# Transportation Statistics Annual Report

2023

U.S. Department of Transportation
**Office of the Secretary of Transportation**

**Bureau of Transportation Statistics**

# Transportation Statistics Annual Report 2023

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# Introduction

Transportation facilitates the economic prosperity and the quality of life. It enables people to engage in productive pursuits and experience the social interactions that take full advantage of efficient spatial specialization and distribution. An efficient and resilient transportation system and its seamless operation underpin the overall efficiency and resilience of the entire economy.

Recognizing the importance of transportation and the importance of objective statistics for transportation decision-making, Congress requires the Director of the Bureau of Transportation Statistics (BTS) of the U.S. Department of Transportation (USDOT) to provide the *Transportation Statistics Annual Report* (TSAR) each year to Congress and the President.[1] BTS published the first TSAR in 1994. This 29th TSAR edition documents the conduct of the duties of BTS as called out in the statute.

Recent events such as the COVID-19 pandemic, unrests in eastern Europe and Middle East, and ongoing geopolitical tensions in Asia and Pacific regions have accelerated changes in domestic and international commerce and passenger flows that normally proceeded at a gradual pace. Manufacturing reshoring, nearshoring, and friendshoring are only some aspects of the overall derisking effort that are already producing unprecedented changes in transportation supply, demand, and performance. The transportation systems and operations must adapt itself to accommodate and facilitate such changes. At the same time, ongoing technological changes, shifting national priorities, and cultural, demographic, and economic challenges have altered expectations of what is important to report to transportation stakeholders. To adjust to the colossal changes, data needs have become more foundational to decision-making. Emerging challenges, such as a better understanding of the impact of telework and eCommerce on transportation; identifying the roles of ride-hailing services, E-scooters, and E-bikes in providing mobility; measuring supply chain performance, vulnerability, and resilience; and reporting on equity, sustainability, and climate are critical concerns identified in the FY 2022- 26 USDOT Strategic Plan and are among the current and ongoing efforts of providing data to support transportation decision-making.

The U.S. Department of Transportation and many other organizations, such as the Transportation Research Board of the National Academy of Sciences, Engineering, and Medicine and the University Transportation Centers program overseen by USDOT, are actively exploring new measures and methods of gathering data to support transportation. More frequent and timely data collection, more geographic detail, and leveraging digital communications and data tools to speed the

[1] Title 49 U.S. Code § 6302.

collection and processing of data are supporting the advancements in data reporting.

This report is organized into 7 chapters that reflect the topics in BTS's legislative mandate, including some new data items. Aside from this Introduction, the report components are Chapter 1 State of the System, Chapter 2 Passenger Travel and Equity, Chapter 3 Freight and Supply Chain, Chapter 4 Transportation Economics, Chapter 5 Transportation Safety, Chapter 6 Energy and Sustainability and Chapter 7 State of Transportation Statistics.

A notable addition to this year's TSAR is the coverage of Emerging Issues. Each chapter identifies notable emerging issues in transportation related to the subject areas (refer to the callout box).

The concluding chapter on the state of transportation statistics documents lessons BTS and its partners have learned from measuring fast-evolving events and highlights changing data needs in response to new legislation.

BTS welcomes comments on the Transportation Statistics Annual Report (TSAR) and the Bureau's other products. Comments, questions, and requests for printed copies should be sent to bts@dot.gov or the Bureau of Transportation Statistics, U.S. Department of Transportation, 1200 New Jersey Avenue SE, Washington DC, 20590.

## Emerging Issues Included in TSAR 2023

Chapter 1 State of the System discusses Recovering from the COVID-19 Pandemic.

Chapter 2 Passenger Travel and Equity discusses COVID Impact on Passenger Travel.

Chapter 3 Freight and Supply Chain discusses Disruptions to the Supply Chains from Drought.

Chapter 4 Transportation Economics discusses Inflation and Transportation.

Chapter 5 Transportation Safety discusses New Normal in Transportation.

