PORT PERFORMANCE

FREIGHT STATISTICS

PROGRAM

Annual Report to Congress

2018

U.S. Department of Transportation
Bureau of Transportation Statistics

Port Performance Freight Statistics Annual Report to Congress 2018

ACKNOWLEDGMENTS

QUALITY ASSURANCE STATEMENT

The Bureau of Transportation Statistics (BTS) provides high-quality information to serve government, industry, and the public in a manner that promotes public understanding. Standards and policies are used to ensure and maximize the quality, objectivity, utility, and integrity of its information. BTS reviews quality issues on a regular basis and adjusts its programs and processes to ensure continuous quality improvement.

Notice

This document is disseminated under the sponsorship of the U.S. Department of Transportation in the interest of information exchange. The U.S. Government assumes no liability for its contents or use thereof.

PREFACE

Pursuant to Section 6018 of the *Fixing America's Surface Transportation (FAST) Act* (Pub. L. 114-94; Dec. 4, 2015; 129 Stat. 1312), the Bureau of Transportation Statistics (BTS) established the Port Performance Freight Statistics Program (PPFSP). The goal of the program is "to provide nationally consistent measures of performance" for the Nation's largest ports, and to report annually to Congress on port capacity and throughput.

The *FAST Act* further requires the BTS Director to submit an annual report to Congress, which includes at a minimum, statistics on capacity and throughput at the top 25 ports by tonnage, twenty-foot equivalent unit (TEU), and dry bulk tonnage; nationally consistent port performance metrics; and recommended future measures. The Port Performance Freight Statistics Working Group (Working Group), composed of representatives from Federal, labor, port, private sector associations, and other organizations as specified in *FAST Act* Section 6018, advised BTS during preparation of the first report, and transmitted final recommendations to the BTS Director on December 4, 2016.

This is the third *Annual Report* under the PPFSP. It presents publicly available, nationally consistent throughput and capacity metrics for the top 25 tonnage, container, and dry bulk ports. It reflects the discussions and recommendations of the Working Group, and the practicalities of the program in its early years. The report also includes background information on U.S. ports and discussions of throughput and capacity concepts to provide a more complete picture of port activity and place the statistics in context.

This *Annual Report* meets *FAST Act* requirements by including recommendations on standards for consistent port performance measures and statistics for port throughput and capacity.

TABLE OF CONTENTS

1. INTRODUCTION

Reflecting the importance of ports to the Nation's multimodal freight transportation system, Section 6018 of the *Fixing America's Surface Transportation* (FAST) *Act* requires the Bureau of Transportation Statistics (BTS) of the U.S. Department of Transportation (USDOT) to establish "a port performance statistics program to provide nationally consistent measures of performance of, at a minimum, the Nation's top 25 ports by tonnage; the Nation's top 25 ports by 20-foot equivalent unit; and the Nation's top 25 ports by dry bulk… [and] submit an annual report to Congress that includes statistics on capacity and throughput at the ports."[1] The status of BTS as a principal Federal statistical agency requires these measures to be objective, the methods of measurement must be transparent, and published statistics must meet reasonable quality standards.[2] *FAST Act* Section 6018 requires BTS to measure port throughput (defined in this report as the amount of cargo a port handles annually) and capacity (defined in this report as a port's maximum possible annual throughput, defined by tonnage, TEU, or other unit). Throughput measures are described in Sections 3 and capacity measures in section 4. Waterborne cargo is generally classified into five major types: containerized, dry bulk, liquid bulk, break-bulk, and roll on/roll off (Ro/Ro). This report covers all five cargo types.

The statistics in this report measure total port capacity and throughput for 2017, as well as the change in throughput from previous years to indicate the extent of trade growth or decline and the increasing challenges facing ports. BTS used the following criteria to select throughput and capacity indicators for this report:

- **Availability** - The chosen measures must be readily available for at least the top 25 ports to which they apply (e.g., tonnage for all ports, TEU for container ports, vessel calls, and sizes for all ports).

- **National consistency** - Measures must be based on a nationally consistent definition and collection methodology. Ideally, the measure should be available from a single, authoritative source. If not, multiple sources were documented and reconciled to ensure consistency.

- **Timeliness** - The most recent information is sought, with a goal of data no more than two years old for key measures.

---

[1] Section 6018 of the *Fixing America's Surface Transportation (FAST) Act* (Pub. L. 114-94; Dec. 4, 2015; 129 Stat. 1312).
[2] *Statistical Policy Directive No. 1: Fundamental Responsibilities of Federal Statistical Agencies and Recognized Statistical Units;* Federal Register / Vol. 79, No. 231 / December 2, 2014. Page 71610.

- **Relevance and clarity** - Measures should be closely connected to the throughput and capacity of ports, terminals, and port infrastructure; and understandable to readers unfamiliar with ports or shipping terminology.

- **Accuracy and transparency** - Measures should be accurate within acceptable data quality standards, and should come from authoritative sources, as outlined in the *PPFSP Definitions and Methods Handbook*.

In addition to measures of throughput on the volume and value of cargo handled, this report includes selected measures of port performance that contribute to cargo throughput such as vessel counts by vessel size and terminal dwell time indexes for container vessels and tankers. BTS will continue to develop additional measures for future editions of this report as resources and data permit.

This is the third edition of the *Port Performance Freight Statistics Program Annual Report*, which builds on the foundation of the 2016 *Annual Report*. In the inaugural edition, BTS published existing, nationally consistent measures of port capacity and throughput, and explained the criteria used to define ports and the measures used to define the top 25 ports in each category. The report included recommendations of the advisory working group to the Port Performance Freight Statistics Program (2016 Working Group), and was delivered to the BTS Director prior to publication as specified in *FAST Act* Section 6018.

This 2018 *Annual Report* expands on previous editions in several ways. The throughput and capacity statistics included in previous editions have been updated with the most recently available annual data and, in many cases, have been enhanced with additional detail. This edition also expands the number of throughput and capacity measures published and incorporates new and improved methodologies. For example, a new index of liquid bulk vessel dwell times using automatic vessel location data builds on the container vessel dwell time index added in the previous *Annual Report*.

This edition includes additional descriptions of global and national maritime trends to provide a more robust context for understanding port performance and the emerging issues and topics, including:

(1) Waterborne transport of food and farm products
(2) Use of Automatic Identification System (AIS) data to measure the impacts of weather disruptions on ports

The *Port Performance Freight Statistics Program Definitions and Methods Handbook* (*PPFSP Definitions and Methods Handbook*),[3] available separately, details the process used to identify the top 25 ports and calculate their capacity and throughput.

BTS plans to continue expanding and improving measures of port capacity and throughput as resources and data permit. Additional discussion of BTS's potential future directions for the Port Performance Freight Statistics Program is included in Section 6: *Looking Ahead*.

Comments on this report are welcomed and should be sent to PortStatistics@dot.gov or to the Port Performance Freight Statistics Program, Bureau of Transportation Statistics, U.S. Department of Transportation, 1200 New Jersey Avenue SE, Washington, DC, 20590.

---

[3] Forthcoming in spring 2019.

2. TOP PORTS AND CONTRIBUTING FACTORS TO PERFORMANCE

Ports are commonly recognized as places where cargo is transferred between ships and trucks, trains, pipelines, or storage facilities. While ports are usually equated with the port authorities that govern them, defining ports for statistical purposes is difficult due to several factors. For example, closely related adjacent land uses (e.g., rail yards), variations in terminal ownership and governance, and proximity to other ports can make it challenging to identify a port's physical or jurisdictional boundaries. Regional waterfront may be divided into separate ports by administrative boundaries, such as the adjacent Ports of Los Angeles and Long Beach on San Pedro Bay. In contrast, the Port of New York and New Jersey and the Ports of Cincinnati-Northern Kentucky are each treated as single entities, even though the former has a river and a state line dividing its facilities and the latter has terminals that stretch along 226 miles through two states. Given the diversity of port ownership arrangements, operating methods, and cargoes handled, developing nationally consistent performance assessments for ports is a challenging task.

Ports are generally located within natural or man-made harbors. San Francisco Bay in California, for example, is a natural harbor where the Ports of Oakland, San Francisco, Richmond, Redwood City, and Benicia are co-located with other public and private waterfront facilities. When cargo statistics are published for harbors, these data may include terminals that are not part of public port authorities and may thus show higher cargo volumes than what port authority statistics report.

There are many ways to define a "port," such as by legislative enactment of Federal, state, or city government. Port definitions are essential for identifying the top 25 ports. Without a consistent port definition, it is impossible to measure national port performance in a consistent manner. This report follows the recommendations of the 2016 Working Group to use the U.S. Army Corps of Engineers (USACE) statistical definitions of ports, which align with the associated Federal, state, and city legislative definitions. These legislative port definitions are relatively stable over time, although some ports have successfully petitioned USACE to alter their boundaries. Most USACE-defined ports are consistent with the common perception of a facility located within a single harbor, yet some, such as the Ports of Cincinnati-Northern Kentucky, cover an extended stretch of river that is not commonly perceived as one entity. In some cases, ports that work together under a common marketing label, such as the Northwest Seaport Alliance (Port of Tacoma and Port of Seattle), are nevertheless defined separately by USACE. The major advantage to using USACE's port definitions is that they align with USACE's nationally consistent cargo throughput data, including the data used to select the top 25 ports.

2.1 Lists of the Top 25 Ports

The *FAST Act* requires the *Port Performance Freight Statistics Program Annual Report* to include the top 25 ports as measured by overall cargo tonnage, by twenty-foot equivalent units (TEU) of container cargo, and by dry bulk cargo tonnage.

To identify the top 25 ports by overall tonnage for this *Annual Report*, the Bureau of Transportation Statistics (BTS) used the total weight of cargo (domestic and international) entering and leaving the port in short tons as reported by USACE for calendar year 2017. To identify the top 25 ports by TEU, BTS includes foreign inbound and outbound loaded and all domestic containers as reported by USACE. This approach is unchanged from the 2017 *Annual Report*.

USACE tonnage statistics are not categorized as dry bulk versus other cargo types, so BTS worked with USACE and the Maritime Administration (MARAD) to develop a method for identifying the top 25 dry bulk ports. This methodology is unchanged from last year's *Annual Report*.

The top 25 ports within each category remained relatively consistent between this report and those reported in the previous *Annual Report*. For the top 25 list by total tonnage, Philadelphia, PA, and Richmond, CA, replace Pascagoula, MS, and Tacoma, WA. For the top 25 list by TEU, Palm Beach, FL, and Gulfport, MS, replace Ketchikan, AK, and Kahului, HI. The 25 ports on the dry bulk list are unchanged from those reported in the 2017 *Annual Report*.

Table 2-1 lists the top 25 ports for each category (total tonnage, TEU, and dry bulk tonnage). A series of three maps (Figure 2-1 through Figure 2-3) following the table provide general port locations. As indicated in Table 2-1, many ports rank in the top 25 in more than one category. Each port listed is profiled in Appendix A: Port Profiles.

Table 2-1: List of Top 25 Tonnage, Container, and Dry Bulk Ports

Port	Tonnage	Container	Dry Bulk
Anchorage, AK		●	
Baltimore, MD	●	●	●
Baton Rouge, LA	●		●
Beaumont, TX	●		
Boston, MA		●	
Charleston, SC		●	
Chicago, IL			●
Cincinnati-Northern KY, Ports of	●		●
Cleveland, OH			●
Corpus Christi, TX	●		●
Detroit, MI			●
Duluth-Superior, MN and WI	●		●
Gulfport, MS		●	
Honolulu, HI		●	
Houston, TX	●	●	●
Huntington - Tristate	●		●
Indiana Harbor, IN			●
Jacksonville, FL		●	
Kalama, WA			●
Lake Charles, LA	●		
Long Beach, CA	●	●	
Longview, WA			●
Los Angeles, CA	●	●	
Miami, FL		●	
Mobile, AL	●	●	●
New Orleans, LA	●	●	●
New York, NY and NJ	●	●	●
Oakland, CA		●	
Palm Beach, FL		●	
Philadelphia, PA	●	●	
Pittsburgh, PA			●
Plaquemines, LA, Port of	●		●
Port Arthur, TX	●		
Port Everglades, FL		●	
Portland, OR			●
Richmond, CA	●		
San Juan, PR		●	
Savannah, GA	●	●	
Seattle, WA		●	●

Port	Tonnage	Container	Dry Bulk
South Louisiana, LA, Port of	●		●
St. Louis, MO and IL	●		●
Tacoma, WA		●	
Tampa, FL	●		●
Texas City, TX	●		
Two Harbors, MN			●
Valdez, AK	●		
Port of Virginia, VA	●	●	●
Wilmington, DE		●	
Wilmington, NC		●	

A total of 49 ports were identified, of which 43 are located within the contiguous United States, three in Alaska, two in Hawaii, and one in Puerto Rico. The ports were assigned to regions based on four USACE categories: Great Lakes, Atlantic Coast, Gulf Coast and Mississippi River, and Pacific Coast, to clarify the regional distribution of U.S. port capacity and cargo throughput.

Figure 2-1 through Figure 2-3 depict the general location of the 25 ports within each of the three categories.

Figure 2-1: Location of the Top 25 Ports by Tonnage, 2017
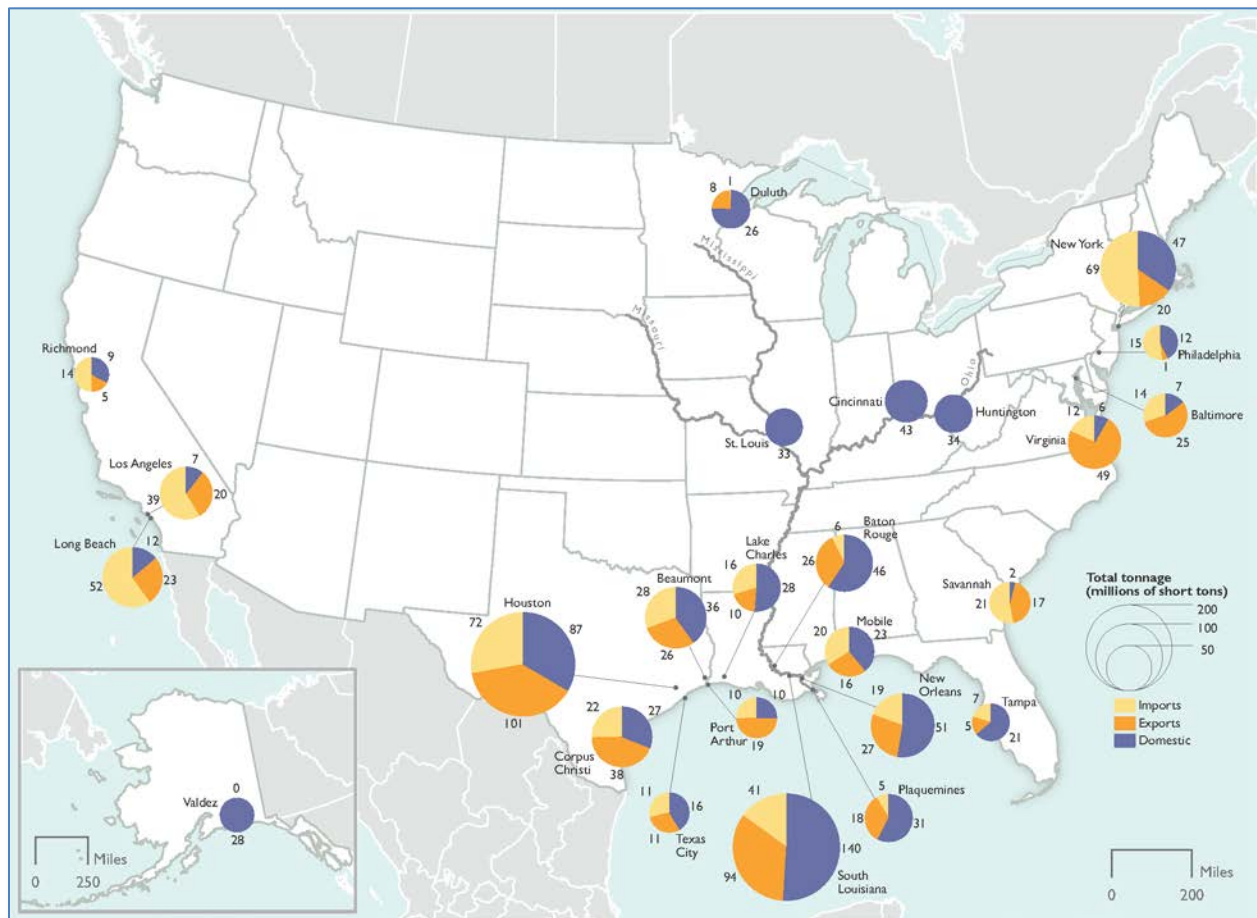
SOURCE: U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center, 2017 data, special tabulation, as of October 2018.

Figure 2-2: Location of the Top 25 Ports by Dry Bulk Tonnage, 2017
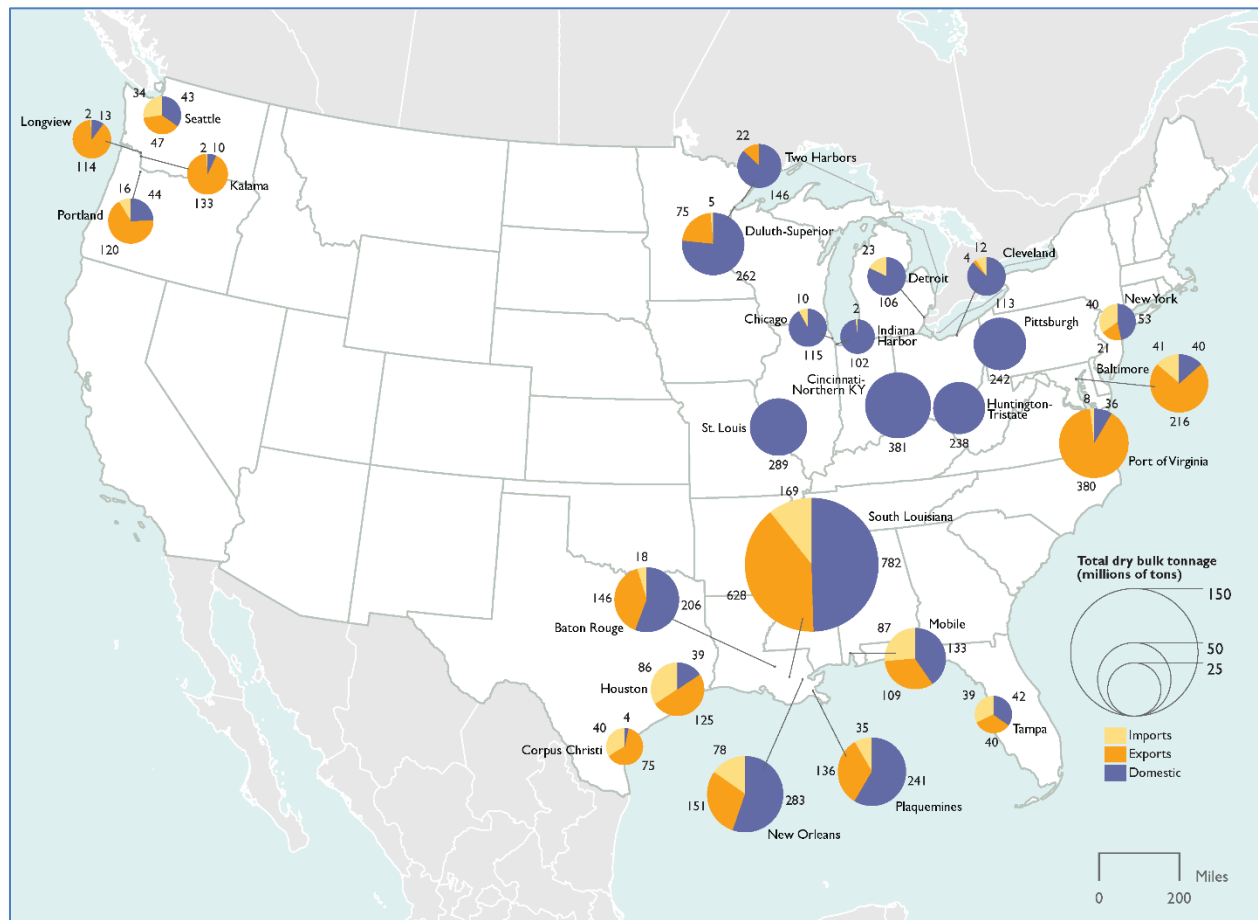
SOURCE: U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center, 2017 data, special tabulation, as of October 2018.

Figure 2-3: Location of the Top 25 Ports by TEU, 2017
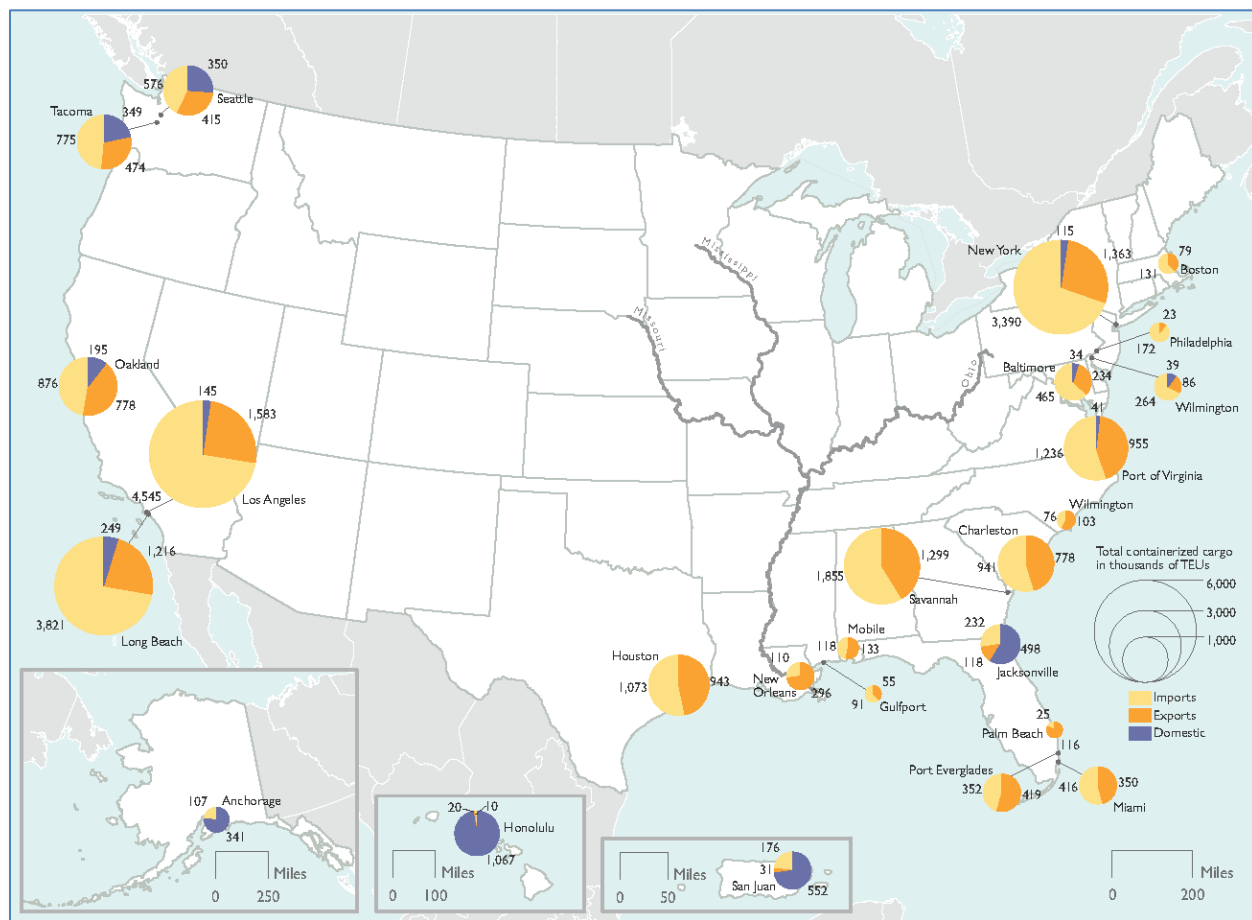
SOURCE: U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center, 2017 data, special tabulation, as of October 2018.

2.2 Port Context

Each port is a unique combination of governance, infrastructure, and operations. The type and volume of cargo a port handles and the type and size of its terminals are dictated by inbound and outbound flows to the markets it serves. This section discusses the differences between ports and how they challenge the development of nationally consistent throughput and capacity metrics.

2.2.1 Port Governance

Port governance influences cargo operations and investment decisions. Ports are organized and governed in several ways, with implications for port definitions and data availability. The port profiles in Appendix A briefly describe each port's governance.

Port Authorities and Public Terminals. A port authority (sometimes called a harbor district) is a government entity that either owns or administers the land, facilities, and adjacent bodies of water where cargo is transferred between modes. Most ports are governed by port authorities or harbor districts, which are usually part of local or state government. A port authority promotes overall port efficiency and development, maintains port facilities, and interacts with other government bodies. Additional activities include business development and infrastructure finance. While the structure, powers, and roles of port authorities vary, the American Association of Port Authorities (AAPA) states that they "share the common purpose of serving the public interest of a state, region or locality." Port authorities may act as one or a combination of:

- **Landlords** - building and maintaining terminal infrastructure and providing major capital equipment, but not engaged in operations. The Port of Los Angeles, Port of New York and New Jersey, and Port of Oakland are examples of landlord ports. In this capacity, ports may also offer concessions to tenants that make infrastructure improvements. For example, the Maryland Port Administration granted a 50-year concession for the Baltimore Seagirt Marine Terminal that included a concessionaire commitment to deepen the Port of Baltimore's channel.

- **Operators** - directly operating some or all of the terminals in the jurisdiction. For example, the Port of Virginia is an operating port.

- **Jurisdictional bodies** - under which private terminals are responsible for providing and operating their infrastructure. For example, the Ports of Cincinnati-Northern Kentucky is a jurisdictional body.

A port authority's jurisdiction typically extends over land, where it may include granting concessions, approving construction, and making policy decisions; and over water, where jurisdiction is primarily focused on navigation. A port may own and operate an extensive range of facilities over a large area, many of which may not be water-related. Several port authorities (e.g., Oakland, Portland) also operate airports. The Port Authority of New York and New Jersey operates airports, tunnels, bridges, and transit systems as well as the seaport.

Certain states, such as Alabama and North Carolina, have statewide port authorities that administer some or all of the state's ports. Boards of appointed members typically lead these entities. Statewide port authorities may also directly operate port facilities within the state. A State port authority may be a separate state department or located within that state's Department of Transportation.

Port authority jurisdictions may cross state boundaries. The Port of Huntington Tri-State and the Port of Metropolitan St. Louis are examples of multi-state ports.

Port authorities typically have jurisdiction over public terminals, which includes most U.S. container terminals, although some container terminals are owned or leased by private interests. Private bulk terminals are normally outside the public port authority jurisdiction, although they are still subject to U.S. Coast Guard (USCG) and Federal regulations. Public port authorities may also own or administer bulk and roll on/roll off (Ro/Ro) terminals.

Port revenue sources may include lease payments from terminal operators, fees charged for direct operation of terminals, and fees for vessel use of port facilities.

Public port authorities generally make selected data on their infrastructure and cargo operations available to the public. Data are usually presented on port authority websites, in annual reports, or in special reports or brochures. BTS uses data from these sources to supplement government and trade association sources, and cross-checks the data to assure accuracy and consistency.

Private Port Terminals. Many dry bulk, liquid bulk, and Ro/Ro terminals are owned and operated by private firms, and may or may not fall within public port authority jurisdictions. Private terminals tend to be of three types:

- **Terminals owned by vessel or barge operators to serve their own operations.** The primary revenue source for these terminals is the transportation service being offered.

- **Terminals owned by cargo interests**. These include grain terminals owned and operated by grain exporters or petroleum terminals operated by refinery owners. The primary revenue sources for these operations are the cargo and any prior/subsequent processing rather than transportation or terminal services.

- **Terminals owned and operated by marine terminal operators.** These facilities provide, and derive revenue from, cargo handling services.

The differences in port, public terminal, and private terminal revenue sources become significant in the context of policy and investment decisions. Revenue sources and profit margin for private terminals can heavily influence long-term port infrastructure investments, thereby impacting port performance.

This report presents performance data at the port level, which in many cases include both public and private terminals. When possible, the profiles focus on the public terminals as port authorities more often make capacity and throughput data available to the public. The wide variety of port ownership, leasing, control, and operating arrangements leads to wide variation in collection, synthesis, and availability of capacity and throughput data. For example, private terminals may or may not publish data on their operations and infrastructure, while a refinery may report total volume of petroleum processed, but not how much was received by vessel versus pipeline. Nationally consistent data are limited for those private terminals not administered by port authorities.

As the observations above suggest, this report provides more detailed information and consistent capacity and throughput measures on public and private terminals governed by port authorities. The ability to measure performance is enhanced when a port authority is actively collecting and reporting data and statistics.

2.2.2 Cargo Types

In general, cargo types handled and geographic location determine the physical characteristics of a port and the relevance of various capacity and throughput metrics. Different cargo types require different vessels, terminal configurations, and handling equipment.

Waterborne cargo is generally classified into five major types:

- Containerized

- Dry bulk

- Liquid bulk

- Break-bulk

- Ro/Ro

FAST Act Section 6018 specified containerized and dry bulk cargoes as statistical categories, these are addressed in detail below. The other cargo types are discussed more briefly. The total tonnage figures included within this report and the port profiles include all five cargo types.

A large port typically has multiple terminals that together can handle many cargo types, but individual terminals are usually designed to move a single cargo type. The requirements of loading, unloading, and storing different cargo types lead to major differences in terminal design and overall port infrastructure.

Containerized Cargo

Containerized cargo includes most consumer goods imported into the U.S. and has been the focus of most concerns over port performance. Cargo is containerized when it is placed in standard shipping containers that can be handled interchangeably on vessels, in terminals, and via inland transport modes. Standard containers used in international maritime trade come in three lengths: 20 feet, 40 feet, and 45 feet. Standard containers are typically 8 feet wide and 8.5 feet high, regardless of length. Almost any commodity can be moved in standardized shipping containers if packed appropriately, but containerized cargo includes the highest value and most time-sensitive maritime commodities. Approximately 90 percent of dry, non-bulk manufactured goods in international trade are currently shipped in containers.

Container cargo volume and the capacity of container ships are usually measured in twenty-foot equivalent units (TEU), each nominally equal to one 20-foot container. Loaded and empty containers occupy the same space, and are equal in terms of TEU. Forty-foot equivalent units (FEU, equal to 2 TEU) are used less frequently in throughput and capacity metrics, even though 40-foot containers dominate international trade and account for approximately 90 percent of waterborne containers. There are also some 45-foot containers used in international trade (typically equal to 2.25 TEU although sometimes counted as 2.0 TEU). Conversion factors are used to shift between TEU and container counts, thereby allowing the comparison of total

container volumes and metrics. Container vessel capacity range from barges carrying about 100 TEU to ships that are capable of carrying over 20,000 TEU.

Containerized cargo is typically transported by truck or rail domestically, although some are moved by barge on the inland waterway network.

