in commerce.

Source: Program Evaluation Division based on review of federal laws and regulations.

Appendix F: Summary Statistics about the Ports

Geographic and Infrastructure		
	Port of Wilmington	**Port of Morehead City**
Miles from Open Ocean	26 miles	4 miles
Mean Lower Low Water (MLLW)	42 feet	45 feet
Harbor Width	500 feet	450 feet
Total Acres	284	128
Storage Acres	124	29
Number of Berths	9	9
Linear Feet of Berth	6,740 feet	5,366 feet
Number of Cranes	11	2

Fiscal and Performance Measures, Fiscal Year 2017–18		
	Port of Wilmington	**Port of Morehead City**
Expenditures	$32,544,556	$15,630,027
Containerized Cargo Operations	Yes	No
Bulk Cargo Materials	Forest Products Metal Products Grain Chemicals Fertilizer Woodchips Wood Pellets	Forest Products Phosphate Sulphur Metal Products Scrap Metal Paper Asphalt Rubber Woodchips Aircraft Parts Grain
Calls	579	444
Throughput		
Tonnage	2,603,641	1,652,009
Container Moves	322,391 TEUs	-
Ship Turnaround Time	27 hours	60 hours

Appendix G: Financial Statement of Net Position from the 2018 Comprehensive Annual Financial Report

June 30, 2018

(Dollars in Thousands)

Statement of Net Position	State Ports Authority
Assets	
Cash and cash equivalents	$ 6,068
Investments	32,637
Securities lending collateral	—
Receivables, net	12,746
Due from component units	—
Inventories	693
Prepaid items	2,413
Notes receivable, net	—
Restricted/designated cash and cash equivalents	18,837
Restricted investments	22,050
Net OPEB asset	38
Capital assets-nondepreciable	94,323
Capital assets-depreciable, net	261,978
Total Assets	451,783
Deferred Outflows of Resources	
Accumulated decrease in fair value of hedging derivatives	—
Deferred loss on refunding	798
Deferred outflows for pensions	3,218
Deferred outflows for OPEB	1,211
Total Deferred Outflows of Resources	5,227
Liabilities	
Accounts payable and accrued liabilities	7,532
Obligations under securities lending	—
Interest payable	1,276
Due to component units	—
Unearned revenue	344
Advance from primary government	595
Deposits payable	—
Funds held for others	—
Hedging derivatives liability	—
Long-term liabilities:	
Due within one year	5,630
Due in more than one year	139,256
Total Liabilities	154,633
Deferred Inflows of Resources	
Deferred state aid	—
Deferred inflows for pensions	255
Deferred inflows for OPEB	6,992
Total Deferred Inflows of Resources	7,247
Net Position	
Net investment in capital assets	235,692
Restricted for:	
Expendable:	
Higher education	—
Health and human services	—
Economic development	40,971
Unrestricted	18,467
Total Net Position	$ 295,130

Source: Comprehensive Annual Financial Report (CAFR) FY 2017–18.

NORTH CAROLINA PORTS

Mr. John W. Turcotte, Director
Program Evaluation Division
The North Carolina General Assembly
300 North Salisbury St, Suite 100
Raleigh, NC 57603-5925

Dear Mr. Turcotte,

Thank you for the opportunity to review and respond to the Program Evaluation Division's (PED) report entitled *'Evaluation of Efficiency and Effectiveness of State Ports at Wilmington and Morehead City'.* Please accept this letter as the North Carolina State Ports Authority's (NCSPA) formal response.

NCSPA appreciates the work by the PED staff during the evaluation process. PED was assigned a task to evaluate the efficiency and effectiveness of NCSPA's operations and toward that goal PED defined, calculated and measured a set of performance metrics to develop their analysis. We recognize the time PED spent learning about our operation by visiting both port locations and reviewing and being responsive to NCSPA staff during the analysis phase. The PED has been thorough in its approach to its analysis, and NCSPA finds the report interesting and helpful.

Recommendation 1: The General Assembly should direct the NCSPA to establish operational objectives, including modifying its strategic plan, in order to improve performance at the Port of Morehead City.
NCSPA agrees with the findings that North Carolina's ports are effective and efficient. NCSPA differs in the opinion that the Port of Morehead City shows a decline in performance as determined by the metrics applied by PED. NCSPA establishes and effectively manages its operations through objectives that focus on commercial, financial and operating goals. This analysis does not take into account the significant increase in cargo volumes being handled by NCSPA directly, or the overall financial performance of the port. NCSPA will continue to identify commercial opportunities that increase cargo volumes and revenues through both facilities. It is important to note that NCSPA has doubled the direct tonnage volume through Morehead City from its fiscal year 2014 to fiscal year 2019.

Recommendation 2: The General Assembly should modify the statute pertaining to containerized shipping to align with current practice.
NCSPA agrees with PED's recommendation that the statute pertaining to containerized shipping should be modified to align with current industry practice.

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NORTH CAROLINA PORTS

Recommendation 3: The General Assembly should direct the NCSPA to improve its service quality measurement.

NCSPA effectively gauges customer satisfaction through methods other than a survey. NCSPA staff regularly meets with various levels throughout our customer's organization, conducts regular workshops and focus meetings with customers and users of the port facilities, and conduct pre- and post- operational review meetings to ensure NCSPA is planning for, and delivering upon, customer expectations. In the commercial logistics community, NCSPA is recognized as delivering superior customer service.

NCSPA understands PED's recommendation that a customer satisfaction survey should contain a sufficient number of questions and generate sufficient responses to be useful in measuring customer satisfaction. If NCSPA should initiate a customer service survey in the future, this recommendation will be taken into consideration.

Recommendation 4: The General Assembly should direct the Authority to periodically update the House and Senate Transportation Committees and its board on the development and implementation of its environmental management system (EMS).

Prior to the PED analysis and final report, NCSPA identified the need to develop and implement an environmental management system. Many of the policies that would be incorporated in such an EMS have been established policies of NCSPA, however, improvements could be made.

Status updates on the development and implementation of the EMS will be provided to the NCSPA Board of Directors during regularly scheduled meetings, and a status update will be included in future general updates by NCSPA to the House and Senate Transportation committees.

Again, NCSPA appreciates the time and effort that went into this report, and we thank you for the opportunity to review and provide comments on the recommendations.

Sincerely,

Paul J. Cozza
Executive Director

c.c.: Secretary James H. Trogdon, III
Mr. Robert A. Wicker, Chairman

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