Chapter 6 Energy and Sustainability discusses Transition to New Energy Sources for Transportation.

Previous editions of the TSAR are available at www.bts.gov/tsar.

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# CHAPTER 3
# Freight and Supply Chain

## Introduction

Freight transportation provides essential links among economic units from production to consumption, serving all sectors of the economy and supplying consumers with goods. This chapter begins by examining U.S. production, commonly referred to as gross output, and international trade as key drivers of transportation demand. The characteristics of the U.S. freight transportation system and the movement of goods are explored. The chapter concludes by identifying essential data sources which, when made available, can greatly assist in planning and performance monitoring endeavors.

## Highlights

- The total 2022 value of U.S. foreign trade reached about $5.31 trillion, a 15.8 percent increase from 2021. This growth exceeded 2022 trade-specific inflation, signifying a recovery from the effects of COVID-19 and a resurgence in trade activity.
- Trade between the United States and Canada in 2022 amounted to nearly $793 billion, reflecting growth from the $666 billion reported for 2021, equivalent to a 19 percent increase (value not adjusted for inflation).
- In 2022, the U.S. freight transportation system moved nearly 20 billion tons of goods valued at approximately $19.0 trillion.
- Trucking maintained its status as the dominant mode of freight transportation by both weight and value in 2022, moving 12.6 billion tons of cargo valued at over $13.6 trillion. This represented 64.5 percent of the total freight weight and 72.5 percent of the total value.
- U.S. east coast ports handled 106.7 billion tons versus 97.2 billion tons for U.S. west coast ports.
- U.S. east coast ports have shown continuous growth of Asian imports over the past 10 years, approaching a near-even split in 2021. U.S. east coast ports' Asian imports ultimately surpassed U.S. west coast ports in 2022, importing 70.2 billion metric tons compared to 63.2 billion imported metric tons for the U.S. west coast ports.
- Pipelines dominated U.S.-Canada trade in 2022, carrying about 44.8 percent of total freight weight. Carrying 58.4 percent of freight weight, vessel transport is the dominant mode in U.S.-Mexico trade. Trucks are the second mode of choice for U.S.-Mexico trade, carrying nearly 32 percent of freight weight.
- In 2019, 2020, and 2021, the average vessel dwell times for the top 25 U.S. container ports were 28.1 hours, 28.2 hours, and 32.1 hours, respectively. The average vessel dwell time continued to increase in the first half of 2022, reaching 35.5 hours, altogether showing a gradual increase due to COVID-19-related demand.

Much of the data presented herein is derived from the Freight Analysis Framework (Box 3-A), a data source that provides a comprehensive perspective of freight movement across states and major metropolitan areas, categorized by commodity groups and transportation modes. The Freight Analysis Framework serves as a valuable resource for understanding the intricate web of freight transportation in the United States, facilitating informed decision-making and strategic planning.

## Factors That Affect Freight Transportation Demand

Freight transportation demand hinges significantly on domestic production and international trade. Table 3-1 shows the output of domestic industries that create demand for freight movement. The manufacturing industry continued its leading role as the sector most dependent on the U.S. freight system, representing about 39 percent of total gross output of the eight industries most dependent on the U.S. freight system. The utilities, wholesale trade, and retail trade sectors had their highest outputs during the 2017–2022 period, while agriculture/forestry/fishing/hunting and construction sectors experienced their lowest outputs during the same period. Manufacturing experienced its highest output since COVID-19 year 2020 but has not yet reached its pre-COVID-19 output levels.