Figure 2-4 illustrates the range of activities that might occur at a container terminal designed to serve large ocean-going vessels.[4]

---

[4] See the 2016 *Port Performance Freight Statistics Program Annual Report* for a detailed description of these activities.

Figure 2-4: Example of Container Terminal Cargo Loading and Unloading
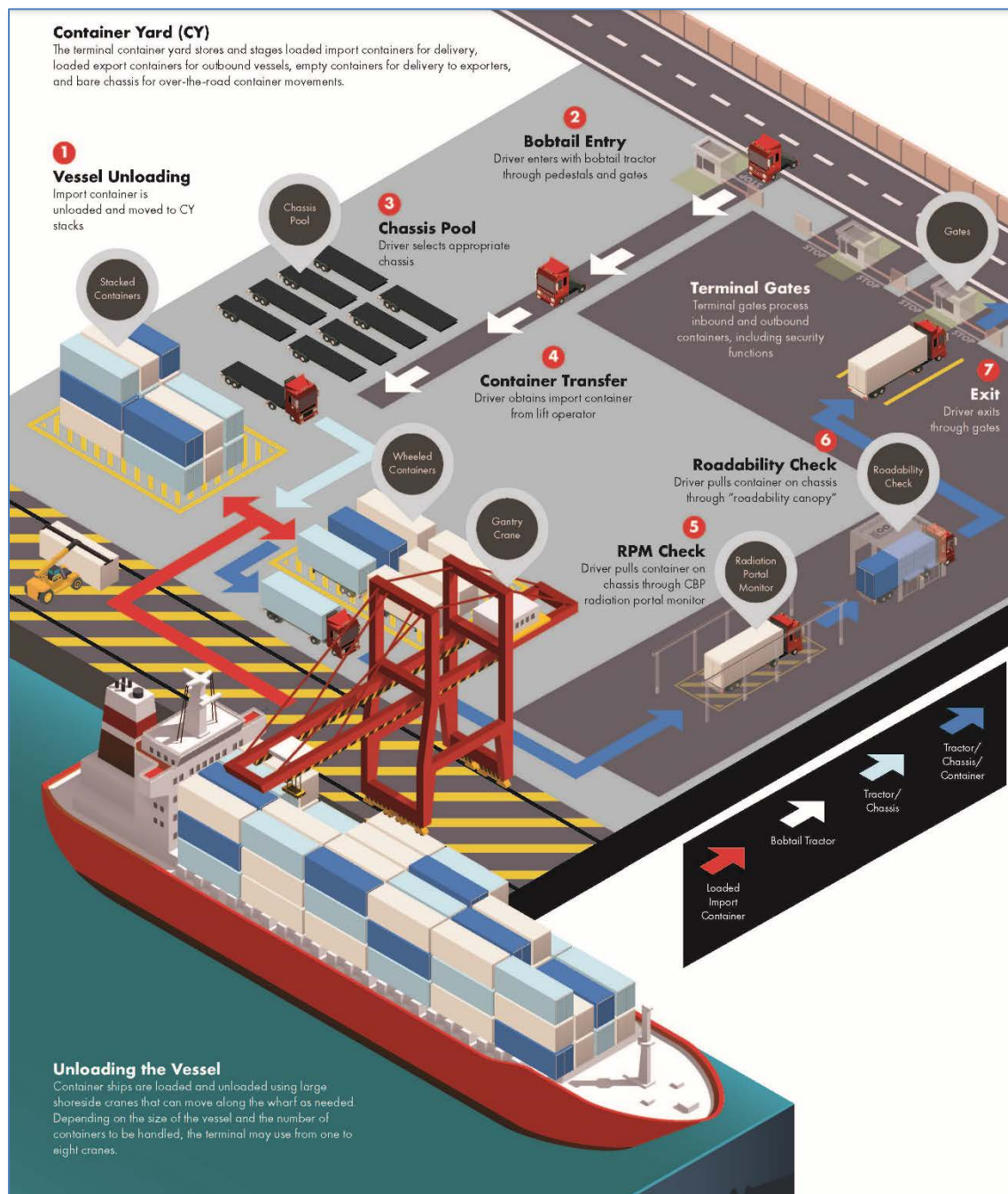
SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics and Volpe Center, November 2018.

Dry Bulk Cargo

Dry bulk cargo includes unpacked, homogenous commodities such as grain, iron ore, or coal. The size of a dry bulk terminal is determined by cargo volume, the number of commodity types, and vessel call frequency. Larger cargo volumes require more space, as do multiple commodities that must be kept separated. Dry bulk terminals usually handle solely imports or exports and are designed accordingly, unlike container terminals that handle both imports and exports. Dry bulk terminals rely on trucks, rail cars, and barges to connect to domestic origins and destinations.

Figure 2-5 illustrates the features of a representative dry bulk terminal serving barges on an inland river port.[5]

---

[5] See the 2016 *Port Performance Freight Statistics Program Annual Report* for a detailed description of these activities.

Figure 2-5: Example of Dry Bulk Terminal Features

SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics and Volpe Center, November 2018.

Liquid Bulk Cargo

Liquid bulk cargo includes crude oil transported in crude tankers; refined products such as gasoline, diesel, and fuel oil transported in product tankers; and a variety of chemicals transported in chemical tankers. The largest ocean-going tankers carry crude oil rather than refined products or chemicals. Liquid bulk cargoes can be loaded or unloaded in there ways:

- Shoreside at a terminal.

- Ship-to-ship as part of a lightering operation.

- Anchored at an off-shore terminal.

In all three cases, pipes and hoses connect to the vessel to allow the liquid bulk cargo to be transferred to or from the vessels' tanks. Barges, rail cars, trucks, and pipelines are all used in domestic transportation of crude and refined products.

Figure 2-6 illustrates the range of activities that might occur at a shoreside marine liquid bulk terminal designed to serve large ocean-going vessels. The infographic presents a simplified depiction of these operations, and not all would occur at every liquid bulk terminal. These activities include:

- Transporting crude oil or refined products to the terminal by pipeline.

- Loading crude oil or refined products onto a liquid bulk vessel via pipeline.

- Unloading crude oil for storage prior to refining.

- Processing crude oil into refined products.

- Transferring refined products to rail tank cars and tank trucks.

Figure 2-6: Example of Liquid Bulk Terminal Cargo Loading and Unloading

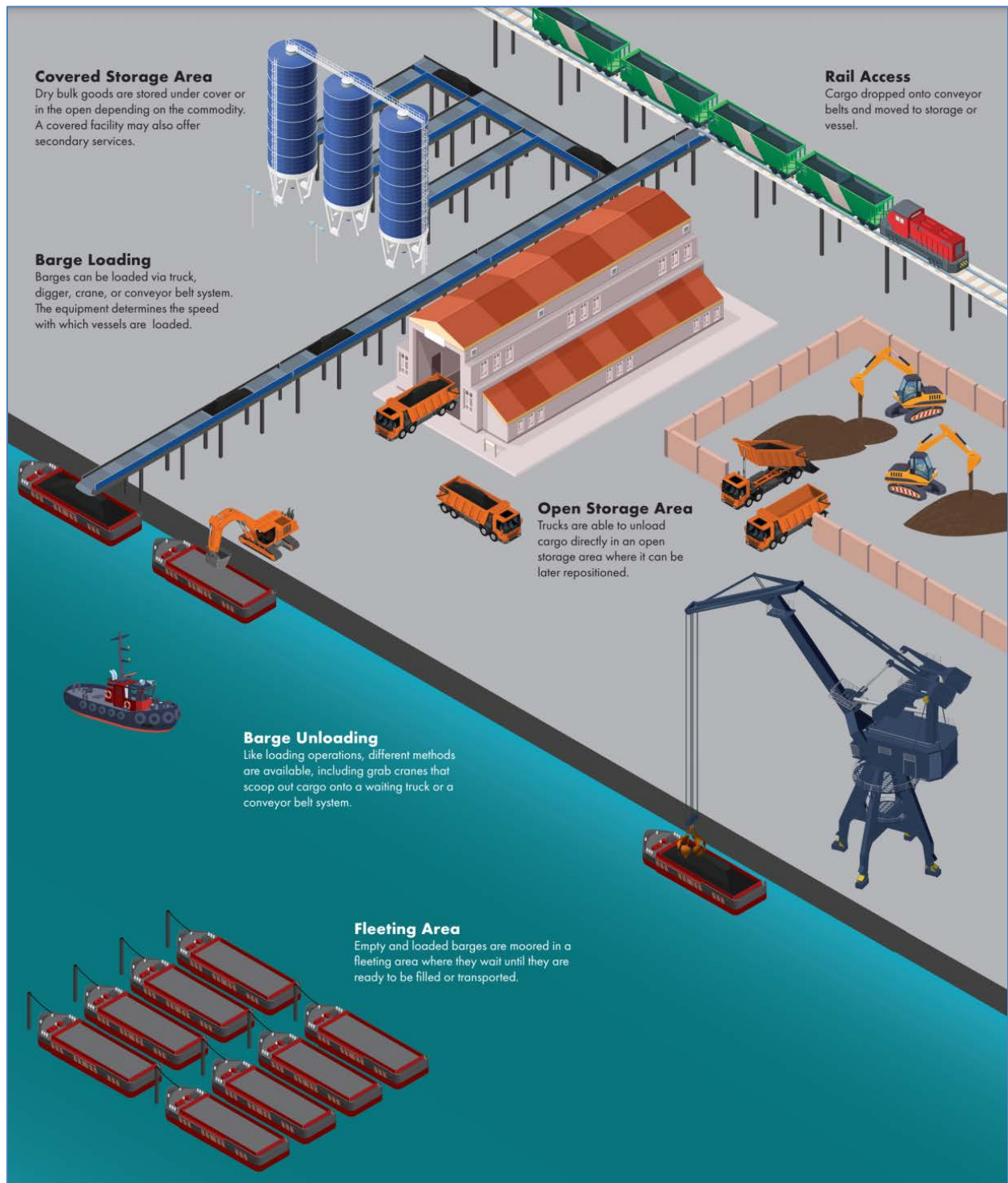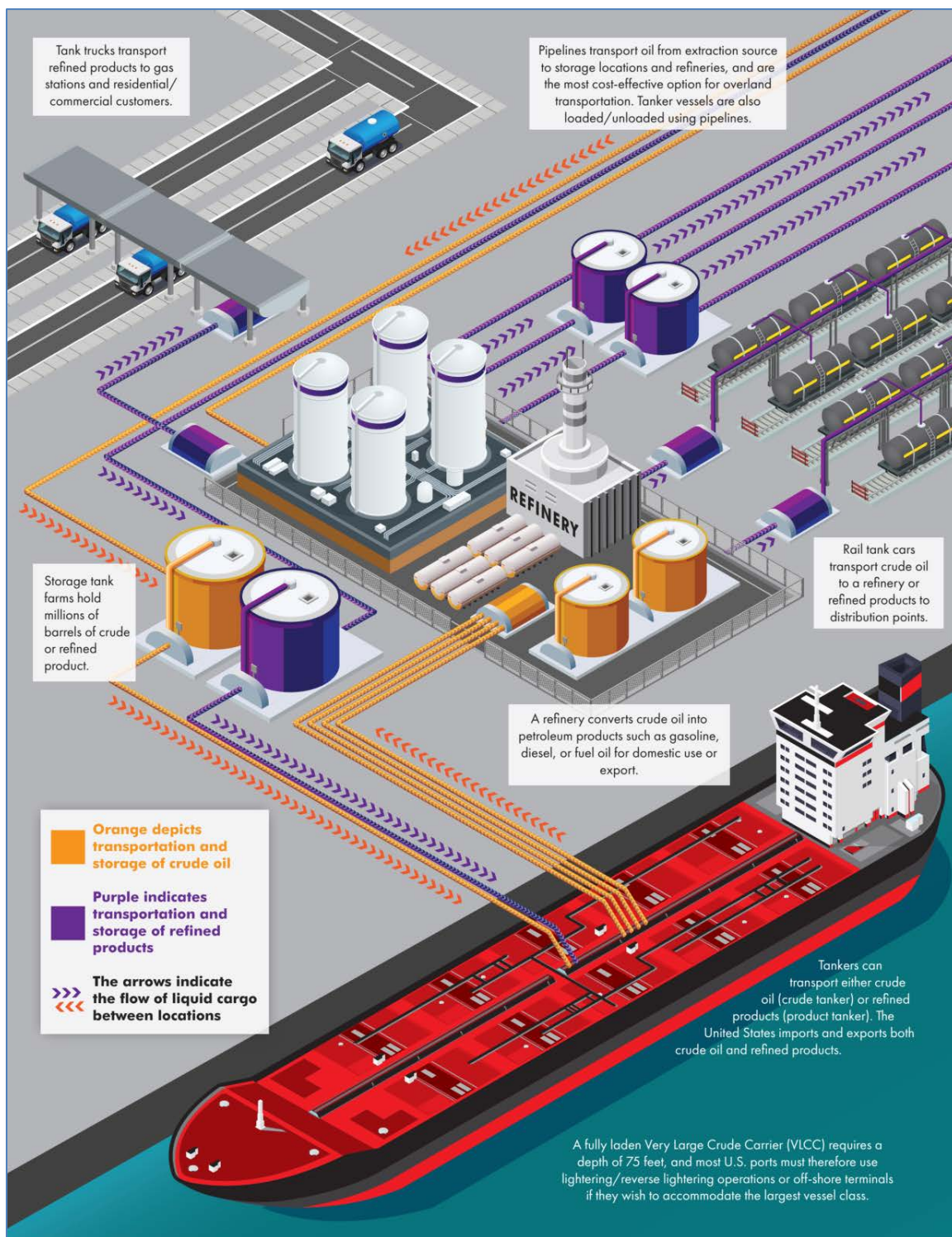**SOURCE**: U.S. Department of Transportation, Bureau of Transportation Statistics and Volpe Center, November 2018.

Other Cargo Types

Other cargo types were not specified in FAST Act Section 6018, although other cargo tonnage is included within the total tonnage data reported in this report. Other cargo types include break-bulk and Ro/Ro cargoes.

2.3 Port Components and Port Performance

Ports are complex entities, with both physical and institutional components that differ by function, cargo type, and geographic location among other factors. The characteristics of these components and their interactions determine a port's overall capacity and annual throughput. While publicly available measures do not exist for all components; those with nationally consistent measures are reflected in the port profiles in Appendix A. Table 2-2 summarizes these key components and their connection to throughput and capacity.

BTS selected multiple throughput and capacity metrics for the top 25 ports by total tonnage, TEU, and dry bulk tonnage based on criteria highlighted in the *Introduction*.

Table 2-2: Key Port Components and Their Influence on Performance

Component	Description	Connection to Throughput and Capacity
Berths	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 size 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 Ro/Ro terminals, where unloading and loading operations use conveyors, ramps, or other means that do not involve the full vessel length. Insufficient berth availability can result in vessels waiting to be unloaded and loaded.
Waterside access	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 navigable designated waterway leading from open water to port terminals. Many channels have had sediment and other materials removed from the bottom of the channel (a process known as dredging) to accommodate larger vessels, and require periodic maintenance dredging to keep them clear.	The shallowest point of a channel can be a limiting factor on the size of ships that can access a terminal. Channel access may also be limited by air draft restrictions imposed by bridges.
Terminal	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. Terminals may be operated by a port authority, independent marine terminal operators, vessel operators, or by private companies handling their own cargo.	Many ports contain numerous terminals, each with its own berths, equipment, and landside storage space, and which may be adjacent to each other or separated by many miles. Terminals vary widely in configuration and infrastructure, and the number and size of terminals are therefore not consistent indicators of port capacity. However, terminal design, size, and infrastructure availability have a significant impact on both throughput and capacity.

Component	Description	Connection to Throughput and Capacity
Loading and unloading equipment	The fixed or mobile terminal equipment needed to handle different vessel and cargo types.	Cargo and vessel types vary greatly. Most container vessels are loaded and unloaded with shore-side gantry cranes ("container cranes"). Smaller vessels and barges may be handled with on-board equipment ("ship's gear") or with mobile harbor cranes. Ro/Ro vessels and barges are loaded and unloaded via ramps. Bulk and break-bulk terminals use a combination of fixed and mobile equipment that typically allows for faster loading and unloading of a vessel, but operations may still be limited by landside infrastructure and operational efficiency. Liquid bulk terminals rely on pipelines that directly connect to vessels for loading and unloading operations. Lightering and off-shore liquid bulk terminals allow servicing of deep draft vessels that might otherwise not be able to call at a landside terminal.
Modal connections	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 Ro/Ro cargo. Highway capacity and congestion can constrain throughput. For container terminals, rail intermodal connections are described as on-dock (located within the terminal), near-dock (close to the terminal), or off-dock (farther away from the terminal). 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. More efficient cargo handling is possible when rail facilities exist on-dock. Pipelines connect liquid bulk terminals to nearby refineries, storage locations, and distribution facilities that move the liquid bulk commodities to and from inland destinations.

Component	Description	Connection to Throughput and Capacity
Geography	Ports are generally classified as coastal, Great Lakes/St. Lawrence Seaway, or river ports. River and inland waterway ports are more likely than coastal ports to consist of privately owned and operated terminals, given historical patterns of development.	Coastal ports typically handle the largest vessels as they can meet the deeper draft requirements and greater cargo handing needs of vessels. Coastal ports tend to have terminals in a relatively compact physical area. Lake terminals can resemble coastal and river facilities, with cargo type and vessel size the primary factors influencing terminal design. River ports also typically handle smaller vessels than coastal ports, including barges. River ports can include general purpose facilities that accommodate a wide range of commodities and vessels; public facilities designed to handle a single commodity; and industrial terminals, which are typically privately owned and operated for a manufacturing, agricultural, refining, or mining facility. River ports may have terminals that stretch over a distance of many miles.
Cargo/ container storage and chassis depots	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; parking areas for empty and loaded containers, for truck chassis to haul containers, and for vehicles being transported in Ro/Ro ships; trackage to store rail cars; space to pile dry bulk cargo; tank farms for liquid bulk cargo; and warehouses for indoor cargo storage. A lack of storage space may constrain the overall capacity of a terminal, as cargo cannot be stored prior to loading or when it awaits pickup after unloading. The availability of space may also facilitate throughput as separation of activities may alleviate terminal congestion.

3. PORT THROUGHPUT

Throughput measures reflect the amount of cargo or number of vessels ports handle over time. Throughput is affected by many variables beyond physical capacity, such as international and domestic cargo demand; competition between ports; contractual arrangements with carriers; and changes in distant facilities such as expansion of the Panama Canal.

This *Annual Report* builds upon the basic measures of tonnage, TEU, vessel calls, and top commodities that were used to characterize port throughput in previous years and provides additional information from the analysis of 2017 data. Several new measures have been developed, including the use of Automatic Identification System (AIS) signals from container and liquid bulk vessels to examine vessel dwell time at terminals, the identification of the top food and farm products handled at each port, and a quarterly index of food and farm product cargo volumes. This report also includes measures of factors that contribute to the amount of cargo or number of vessels handled, such as vessel dwell times.

This report includes these throughput statistics:

1) total cargo tonnage,

2) dry bulk tonnage,

3) container TEU,

4) vessel calls by type,

5) top commodities handled,

6) top food and farm product commodities handled,

7) agricultural product index,

8) average container vessel dwell time index, and

9) average tanker vessel dwell time index.

Specific statistics and related data sources are summarized in table 3-1. It is important to note that except for the indices all throughput statistics presented in this report are annual totals, which can mask seasonal variations in cargo flows that place recurring stress on available port capacity. Each metric is examined in greater detail below along with an analysis for the top 25 ports relevant to that specific metric.

Table 3-1: Summary of Throughput Measures and Data Sources

Element/ Metric	Details/Notes	Source (More Details in Notes/Sources in Profiles)
Annual total tonnage	Domestic, foreign, import, export, and total short tons, 2017 and percentage change from 2016	USACE, special tabulation, as of October 2018
Annual container throughput	Inbound loaded, outbound loaded, empty, and total TEU, 2017 and percentage change from 2016	AAPA, Port Industry Statistics, NAFTA Region Container Traffic, October 2018[6]
Annual dry bulk tonnage	Domestic, foreign, import, export, and total short tons, 2017 and percentage change from 2016	USACE, special tabulation, as of October 2018
Annual vessel calls by vessel type	2017 and percentage change from 2016	USACE, special tabulation, as of October 2018
Top 5 commodities	Total short tons 2017 and percentage share of total	USACE, special tabulation, as of October 2018
Top 5 Food and Farm Product commodities	Total short tons 2017 and percentage share of total	USACE, special tabulation, as of October 2018
Average container vessel dwell time	Port terminal boundaries limited to terminals servicing container vessels	USDOT, BTS and Volpe Center, calculated using USCG AIS data provided by USACE.
Average liquid bulk vessel (tanker) dwell time	Port terminal boundaries limited to terminals servicing liquid bulk vessels	USDOT, BTS and Volpe Center, calculated using USCG AIS data provided by USACE.

KEY: *AIS*: Automatic Identification System, *APAA*: American Association of Port Authorities, *NAFTA:* North American Free Trade Agreement, *USACE*: U.S. Army Corps of Engineers, and *USCG*: U.S. Coast Guard.

3.1 Cargo Tonnage

Cargo tonnage is the most fundamental measure of port and terminal throughput. Total cargo tonnage includes the weight of dry bulk and liquid bulk cargo, break-bulk cargo, roll-on/roll-off (Ro/Ro) vehicles and industrial equipment, and the contents of shipping containers. Total cargo tonnage does not include the weight of shipping containers themselves, even though movement of empty containers may be a significant portion of a port's activity.

---

[6] Where annual container throughput was unavailable from AAPA, an alternate source is noted in the port profile.

Figure 3-1: Annual Total Tons of the Top 25 Ports by Tonnage, 2017

Total tonnage at the top 150 principal ports: 2.63 billion tons
Total tonnage at the top 25 ports: 1.83 billion tons

Port	Domestic | Foreign
Baltimore	7 | 39
Baton Rouge	46 | 31
Beaumont	36 | 54
Cincinnati - Northern KY	43 | 0
Corpus Christi	27 | 60
Duluth-Superior	26 | 8
Houston	87 | 173
Huntington - Tristate	34 | 0
Lake Charles	28 | 26
Long Beach	12 | 74
Los Angeles	7 | 59
Mobile	23 | 36
New Orleans	51 | 46
New York and New Jersey	47 | 89
Philadelphia	12 | 16
Plaquemines	31 | 23
Port Arthur	10 | 29
Richmond	9 | 19
Savannah	2 | 38
South Louisiana	140 | 135
St. Louis	33 | 0
Tampa	21 | 12
Texas City	16 | 22
Valdez	28 | 0
Virginia	6 | 62

Millions of Tons

■ Domestic ■ Foreign

NOTES: *Domestic* is cargo moving from a U.S. dock to a U.S. dock. *Foreign* is waterborne import, export and in-transit cargo between the U.S. and any foreign country.
SOURCE: U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center, 2017 data, special tabulation, as of November 2018.

Figure 3-1 displays the total short tons moved in 2017 for the 25 top tonnage ports, which includes the weight of all cargo. The top 25 ports by total tonnage remained relatively consistent between 2017 and those included in the 2016. The ports of Philadelphia, PA; and Richmond, CA; replace Pascagoula, MS; and Tacoma, WA.

The total tonnage handled at the 25 top tonnage ports increased by 4.7 percent between 2016 and 2017. Between 2015 and 2016 there was no change, as increased foreign tonnage was offset decreased domestic tonnage. The total of 1.83 billion tons handled by the top 25 tonnage ports in 2017 consisted of 779.1 million tons of domestic cargo and 1,052.4 million tons of foreign cargo (Table 3-2). Domestic cargo tonnage increased by 1.9 percent between 2016 and 2017 (following a 3.2 percent decrease between 2015 and 2016). Foreign cargo tonnage increased by 6.9 percent between 2016 and 2017 (building on a 2.7 percent increase between 2015 and 2016).

Foreign cargo has continued to increase its share of the total, growing from 54.8 percent in 2015 to 56.3 percent in 2016 and to 57.5 percent in 2017 (Table 3-2).[7] This shift is due to a higher rate of growth in export tonnage: in 2015, the 482.7 million tons of exports accounted for 50.4 percent of total foreign tonnage, compared to the 560.0 million tons in 2017 that accounted for a 53.2 percent share.

Table 3-2: Cargo Tonnage Handled, 2015-2017

	Total Tonnage Handled at Principal Ports	**Tonnage Handled by Top 25 Ports**		
		Total	**Domestic**	**Imports and Exports**
2015	2.53 billion	1.75 billion (100.0%)	790 million (45.2%)	959 million (54.8%)
2016	2.52 billion	1.75 billion (100.0%)	764 million (43.7%)	984 million (56.3%)
2017	2.63 billion	1.83 billion (100.0%)	779 million (42.5%)	1.05 billion (57.5%)

NOTE: Principal ports are defined by USACE; and includes the top 150 ports by tonnage each year.
SOURCE: U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center, 2017 data, special tabulation, as of November 2018.

---

[7] USACE defines foreign cargo as the combination of inbound cargo transported from a foreign port and outbound cargo transported to a foreign port.

Figure 3-2 displays the dry bulk tonnage in 2017 for the top 25 dry bulk ports. The top 25 ports by dry bulk tonnage remained unchanged between this report and those included in the previous *Annual Report*.

Dry bulk tonnage is determined by the type of vessel that carried the cargo, as described in Section 2.2.4. The highest tonnage figures are associated with ports that handle large quantities of both liquid bulk cargo (e.g., petroleum or chemicals) and dry bulk cargo (e.g., grain or coal), such as the Ports of South Louisiana and Houston.

The dry bulk tonnage handled at the 25 top tonnage ports increased by 6.7 percent between 2016 and 2017, after a 2.6 percent decrease between 2015 and 2016 that was again caused by a larger decrease in imports than the increase in exports (Table 3-3). The 729.4 million tons of dry bulk cargo in 2017 consisted of 397.4 million tons of domestic cargo and 332.0 million tons of foreign cargo. Domestic cargo dry bulk tonnage increased by 2.3 percent between 2016 and 2017 (following a 3.9 percent decrease between 2015 and 2016). Foreign cargo tonnage increased by 12.4 percent between 2016 and 2017 (following a 0.9 percent decrease between 2015 and 2016).

Domestic cargo accounts for more than half of the total dry bulk tonnage, but the share of the total has decreased in each of the past three years. In 2017 domestic tonnage accounted for 54.5 percent of the total, decreasing from 56.8 percent in 2016 and 57.5 percent in 2015. As was the case with total tonnage, the growth in foreign dry bulk tonnage is due to a higher rate of growth in export tonnage: in 2015, the 212.5 million tons of exports accounted for 71.3 percent of total foreign tonnage, compared to the 255.9 million tons in 2017 that accounted for a 77.1 percent share.

Figure 3-2: Annual Dry Bulk Tons of the Top 25 Ports by Dry Bulk Tonnage, 2017

Total dry bulk tonnage at the top 100 ports: 1,002 million tons
Total dry bulk tonnage at the top 25 ports: 729 million tons
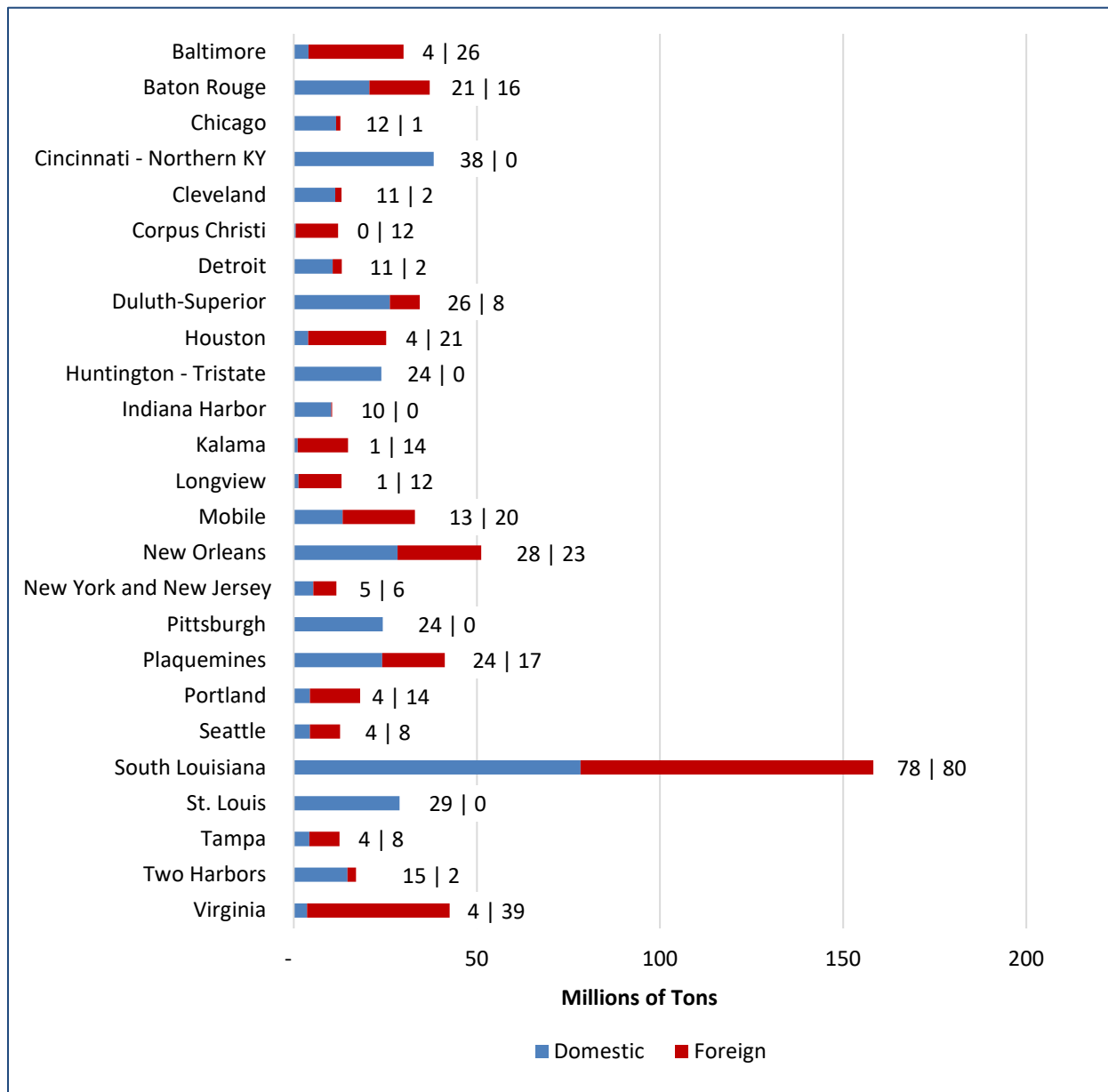
NOTE: *Domestic* is cargo moving from a U.S. dock to a U.S. dock. *Foreign* is waterborne import, export and in-transit cargo between the United States and any foreign country.
SOURCE: U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center, 2017 data, special tabulation, as of November 2018.

Table 3-3: Dry Bulk Cargo Tonnage Handled, 2015-2017

	Total Tonnage Handled at Top 100 Dry Bulk Ports	Tonnage Handled by Top 25 Dry Bulk Ports		
		Total	Domestic	Import and Export
2015	973 million	702 million (100.0%)	404 million (57.5%)	298 million (42.5%)
2016	948 million	684 million (100.0%)	388 million (56.8%)	295 million (43.2%)
2017	1.00 billion	729 million (100.0%)	397 million (54.5%)	332 million (45.5%)

NOTE: *Dry bulk cargo* includes unpacked, homogenous commodities such as grain, iron ore, or coal. *Dry bulk ports* are defined by USACE; and includes the top 100 ports by tonnage each year.
SOURCE: U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center, 2017 data, special tabulation, as of November 2018.

3.2 Container TEU

The top 25 container ports by twenty-foot equivalent unit (TEU) count were identified using U.S. Army Corps of Engineers (USACE) data for loaded and empty domestic containers, and loaded foreign containers. USACE does not include foreign empty containers in its published statistics. Since empty containers can have a significant impact on port operations, the throughput statistics presented in this report draw on American Association of Port Authorities (AAPA) data to include both foreign empty and loaded containers and thus reflect the full volume of activity. This approach is consistent with previous *Annual Reports* and allows for a nationally consistent methodology.

USACE TEU tabulations are derived from cargo manifest data collected by the Federal government and compiled through the Port Import Export Reporting Service (PIERS). AAPA publishes container statistics from data released by the ports, which the Bureau of Transportation Statistics (BTS) checked through comparisons with data available on port authority websites.

Container flows are characterized as "inbound" (including imports received from foreign origins, domestic cargo from U.S. origins, and inbound empty containers) and "outbound" (including exports to foreign destinations, domestic cargo shipped to other U.S. destinations, and outbound empty containers). Figure 3-3 displays the 2017 TEU volumes for the top 25 U.S. container ports. The top 25 ports by TEU remained relatively consistent between 2017 and 2016. In 2017, Palm Beach, FL; and Gulfport, MS; replace Ketchikan, AK and Kahului, HI.

The highest container volumes continue to pass through ports that serve large coastal and inland markets, such as the Port of Los Angeles, the Port of Long Beach, and the Port of New York and New Jersey.

Figure 3-3: Annual TEU of the Top 25 Ports by TEU, 2017

Total TEU for the top 25 ports: 51.1 million TEU

Port	TEU (Loaded Inbound / Loaded Outbound / Empty Inbound and Outbound)
Anchorage	245 / 41 / 175
Baltimore	474 / 241 / 248
Boston	130 / 88 / 53
Charleston	955 / 804 / 418
Gulfport	98 / 81 / 38
Honolulu	490 / 296 / 427
Houston	1,076 / 966 / 417
Jacksonville	294 / 436 / 378
Long Beach	3,863 / 1,471 / 2,211
Los Angeles	4,716 / 1,900 / 2,727
Miami	395 / 390 / 262
Mobile	154 / 174 / 0
New Orleans	114 / 274 / 138
New York and New Jersey	3,396 / 1,415 / 1,899
Oakland	920 / 931 / 570
Palm Beach	134 / 141 / 0
Philadelphia	268 / 277 / 0
Port Everglades	359 / 442 / 273
San Juan	581 / 171 / 447
Savannah	1,876 / 1,372 / 798
Seattle	651 / 597 / 442
Tacoma	866 / 726 / 420
Virginia	1,276 / 1,015 / 550
Wilmington (DE)	188 / 72 / 116
Wilmington (NC)	75 / 115 / 57

Thousands of TEU

■ Loaded Inbound　■ Loaded Outbound　□ Empty Inbound and Outbound

NOTE: Data provided by USACE Waterborne Commerce Statistics Center was used to identify the top 25 ports. Data provided by AAPA and port authorities was used to provide detailed TEU counts.
SOURCES: American Association of Port Authorities, *NAFTA Region Container Traffic* and *Port Industry Statistics,* available at http://www.aapa-ports.org/, as of October 2018; and U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center, 2017 data, special tabulation, as of November 2018.

While TEU is the standard measure of container movement, it does not fully represent the work accomplished by container terminals, or by the motor carriers and railroads that connect them to the marketplace. The total work accomplished is a function of the number of containers handled rather than the total TEU volume. The mix of container sizes at most U.S. ports yields an average TEU per container ratio of 1.5–1.8, because 40' containers (equal in capacity to two 20' containers or 2.0 TEU) are most common. The Port Profiles in Appendix A report the volume of containers handled in TEU for each port. Forty-eight foot and 53' domestic containers are also used in North America and sometimes move in domestic barge service through coastal ports. These larger containers are reflected in USACE domestic trade data, but rarely move in foreign oceanborne trade.

The 25 top container ports handled a total of 51.1 million TEU in 2017, a 7.3 percent increase over the 47.6 million TEU moved in 2016. Loaded inbound containers accounted for approximately 46.2 percent of the total while loaded outbound containers represented 28.2 percent; the remainder were empty containers.[8] Loaded inbound containers increased by 7.5 percent between 2016 and 2017 to 23.6 million TEU, growing faster than loaded outbound containers (which increased by 4.3 percent to 14.4 million TEU). In contrast, the outbound TEU volume increased faster than the inbound volume in 2016.

3.3 Vessel Calls

The individual port profiles in this *Annual Report* include the number of cargo vessel calls that each port handled in 2017, and the change from previous years. Cargo vessel calls are divided into five categories based on International Classification of Ships by Type (ICST) codes, and exclude two broad categories: passenger vessels such ferries and cruise ships, and support vessels such as tugs.[9] Dry bulk and other cargo vessels are divided into barge and non-barge groups, allowing for a more meaningful description of port activity. The full list of vessel call categories is as follows:

- **Container** - Non-barge vessels identified as carrying containers. A container vessel is either a cellular, gearless container ship loaded and unloaded using shoreside container cranes, or a "geared" vessel that can also handle containers with its own on-board cranes. Some ports handle containers on roll-on/roll-off (Ro/Ro) vessels or barges. These vessel types are not included in the container vessel counts unless specifically classified as container vessels, as it is not feasible to separate out which Ro/Ro or barge calls include containers.

---

[8] A number of ports did not separate out empty containers from their loaded totals or domestic from international.
[9] See updated *PPFSP Definitions and Methods Handbook*.

- **Dry bulk** - Non-barge vessels identified as carrying dry bulk cargo. The method for selecting vessel types most commonly used in shipping dry bulk, described in the *PPFSP Definitions and Methods Handbook*, was developed to quantify dry bulk port cargo volumes and select the top 25 dry bulk ports. Six of the 13 vessel types selected to measure dry bulk cargo tonnage and dry bulk vessel calls are self-propelled or otherwise classified as non-barge vessels, and are included in this category.

- **Dry bulk barge** - The remaining seven vessel types that were identified both as carrying dry bulk cargo and as barges.

- **Other cargo** - All other vessels that predominantly handle cargo and are not designated as container or dry bulk vessels, and are not barges. These include crude oil tankers, liquefied natural gas (LNG) tankers, chemical tankers, general cargo vessels, and vehicle or Ro/Ro carriers. The combination of "Other freight vessel" calls and "Other freight barge" calls represent overall cargo tonnage minus container and dry bulk cargo tonnage.

- **Other cargo barges** - Vessels that were identified both as barges and as carrying non-containerized, non-dry bulk cargo.

Figures 3-4 through 3-6 show 2017 vessel calls by category of vessel for the top 25 ports by tonnage, dry bulk, and container TEU.

There were 348,114 calls at the 49 ports that make up the three port lists in 2017, which is a 0.4 percent increase over the 346,895 calls at the same ports in 2016 (Table 3-4). Container vessel calls at the top 25 ports by TEU decreased by 1.5 percent between 2016 and 2017 with 18,521 calls. There were 183,030 total dry bulk vessel calls at the top 25 dry bulk tonnage ports, a 2.6 percent increase between 2016 and 2017. Dry bulk barges comprised most of these vessels, with 95.3 percent of the total in 2017. Dry bulk barge calls at the 25 ports increased by 2.3 percent between 2016 and 2017, while non-barge dry bulk vessel calls increased by 10.3 percent. The Maritime Administration reported a total of 20,630 international trade calls by containerships at U.S. ports in 2017, which is a 2.6 percent increase over the 20,116 calls in 2016.
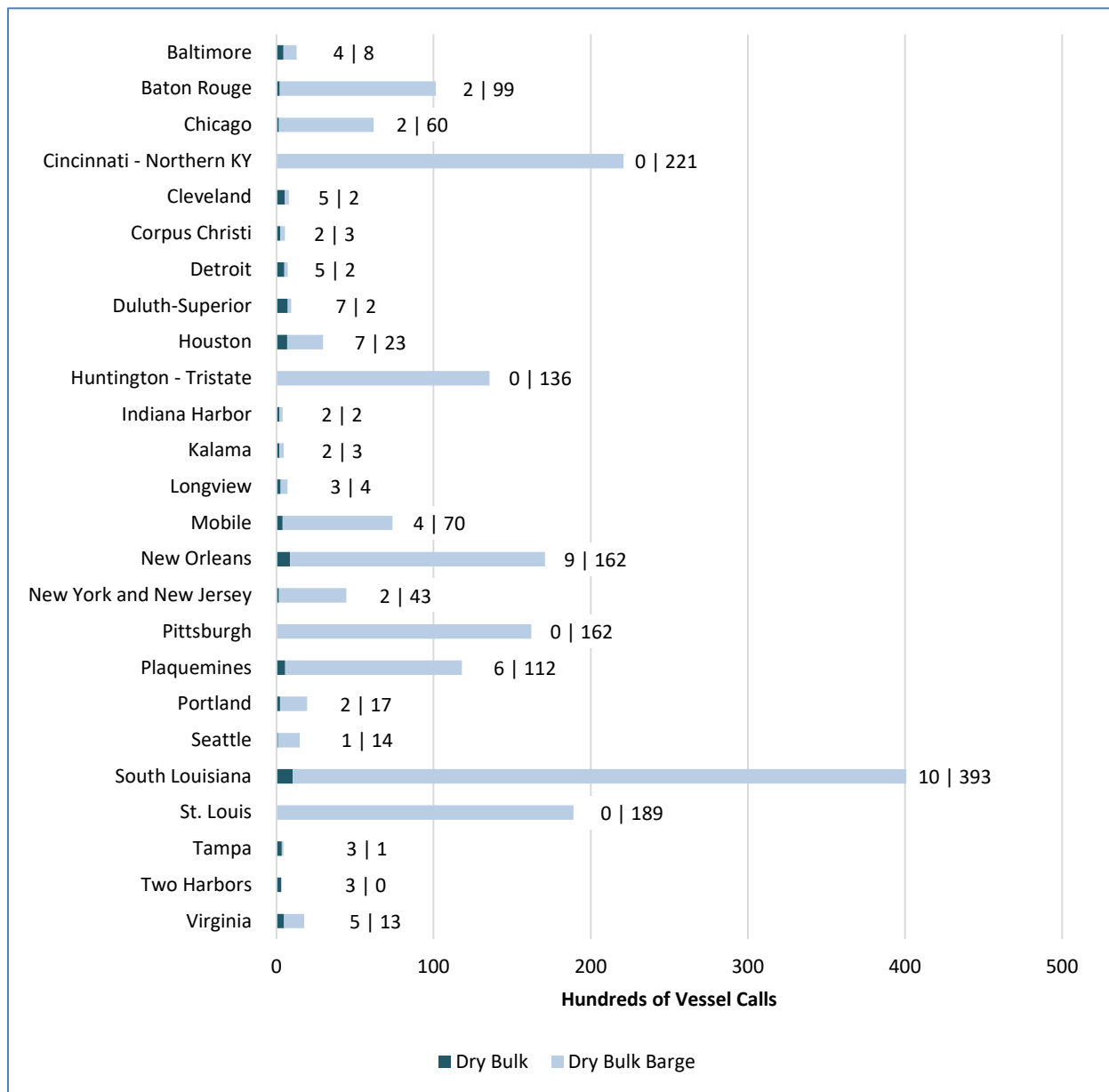
Figure 3-4: Freight-Related Vessel Calls for Top 25 Ports by Tonnage, 2017
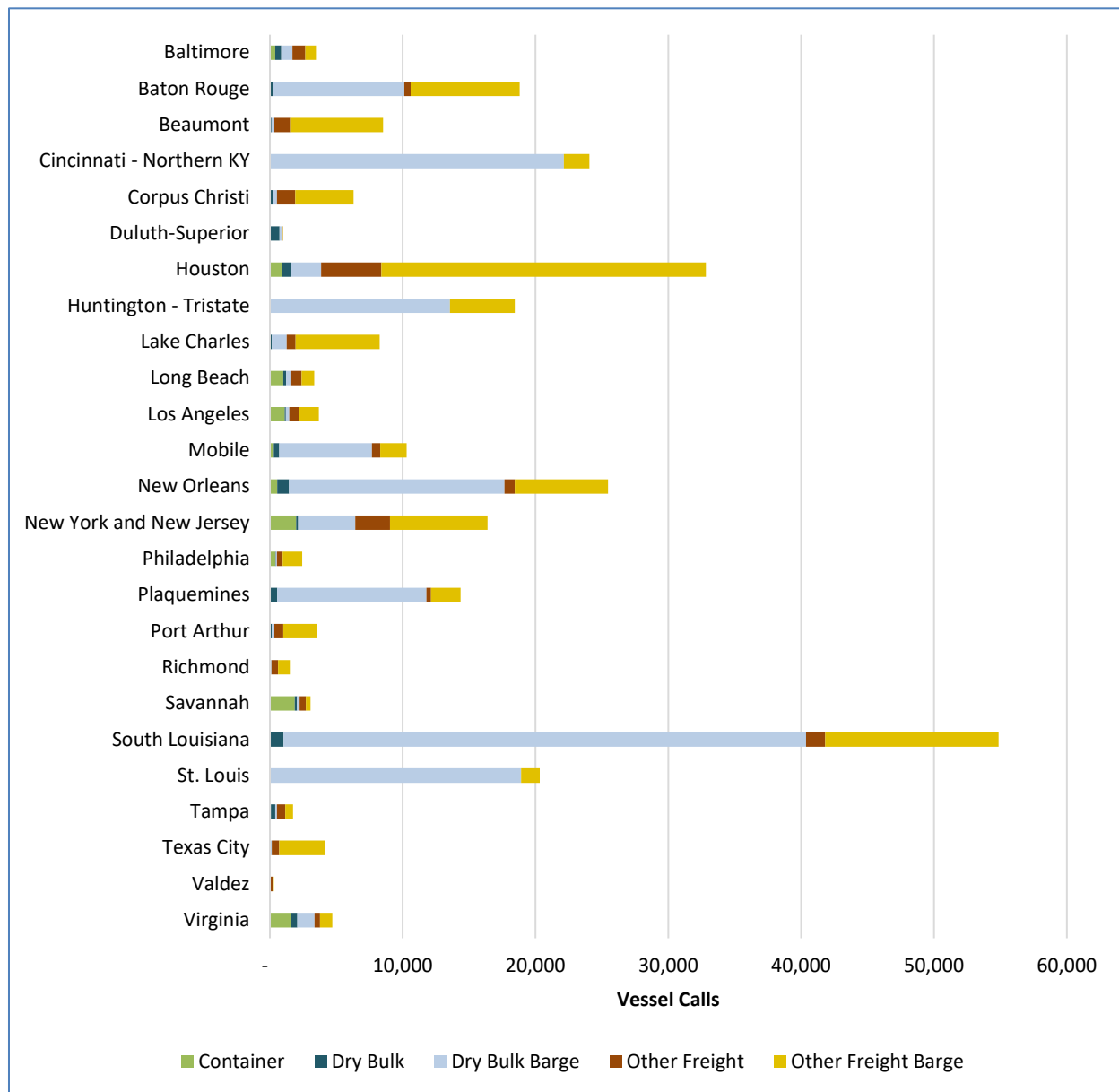
NOTE: The ports in this figure reflect the list of the top 25 ports by tonnage.
SOURCE: U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center, 2017 data, special tabulation, as of November 2018.

Figure 3-5: Dry Bulk Vessel Calls for Top 25 Ports by Dry Bulk Tonnage, 2017

Port	Dry Bulk	Dry Bulk Barge
Baltimore	4	8
Baton Rouge	2	99
Chicago	2	60
Cincinnati - Northern KY	0	221
Cleveland	5	2
Corpus Christi	2	3
Detroit	5	2
Duluth-Superior	7	2
Houston	7	23
Huntington - Tristate	0	136
Indiana Harbor	2	2
Kalama	2	3
Longview	3	4
Mobile	4	70
New Orleans	9	162
New York and New Jersey	2	43
Pittsburgh	0	162
Plaquemines	6	112
Portland	2	17
Seattle	1	14
South Louisiana	10	393
St. Louis	0	189
Tampa	3	1
Two Harbors	3	0
Virginia	5	13

Hundreds of Vessel Calls

■ Dry Bulk ■ Dry Bulk Barge

NOTE: The ports in this figure reflect the list of the top 25 ports by dry bulk tonnage.
SOURCE: U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center, 2017 data, special tabulation, as of November 2018.
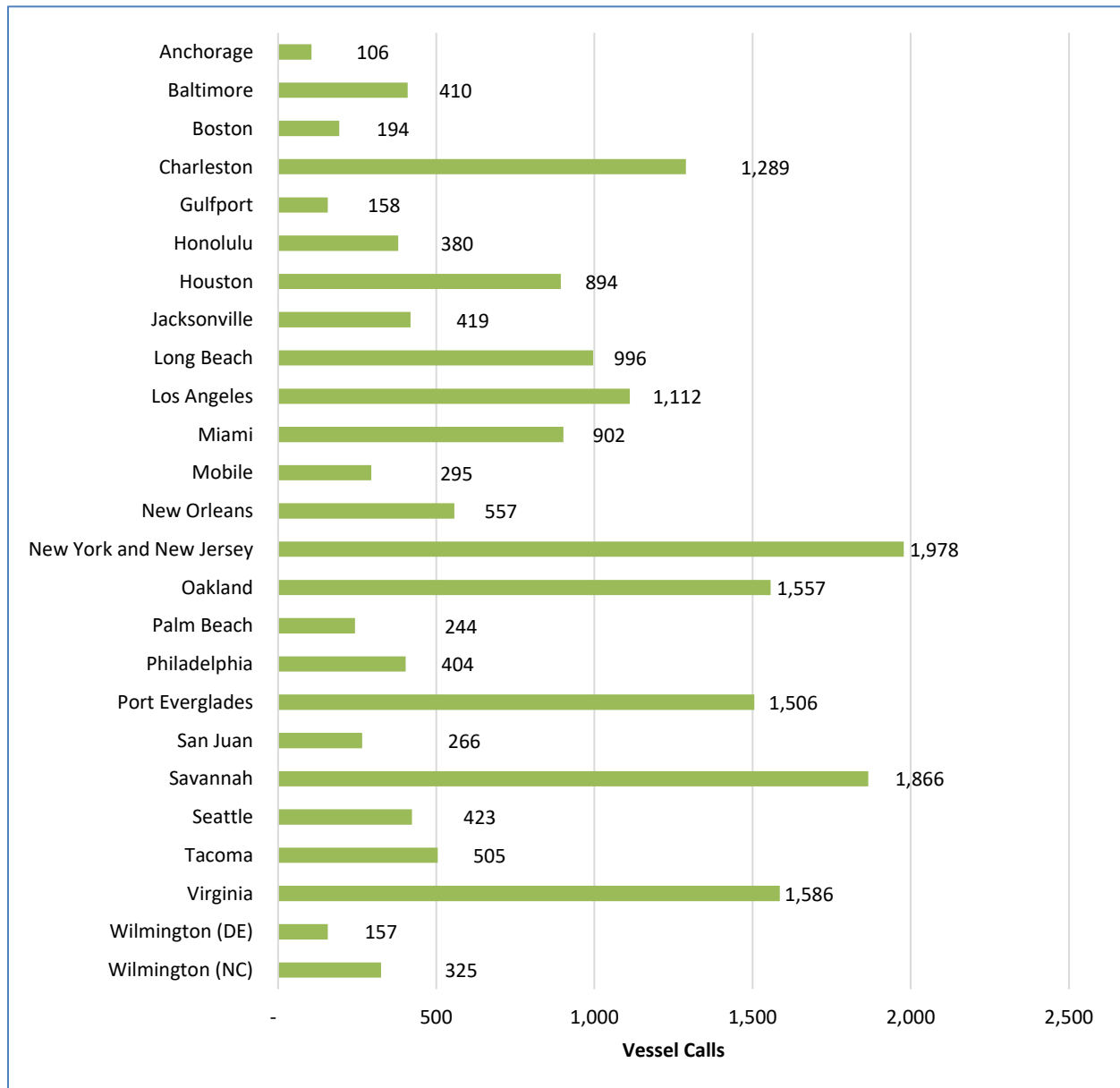
Figure 3-6: Container Vessel Calls for Top 25 Container Ports, 2017

Port	Vessel Calls
Anchorage	106
Baltimore	410
Boston	194
Charleston	1,289
Gulfport	158
Honolulu	380
Houston	894
Jacksonville	419
Long Beach	996
Los Angeles	1,112
Miami	902
Mobile	295
New Orleans	557
New York and New Jersey	1,978
Oakland	1,557
Palm Beach	244
Philadelphia	404
Port Everglades	1,506
San Juan	266
Savannah	1,866
Seattle	423
Tacoma	505
Virginia	1,586
Wilmington (DE)	157
Wilmington (NC)	325

SOURCE: U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center, 2017 data, special tabulation, as of November 2018.

Table 3-4: Vessel Calls, 2015-2017

	2015	2016	2017
Total Calls at Profiled Ports	345,748	346,895	348,114
Top 25 Tonnage Ports	288,715	292,247	291,787
Top 25 Dry Bulk Ports	175,859	178,365	183,030
Top 25 Container Ports	18,256	18,806	18,521

NOTES: Vessel call by top 25 tonnage, dry bulk, and container ports are not additive due to overlap between the 3 port list.
SOURCE: U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center, 2017 data, special tabulation, as of November 2018.

3.4 Top Five Commodities Measured by Tonnage

USACE tabulates cargo tonnage by commodity, including dry bulk and container cargo (excluding the weight of containers), and classifies the cargo using a series of four-digit codes corresponding to the Lock Performance Monitoring System. These codes reflect the hierarchical structure of the Standard International Trade Classification system. The port profiles provide the tonnage of the top five commodities at the four-digit classification level using common names to describe the categories rather than the complex regulatory categories. The profiles in Appendix A also provide the percentage share of total tonnage for each of the top five commodities.

3.5 Top Five Food and Farm Product Commodities Measured by Tonnage

Food and farm products are of particular concern because they include some of the largest U.S. export commodities and make up most of the trade at many dry bulk ports. As described in Section 3.4, USACE classifies cargo tonnage using a series of four-digit codes that include food and farm products. The port profiles provide the tonnage of the top five food and farm product commodities at the four-digit level using the regulatory category names. Section 5.2 includes a detailed discussion on the food and farm products handled at the profiled ports.

3.6 Food and Farm Products Index

In collaboration with BTS, USACE has developed a Food and Farm Product Index that depicts quarterly commodity tonnage indexed to the moving average of the four previous quarters. This index is used in the profile to protect the confidentiality of confidentiality of individual businesses.

3.7 Container Vessel Dwell Time

Container vessels operate on schedules. The amount of time they spend in port – known as dwell time – is a major factor contributing to throughput and capacity performance. Shorter dwell times are usually desirable because vessel and marine terminal operating costs rise with dwell time.

Dwell times for non-containerized break-bulk, Ro/Ro, and tanker vessels and barges are governed by different factors. Such vessels usually do not operate on a schedule, and their time in port depends on cargo volume, cargo type, and cargo handling methods.

In collaboration with USACE, BTS has developed a method to estimate vessel dwell times at U.S. ports using USCG Automatic Identification System (AIS) data. AIS is a ship-to-ship and ship-to-shore maritime navigation safety communications system that monitors and tracks ship movements, primarily for collision avoidance (47 CFR §80.5). USCG regulates the use of AIS in U.S. waters, and has deployed a Nationwide AIS (NAIS) system of towers and transceivers to receive and transmit AIS messages. The USACE has also deployed AIS transceivers at inland navigation locks to support the Lock Operations Management Application (LOMA). The NAIS and LOMA vessel position reports are stored in a multi-year NAIS archive accessible to authorized parties.

For 2017 AIS data, about 16,600 records of container vessel calls at U.S. ports are included.[10] The average container vessel dwell time at U.S. ports was 25.9 hours, up slightly from 24.8 hours in 2016. As Figure 3-7 shows, the month-to-month U.S. average dwell time is fairly consistent (the apparent difference in May is due to a data gap in 2016). Except in winter, the average remains within 5 percent of the annual mean. The higher averages in January and February may be due to winter weather impacts at some ports. It can be instructive to compare the overall U.S. seasonal pattern with the port-by-port patterns shown in the port profiles in Appendix A.

---

[10] Vessel calls of less than 4 hours or over 120 hours were excluded as representing calls either too short for significant cargo handling or too long for normal operations.

**Figure 3-7: Average U.S. Container Vessel Dwell Times, 2016 (n=18,300) and 2017 (n=16,600)**
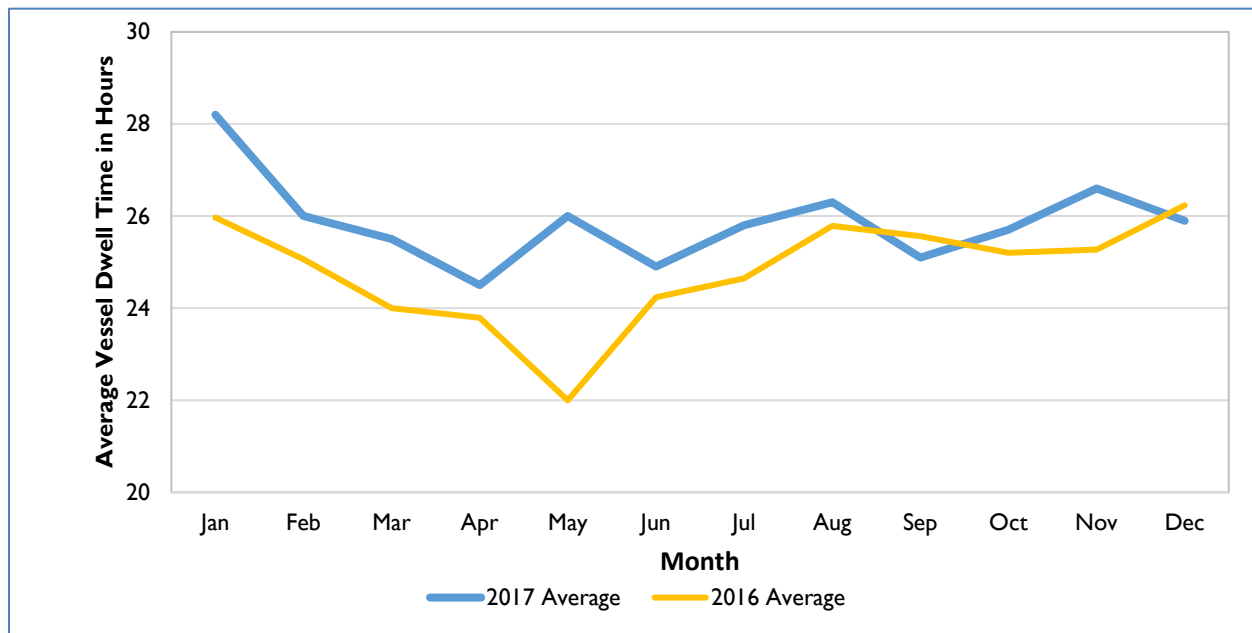
NOTE: May 2016 is missing data for ports in Southern California.
SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics and Volpe Center, calculated using AIS data provided by U.S. Army Engineer Research and Development Center, as of November 2018.

Geared vessels are typically smaller than gearless vessels, and include onboard equipment for loading and unloading freight. Geared vessel dwell times therefore vary more widely. As shown in Figure 3-8, the smaller geared vessels have shorter average dwell times than the average of the gearless vessels. At the Port of Jacksonville, for example, the capacity of gearless vessels averaged 5,302 TEU and those vessels stayed in port an average of 18.2 hours, while geared vessels averaged 1,966 TEU in capacity and stayed in port an average of 11.0 hours.