Figure 3-1 highlights the international trade that creates additional demand for freight movement. The total 2022 value of U.S. trade reached about $5.31 trillion, a 15.8 percent growth from 2021. The 2022 Import Price Index increased 8.5 percent and the Export Price Index increased 13.0 percent from the previous year; the increases signify a recovery from the effects of COVID-19 and a resurgence in trade activity.[1]

In the same year, Canada maintained its position as the top U.S. trading partner, a status it had attained the previous year (Figure 3-1). Trade between the United States and Canada in 2022 amounted to nearly $793 billion, reflecting an impressive growth over the $666 billion in trade from 2021—a 19 percent increase. Mexico and China also retained in 2022 their second and third positions, respectively, from the previous year. China's trade growth from 2021 to 2022

[1] U.S. Bureau of Labor Statistics, Import Price Index (End Use): All Commodities and Export Price Index (End Use): All Commodities as of December 2023. The U.S. Import and Export Price Indexes (MXP) measure changes in the price of goods and services traded between the United States and its top five trading partners (Canada, Mexico, China, Japan, and Germany).

### Box 3-A Freight Analysis Framework

The Freight Analysis Framework (FAF), produced through a partnership between the Bureau of Transportation Statistics and the Federal Highway Administration, integrates data from a variety of sources to create a comprehensive picture of freight movement among states and major metropolitan areas by major commodity groups and by all modes of transportation. Primarily based on data from the Commodity Flow Survey (CFS), FAF incorporates data from international trade, agriculture, extraction, utility, construction, service, and other sectors.

FAF version 5 (FAF5) provides estimates for tonnage, value, and ton-miles by regions of origin and destination, commodity type, and mode. Data are available for the base year (currently 2017), the recent years (2018–2022), and forecast year estimates through 2050. Data may be accessed through the FAF Data Tabulation Tool.

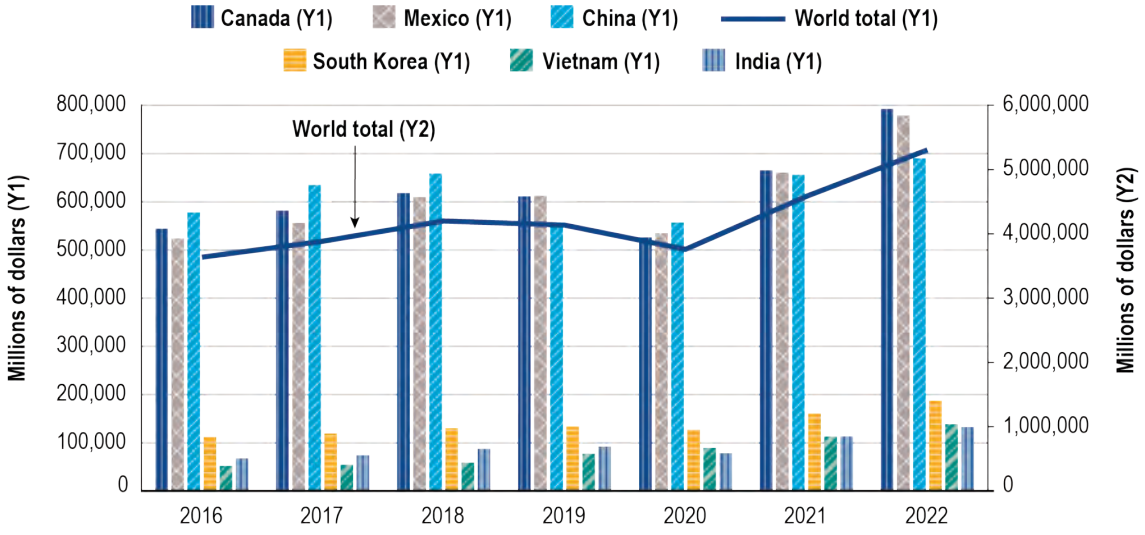
Table 3-1 Gross Output of Freight System-Dependent Industry Sectors: 2017–2022 (Billions of 2017 Chained Dollars)