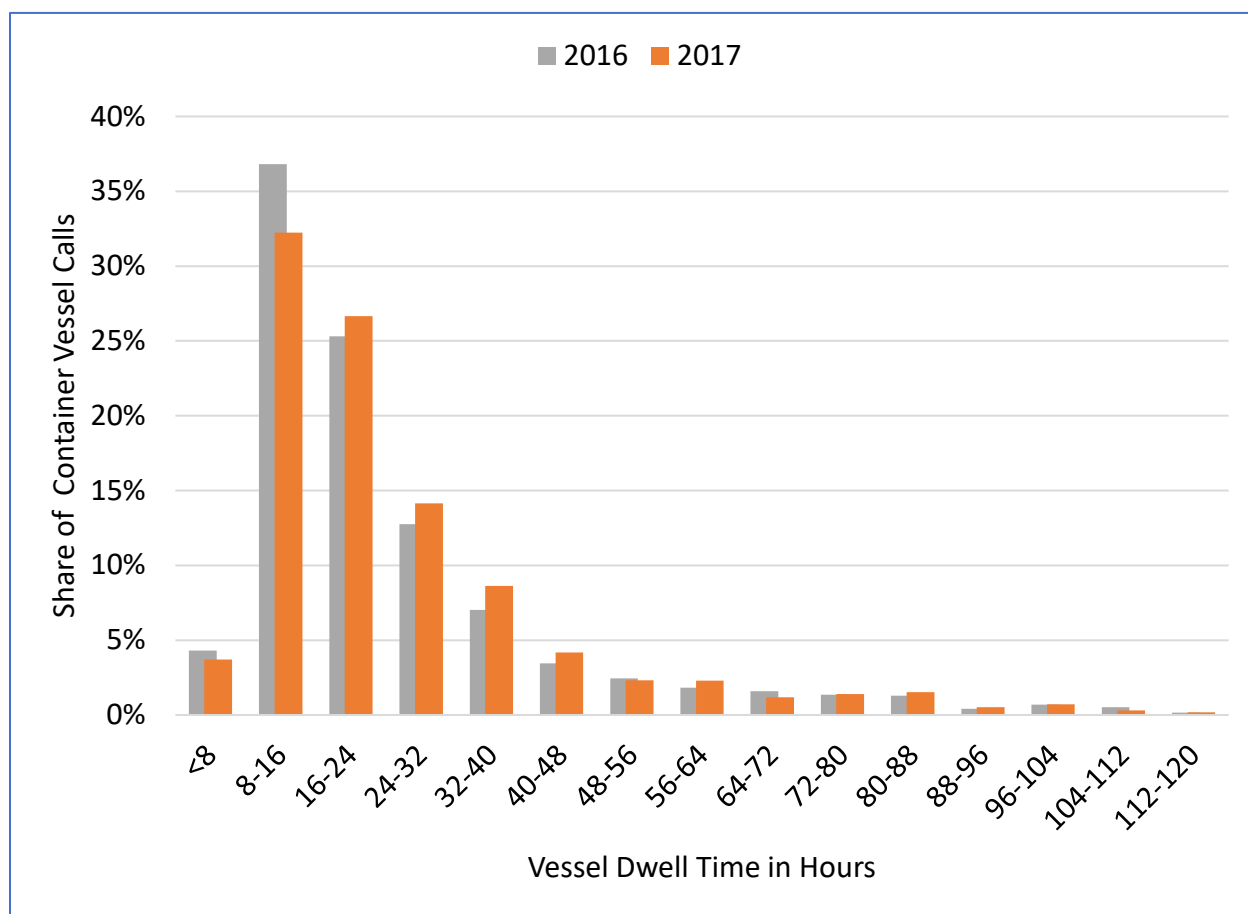**Figure 3-8: Average U.S. Geared and Gearless Container Vessel Dwell Times, 2017 (n=16,600)**
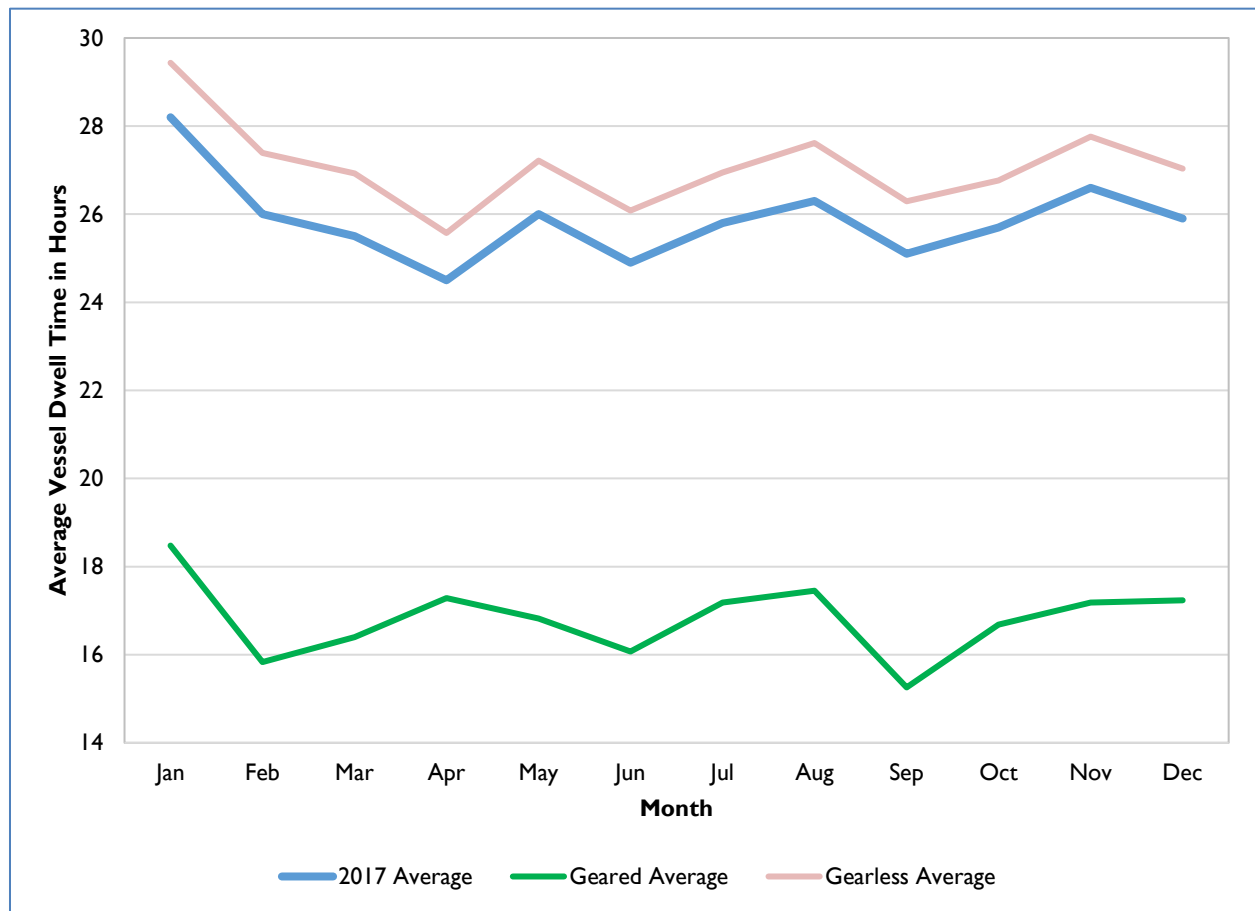
SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, and Volpe Center, calculated using AIS data provided by U.S. Army Engineer Research and Development Center, as of November 2018.

Dwell Time Variability and Scheduled Vessel Calls

Despite stability of the U.S. average in Figure 3-7, review of the AIS data reveals that dwell times vary widely between vessels, ports, and even different calls by the same vessel at the same port. Figure 3-9 shows the distribution of the dwell times in Figure 3-7. The long "tail" of dwell times greater than 48 hours in Figure 3-9 illustrates dwell time variability. The distribution is skewed because vessels seldom spend less than their scheduled time in port, but may spend much longer in port if delayed. In 2017, more vessel dwell times were in the 8-16 hour bracket than in 2016.

Figure 3-9: Distribution of Container Vessel Dwell Times, 2016 (n=18,300) and 2017 (n=16,600)

SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, and Volpe Center, calculated using AIS data provided by U.S. Army Engineer Research and Development Center, as of November 2018.

Adherence to vessel schedules is critical in managing port capacity, equipment, and labor to maximize throughput. The published schedule governs the time span over which the vessel is expected to be available for discharge and loading. Container vessels are typically scheduled for one, two, or three days in port. Marine terminal operators may not be ready to handle early

vessels, or may use the extra time to reduce the need for overtime labor costs at night. Vessels rarely leave before scheduled departure. Although AIS data are not yet linked to vessel schedules, preliminary analysis of the available dwell time data suggests that dwell times do generally correspond to scheduled vessel calls. As Figure 3-9 shows, 85.8 percent of container vessel dwell times were within 8 to 48 hours, typical of a one- to two-day scheduled vessel call.

Dwell Time, Vessel Size, and Container Volume

Container vessel dwell time is commonly attributed to vessel size. The container shipping industry and its customers are concerned that the growing size of container vessels will lead to longer dwell times, reduced service reliability, and higher terminal costs. The AIS data indicate that container vessel size (measured in TEU capacity) does influence terminal dwell time, but that cargo volume handled per call ("call volume") is the major factor. Figure 3-10 suggests that average dwell time for the more common, gearless container vessels is more closely associated with volume per call than with vessel size or capacity. For example, in 2017 the Port of Boston had an average container vessel size (capacity) of 7,144 TEU, an estimated average cargo volume of 1,800 TEU per call, and an average container vessel dwell time of 18.6 hours (28 percent below the 25-port average of 25.9 hours). The Port of Long Beach had an average container vessel size of 7,169 TEU (roughly the same as Boston), but an average cargo volume of 10,109 TEU per call (over five times greater than Boston), leading to an average dwell time of 61.8 hours (41 percent above the 25-port average of 25.9 hours).

Figure 3-10: Average Gearless Vessel Size, TEU per Call, and Dwell Times for Mainland U.S. Ports, 2017
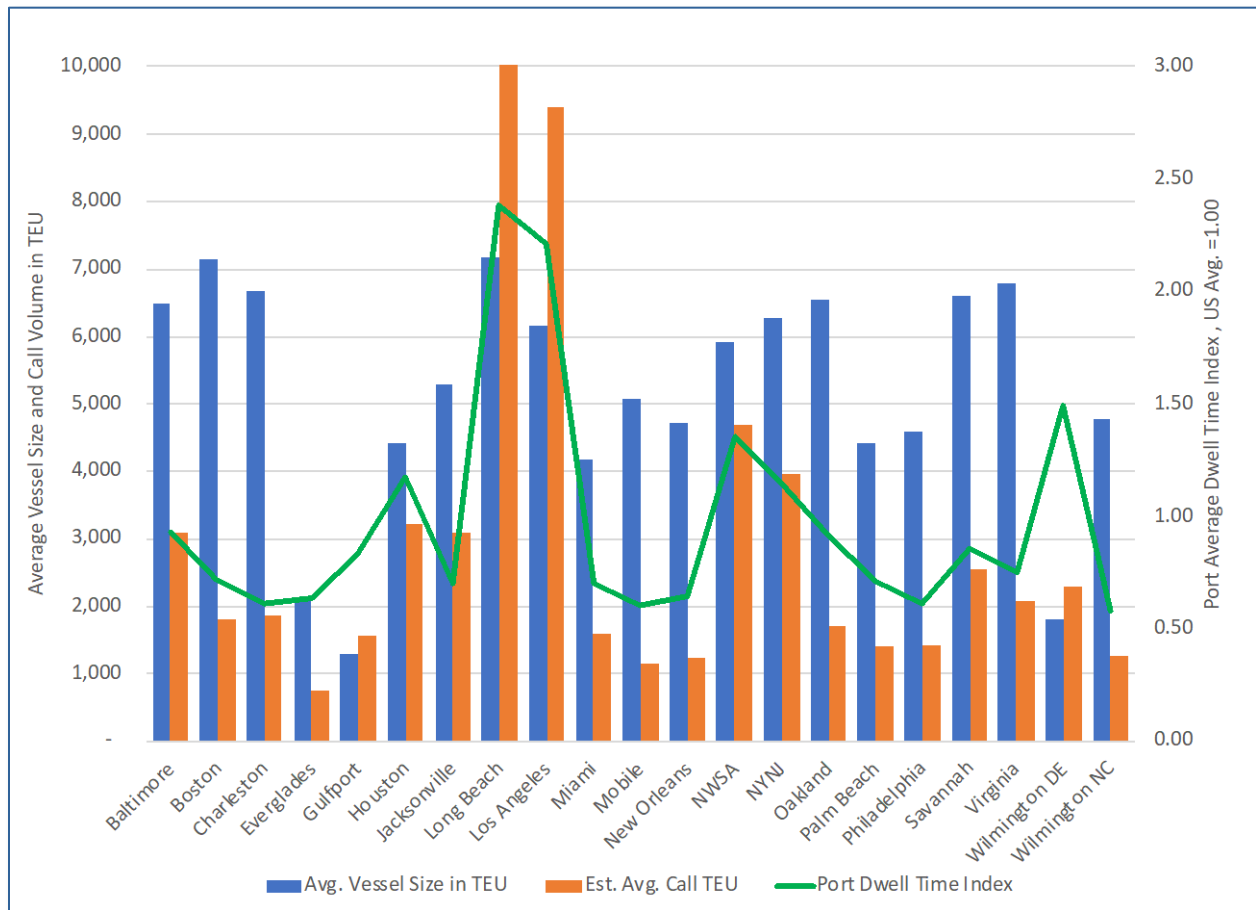
NOTES: Gearless vessels do not have their own onboard gear, and must be handled with shoreside gantry or mobile harbor cranes.
KEY: *TEU:* Twenty-foot equivalent unit
SOURCES: U.S. Department of Transportation, Bureau of Transportation Statistics, and Volpe Center, calculated using AIS data provided by U.S. Army Engineer Research and Development Center, as of November 2018.

The difference between vessel size or capacity and container volume handled leads to a disconnect between vessel size and dwell time. Ocean carriers assign vessel sizes and capacities for complete multi-port voyages, not for the cargo volume at each port. The average vessel capacity at most U.S. mainland ports ranges from about 4,000-6,000 TEU. Hawaiian, Alaskan, and Puerto Rican ports have a very different mix, including barges or Ro/Ro vessels and vessels in the domestic *Jones Act* trades. The average TEU per vessel call, however, varies widely. On the Atlantic Coast vessels typically call at multiple ports, spreading the volume over multiple markets. On the Pacific Coast, most vessels just call at one or two ports. At Los Angeles and Long Beach, many vessels unload and load nearly their full capacity at a single call, resulting in longer dwell times. Patterns vary on the Gulf Coast, with Houston handling higher volumes per

call than other ports. Data on average TEU per call are provided for each port in the Port Profiles.

Implications for Port Capacity and Throughput

Port terminals must provide sufficient capacity to discharge and load container vessels within scheduled calls. Ocean carriers and terminal operators are concerned with dwell times due to the costs of holding and handling vessels while in port. Port customers are concerned when longer dwell times affect schedules and raise costs that are ultimately reflected in shipping rates.

This analysis of AIS dwell time data implies there might be cause for concern, but the cause for concern is not so much the physical size of larger vessels as the greater container volumes they may hold. A trend toward handling the same cargo volume in fewer vessel calls will require increased terminal capacity to avoid longer dwell times and higher costs. As trade volume increases, port terminal capacity may not grow fast enough to meet the throughput demands of larger vessel calls. These implications are consistent with the observed industry practice of assigning cranes to a vessel call based on the number of containers to be handled, rather than on the size of the vessel alone.

BTS continues to explore the AIS data and seek ways to improve their use in measuring port performance.

3.8 Tanker Vessel Dwell Time

Tanker vessels move much of the total U.S. tonnage in the form of liquid bulk cargo. For example, 4 of the 5 top commodities at the port of New York and New Jersey are liquid bulk (e.g., gasoline, distillate fuel oil, crude petroleum, and residual fuel oil), accounting for approximately 48.8 percent of the total tonnage in 2017. Tanker vessels accounted for 1,036 calls at port of New York and New Jersey, compared to 1,812 container vessels calls.

Tanker dwell times are governed by different factors than container vessel dwell times. Tankers do not operate published schedules. Their times in a lightering zone or port may depend on:

- Weather, tides, and currents
- Cargo volume and type being delivered
- Cargo volume that must be lightered to allow mothership berthing
- Number of lightering vessels employed and lightering operations needed
- Remaining cargo volume the mothership must unload after lightering.

Average port dwell times for tankers are longer than for container vessels and are determined by different factors. The overall average 2017 tanker dwell time at the 24 largest liquid bulk ports was 40.6 hours, changed minimally from 2016, compared to 25.9 hours for container vessels. The monthly dwell time in Figure 3-12 stays within 5 percent of the average, with December 2017 having the longest dwell times.

Figure 3-11: Monthly Average Tanker Dwell Times, 24 Largest Liquid Bulk Ports, 2016 (n=17,417) and 2017 (n=15,638)
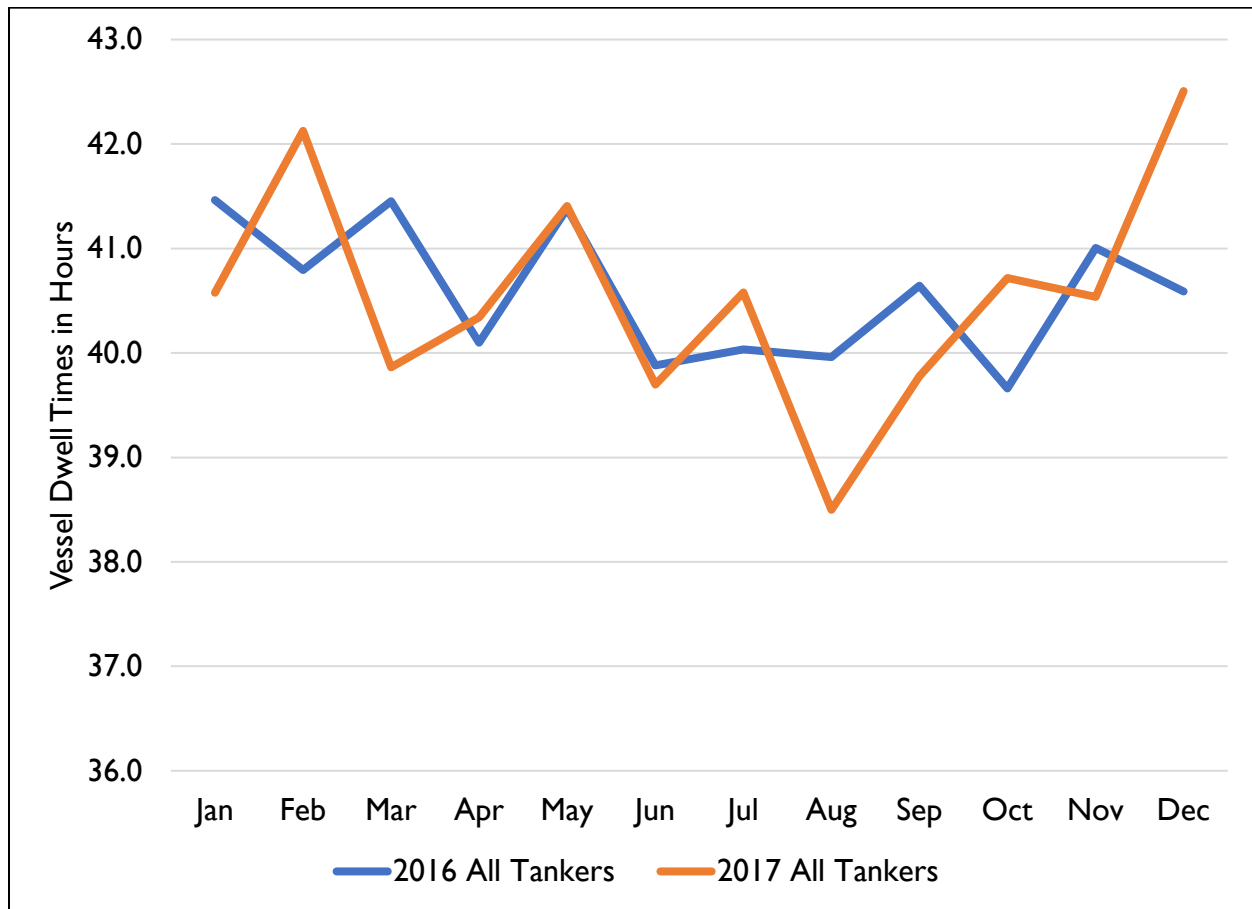
SOURCES: U.S. Department of Transportation, Bureau of Transportation Statistics and Volpe Center, calculated using AIS data provided by U.S. Army Engineer Research and Development Center, as of November 2018.

Crude petroleum and petroleum product tankers usually call at specialized private refinery or tank farm terminals. Figure 2-6 shows inbound flows of crude oil to a refinery, and outbound flows of refined products from storage tanks. As of 2017, the U.S. both imports and exports a range of crude and refined pertoleum products, so in practice the flows can be in either direction.

The relationship between dwell time and vessel size (gross tonnage) in There were also 8.9 percent fewer crude oil tanker calls in 2017, which may reflect the reduction in U.S. imports of crude petroleum. There was also a reduction in liquefied gas (LNG) carrier call, which may reflect expanded U.S. production with reduced imports offsetting increased exports. The largest reduction was 12.5 percent in product tankers, which likely represents reduced imports of petroleum products (e.g., gasoline, fuel oil, diesel) due to increased U.S. production of those products from domestic crude. There was a 10.8 percent increase in liquefied natural gas

(LNG) carrier calls, which may reflect expanded U.S. production with some offset from reduced imports.

While tankers are commonly associated with crude oil shipments, as figure 3-13 indicates the majority of liquid bulk calls are made by chemical tankers, with crude tankers accounting for a bit less than a quarter of the calls.

Table 3-5 suggests that crude carriers load or unload at the quickest rates with an average of 0.66 per 1,000 gross tons for crude vessel calls vs. 1.89 hours per 1,000 gross tons for LNG tankers, for example. Chemical and LNG tankers, which have special safety and handling requirements, appear to take longer to load or unload. For example, transfer pipelines, hoses, and holding tanks for LNG must be pre-cooled to avoid problems when the extremely cold cargo encounters handling equipment at ambient temperatures.

The number of tanker calls by type varies dramatically between major ports, as shown in Figure 3-13, with chemical tankers dominant almost everywhere. Houston, with multiple refinery and chemical complexes, has by far the greatest number of tanker calls with most being chemical tankers. Houston is followed by the Gulf ports of New Orleans, Corpus Christi, and South Louisiana, and by the Port of New York-New Jersey. Only a few ports have facilities capable of loading or unloading LNG and handling liquid gas carriers, with Corpus Christi and Houston having most of the LNG vessel calls in 2017.

Figure 3-12: Tanker Calls by Type at Major Liquid Bulk Ports, 2017
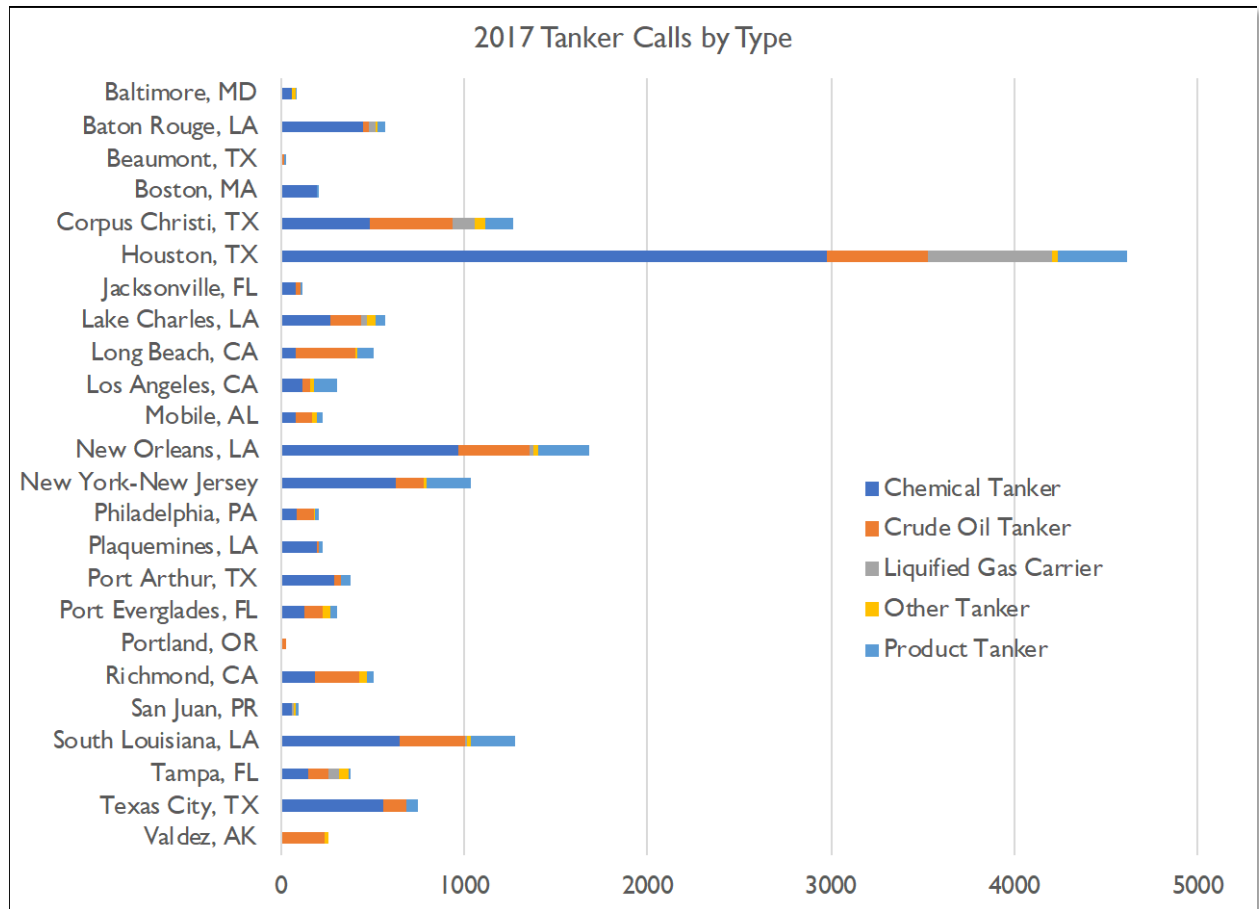
SOURCES: U.S. Department of Transportation, Bureau of Transportation Statistics, and Volpe Center, calculated using AIS data provided by U.S. Army Engineer Research and Development Center, as of November 2018.

4. PORT CAPACITY

In theory, port capacity is a simple measure of the maximum throughput in tons, twenty-foot equivalent unit (TEU), or other units that a port and its terminals can handle over a given period. This maximum can be set by physical constraints (where the port is unable to handle any additional cargo) or by economic conditions (where the marginal cost of additional throughput is prohibitive).

Many factors influence port capacity. The most obvious include the physical size (acreage) of terminals, the length of berths, the depth of access channels, and the amount and type of cargo handling equipment (e.g., container cranes).

Capacity also depends on the type of cargo being handled, and can be affected by short-term adjustments (e.g., extended hours at terminal gates) or long-term changes (e.g., terminal expansion). Port hours of operation, customs inspection procedures and staff availability, and terminal operating methods can also influence short-term capacity. Individual ports monitor their operations, yet specific measures and measurement methods vary among ports and even among terminal operators within the same port.

In addition to internal operations, port capacity is routinely affected by external events such as weather, vessel schedule reliability, and institutional disruptions. Many of these are seasonal in nature, including closures of Great Lakes ports every winter due to ice or harsh weather, or snow storms that hamper operations at some Atlantic Coast ports. Floods and droughts have shut down inland waterways or placed limits on the maximum vessel size that may traverse the route. In 2017 and 2018, Hurricanes Florence, Harvey, Irma, and Maria caused major disruptions to port operations (see Figure 5-16 in the *Hurricane Season Impact on Port* spotlight).

Other disruptions can include institutional events, such as the 2016 Hanjin Shipping bankruptcy that delayed shipments and impacted container port operations, or cyber-attacks such as the one that caused delays and temporary closures at APM Terminals in June 2017. More common external factors include ship arrival variability and cargo volume surges during the peak back-to-school and holiday shipping seasons.

Measuring port capacity is complex and the number of available, nationally consistent capacity measures remains limited. This report focuses on indicators of port capacity that are both available and nationally consistent. The list of port capacity metrics included in the port profiles are listed in Table 4-1. It should be noted that these indicators suggest relative capacities rather than absolute capacities and do not provide the complete picture that can come from detailed capacity studies of specific ports. A container port with longer berths and more cranes, for example, can be expected to have higher annual container throughput capacity than a port with

shorter berths and fewer cranes, but these metrics do not support the measurement of absolute port capacities.

Total terminal acreage may be another usable indicator for port capacity. Yet the number of individual terminals into which that acreage is divided is not an indicator of capacity because terminals are varied in governance and service type, and a nationally consistent, standard definition of a "terminal" as a statistical unit does not exist. Although port acreage is a useful capacity indicator, it tells only a part of the story, as containers can be stacked higher and dry bulk cargo piled higher when needed. Also, storage within a port's boundaries may be only part of the storage capacity accessible nearby. Acreage is most relevant for container terminals, which are less variable in their configuration than bulk terminals.

The Bureau of Transportation Statistics (BTS) has expanded some port capacity indicators from previous *Annual Reports* by increasing the level of detail. A terminal-level analysis of channel depths expands the description of port-level authorized depths and air drafts in the vicinity of ports are identified. Container crane counts are presented at the terminal level in addition to the port level to provide better perspective on the capacity available for vessels at each terminal. BTS continues to research new approaches to improving port capacity measurement.

The capacity metrics included in this year's *Annual Report* are (1) channel depth, (2) air draft, (3) length of berth for container ships, (4) container terminal size (acreage), (5) number and type of container cranes, and (6) rail connectivity. Each is examined in greater detail below.

Table 4-1: Port Capacity Metrics in Port Profiles

Element/ Metric[11]	Details/Notes	Source (More Details in Notes/Sources in Profiles)
Channel depth	Measured in feet Authorized Channel Depth Minimum Project Dimension Depth Mean Lower Low Water (MLLW) for each container terminal	USACE Deep Draft and Shallow Draft Navigation Project listing, special tabulation, as of December 2017
Air draft restrictions	Measured in feet Located within the vicinity of the port	NOAA and USACE charts, as of December 2017
Berth length for container ships	Measured in feet Presented for top 25 container ports	Port and terminal websites
Container terminal size (acreage)	Measured in acres	Port and terminal websites
Number and Type of container cranes	Number of cranes capable of serving (1) Panamax, (2) Post-Panamax, and (3) Super Post-Panamax vessels Presented at terminal level for top 25 container ports	Port and terminal websites
Presence of on-dock rail transfer facilities	Presented for top 25 container ports	Port and terminal websites

KEY: *USACE*: U.S. Army Corps of Engineers, *NOAA*: National Oceanic and Atmospheric Administration

4.1 Channel Depths

Channel depth limits the sailing draft (the vertical distance between the waterline and keel) of vessels that can call at the port. Table 4-2 details the components of channel depth and their influence on port capacity.

Table 4-2: Measures of Channel Depth

Measure	Description	Notes
Authorized Depth	The depth specified in the congressional legislation authorizing USACE to construct and maintain a Federal navigation project.	The authorized depth applies to specific port channels or approaches, not necessarily to the entire port or harbor area. Not all authorized navigation channels are constructed or maintained to their exact authorized dimensions. The profiles in this *Annual Report* list the maximum authorized depth for each port, based on port-provided data (or USACE data when port-provided data were unavailable). Both authorized and maintained minimum depths are nine feet on the inland river system. Deep-draft coastal navigation projects typically range from 35-50 feet, with most high-use ports at 40-50 ft.

---

[11] Ports were provided opportunities to verify capacity data through AAPA. The notes/sources boxes in individual port profiles provide additional detail on respondent ports.

Measure	Description	Notes
Maintained Depth	The level to which USACE maintains the channel through regular dredging of sediment accumulated via tidal currents, watershed runoff, and storm events	Maintained depths may be less than authorized or constructed depths. In some cases, limited annual budget allocations may have precluded maintaining the entire navigation project to full authorized dimensions, particularly when the initial deepening results in significantly higher-than-expected sediment loads accumulating in the channel. In other cases, the difference is only temporary, pending completion of ongoing channel deepening activities, which can require several years depending on the required dredging scope. The Great Lakes system has maintained depths between 26-28 feet for most projects.
Controlling (or limiting) Depth	Governs the maximum sailing draft of a vessel that can enter a channel, and represents the least depth that might be encountered due to other factors such as tide or localized shoaling from sediment accumulation.	A channel is typically divided into four quartiles for the purposes of determining the controlling depth, with each quartile detailing the absolute shallowest spot within the associated footprint area. For the channel side slopes (the outer edges of the two outer quarters), the shallowest spot will be the periphery of the area that a vessel transits and the channel may therefore safely handle traffic. The controlling depth may also be updated several times per year, especially in an area prone to shoaling. For these reasons the controlling depth is not being included in the port profiles.
MLLW Depth	The Mean of the Lower Low Water height of each tidal day observed over a specified period (typically 19 years, but in some regions like Alaska or the Gulf of Mexico a five-year period is used)	The profiles in this report detail the minimum project dimension MMLW depth for each container terminal using the current minimum MLLW for each set of reaches and ranges encountered between a port's entrance channel and the container terminal.