| Industry sector | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|
| Total of sectors highly dependent on transportation and warehousing | 13,768.1 | 14,181.9 | 14,165.9 | 13,446.8 | 14,177.3 | 14,231.4 |
| Sectors highly dependent on transportation and warehousing | | | | | | |
| Agriculture, forestry, fishing, and hunting | 448.9 | 447.2 | 440.1 | 454.5 | 454.8 | 434.8 |
| Mining | 462.8 | 536.2 | 568.2 | 471.8 | 501.7 | 531.9 |
| Utilities | 474.1 | 496.4 | 492.9 | 481.5 | 492.5 | 507.1 |
| Construction | 1,578.0 | 1,601.3 | 1,614.9 | 1,643.6 | 1,669.3 | 1,564.3 |
| Manufacturing | 5,676.6 | 5,786.4 | 5,724.7 | 5,335.3 | 5,498.2 | 5,541.9 |
| Wholesale trade | 2,053.9 | 2,115.5 | 2,089.1 | 1,986.7 | 2,203.5 | 2,198.7 |
| Retail trade | 1,846.9 | 1,914.6 | 1,932.0 | 1,931.2 | 2,089.5 | 2,092.2 |
| Transportation and warehousing | 1,226.9 | 1,284.3 | 1,304.0 | 1,142.2 | 1,267.8 | 1,360.5 |

NOTES: Chain dollars adjust for inflation over time allowing for equitable comparisons among dollar amounts. Transportation and Warehousing includes warehousing and stroage, water, truck, and pipeline transportation only; rail and air transportation are excluded due to a mix of freight and passenger output. Transit and ground transportation and other transportation and support activities are also excluded due to their focus on passenger transportation.

SOURCE: Bureau of Economic Analysis, *Gross Output by Industry (billions of 2017 chain dollars)*, available at: https://apps.bea.gov/iTable/?reqid=150&step=2 as of November 2023.

Figure 3-1 U.S. Trade Growth with Selected 6 of Top-10 Trading Partners: 2016–2022 (Current Dollars)




NOTES: Not-Seasonally Adjusted (NSA) trade data refers to raw or unadjusted economic data that has not undergone the process of removing seasonal variations. It reflects the actual values observed for a given time period without any adjustments for regular, recurring patterns associated with specific seasons, months, or quarters. NSA data includes the effects of seasonality, making it subject to fluctuations influenced by factors such as holidays, weather patterns, and other calendar-related events. NSA data are not inflation adjusted.

SOURCE: Bureau of Census, U.S. Department of Commerce, "U.S. International Trade in Goods and Services: 2022", available at https://www.census.gov/foreign-trade/Press-Release/ft900/final_2022.pdf as of August 2023.

was more modest, with an increase of about 5.2 percent. Notably, Vietnam, South Korea, Mexico, India, and Canada all exhibited robust growth rates during this period, ranging from a low of 16.6 percent (South Korea) to a high of 23 percent (Vietnam).

U.S. trade with Mexico and China in 2022 amounted to $779 billion and $690 billion, respectively. Mexico's trade experienced significant growth during the 2016–2022 period, surpassing China in trade value in 2019, mainly due to trade tensions in 2018. Although China held the title of the United States' leading trade partner in 2020, primarily due to the surge in pandemic-related consumer purchases, Canada and Mexico reclaimed their historic positions of trade dominance in 2021, securing the top two trading partner positions, while China dropped to third in the list of top 10 trade partners.

## Evolving Trends in Total Freight Movement

In 2022, the U.S. freight transportation system moved nearly 20 billion tons of goods valued at approximately $19.0 trillion (in 2017 dollars) (Table 3-2). This extensive transportation system relied on capital assets totaling $8 trillion, encompassing critical infrastructure elements such as ports, highways, rail systems, airports, and pipelines. In 2022, the industry saw an increase in asset value of $143.3 billion from 2021.[2]

Data from 2022 reveals notable shifts when compared to the pre-COVID-19 year 2019. There was an overall reduction in both weight and value, with a decrease of 321 million tons and $184 billion between 2019 and 2022. The "Air, air and truck" category was the only exception, though with modest weight and value gains from 2019 to 2022. Similarly, the "Multiple modes and mail" sector exhibited marginal growth in terms of value.