KEY: *MLLW*: Mean of the Lower Low Water, *USACE*: U.S. Army Corps of Engineers

To the extent that the work is cost-effective given inherent budget limitations, USACE conducts regular maintenance dredging to remove accumulated sediment. Channel conditions relative to this maintained depth are monitored via channel surveys conducted on a regular, sub-annual basis by USACE

This edition of the *Annual Report* lists the authorized channel depths for each port and the operational depths of approach channels for each container terminal; both are measured in feet. The starting point for the authorized channel depths was a dataset compiled by USACE; port authorities were subsequently contacted to confirm the depths. The minimum project dimension depth MLLW (Mean of the Lower Low Water) values were determined by BTS from USACE hydrographic surveys accessed through the online eHydro system; a USACE

representative subsequently confirmed the depths.[12] Additional detail is provided in the *PPFSP Definitions and Methods Handbook* to be made available online at www.bts.gov.

4.2 Air Draft

Bridges located over shipping channels can impose air draft restrictions on vessel heights. The numerous bridges over the rivers and lakes that comprise the inland waterway system do not typically restrict the vessels that use those channels, although temporary conditions, such as a storm surge or water runoff, may reduce air drafts and lead to short-term limits. Bridges over access channels are not common at the largest container terminals at coastal ports, but there are some instances in which bridges limit access for the largest ships now in service. The profiles included in this report (in Appendix A) detail what, if any, air draft restrictions exist within the port vicinity.

4.3 Length of Container Berths

Along with channel depth, the length of berths determines the number and size of vessels the port can handle. The number of berths, their length, and the total berth length are interrelated. A small terminal may have a single berth with a fixed length. Large container terminals can have 2,000-6,000 feet of continuous berth, and vessels of different lengths can often be handled with flexible berth arrangements. For example, ports and terminals can decide whether a 6,000-foot face is operated as four 1,500-foot berths or five 1,200-foot berths. In multi-berth container terminals, cranes can usually be moved up and down the wharf face, further complicating the definition of "berth." Since a given length of berth space can be divided into different numbers of berths without affecting total capacity, only total length is included in this report.

As described in Table 2-2, berth length is most relevant to container terminals. Since most container vessels in service are less than 1,000 feet long and 1,000-foot berths are common, berth length has seldom been a limiting factor in handling vessels. However, berth length has started to affect vessel calls as vessels longer than 1,000 feet call more often at U.S. container ports. As Figure 4-1 shows, the largest and busiest (i.e., highest annual TEU) container ports also have the greatest total berth length.

---

[12] Available http://navigation.usace.army.mil/Survey/Hydro as of November 2018.

Figure 4-1: Container Berth Length in Feet versus Annual TEU at Top 25 Container Ports by TEU, 2017
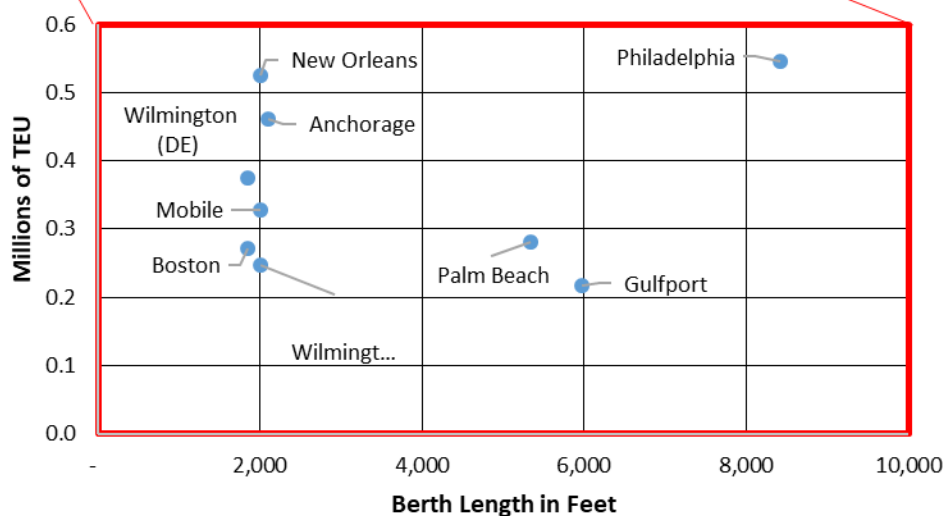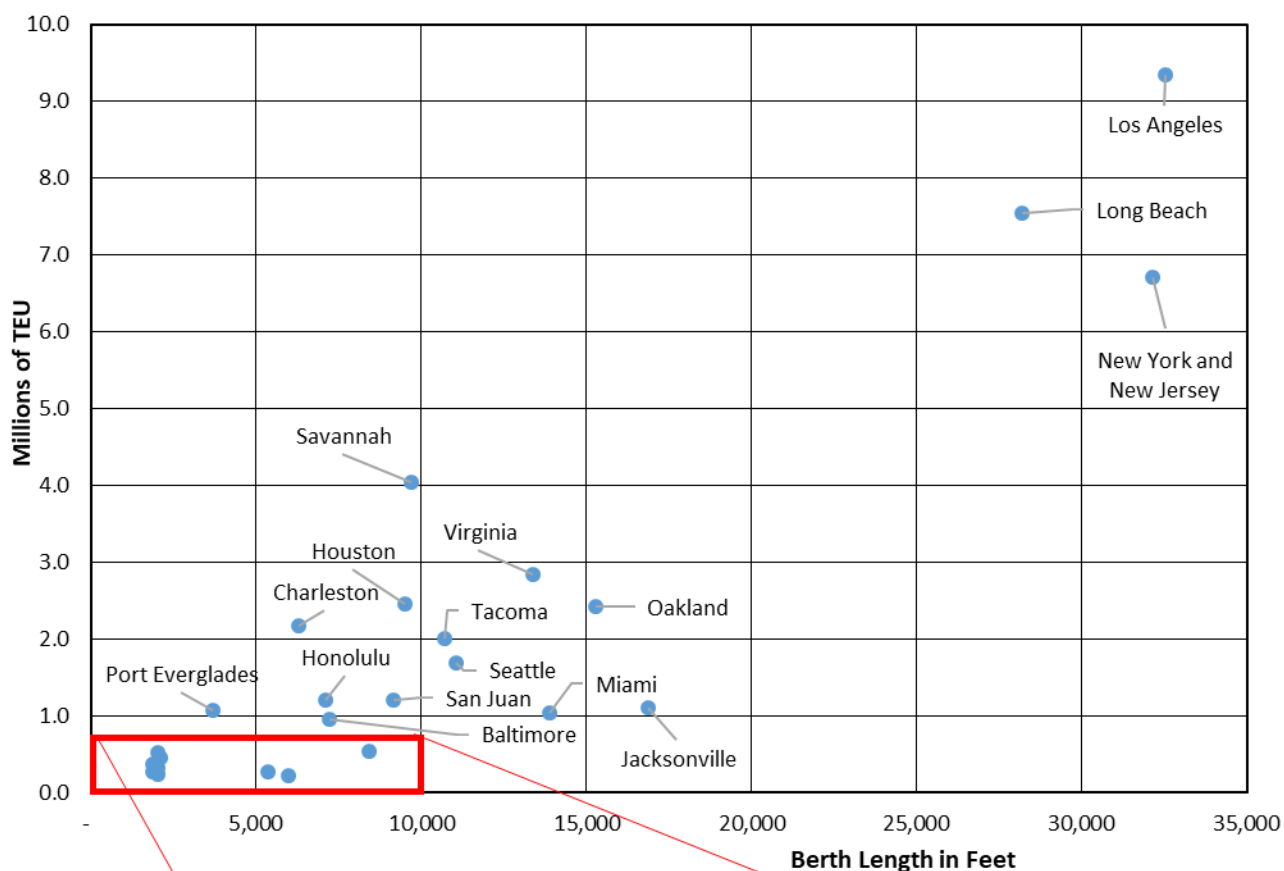
KEY: *TEU*: Twenty-foot equivalent unit
SOURCES: *Annual TEU*: AAPA, Industry Statistics, Port Authorities. *Berth length*: port websites including linked terminal-specific websites (see port profiles in Appendix A for more details), as of November 2018.

4.4 Container Terminal Size

Measuring the physical size of a port and its terminals can be problematic as terminal components and configurations differ widely. Container terminals consist of three major elements:

- Berth, wharf, and container cranes, which together provide the capability to receive vessels and transfer containers between the vessel and the terminal.

- Container yard, where loaded and empty containers are stored for transfer between vessels and truck or rail modes.

- Gates, through which inbound and outbound trucks and containers are processed.

Many container terminals also have rail transfer facilities within the terminal gates ("on-dock rail") that can transfer containers to and from trains without over-the-road trucking moves. At terminals without on-dock rail, containers may be trucked to and from external (off-dock or near-dock) rail terminals.

Container terminals may also have chassis storage areas, container or chassis maintenance and repair facilities, or container freight stations. Some marine container terminals are combination facilities that also handle break-bulk, project, or roll-on/roll-off (Ro/Ro) cargo. In other cases, terminals may have established satellite operations to store or stage containers or chassis. The wide variety of configurations and functions makes terminal acreage less relevant for dry bulk and other terminal types.

Figure 4-2 shows reported total container terminal acres (or estimated acres where not reported) for the top 25 container ports by TEU. In general, container ports with the highest annual TEU have the largest total container terminal acreage.

Figure 4-2: Container Terminal Acres of Top 25 Container Ports by TEU, 2017
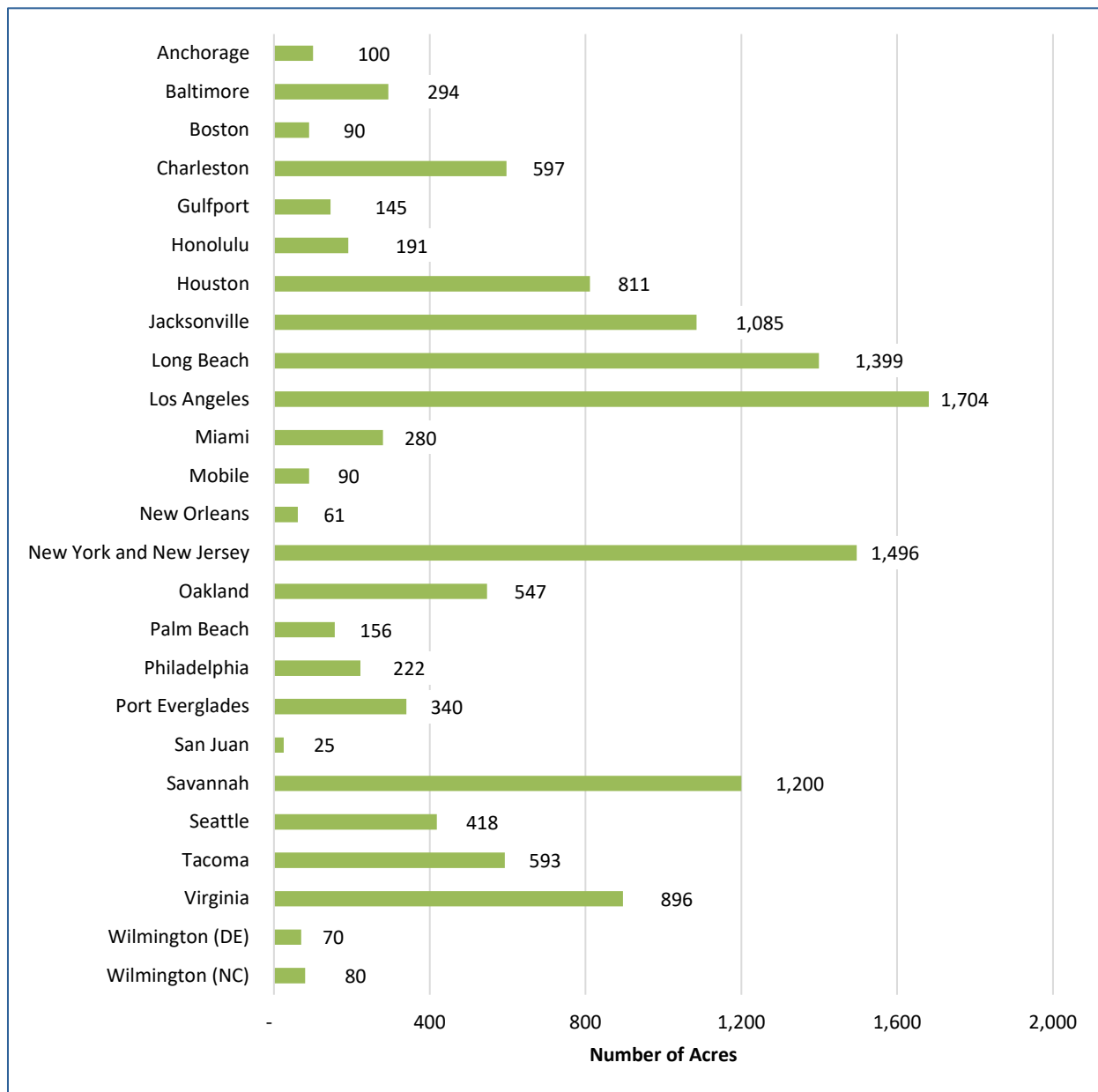
KEY: *TEU:* Twenty-foot equivalent unit

NOTES: The container terminal sizes reflect gross container terminal acres, including on-dock rail transfer facilities (raising the acreage totals) and non-container operations at mixed-use terminals. Some terminals may be only partly in use as capital upgrade projects are completed or due to temporary closures, leading to an overestimate of acres that are actively used for container operations.

SOURCE: Port websites including linked terminal-specific websites (see port profiles in Appendix A for more details), as of November 2018.
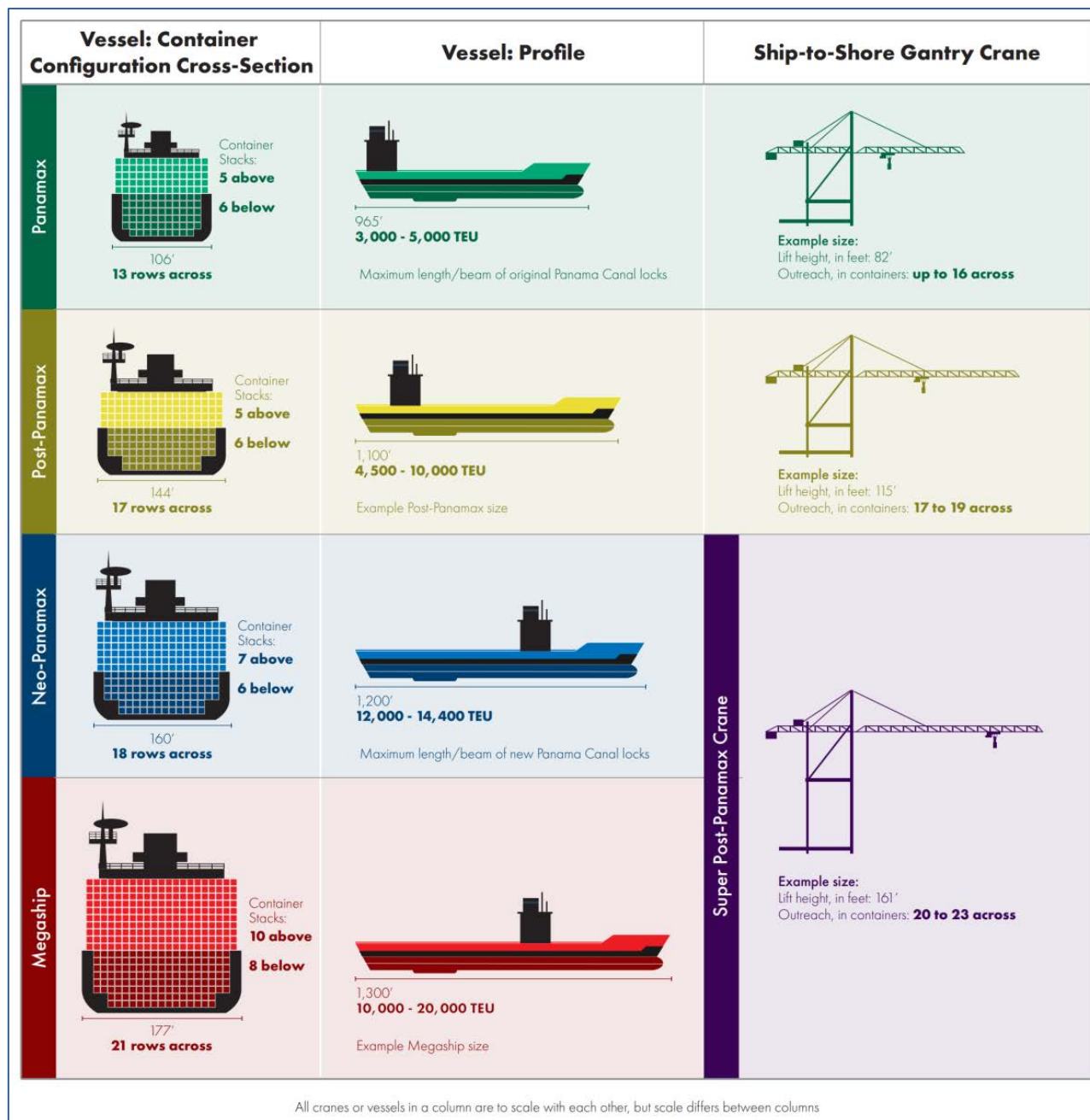
4.5 Number of Container Cranes

Most container terminals use ship-to-shore gantry cranes mounted on rails that run alongside the wharf to load and unload berthed container vessels. Smaller terminals may instead rely on mobile cranes, equipment on the container vessel itself (known as ship's gear), or Ro/Ro operations.

Figure 4-3 illustrates how vessel size impacts port infrastructure. Larger vessels require greater berth lengths, bigger loading and unloading equipment, and more cargo/container storage space.
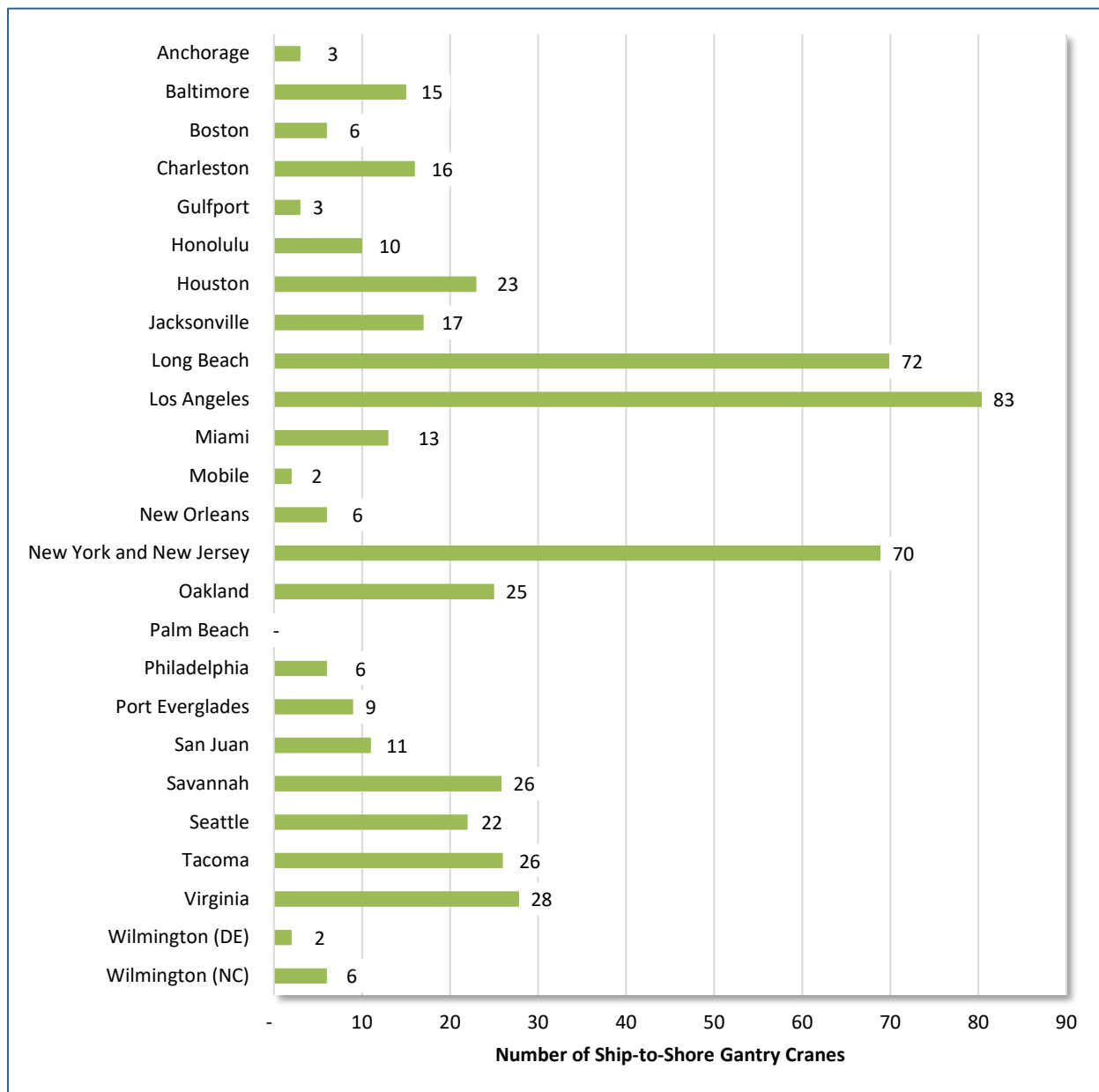
The number and size of cranes affects the number and size of ships a terminal can service simultaneously. Most port and terminal websites provide information about the number and types of shore-side container cranes used to load and unload ships (Figure 4-4), making that information a useful indicator for terminal capacity. The busiest container ports also have the most container cranes, as Figure 4-5 highlights. This is expected, because cranes can provide increments of capacity at lower cost (in the tens of millions of dollars) as compared to building new terminals or major dredging projects (which are typically in the hundreds of millions of dollars).

Figure 4-3: Type and Size Classes of Containerized Shipping Equipment

Vessel: Container Configuration Cross-Section	Vessel: Profile	Ship-to-Shore Gantry Crane
Panamax — Container Stacks: 5 above, 6 below; 106', 13 rows across	965' **3,000 - 5,000 TEU** — Maximum length/beam of original Panama Canal locks	Example size: Lift height, in feet: 82' Outreach, in containers: **up to 16 across**
Post-Panamax — Container Stacks: 5 above, 6 below; 144', 17 rows across	1,100' **4,500 - 10,000 TEU** — Example Post-Panamax size	Example size: Lift height, in feet: 115' Outreach, in containers: **17 to 19 across**
Neo-Panamax — Container Stacks: 7 above, 6 below; 160', 18 rows across	1,200' **12,000 - 14,400 TEU** — Maximum length/beam of new Panama Canal locks	**Super Post-Panamax Crane** — Example size: Lift height, in feet: 161' Outreach, in containers: **20 to 23 across**
Megaship — Container Stacks: 10 above, 8 below; 177', 21 rows across	1,300' **10,000 - 20,000 TEU** — Example Megaship size	

All cranes or vessels in a column are to scale with each other, but scale differs between columns

SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics and Volpe Center, November 2018.

## Figure 4-4: Number of Container Cranes at the Top 25 Container Ports by TEU, 2017

Port	Number of Ship-to-Shore Gantry Cranes
Anchorage	3
Baltimore	15
Boston	6
Charleston	16
Gulfport	3
Honolulu	10
Houston	23
Jacksonville	17
Long Beach	72
Los Angeles	83
Miami	13
Mobile	2
New Orleans	6
New York and New Jersey	70
Oakland	25
Palm Beach	-
Philadelphia	6
Port Everglades	9
San Juan	11
Savannah	26
Seattle	22
Tacoma	26
Virginia	28
Wilmington (DE)	2
Wilmington (NC)	6

KEY: *TEU:* Twenty-foot equivalent unit
SOURCE: Port websites including linked terminal-specific websites (see port profiles in Appendix A for more details), as of November 2018.

Figure 4-5: Container Cranes versus Annual TEU at Top 25 Container Ports, 2017
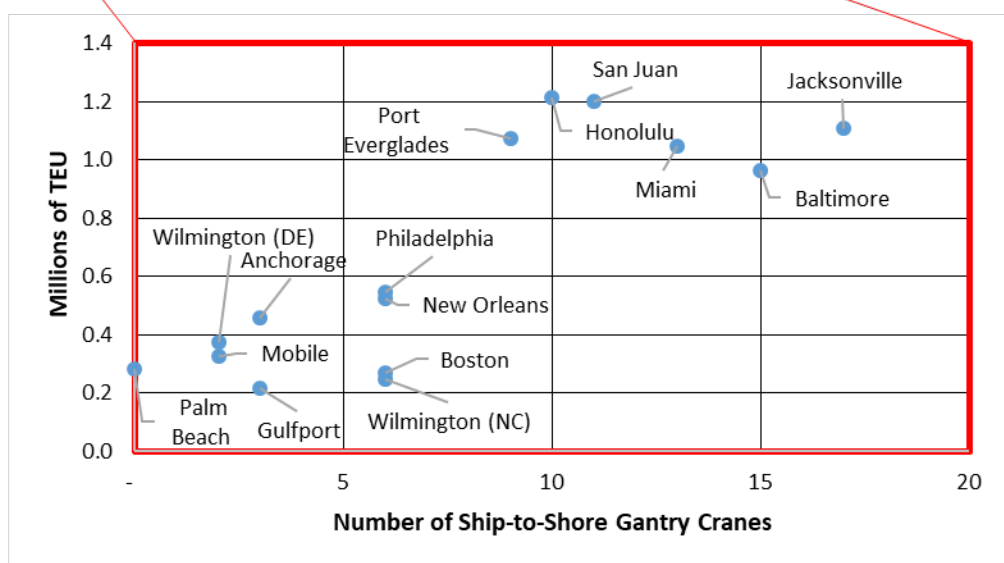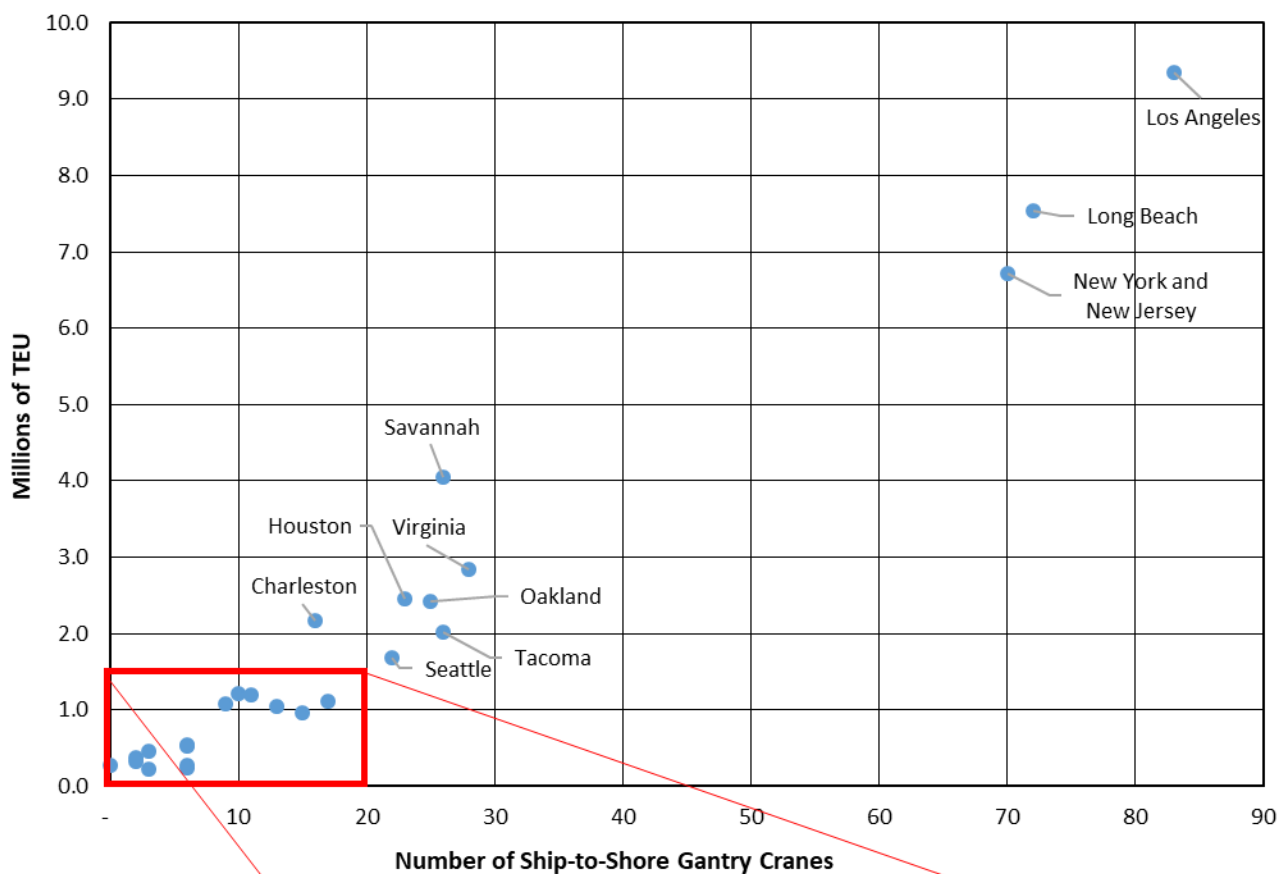
KEY: *TEU:* Twenty-foot equivalent unit
SOURCES: *Annual TEU:* AAPA, Industry Statistics, Port Authorities. *Number of cranes:* port websites including linked terminal-specific websites (see port profiles in Appendix A for more details), as of November 2018.

The inclusion of Ro/Ro barge operations or container operations using ship's gear can distort the crane-related metrics, so such operations are omitted from this analysis. The Port of San Juan, for example, handles many of the containers included in port totals at Ro/Ro barge terminals.

The profiles included in Appendix A provide the number and types of ship-to-shore gantry container cranes located at each container terminal. The two primary measures that determine a crane's ability to service a given vessel are lift height and outreach length, with newer vessels having both wider beams that allow for more containers to be stacked across the width of the vessel, and greater height to allow containers to be stacked higher. Container terminals purchase new cranes or retrofit older cranes to increase capacity and accommodate larger vessels. The outreach measured in container equivalents is used to classify cranes into three size classes: up to 16 rows for Panamax, between 17 and 19 rows for Post-Panamax, and 20 rows and up for Super Post-Panamax. Cranes can typically handle loading and unloading operations of vessels in an equivalent size class or smaller, although the three classes overlap in physical dimensions.

4.6 Rail Connectivity

All high-volume ports are either directly connected to the rail system or have nearby rail facilities. Bulk terminals have a variety of rail service connections suited to the type and volume of commodities they handle. Most container terminals have either on-dock transfer facilities within the terminal boundaries or off-dock facilities nearby.

Table 4-3 indicates the number of container terminals with on-dock rail at 12 of the top 25 container ports by TEU that have at least one terminal with on-dock connectivity.

Table 4-3: Number of Container Terminals with On-Dock Rail Access at the Top 25 Container Ports by TEU, 2017

Port	Number of Container Terminals	Number of Container Terminals with On-Dock Rail Access
Gulfport	2	2
Jacksonville	3	1
Long Beach	7	6
Los Angeles	7	7
Miami	3	3
New York & New Jersey	6	4
Palm Beach	1	1
Savannah	1	1
Seattle	4	1
Tacoma	6	4
Virginia	3	2
Wilmington (NC)	1	1

SOURCE: Port websites including linked terminal-specific websites (see port profiles in Appendix A for more details), as of November 2018.