Trucking maintained its status as the dominant mode of freight transportation in both weight and value in 2022, moving 12.6 billion tons of cargo valued at over $13.6 trillion. This represented 64.5 percent of the total freight weight and 72.5 percent of the total value. Notably, trucking's freight volume was approximately 8.1 times higher than that of rail, the third-ranked mode. Pipelines played an important role, transporting 3.9 billion tons in 2022, or roughly 19.9 percent of the total freight tons transported, demonstrating the importance of energy-related flows to the entirety of U.S. freight movements.

### *Distance of Freight Movement and Modes of Transportation Used*

In the realm of freight transportation, a considerable proportion of both value and weight is attributed to relatively short distances. In 2022, for instance, freight moved by all modes covering distances less than 100 miles accounted for approximately 30 percent of the total freight value and 36 percent of the total freight weight (Figure 3-2A and Figure 3-2C). This translates to a substantial $5.6 trillion in value and 7.1 billion tons in weight. As shipment distances extend up to 249 miles, these proportions escalate significantly, reaching 56 percent of the total value and 74 percent of the total weight, increasing value and weight to $10.5 trillion and 14.6 billion tons.

When it comes to modal preferences across various distances, the landscape varies considerably. Trucks emerged as the dominant mode, carrying the most goods in terms of value for distances less than 2,000 miles (Figure 3-2B) within the United States. Figure 3-2D and Figure 3-2F illustrate that trucking also carried

[2] Bureau of Transportation Statistics, Freight Transportation and the Economy – Freight-related fixed assets, available at https://data.bts.gov/stories/s/Freight-Transportation-the-Economy/6ix2-c8dn as of September 2023.

Table 3-2 **Freight Weight and Noninflation Adjusted Value by Mode: 2019 and 2022**

| | Weight | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 2019 | | | | 2022 | | | |
| **Millions of tons** | Total | Domestic | Exports[1] | Imports[1] | Total | Domestic | Exports[1] | Imports[1] |
| TOTAL | 19,932 | 17,825 | 1,139 | 968 | 19,611 | 17,414 | 1,208 | 989 |
| Truck | 12,852 | 11,941 | 468 | 443 | 12,641 | 11,747 | 448 | 446 |
| Rail | 1,599 | 1,160 | 267 | 172 | 1,567 | 1,081 | 319 | 167 |
| Water | 821 | 657 | 113 | 51 | 784 | 626 | 118 | 40 |
| Air, air and truck | 7 | 2 | 3 | 2 | 8 | 2 | 4 | 2 |
| Multiple modes and mail | 653 | 538 | 63 | 52 | 624 | 514 | 57 | 53 |
| Pipeline | 3,905 | 3,437 | 221 | 247 | 3,901 | 3,364 | 258 | 280 |
| Other and unknown | 96 | 89 | 5 | 2 | 86 | 80 | 5 | 2 |

| | **Value** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 2019 | | | | 2022 | | | |
| Billions of 2017 dollars | Total | Domestic | Exports[1] | Imports[1] | Total | Domestic | Exports[1] | Imports[1] |
| TOTAL | 18,945 | 15,126 | 1,575 | 2,243 | 18,761 | 14,838 | 1,522 | 2,401 |
| Truck | 13,809 | 11,294 | 985 | 1,530 | 13,611 | 11,032 | 933 | 1,646 |
| Rail | 584 | 226 | 138 | 220 | 563 | 215 | 133 | 214 |
| Water | 268 | 182 | 47 | 39 | 253 | 174 | 44 | 36 |
| Air, air and truck | 611 | 150 | 237 | 223 | 655 | 154 | 242 | 259 |
| Multiple modes and mail | 2,582 | 2,343 | 78 | 161 | 2,596 | 2,361 | 65 | 170 |
| Pipeline | 1,061 | 929 | 73 | 59 | 1,058 | 901 | 89 | 68 |
| Other and unknown | 30 | 2 | 17 | 11 | 26 | 2 | 16 | 8 |

[1] Data do not include imports and exports that pass through the United States from a foreign origin to a foreign destination by any mode.

NOTES: Numbers may not add to totals due to rounding. The 2016 data are provisional estimates based on selected modal and economic trend data. Data in this table are not comparable to similar data in previous years because of updates to the Freight Analysis Framework. All truck, rail, water, and pipeline movements that involve more than one mode, including exports and imports that change mode at international gateways, are included in multiple modes & mail to avoid double counting. As a consequence, rail and water totals in this table are less than other published sources.

SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics and Federal Highway Administration, Freight Analysis Framework, version 5.5.1, July 2023.

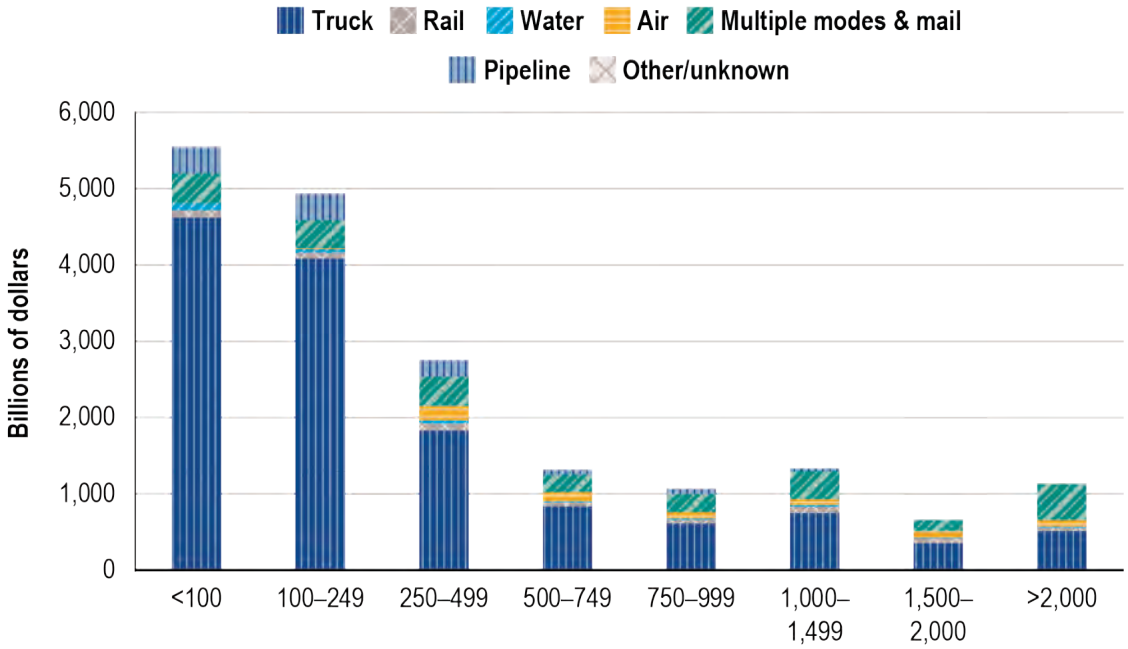
the greatest share of tons and ton-miles of goods for distances under 250 miles. Trucking remains widely used across other distances in 2022, even for distances exceeding 2,000 miles. Rail, on the other hand, takes the lead in both tonnage and ton-miles for goods shipped over distances ranging from 1,000 to 2,000 miles, particularly for heavy commodities. Notably, air and multiple modes collectively accounted for nearly half of the value of all shipments covering distances exceeding 2,000 miles.