5. PORT PERFORMANCE CONTEXT

The Port Performance Freight Statistics Program defines port *performance* in terms of throughput and capacity. This report defines port *throughput* as the volume of cargo and number of vessel calls that ports handle each year, and port *capacity* as the infrastructure elements that support cargo handling and vessel calls. This report focuses on a subset of U.S. ports, yet port performance should be understood in the context of relevant global, national, and regional trends. This chapter describes relevant maritime trends, emerging issues, and their implications for throughput and capacity. The emerging and topical issues highlighted in this year's report include:

(1) Waterborne transport of food and farm products
(2) Impacts of extreme weather on port capacity and throughput

Food and farm products represent a major portion of the cargo exported from the United States, with the 179.3 million tons shipped from the top 49 ports in 2017 representing 27.2 percent of total exports from those ports.[13] The efficient movement of cargo through ports is especially critical for food and farm products that may spoil if delays occur.

5.1 Global and National Maritime Trends

Global maritime trade in 2017 grew by 4.0 percent over the previous year, which is higher than the 2.6 percent increase recorded in 2016 and is the fastest pace in five years.[14] In comparison, the United Nations (UN) estimated that world gross domestic product (GDP) increased by 2.5 percent in 2016 and 3.1 percent in 2017.[15] The relationship between national and global trade growth and GDP growth has shifted over time, but trade volumes typically increase at a faster rate than economic output when economies grow and decrease at a faster pace than economic output during periods of decline. Maritime trade has grown at a compound annual rate of 3.0 percent over the past decade, including a 4.5 percent decrease during the global recession in 2009 and a 7.0 percent rebound in 2010.[16]

The World Bank ranked the U.S. economy as the world's largest in 2017, accounting for 24.0 percent of the total global gross domestic product (GDP), down from 24.6 percent in 2016.[17] International trade continues to play a large role in the U.S. economy, accounting for $3.9

---

[13] U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center, special tabulation as of November, 2018.
[14] United Nations Conference on Trade and Development (UNCTAD), *Review of Maritime Transport: 2018*, p. 4, available at http://unctad.org/ as of October 2018.
[15] Ibid.
[16] Calculation using data from United Nations Conference on Trade and Development (UNCTAD) STAT, *World seaborne trade by types of cargo and by group of economies: 1970-2016*, available at http://unctadstat.unctad.org/ as of October 2018.
[17] The World Bank, *Data Bank*, available at http://databank.worldbank.org/data/ as of October 10, 2018.

trillion in 2017, a 6.8 percent increase over 2016.[18] While almost one-third of U.S. trade by value is with Canada and Mexico, the remaining majority requires maritime shipping or air cargo service to reach foreign countries (Figure 5-1).[19]

---

[18] Seasonally Adjusted. U.S. Census Bureau, *U.S. International Trade in Goods and* Services, available at https://www.census.gov/ as of October 2018.

[19] U.S. Department of Commerce, Census Bureau, Foreign Trade Division, *FT920 - U.S. Merchandise Trade: Selected Highlights* (Washington, DC: annual issues).

Figure 5-1: Value of U.S. International Freight Trade by Coasts and Borders, 1990-2017
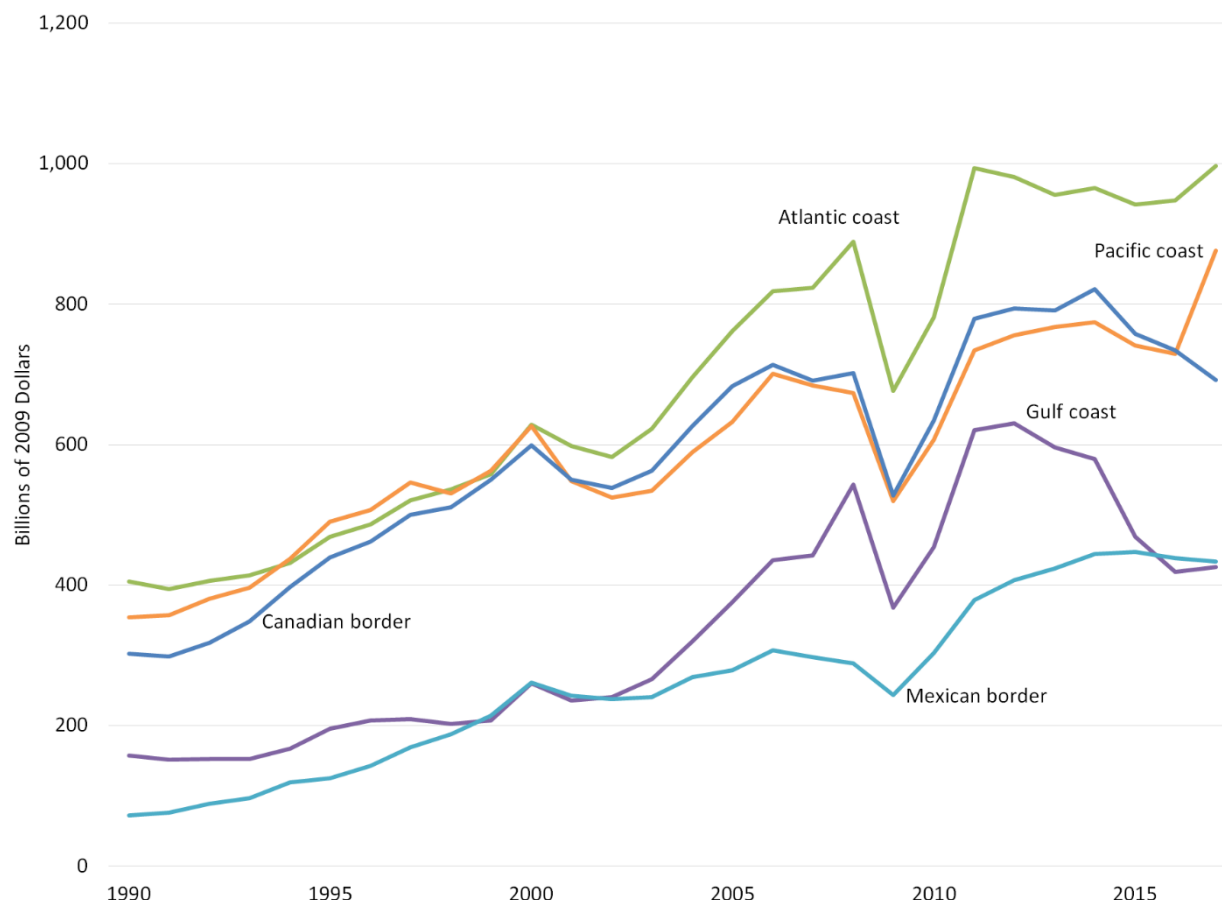
NOTES: The value of coal shipments through Mobile, AL, Charleston, SC, and Norfolk, VA are considered proprietary information and are consolidated. The total value of coal exports for the above three cities are included under the Atlantic Coast Customs District.
**SOURCES**: *1990-1999*: U.S. Department of Commerce, Census Bureau, *Statistical Abstract of the United States* (Washington, DC: annual issues); *2000-2017*: U.S. Department of Commerce, Census Bureau, Foreign Trade Division, *FT920 - U.S. Merchandise Trade: Selected Highlights* (Washington, DC: annual issues). *Implicit GDP Deflator*: U.S. Department of Commerce, Bureau of Economic Analysis, Current-Dollar and Real Gross Domestic Product, available at www.bea.gov, as of October 2018.

According to the United Nations Conference on Trade and Development (UNCTAD), total maritime trade has grown more than four-fold since 1970.[20] It has increased in nine of the last 10 years, with the sole downturn occurring during the recession in 2009 (Figure 5-2). In 2017, UNCTAD estimated that 11.8 billion tons of cargo were transported over water.[21]

---

[20] United Nations Conference on Trade and Development (UNCTAD) STAT, *World seaborne trade by types of cargo and by group of economies: 1970-2017*, available at http://unctadstat.unctad.org/ as of October 2018.
[21] UNCTAD, *Review of Maritime Transport: 2018*, available at http://unctad.org/ as of October 2018.

Figure 5-2: Global Maritime Trade in Tons, 2008-2017
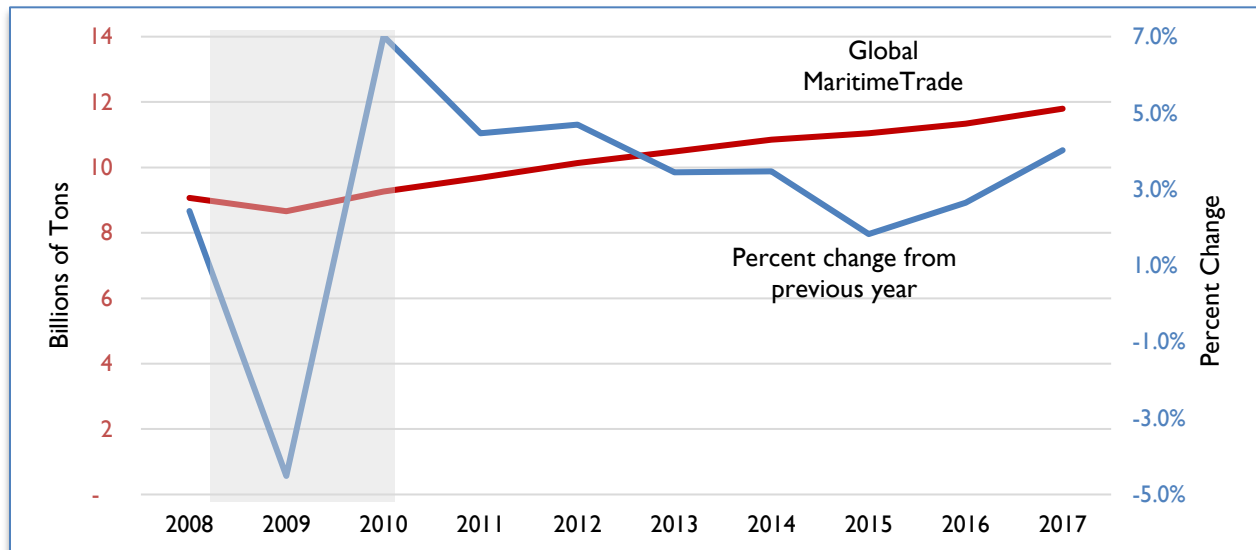
NOTES: *Global maritime trade* measures the total tonnage of goods loaded. Shaded gray box indicates period of global recession, which the National Bureau of Economic Research details as starting in December 2007 and ending in June 2009 in the United States.
SOURCE: United Nations Conference on Trade and Development, *Review of Maritime Transport: 2018*, available http://unctad.org/, as of October 2018.

Global trade has expanded the market for U.S. manufactured and natural resource exports, while imports supply consumer goods and inputs to U.S. industries. The growth in global maritime trade has resulted in the construction of new ports in developing nations and port expansion in the United States and other developed economies.

UNCTAD classifies maritime trade into five categories, with main bulk (iron ore, coal, and grain[22]) and other dry cargo combined accounting for 53.5 percent of the total by weight in 2017, and crude oil and other petroleum products combined accounting for a 29.4 percent (Figure 5-3).[23]

The main bulk commodities were the largest class of waterborne cargo shipped in 2017, with 3.5 billion tons or 29.9 percent of the total (Figure 5-3 and Figure 5-4), up from 2.1 billion tons in 2008.[24] The increase in tonnage of main bulk commodities over the past 10 years was 64.2 percent, the largest of the five categories over the period. This increase was driven by import demand in China.[25]

---

[22] In previous years UNCTAD classified bauxite, alumina, and phosphate as Main Bulk Commodities; they are now included in the *Other Dry Cargo* category.
[23] United Nations Conference on Trade and Development, *UNCTAD STAT, World seaborne trade by types of cargo and by group of economies: 1970-2016*, available at http://unctadstat.unctad.org/ as of October 2018.
[24] Ibid.
[25] Ibid.

Figure 5-3: Share of Global Maritime Trade Tonnage by Category, 2017
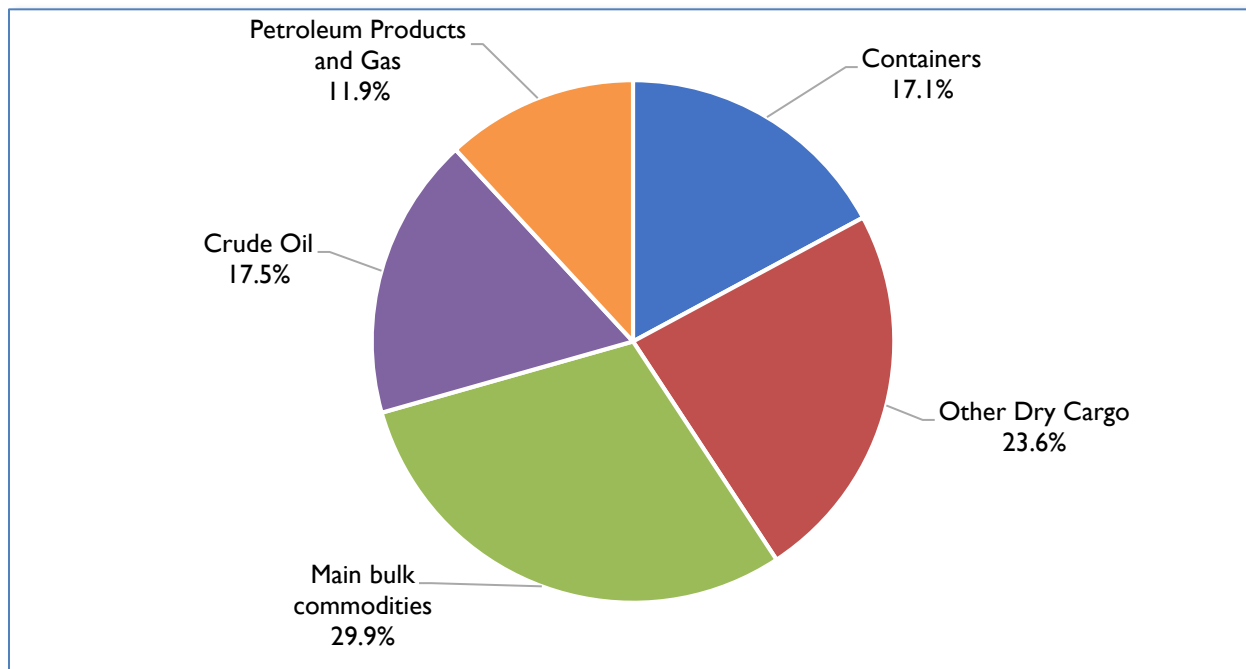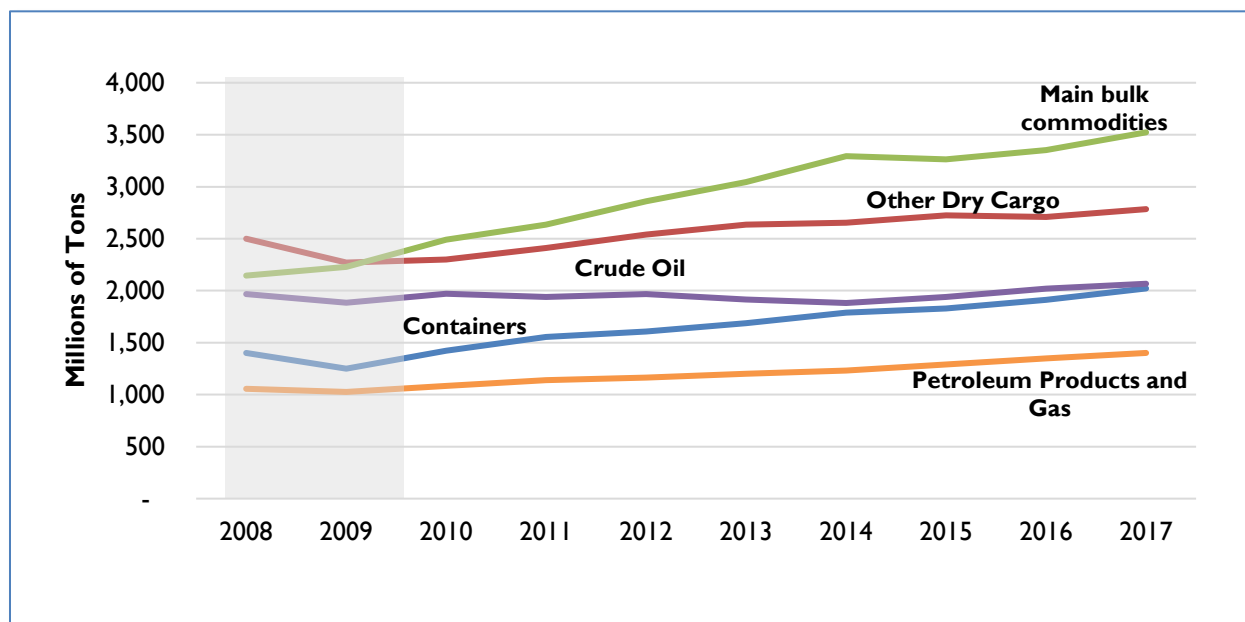

NOTE: *Main bulk commodities* include iron ore, coal, and grain. *Other dry cargo* includes bauxite, alumina, phosphate, forestry and steel products, cement, etc.
SOURCE: United Nations Conference on Trade and Development (UNCTAD*), Review of Maritime Transport: 2018*, available at http://unctadstat.unctad.org/ as of October 2018.

Crude oil and petroleum products and natural gas trade have together increased by 3.0 percent from 2016 to 2017, which is slower than the 4.2 percent increase from 2015 to 2016. In 2017 the combined energy product categories totaled 3.5 billion tons, a 14.7 percent increase over the past 10 years.[26]

---

[26] Ibid.

Figure 5-4: Global Maritime Trade in Tons by Category, 2008-2017

NOTES: *Main bulk commodities* include iron ore, coal, and grain. *Other dry cargo* includes bauxite/alumina, phosphate, forestry and steel products, cement, etc. Shaded gray box indicates period of global recession, which the National Bureau of Economic Research details as starting in December 2007 and ending in June 2009 in the United States.
SOURCE: United Nations Conference on Trade and Development (UNCTAD*), Review of Maritime Transport: 2018*, available at http://unctadstat.unctad.org/ as of October 2018.

Transportation of petroleum products and natural gas increased at a faster rate than crude oil between 2016 and 2017, with gains of 3.9 percent and 2.4 percent respectively, and their growth over the past 10 years (32.8 percent) has also outpaced that of crude oil (5.0 percent). The largest 2017 increases in energy cargo transportation were for liquefied natural gas (up 9.6 percent over 2016) and coal (up 5.8 percent over 2016).

Growth in energy products trade was mirrored at U.S. ports, as the United States is an exporter of coal (primarily via Atlantic Coast ports) and crude petroleum and liquefied natural gas (LNG, primarily via Gulf Coast ports).[27] Outbound waterborne coal tonnage increased by 55.2 percent between 2016 and 2017, with a total of 85.2 million tons; while crude petroleum tonnage increased by 135.2 percent to 41.4 million tons and petroleum product tonnage increased by 12.1 percent to 226.6 million tons.[28] Multiple new facilities are under construction to support the anticipated continued growth of LNG exports from the United States, with terminals in Cove Point, MD and Corpus Christi, TX; commencing exports in 2018. LNG terminals require expansive sites for liquefaction and storage, with some facilities stretching over 1,000 acres. The increase in coal exports in 2017 reverses a decline in tonnage since the

---

[27] For a more detailed discussion on the waterborne transportation of energy products, please see the *2017 Annual Report.*
[28] USACE, Waterborne Commerce Statistics Center, *The U.S. Waterway System: 2017 Transportation Facts and Information*, available at https://www.iwr.usace.army.mil as of October 2018.

2012 peak but has not resulted in the construction of any new terminals. The U.S. remains a net importer of crude oil, but increased export volumes have resulted in plans for new facilities in Plaquemines, LA and Corpus Christi, TX. Gulf Coast ports are currently unable to fully load Very Large Crude Carriers. They either handle smaller vessels or rely on lightering operations to transfer crude oil to the larger vessels.

LNG exports by vessels during the first half of the year increased by 58.3 percent compared to the same period of 2017.[29] This growth follows quadrupling of LNG exports between 2016 and 2017.[30] All the LNG exports in 2017 originated from the Sabine Pass terminal in Louisiana; two new facilities commenced operations in 2018, and three other projects are scheduled to be completed in the next two years.[31] Crude oil exports for the first half of 2018 increased by 80.5 percent over the first half of 2017.[32] A number of new crude oil facilities are planned or under construction to handle future needs. Coal exports in the first half of 2018 increased over the same period of 2017 while imports decreased, with net exports increasing by 38.0 percent.[33]

UNCTAD reported that global containerized trade in 2017 increased at more than double the rate of 2016, with the 148 million TEU in 2017, up 6.4 percent from 2016 (compared to a 3.1 percent increase in 2015-2016).[34] Containerized cargo tonnage reached 2.0 billion tons in 2017, up 5.8 percent from 2016.[35] Containerized trade accounted for 17.1 percent of total cargo by weight in 2017, an increase from 15.5 percent in 2008, but only slightly higher than the 16.9 percent share recorded in 2016.

Shipping lines have responded to containerized trade growth with increased vessel sizes.[36] This increase results in fewer calls to move the same number of containers. The greater cargo volumes that these larger ships unload during a single call can challenge terminal throughput and capacity. Additionally, larger vessel sizes may limit which ports can be called due to insufficient access channel depths and air drafts, or due to the lack of container cranes can meet the reach or height of the new vessels.

Figure 5-5 shows the average 2017 container vessel capacity in TEU at major U.S. container ports. The average TEU per vessel call for the Ports of Anchorage, Honolulu, and San Juan are not included because the vessel call data for these ports does not consistently reflect their complex mix of foreign and domestic vessels and types. As shown in Figure 5-5:

---

[29] U.S. Energy Information Administration, *Liquefied U.S. Natural Gas Exports by Vessel*, available at https://www.eia.gov as of December 2018.
[30] U.S. Energy Information Administration, *Today in Energy March 27, 2018*, available at https://www.eia.gov as of December 2018.
[31] Ibid.
[32] U.S. Energy Information Administration, *U.S. Exports of Crude Oil,* available at https://www.eia.gov as of December 2018.
[33] U.S. Energy Information Administration, *U.S. Coal Imports and Exports*, available at https://www.eia.gov as of December 2018.
[34] Ibid. p. 11
[35] Ibid. p. 6
[36] For a more detailed discussion on the impact of megaships on container ports, please see the *2017 Annual Report*.

- The average vessel size calling at Pacific Coast ports has increased from over 6,000 TEU in 2016 to almost 7,000 TEU in 2017.

- Atlantic Coast ports are seeing larger vessels in 2017 than in 2016, with the average vessel size calling at these ports up from about 5,000 TEU to 6,000 TEU in 2017.

- Gulf Coast ports have also seen an increase in size with the average vessel size between 4,000 and 5,000 TEU.

Figure 5-5: Average Vessel Capacities and Call Volumes at Major Mainland U.S. Container Ports, 2016 and 2017
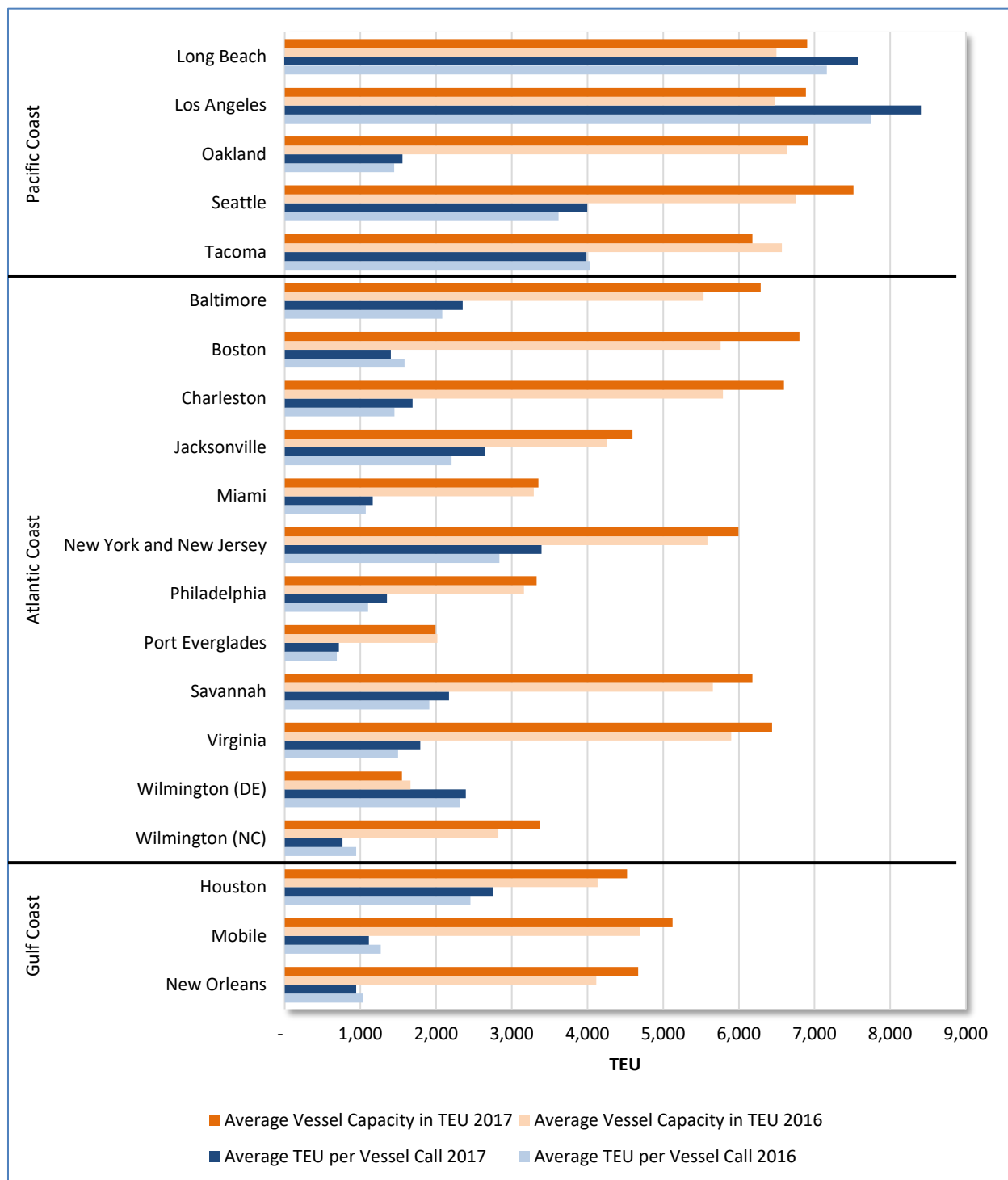
SOURCES: *Average vessel size*: USDOT, MARAD, *Vessel Calls in U.S. Ports, Selected Terminals and Lightering Areas*, available at https://www.marad.dot.gov/ as of November 2018. *Container volumes*: AAPA, Industry Statistics, Port Authorities. *Vessel calls*: USACE, Waterborne Commerce Statistics Center, 2017 data and 2016 data, special tabulation, as of November 2018.

Figure 5-5 also shows the average TEU handled per vessel call. Atlantic Coast and Gulf Coast ports have typically handled 1,000–3,000 TEU per call versus 7,000–8,000 per call at Los Angeles and Long Beach. Theoretically, a vessel is able to handle twice its TEU capacity in a single call if it discharges its full capacity inbound and loads its full capacity again outbound. In 2017, only the Ports of Los Angeles, Long Beach, and Wilmington, DE, handle more than 100 percent of vessel capacity on an average call.

Ocean carriers' adoption of 10,000+ TEU container vessels has accelerated since 2010. The number of such vessels increased from 388 at the end of 2016 to 453 at the end of 2017. Those vessels accounted for 29.5 percent of available TEU capacity at the end of 2017, up from 25.8 percent at the end of 2016.[37] This trend will likely continue as vessels of 15,000 TEU and larger account for 55.7 percent of the orders of large vessels (those with a capacity of at least 7,500 TEU) scheduled for delivery in 2018, 2019, and 2020.[38] These large vessels may require infrastructure upgrades, like dredging projects to increase channel drafts or new ship-to-shore container cranes that are higher and have a longer outreach. The potential surge in cargo volume that accompanies calls from larger vessels may strain landside operations and result in terminal congestion and delays.

Preliminary data for 2018 point to the continued growth of both containerized imports and exports despite uncertain international trade conditions. Numerous container ports are in the planning or construction phase for infrastructure upgrades designed to increase throughput and capacity to handle the anticipated long-term growth in container volume (see individual port profiles in Appendix A: Port Profiles). Energy exports also continued to show growth in 2018.

---

[37] Alphaliner, *Alphaliner Monthly Monitor: January 2018*, available at www.alphaliner.com/ as of November 2018.
[38] Alphaliner, *Alphaliner Monthly Monitor: October 2018*, available at www.alphaliner.com/ as of November 2018.

5.2 Spotlight: Waterborne Transport of Food and Farm Products

In 2017, 237.3 million tons of food-related agricultural commodities moved to and from the United States by water, a decrease of 2.6 percent from 243.7 million tons in 2016, but up 16.0 percent from 204.5 million tons in 2008.[39] This growth in the shipment of agricultural products leads to increased pressures on infrastructure beyond those from other cargo types due to the special handling and transportation that perishable goods may require. Some, such as fruits and vegetables, dairy, and fish, usually require temperature-controlled refrigerated containers (reefers), while other products, such as grains, require dry cargo containers to prevent condensation.

These special handling requirements are especially important for the marine transportation system because it typically moves agricultural products over longer distances and at lower costs than other modes. While trucks are cost-competitive for travel distances of less than 250 to 500 miles and railroads offer a cost advantage over longer distances, barges can provide the lower cost when a waterway is available as the cost advantage offsets the slower speed.[40] The 1,750 ton dry cargo capacity of a single hopper barge is equal to 16 rail cars or 70 trucks, and a single barge tow could include 15 hopper barges.[41]

There are about 12,000 miles of commercially navigable waterways in the lower 48 states.[42] Agricultural products make up a large part of U.S. waterborne trade at both coastal and river ports, but the mix of agricultural products handled at each port differs. For example, coastal ports handle more bulk and containerized agricultural imports and exports, while bulk movements of soybeans, corn, and grain are prominent in cargo movements on the inland waterway system.

The agricultural products discussed in this section are defined by USACE in the Lock Performance Monitoring System (LPMS). They include harvested products, such as soybeans, corn, and cotton, and processed food products such as beverages, packaged foods, and prepared meat.

---

[39] USACE, Waterborne Commerce Statistics Center, *The U.S. Waterway System Fact Cards, 2008-2017*, available at https://publibrary.planusace.usas of November 2018.
[40] Envision Freight, *Transportation of Grain*, available at http://www.envisionfreight.com/ as of October 2018.
[41] Based on 110 ton capacity of a bulk rail car and 25 ton capacity of a highway tractor trailer. National Waterways Foundation, *Waterways: Working for America*, available at http://www.nationalwaterwaysfoundation.org/ as of October 2018.
[42] Water Encyclopedia, *Transportation*, available at http://www.waterencyclopedia.com/ as of October 2018.

International Market

The United States exports more than 20 percent of its agricultural production,[43] and the Nation has had an agricultural trade surplus for over 50 years.[44] The Nation exported $138.2 billion of agricultural products in 2017 (up 2.6 percent from 2016) and imported $121.0 billion of agricultural products (up 5.7 percent from 2016).[45] Canada was the top market by value for U.S. agricultural exports in 2017, followed by China, Mexico, Japan, and South Korea.[46] These top five nations accounted for 56.1 percent of the total value of U.S. agricultural exports in 2017.[47] Mexico and Canada were the largest sources of agriculture imports to the U.S. in 2017, followed by Italy, China, and Indonesia. Together these top five accounted for 49.3 percent of U.S. agricultural import value (with Mexico and Canada alone accounting for 38.8 percent).[48]

Figure 5-6 shows the growth in food and farm product tonnage over the past decade by direction and vessel type – bulk (non-containerized) or containerized. In 2017, about 78.8 percent of agricultural exports (157.9 million tons) moved in bulk vessels versus 24.4 percent of agricultural imports (12.0 million tons). In most years between 2008 and 2017, containerized tonnage was almost balanced between imports and exports, whereas bulk export tonnage was about four times import tonnage. This near balance in containerized agricultural tonnage is not typical of overall U.S. containerized trade, where imports typically outnumber exports.

---

[43] U.S. Department of Agriculture (USDA), Foreign Agricultural Service, *Percentage of U.S. Agricultural Products Exported*, available at https://www.fas.usda.gov/ as of August 2018.
[44] USDA, Foreign Agricultural Service, *Agricultural Exports Finish Strong in FY 2017,* available at https://www.fas.usda.gov/ as of August 2018.
[45] USDA, Foreign Agricultural Service, *Global Agriculture Trade System Online*, available at https://apps.fas.usda.gov/gats/default.aspx as of August 2018.
[46] Ibid.
[47] Ibid.
[48] Ibid.

Figure 5-6: Waterborne Import and Export of Food and Farm Products, 2008–2017
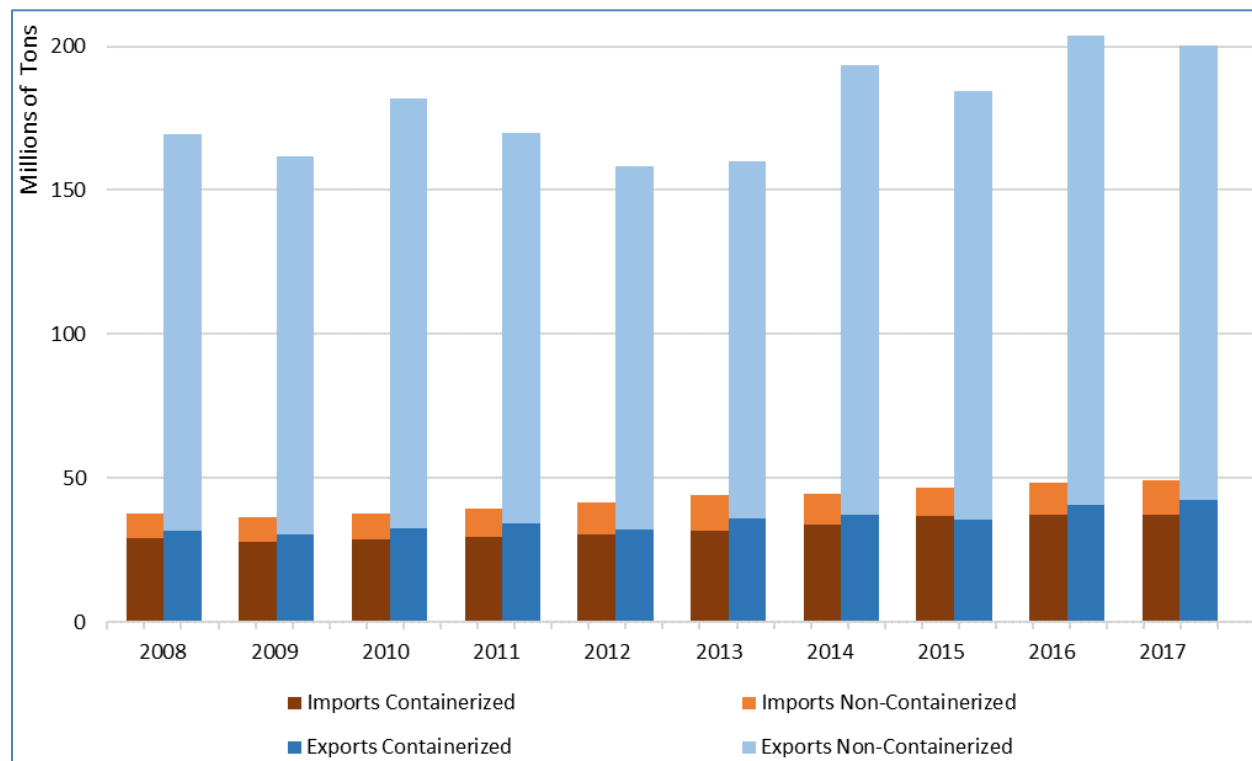
NOTE: Includes commodities from Harmonized Tariff Schedule (HTS) aligned with USACE Food and Farm Product classification in the Lock Performance Monitoring System (LPMS).
SOURCE: U.S. Census Bureau, Foreign Trade Division, *USA Trade Online*, available at https://usatrade.census.gov as of August 2018.

Domestic Market

The USACE Waterborne Commerce Statistics Center (WCSC) reported that 100.2 million tons of food and farm products moved internally on domestic waterways in 2017 (Figure 5-7).[49] This is a 36.5 percent increase since 2008, with a 10-year compound annual growth rate of 3.5 percent. The share carried on internal waterways increased from 92.1 to 94.7 percent over this same time period, with the remainder moving coastwise, lakewise, or intraport/intra-territory.[50]

---

[49] U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center, *The U.S. Waterway System Fact Cards, 2008–2017*, available at http://www.navigationdatacenter.us/ as of October 2018.
[50] Ibid.

Figure 5-7: Domestic Waterborne Movement of Food and Farm Products, 2008–2017
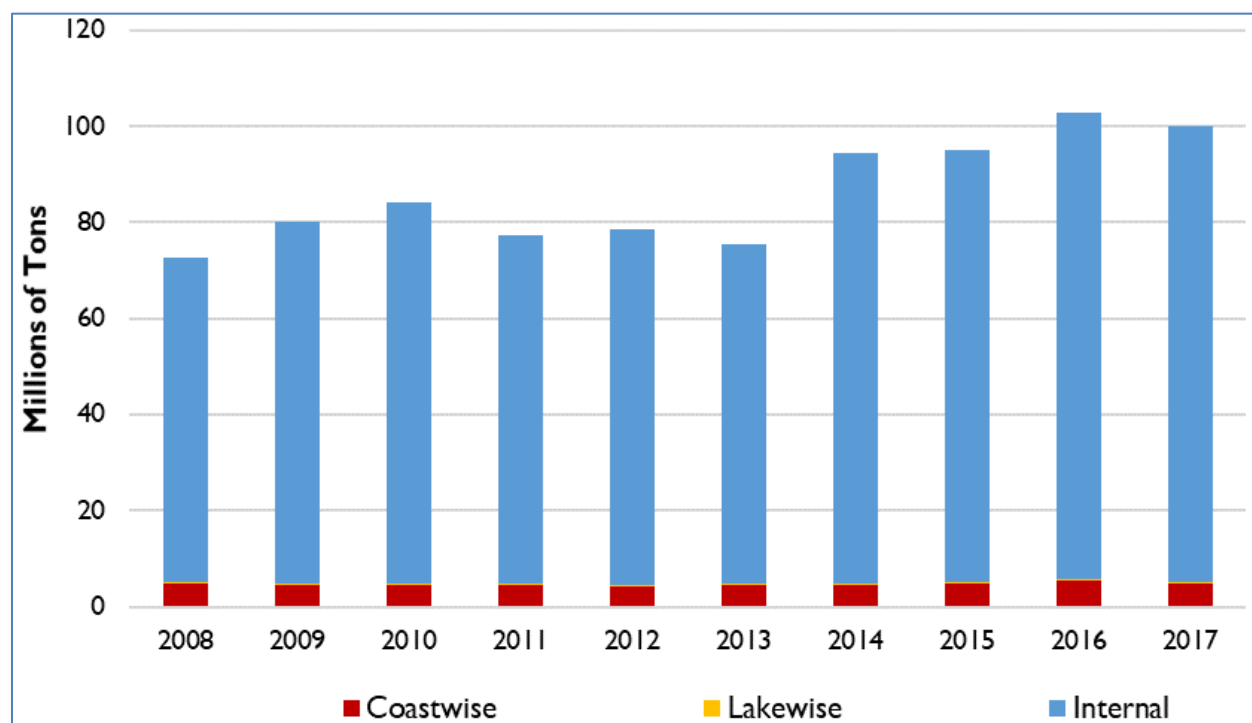
NOTES: Does not include intra-port and intra-territory moves.
SOURCE: U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center, *The U.S. Waterway System Fact Cards, 2008–2017*, available at http://www.navigationdatacenter.us/ as of October 2018.

Food and Farm Products

The 49 ports profiled in this report handled a total of 333.2 million tons of food and farm cargo in 2017, 15.2 percent of their total cargo, but a 2.3 percent decrease from 2016 (Figure 5-8).[51] The 219.9 million tons of foreign food and farm cargo accounted for 66.0 percent of the total in 2017 as the percentage of foreign cargo increased over each of the prior 3 years. The remaining 34.0 percent of the cargo was domestic, a total of 113.3 million tons. The top 25 dry bulk ports handled 80.7 per cent of the food and farm product tonnage transported through the 49 ports.[52]

---

[51] U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center, special tabulation as of November 2018.
[52] Ibid.

Figure 5-8: Total Food and Farm Products Cargo at 49 Profiled Ports, 2014–2017
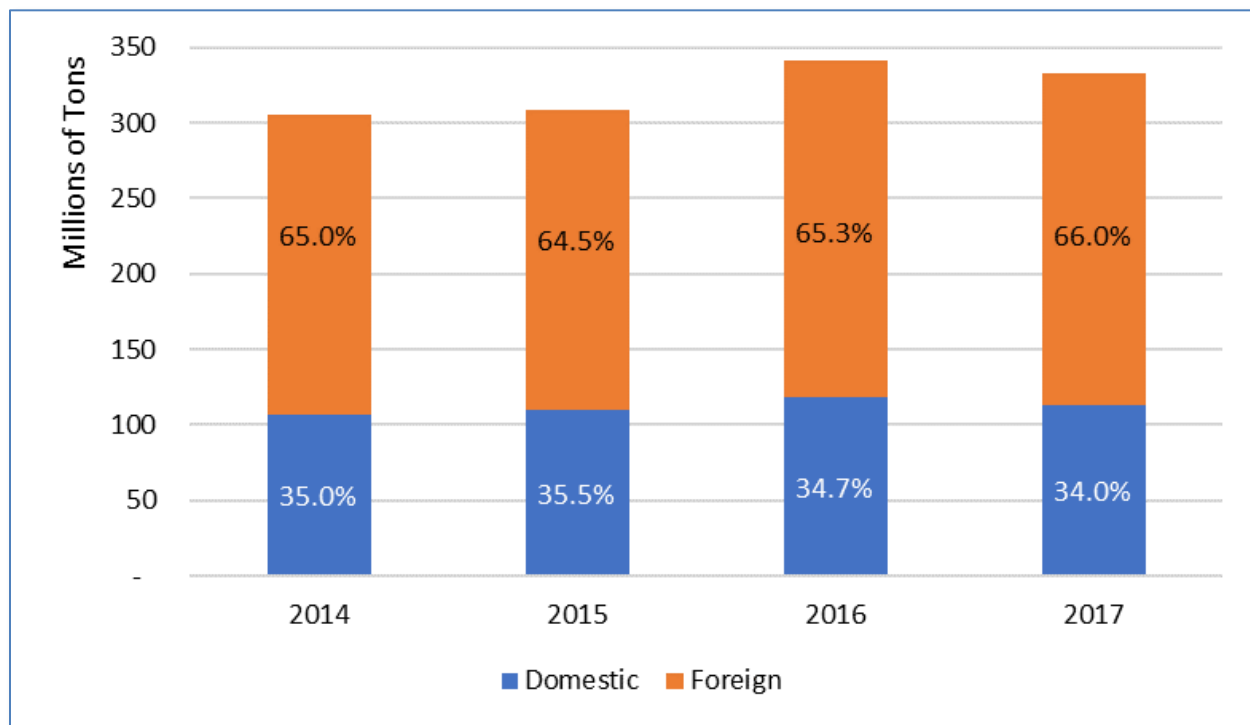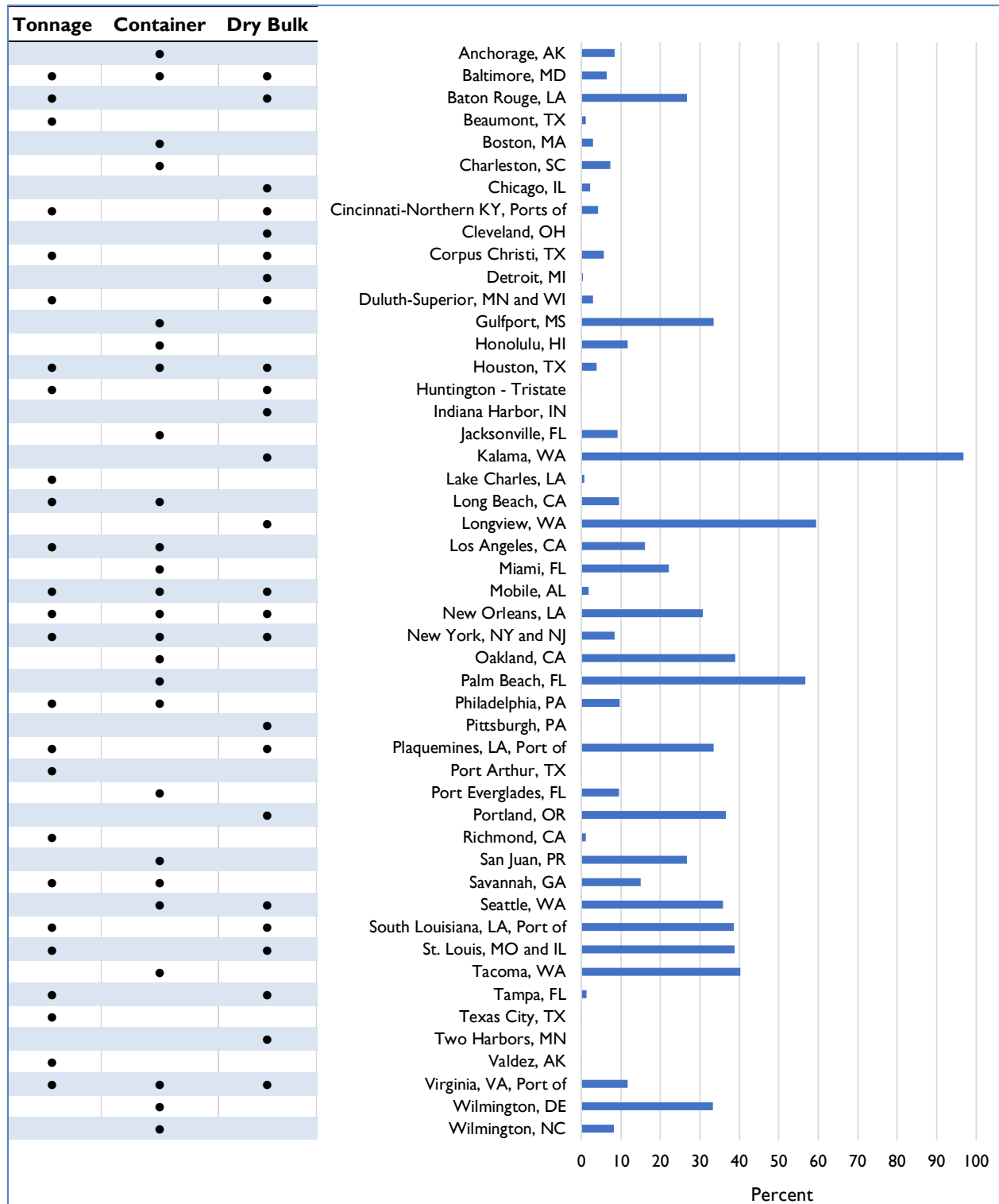

NOTES: *Domestic* includes coastwise, lakewise, and internal movement of cargo. *Foreign* includes inbound and outbound movement of cargo.
SOURCE: U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center, special tabulation, as of November 2018.

Exports account for 81.5 percent of the foreign food and farm products cargo at the 49 profiled ports, with 179.3 million tons. The remaining 18.5 percent was imports, with 40.6 million tons. Food and farm products account for a larger share of exports than imports, with 27.2 and 6.9 percent of the tonnage, respectively. Figure 5-9 displays the share of tonnage related to food and farm products at each profiled port. Ports such as Kalama, WA and Longview, OR are dominated by bulk agricultural products, while major container ports such as Los Angeles, Long Beach, or New York-New Jersey have a relatively small share attributed to agricultural trade.

Figure 5-9: Percentage of Food and Farm Products Tonnage at 49 Profiled Ports, 2017

| Port	Tonnage	Container	Dry Bulk
Anchorage, AK			●
Baltimore, MD	●	●	●
Baton Rouge, LA	●		●
Beaumont, TX	●		
Boston, MA		●	
Charleston, SC		●	
Chicago, IL			●
Cincinnati-Northern KY, Ports of	●		●
Cleveland, OH			●
Corpus Christi, TX	●		●
Detroit, MI			●
Duluth-Superior, MN and WI	●		●
Gulfport, MS		●	
Honolulu, HI		●	
Houston, TX	●	●	●
Huntington - Tristate	●		●
Indiana Harbor, IN			●
Jacksonville, FL		●	
Kalama, WA			●
Lake Charles, LA	●		
Long Beach, CA	●	●	
Longview, WA			●
Los Angeles, CA	●	●	
Miami, FL		●	
Mobile, AL	●	●	●
New Orleans, LA	●	●	●
New York, NY and NJ	●	●	●
Oakland, CA		●	
Palm Beach, FL		●	
Philadelphia, PA	●	●	
Pittsburgh, PA			●
Plaquemines, LA, Port of	●		●
Port Arthur, TX	●		
Port Everglades, FL		●	
Portland, OR			●
Richmond, CA	●		
San Juan, PR		●	
Savannah, GA	●	●	
Seattle, WA		●	●
South Louisiana, LA, Port of	●		●
St. Louis, MO and IL	●		●
Tacoma, WA		●	
Tampa, FL	●		●
Texas City, TX	●		
Two Harbors, MN			●
Valdez, AK	●		
Virginia, VA, Port of	●	●	●
Wilmington, DE		●	
Wilmington, NC		●	

Percent

SOURCE: U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center, special tabulation, as of November 2018.

In 2017 the 49 profiled ports handled 93.8 million tons of soybeans, of which 40.4 million tons was domestic and 53.4 million tons was import/export, and 81.5 million tons of corn, of which 36.1 million tons was domestic and 45.5 million tons was import/export. Soybeans and corn together account for 52.6 percent of the total food and farm tonnage at those ports in 2017. Soybeans accounted for 35.7 percent of domestic tonnage and corn accounted for 31.8 percent of domestic tonnage (Figure 5-10). Soybeans accounted for 24.3 percent of import/export tonnage and corn accounted for 20.7 percent of import/export tonnage (Figure 5-11).

Figure 5-10: Share of Domestic Food and Farm Products Tonnage by Category at 49 Profiled Ports, 2017

Total Domestic Food and Farm Product Tonnage at Profiled Ports: 113.3 million tons
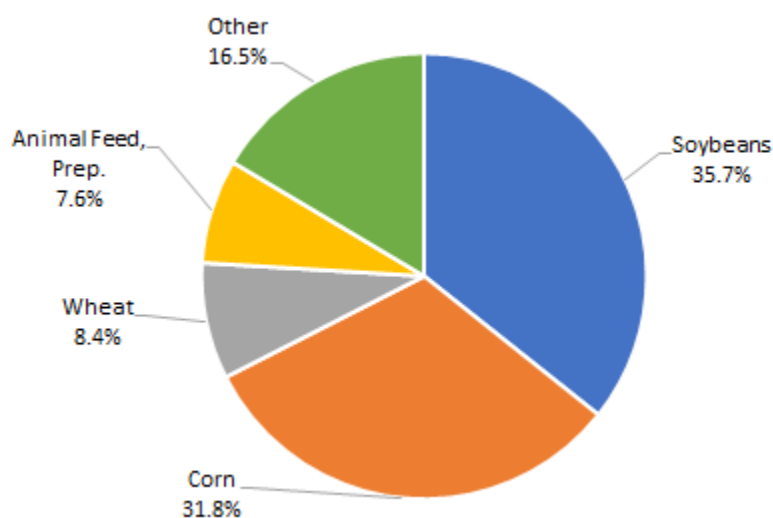
SOURCE: U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center, special tabulation, as of November 2018.

Figure 5-11: Share of Import/Export Food and Farm Products Tonnage by Category at 49 Profiled Ports, 2017

Total Import/Export Food and Farm Product Tonnage at Profiled Ports: 219.9 million tons
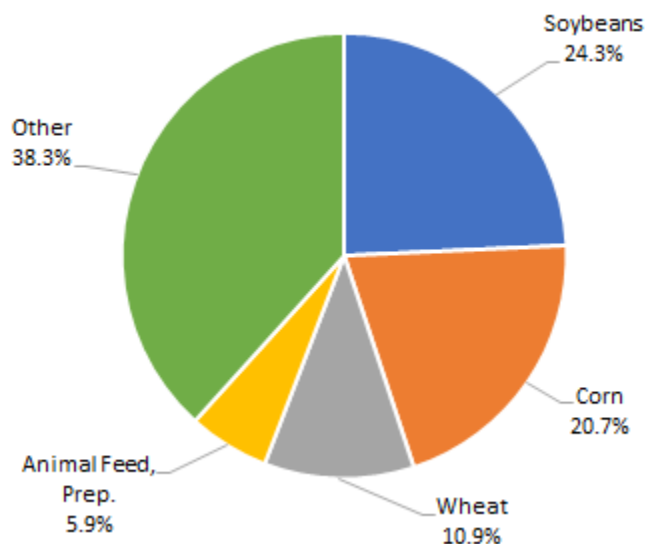
SOURCE: U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center, special tabulation, as of November 2018.

Grains and Soybeans

The USDA Agricultural Marketing Service (AMS) reports that soybeans[53] were the largest agricultural export by value in 2017 at $22.8 billion, followed by corn at $9.9 billion.[54] Corn and soybeans are the top two grains by weight produced in the United States, with 408.9 million tons of corn grown in 2017 and 131.7 million tons of soybeans.[55] Corn production has increased by 20.8 percent over the past decade, while soybean production has increased by 48.0 percent.[56]

In 2017, 9.6 percent of total U.S. waterborne grain exports were transported in containers. Asia is the primary destination for U.S. grain exports, accounting for 68.1 percent of the total tonnage and 91.4 percent of the containerized tonnage.[57] Containerized exports of grains and soybeans increased faster than bulk exports, with a 35.1 percent increase in containerized tonnage between 2008 and 2017, versus a 28.3 percent increase in bulk tonnage.[58]

---

[53] Soybeans are technically a pulse, part of the pea family, but are treated as a grain in most discussions and statistics.
[54] USDA, Economic Research Service, *U.S. Agricultural Exports Year-to-date and Current Months,* available at https://www.ers.usda.gov as of October 2018.
[55] Association of American Railroads, *Railroads and Grain*, available at https://www.aar.org/ as of August 2018.
[56] Ibid.
[57] U.S. Census Bureau, Foreign Trade Division, *USA Trade Online*, available at https://usatrade.census.gov as of August 2018. Commodities include HTS codes: 1002, 1003, 1004, 1005, 1007, 1101, 1102, 1201, 1208, 2302, 2303, and 2309.
[58] U.S. Census Bureau, Foreign Trade Division, *USA Trade Online*, available at https://usatrade.census.gov as of August 2018.

Figure 5-12: Waterborne Grain Export Tonnage from U.S. Ports, 2008–2017
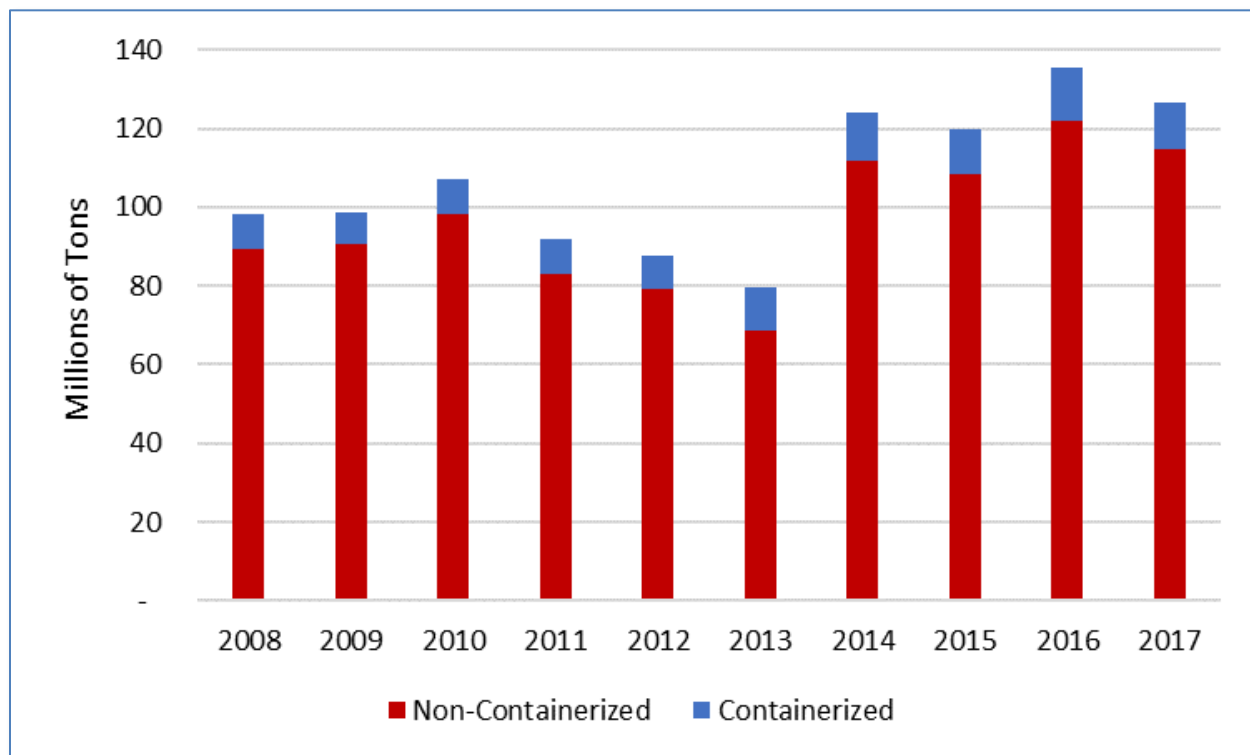
SOURCE: U.S. Census Bureau, Foreign Trade Division, *USA Trade Online*, available at https://usatrade.census.gov as of September 2018.

Grains moving along the Nation's inland waterways are primarily transported by barge. In 2017, 22.2 million tons of corn and 16.1 million tons of soybeans were transported on the Mississippi River.[59] Of the 150.5 million tons of grain inspected and/or weighed for export in 2017, 57.0 percent departed from Mississippi River, Texas, or Gulf ports, with 28.4 percent departing from Pacific Northwest ports.[60]

Rail is also an important mode for the transportation of grains movements to ports for export. Class I railroads carried 144.1 million tons of grain in 2017, 8.9 percent of the total tonnage handled.[61] That total included 71.7 million tons of corn (49.8 percent of the total) and 27.0 million tons of soybeans (18.7 percent of the total).[62] The largest destination for rail grain

---

[59] U.S. Department of Agriculture (USDA), Agricultural Marketing Service, *Grain Transportation Report*, available at https://www.ams.usda.gov/ as of August 2018

[60] USDA, Agricultural Marketing Service, *USDA Market News* (Jan. 16, 2018), available at https://www.ams.usda.gov/ as of August 2018.

[61] Association of American Railroads, *Railroads and Grain*, available at https://www.aar.org/ as of August 2018.

[62] Ibid.

deliveries to ports is the Pacific Northwest, with 69.4 percent of the total in 2017, while 25.3 percent was delivered to ports on the Gulf Coast.[63]

Growing seasons and subsequent harvests vary by grain type and time of year. The combination of short harvest periods and cargo perishability can increase pressure on the transportation network. Ports must provide sufficient export capacity to avoid potential spoilage from delays.[64] Harvest timing affects grain export tonnage: corn and wheat exports are typically lowest in October through January, when soybean exports are highest (Figure 5-13). Grain-growing locations also have a major influence on shipping patterns, with crops along the Mississippi River more likely to be exported through Gulf Coast ports. Spring wheat, for example, is harvested primarily in Montana and North Dakota, while winter wheat is grown primarily in Colorado, Kansas, Montana, Oklahoma, Oregon, Texas, and Washington.[65] The impact of the seasonality of food and farm products on port performance can be significant and varies from port to port. The port profiles (see Appendix A: Port Profiles) contain an index that depicts quarterly movement of agricultural products through ports.

Figure 5-13: Monthly Exports of Soybeans, Wheat, and Corn, 2017
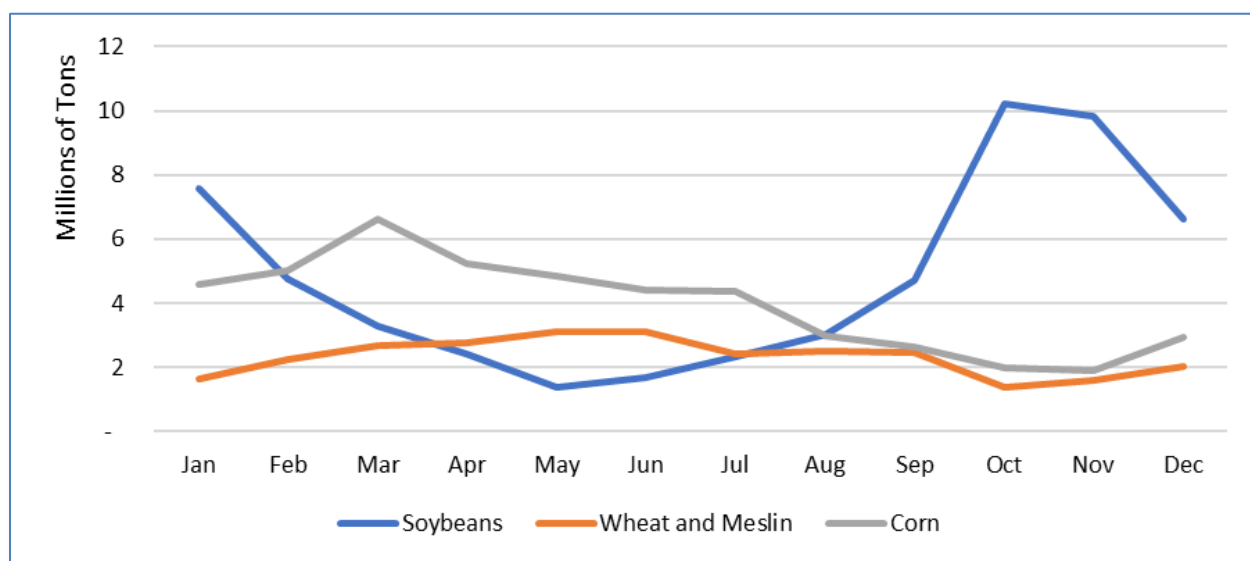
NOTE: Wheat tonnage includes meslin, a combination of wheat and rye that is sown and harvested together.
SOURCE: U.S. Census Bureau, Foreign Trade Division, *USA Trade Online*, available at https://usatrade.census.gov/ as of August 2018.