### *Top 10 Commodities*

Table 3-3 and Figure 3-3 and Figure 3-4 present the top 10 domestic commodities for the year 2022, categorized both by weight and mode, as well as by value and mode. Collectively, these top 10 commodities account for nearly 13.3 million tons, a substantial 67.2 percent share of all domestic commodities by weight, as shown in Table 3-3. Notably, these commodities fall primarily within the bulk freight category, with a clear absence of manufactured goods. They

Figure 3-2 **Domestic Shipment Value and Weight by Mode and Distance Bands: 2022**

**A. Total Value by Distance Band (Billions of 2017 Dollars): 2022**




**B. Mode Share of Value by Distance Band: 2022**

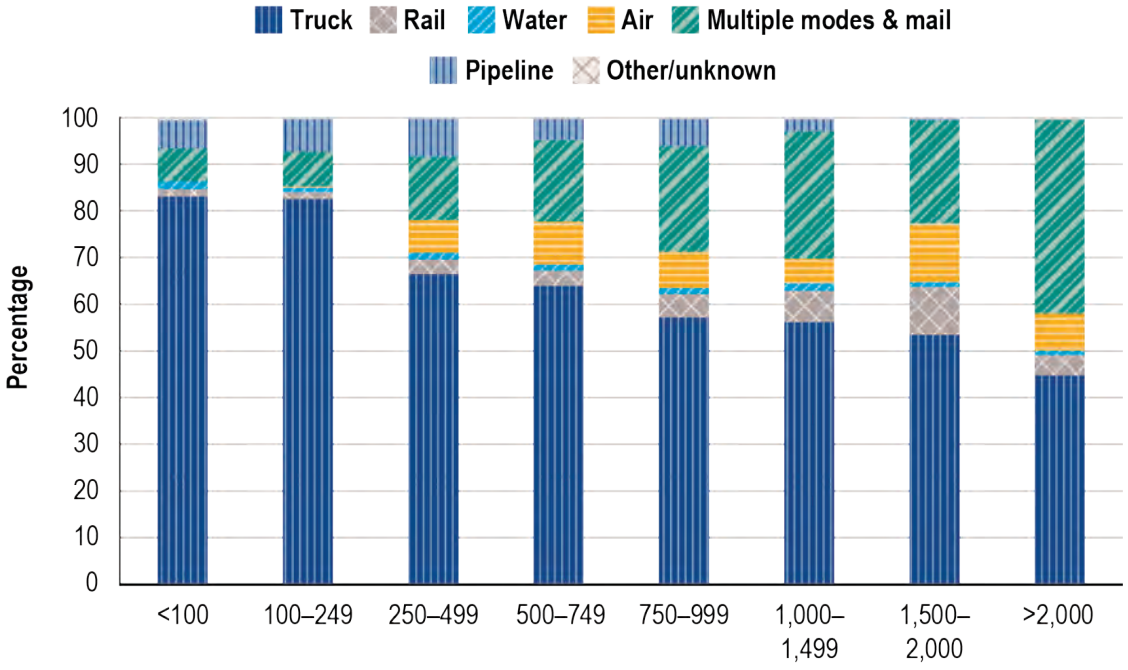
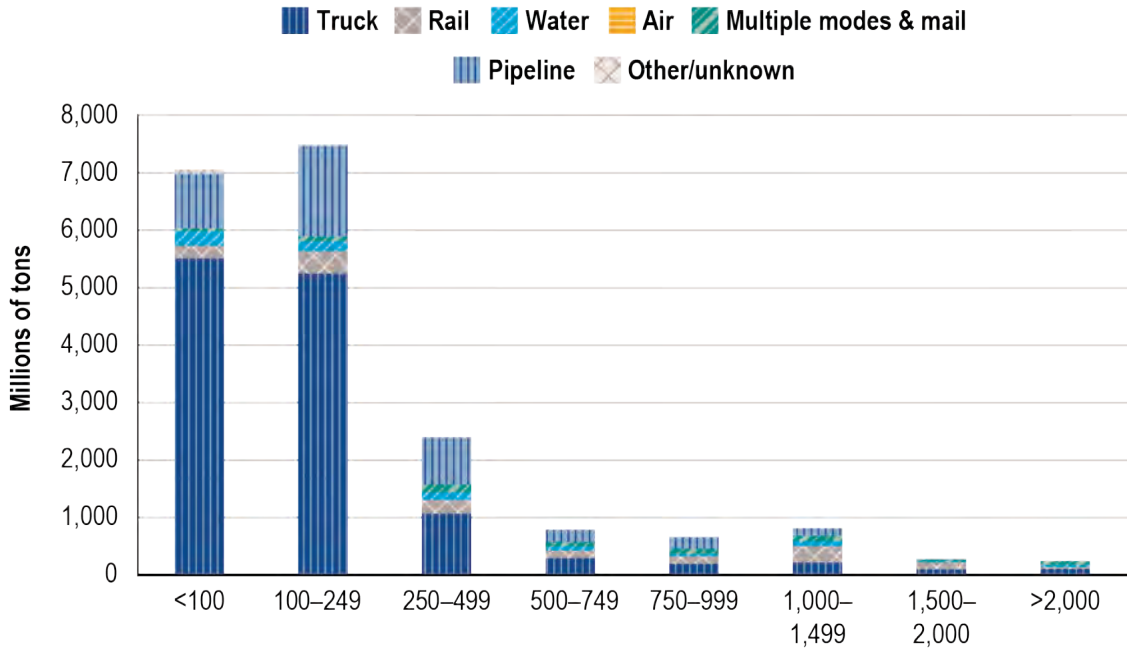