---

[63] USDA, Agricultural Marketing Service, *Grain Rail Deliveries to Port*, available at https://www.ams.usda.gov/ as of October 2018. Excludes cross-border and based on carloads.
[64] After an April through May planting season, the 2017 corn harvest started in early September with peak activity between mid-October and mid-November. The 2017 soybean harvest (following a May planting) began in mid-September and neared completion in late October. There are two harvests of wheat: winter wheat planted in September and October 2016 for a June-July 2017 harvest; and spring wheat planted in April and May 2017 for an August 2017 harvest. Ibid.
[65] USDA, National Agricultural Statistics Service, *Crop Production by County*, available at https://www.nass.usda.gov as of August 2018.

Impact on Port Infrastructure and Productivity

Agricultural product seasonality creates import and export cargo volume surges throughout the year. As noted above, corn exports peak in spring while soybean exports peak in winter. Recently harvested fruits and vegetables from the southern hemisphere reach the U.S. market during the spring months. The impact on ports varies by cargo composition and market served. A terminal that specializes in dry bulk grain exports, for example, will experience a larger increase in tonnage during peak months than a containerized terminal that imports and exports a variety of food and farm products.

The perishable nature of food and farm products has led to development of specialized terminals and equipment that keep cargo chilled. Perishable containerized cargo in reefers requires electrical power (plugs) at the terminal and on the vessel to maintain a food-safe temperature. Port authorities and terminal operators need to ensure power supply for reefers to handle increased perishable imports and exports. Some USDA sanitary requirements for pests and pathogens for imported fruit have led to construction of port cold-storage facilities. These facilities allow importers to chill cargo for specified times at the port rather than transporting the cargo to an off-site location, saving both time and money. In some cases, terminals and vessels are operated by a single major fruit company, optimizing port infrastructure for those commodities.

Delays at any point in the transportation network can result in spoilage. For example, winter storms may delay rail service, port congestion may delay imports, and lock maintenance can delay barges. Transportation of export food and farm products to ports can also be delayed by reductions in inland waterway channel depths and widths.

5.3 Spotlight: Impacts of Extreme Weather on Port Capacity and Throughput

Weather affects the operations of coastal, lake, and river ports. Hurricanes and typhoons have made headlines worldwide for their effects on coastlines, but other extreme weather events like snow storms, heavy fog, droughts, and heavy rain can force terminal closures or prompt draft restrictions. For example, the length of the navigation season for the St. Lawrence Seaway is based upon the presence of ice.

Automatic Identification System (AIS) data can be used to measure the resilience of ports to severe weather disruptions. Resilience is defined as a four-part cycle involving ports' ability to

prepare, resist, recover, and adapt to disruptions (Figure 5-14).[66],[67] AIS data is broadcast in real-time from transponders onboard individual vessels and includes information like vessel name, vessel type, speed, and location.[68] Within the United States, vessel data is maintained by the U.S. Coast Guard and the U.S. Army Corps of Engineers has developed a web application to easily query this stored data.[69]

Figure 5-14: Four-Part Resilience Cycle

SOURCE: U.S. Army Corps of Engineers, personal communications, 2018.

New methods utilizing AIS are being developed to measure and understand the nature of weather impacts on port performance. By knowing how a particular port is able to resist and recover from a storm, port authorities, terminal operators, and government can evaluate the efficiency of best practices for response and recovery. They can also make informed decisions about how-to best adapt existing practices so that ports are better prepared for future storms. These actions increase port resilience; an aim that then improves the reliability of port capacity and throughput when faced with future storms.

Hurricane Season Impact on Port Capacity and Throughput (2017 – 2018)

The 2017 hurricane season produced 17 named storms, with 4 hurricanes making landfall in the United States: Harvey, Irma, Maria, and Nate. This spotlight focuses on the three hurricanes

---

[66] Rosati, J. D., Touzinsky, K. F., and Lillycrop, W. J. [2015]. *Quantifying Coastal System Resilience for the US Army Corps of Engineers*. Environment Systems and Decisions, 35(2), 196-208.
[67] Obama, B. (2013). *Executive order 13653: Preparing the United States for the impacts of climate change*. The White House, Washington, DC.
[68] ITU (International Telecommunication Union). (2010). "Technical characteristics for an automatic identification system using time division multiple access in the VHF maritime mobile band." ITU-R M.1371-5, Geneva, Switzerland.
[69] AISAP [Computer software]. U.S. Army Corps of Engineers, Washington, DC.

that occurred in quick succession between August and October 2017: Harvey in Texas, and Irma and Maria in the Caribbean. Each storm had unique damage factors (e.g., inland flooding during Harvey, storm surge during Irma, and high winds during Maria) that affected large geographic regions in a short time, and impacted operations of at least 45 ports throughout the lower continental U.S. and U.S. Caribbean areas. As of November 7, 2018, the 2018 hurricane season had produced 14 named storms with 2 hurricanes making landfall in the United States: Florence and Michael. Selected storm tracks and container port closures along the Atlantic and Gulf Coasts of the United States are shown in Figure 5-15.

**Figure 5-15: Hurricane Tracks and Select Container Port Closures, 2017 and 2018**
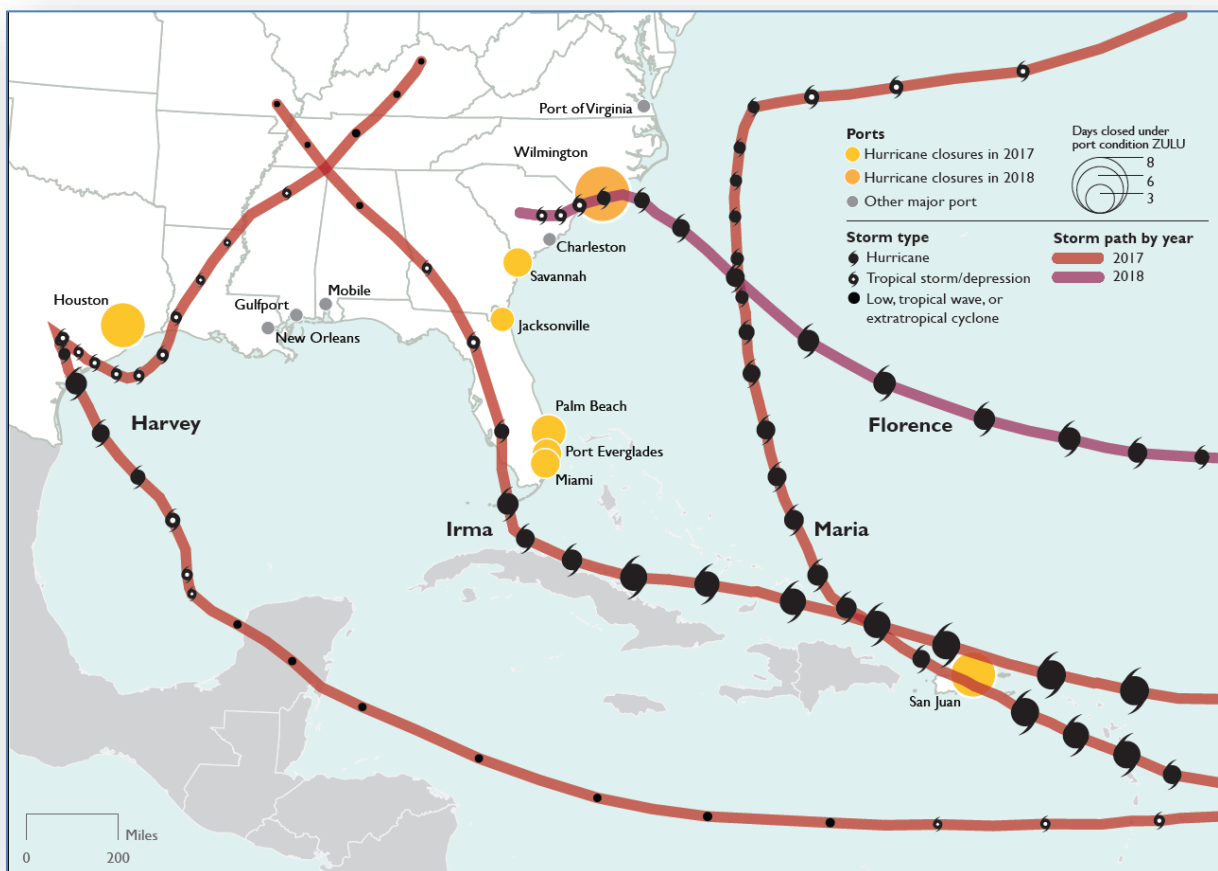
SOURCES: *Hurricane paths*: based on preliminary best track data from the U.S. Department of Commerce, National Oceanic and Atmospheric Administration (NOAA), National Hurricane Center (NHC), NHC Data in GIS Formats, available at http://www.nhc.noaa.gov/gis/, as of October 2018. *ZULU conditions*: based upon data from the U.S. Coast Guard's Homeport, as of October 2018.

The impact of Hurricane Harvey on shipping in the Houston-Galveston area can be depicted via heat maps created from AIS signal densities that show the presence of ships for 24-hour periods before, during, and after the storm (Figure 5-16). These heat maps provide examples of

when the area was under normal operating conditions on August 1, after U.S. Coast Guard (USCG) declared the Port of Houston under condition ZULU (requiring vessels to depart the area) on August 25, and in anticipation of port reopening with vessels queued in anchorage areas on September 4.

Figure 5-16: Vessel Heat Maps of the Houston-Galveston Area Before, During, and After Hurricane Harvey
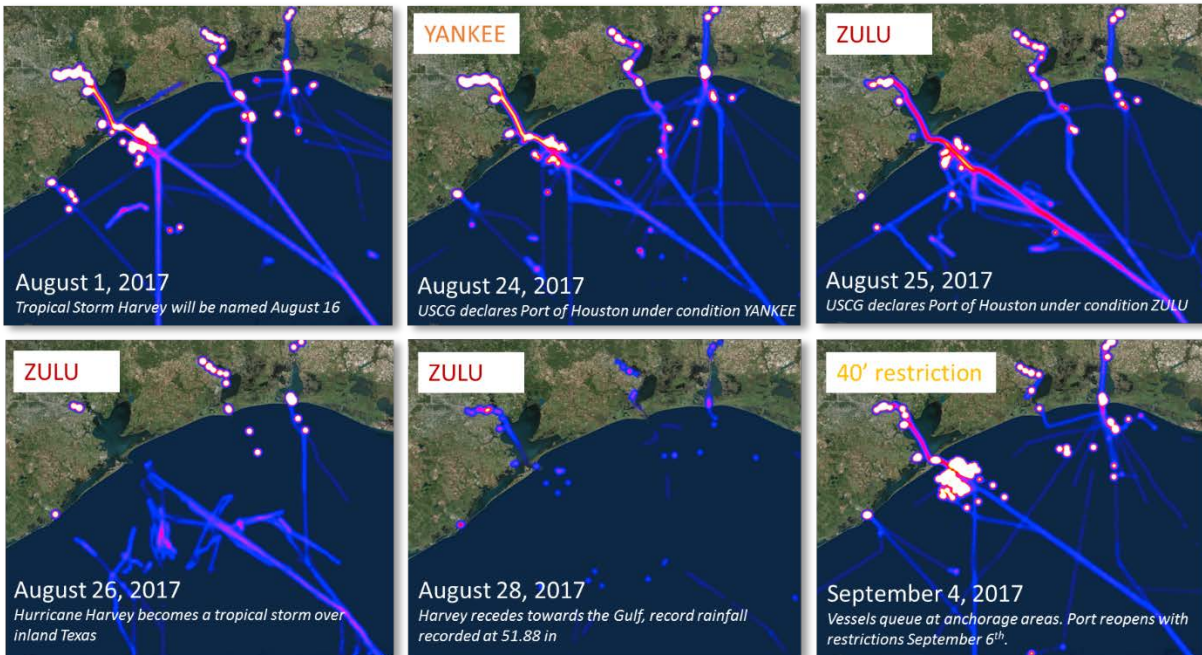
KEY: *Yankee*: ports are closed to inbound traffic and vessel traffic control measures in effect on vessel movements within the port. *Zulu*: ports are closed to all inbound and outbound traffic. 40' restriction: ports are open to vessels with a draft less than 40 feet.
NOTES: *White* – heavy vessel traffic. *Magenta* - medium vessel traffic. *Blue* - low vessel traffic.
SOURCE: U.S. Army Engineer Research and Development Center, *Automatic Identification System Analysis Package*, available at https://ais-portal.usace.army.mil as of October 2018.

These impacts can also be observed via indicators and statistical analysis developed from AIS data. For example, net vessel count describes the traffic in and out of a port or major waterway and provides qualitative insights into the disruption of vessel movements and the length of time before full recovery. Net vessel count to estimate the time it takes ports to return to normal post-storm activity (e.g., 11-days for Houston-Galveston Ports) by comparing the count of cargo and tanker ships within the port during normal operations with the count after reopening.[70] The vessel counts after reopening may never return to the pre-storm levels due to draft restrictions or seasonal variations in traffic, so a statistical analysis identifies any increased

---

[70] Touzinsky, K., Scully, B.S., Kress, M.K., and K.M. Mitchell. 2018. *Using Empirical Data to Quantify Port Resilience: Hurricane Matthew and the Southeastern Seaboard.* Journal of Waterway, Port, Coastal and Ocean Engineering. 144(4): 05018003

probability of "changepoints" (or times where the net vessel count undergoes a meaningful change).[71] This analysis indicates when a port closes, reopens, and importantly, when traffic returns to a "post-storm normal" state.

Simple metrics such as monthly vessel counts can also be calculated from AIS data. The Port of Ponce in Puerto Rico typically received five tanker vessel calls per month in the years prior to Hurricane Maria. After Hurricane Maria devastated Puerto Rico in late September 2017, Ponce was heavily utilized by vessels delivering supplies for emergency response and energy grid restoration.[72] This shift was revealed by an increase in towing and tug vessels in the area following the hurricane (Figure 5-17).[73]

Figure 5-17: Monthly Freight Vessel Counts for the Port of Ponce, Puerto Rico: January 2016 – December 2017
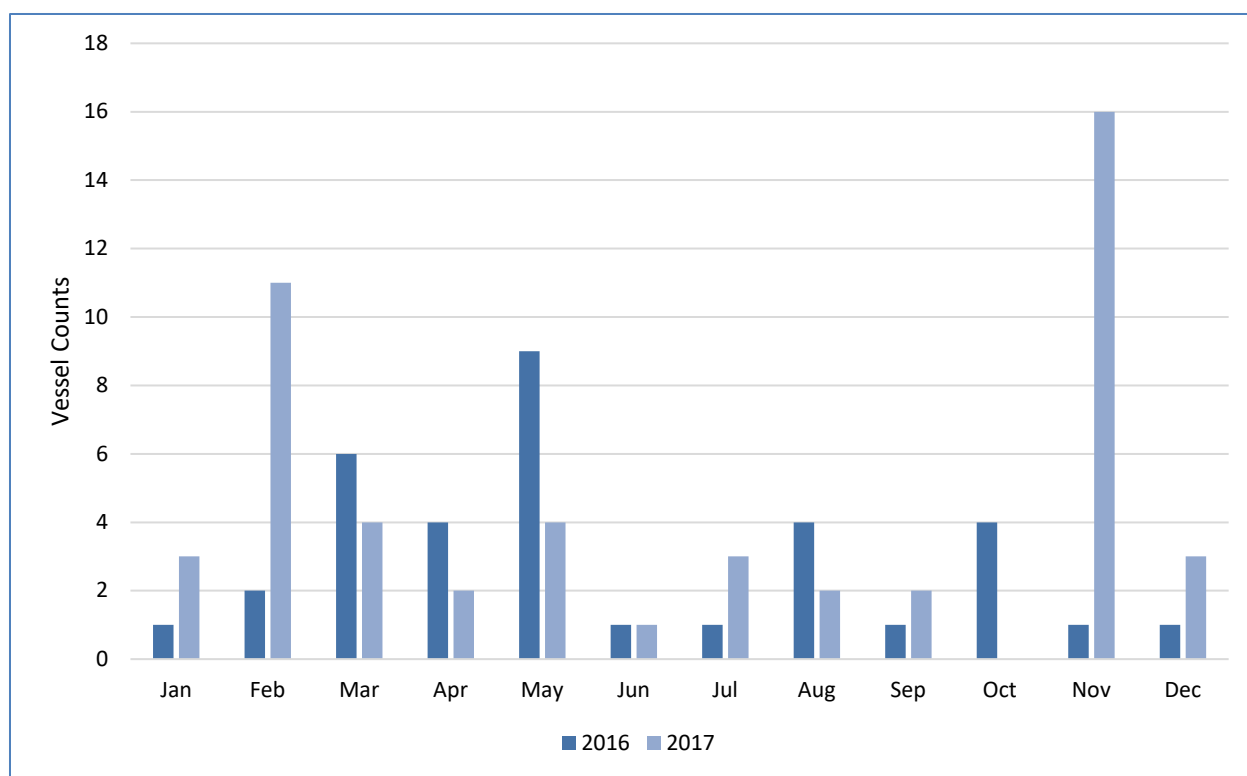
NOTE: AIS data may be incomplete from September 20, 2017 to February 1, 2018. Freight vessels include the following vessel types: cargo, tanker, and towing and tug.
SOURCE: U.S. Army Engineer Research and Development Center, *Automatic Identification System Analysis Package*, available at https://ais-portal.usace.army.mil as of October 2018.

---

[71] Changepoints are found using a Bayesian Changepoint Analysis (BCA) and are defined as the probability that a change in the data has been observed over time. For more information on BCA, see Adams, R.P. and MacKay, D.J.C. 2007. *Bayesian Online Changepoint Detection*. University of Cambridge Technical Report, Cambridge, U.K.

[72] U.S. Army Engineer Research and Development Center, personal communications, November 2018.

[73] The impacts of Hurricane Maria negatively impacted many land-based AIS receivers and transmissions of data to storage centers was intermittent. Therefore, while AIS data was available for the area it cannot be considered a complete dataset until February 2018.

Winter Storm Impacts on Port Capacity and Throughput

For coastal ports, disruptions are not limited to hurricanes. The same port performance analyses can yield insights into performance for all type of disruptions, including winter storms. The January 2018 North American blizzard (informally named Winter Storm Grayson) was an intense low-pressure system that affected the U.S. Atlantic Coast from January 3-5, 2018.[74] Wind gusts of up to 76 miles per hour were recorded in Nantucket, MA, and snowfall accumulated from Florida (0.25 inches) to Maine (22.0 inches).[75] Winter Storm Grayson caused over a billion dollars' worth of damage in the region,[76] and required the Port of Virginia to close its truck gates and several terminal operations for three days.

As snow and wind impacted the region, the net vessel count estimates from AIS data reveal that a large number of cargo and tanker vessels were halted. Although the USCG did not issue a condition ZULU, mariner updates from the Port of Virginia indicated that truck gates and terminals were closed.[14] However, the impacts were short-lived, as normal operations returned almost immediately to the navigation channels in the area (Figure 5-20). The Port of Virginia indicated on the day following the storm that extended hours for truck gates would be announced.[77] It is possible that these extended hours, along with storm preparations, may have expedited recovery of shipping operations.

---

[74] NOAA, National Centers for Environmental Prediction (NCEI) (2018): "Storm Summary Message", available at https://www.wpc.ncep.noaa.gov/ as of October 2018.
[75] Ibid.
[76] NOAA, National Centers for Environmental Information (NCEI) *U.S. Billion-Dollar Weather and Climate Disasters* (2018), available at https://www.ncdc.noaa.gov/billions/ as of October 2018.
[77] Port of Virginia, *Winter Weather Advisory 3* (January 4, 2018), available at http://www.portofvirginia.com/ as of October 2018.

Figure 5-18: Daily Vessels Counts by Type at the Port of Virginia, December 20, 2017 - January 20, 2018
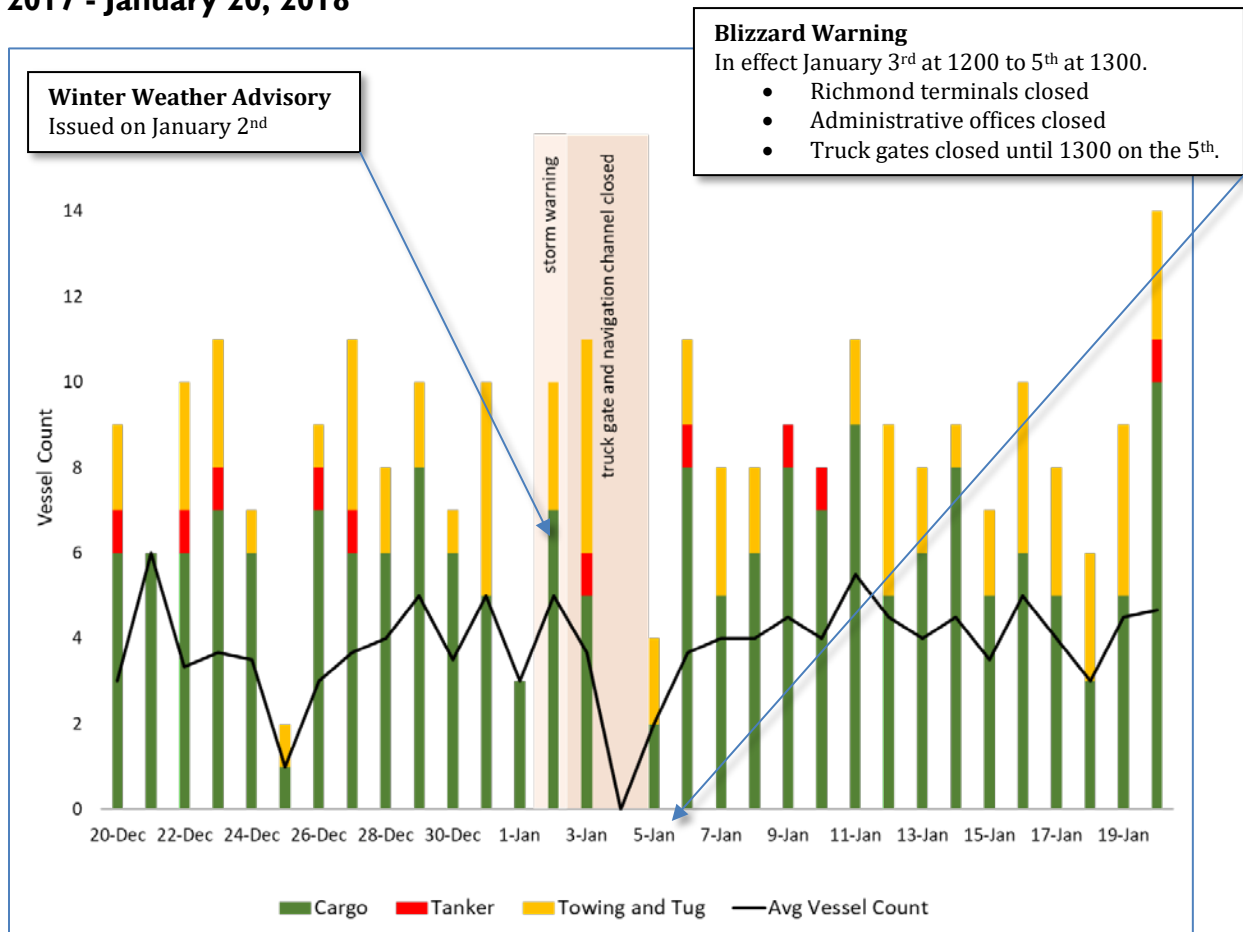
SOURCE: U.S. Army Engineer Research and Development Center, *Automatic Identification System Analysis Package*, available at https://ais-portal.usace.army.mil as of October 2018.

The impact of the storm is also apparent when vessel types are considered; the only vessels moving in the area during the full force of the storm were tug boats. Cargo, tanker vessels and associated towing and tug vessels had returned to the area almost immediately after port reopening on January 6.

As each storm season passes, lessons learned during response and recovery lead to identification of best practices following discussion among maritime agencies, emergency responders, and port communities. Analyses of response and recovery using empirical data gathered in the field is especially helpful to sparking discussion amongst responders. The information has been used in this way to evaluate the successes, challenges, and best practices for the 2017 hurricane season by the U.S. Committee on the Marine Transportation Team

Resilience Integrated Action Team.[78] While every storm and every port are unique, the analysis methods outlined in this spotlight allow decision makers to prioritize or justify investments in adapting operations, coordination, or infrastructure to be better prepared for the next storm season.

---

[78] U.S. Committee on the Marine Transportation System Resilience Integrated Action Team, available at https://www.cmts.gov/topics/resilience as of November 2018.

6. LOOKING AHEAD

This effort to present nationally consistent statistics on port throughput and capacity represents a continuing evolution in the development of a complete national port performance picture.

As discussed with the 2016 Working Group, the Bureau of Transportation Statistics (BTS) must consider six basic questions when considering development of a new measure for port performance (or any other topic in the Bureau's domain):

- Is the proposed statistic relevant to capacity and throughput?

- Is the statistic nationally consistent?

- Is the statistic reasonably accurate, timely, and verifiable?

- Are data collection and estimation methods transparent?

- Is the statistic based on data that are affordable to collect or obtain?

- If data collection is required, is respondent burden kept to a minimum?

The evolving nature of the port industry and of data collection itself presents BTS with both challenges and opportunities in further developing the Port Performance Freight Statistics Program.

Developing Future Port Performance Measures

To avoid burdensome and costly surveys, BTS is exploring a variety of unobtrusive methods to measure port performance. Examples include determining port capacity using satellite imagery, calculating containers moved per vessel dwell time, and measuring truck turn times in port.

USACE collected extensive data on port infrastructure for many years through on-site surveys. The resulting information was compiled in a database of load capacity, mechanical handling facilities, berth space, apron width, and other details. The information was compiled for piers, wharves, and docks at principal ports. However, the collection of these detailed characteristics was discontinued in 2008 due to budget constraints, and a significant portion of the information is now at least a decade old.

Some of the key information formerly collected in this legacy program may be extracted from overhead imagery. In the past, aerial photography typically required expensive arrangements with specialized aviation firms. Satellite imagery with adequate resolution is now available at lower cost and greater frequency. However, information cannot be extracted from aerial

photography or satellite imagery until precise landside boundaries of the port are identified. USACE identifies the facilities included in a port's definition, but does not provide precise geo-spatial facility boundaries. BTS has examined a range of port boundaries defined and used by Federal agencies on the U.S. Committee for the Marine Transportation System, but those boundaries are used for specific purposes inconsistent with this program's requirements. Landside boundaries are rarely clear because port infrastructure often blends with surrounding port-related land uses. BTS has developed waterside port boundaries for calculating container and liquid bulk vessel dwell times, but continues work on developing nationally consistent landside port boundaries.

Many factors contribute to the complexity of this ongoing effort to consistently measure port capacity, particularly infrastructure. New technologies such as machine learning, specifically deep learning combined with high resolution satellite imagery, show promise for affordable and nonintrusive ways of measuring port capacity and possibly even throughput for future editions of this *Annual Report*. Once a machine learning model has been developed for one port (e.g., an algorithm for classifying and counting container), it can be used for all ports. Timely satellite imagery in conjunction with machine learning automation may allow BTS to measure port capacity more frequently than previous on-site surveys, which required USACE staff to travel across the country to physically measure port infrastructure.

BTS is also exploring how to measure containers moved per hour of vessel dwell time, which will require linking the number of containers moved for each vessel call to the corresponding dwell time. This measure will help gauge the typical level of effort for each vessel call. BTS is also exploring data sources for the number of loaded, unloaded, and repositioned containers during each vessel call. Ports typically report the number of inbound and outbound twenty-foot equivalent units (TEUs), including those moved by roll-on/roll-off (Ro/Ro), on an annual basis, but do not usually report the number of containers moved by vessel call. TEU is a standard unit of measure, not a count of containers. For example, a single forty-foot container is reported as two TEU. Standard international shipping containers come in a range of sizes from twenty to forty-five feet, but the most common shipping container is forty feet long.

BTS is also exploring publishing technical briefs on topics such as measuring inland freight fluidity, which can indicate dependability, reliability, or predictability between port pairs. BTS continues to explore alternate and big data sources to supplement or supplant data contained in this report. Each year, BTS identifies port data gaps such as berth availability and total global and domestic un-/loaded and empty TEUs, thus BTS will work with its Federal and Transportation Research Board partners to close these gaps.

Trucks link marine container terminals with importer and exporter locations, off-dock rail yards, transloaders, and container storage depots. Truck turn time is the length of time required for a truck to enter a marine terminal and complete a transaction (drop off or pick up a container, or both). There are two components to overall truck turn time at container terminals:

- Queue or wait time, the time spent waiting to enter the terminal gate.

- Terminal time, the time between terminal entry and exit.

The truck turn time issue was raised by the Port Performance Freight Statistics Program Working Group convened in 2016 in accordance with *FAST Act* Section 6018. Despite the desire to have truck turn time information, the Working Group recognized that nationally consistent turn time data were not available, and that there were issues of definition, interpretation, and comparability to be resolved. BTS is reviewing available options for capturing accurate and relevant truck turn time statistics.

The Port Performance Freight Statistics Program serves a variety of stakeholders with diverse information needs and concerns, from USDOT policy officials and members of Congress to the many groups involved in port management and operations to the shipper community to the public. This third annual report reflects an ongoing evolution of the Port Performance Freight Statistics Program to meet the diverse needs and concerns of our stakeholders.

BTS will continue to review stakeholders' comments to this *Annual Report* and develop strategies for improving and expanding statistics on port throughput and capacity. BTS will work with USACE, the Maritime Administration, and the other principal Federal statistical agencies to develop and implement those strategies, as resources allow. BTS looks forward to comments on this third *Annual Report* and ideas for future improvements. Comments and ideas should be sent to PortStatistics@dot.gov or to the Port Performance Freight Statistics Program, Bureau of Transportation Statistics, U.S. Department of Transportation, 1200 New Jersey Avenue, SE, Washington, DC, 20590.

U.S. Department of Transportation
Bureau of Transportation Statistics