FIGURE 3-2 Continued

**C. Total Tonnage by Distance Band: 2022**




**D. Mode Share of Tonnage by Distance Band: 2022**

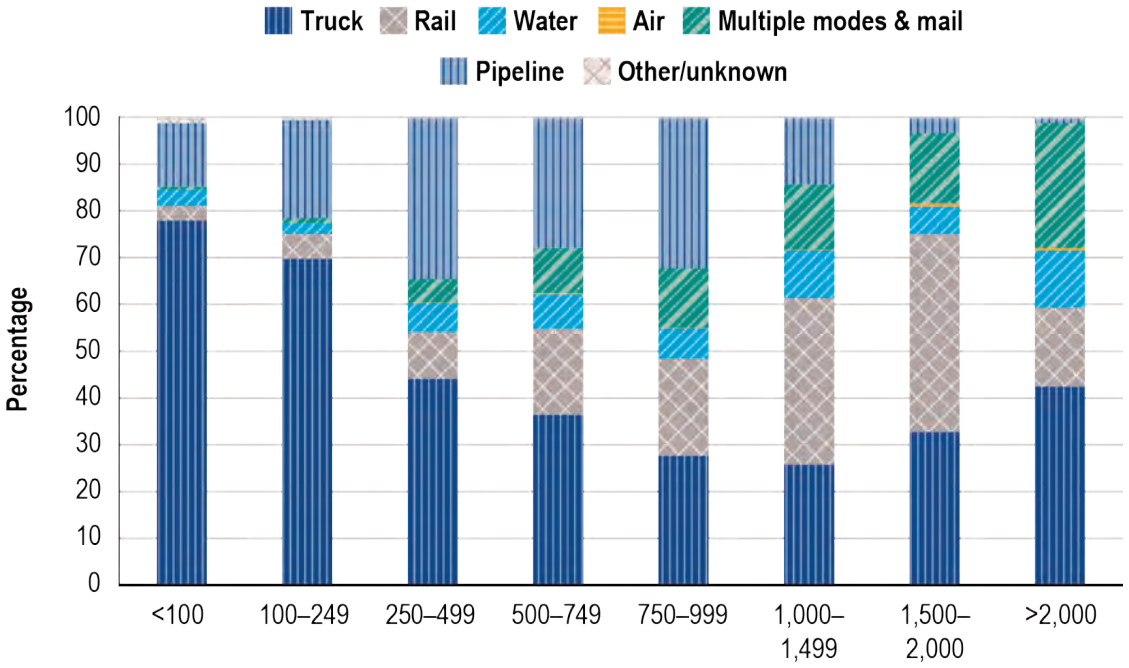
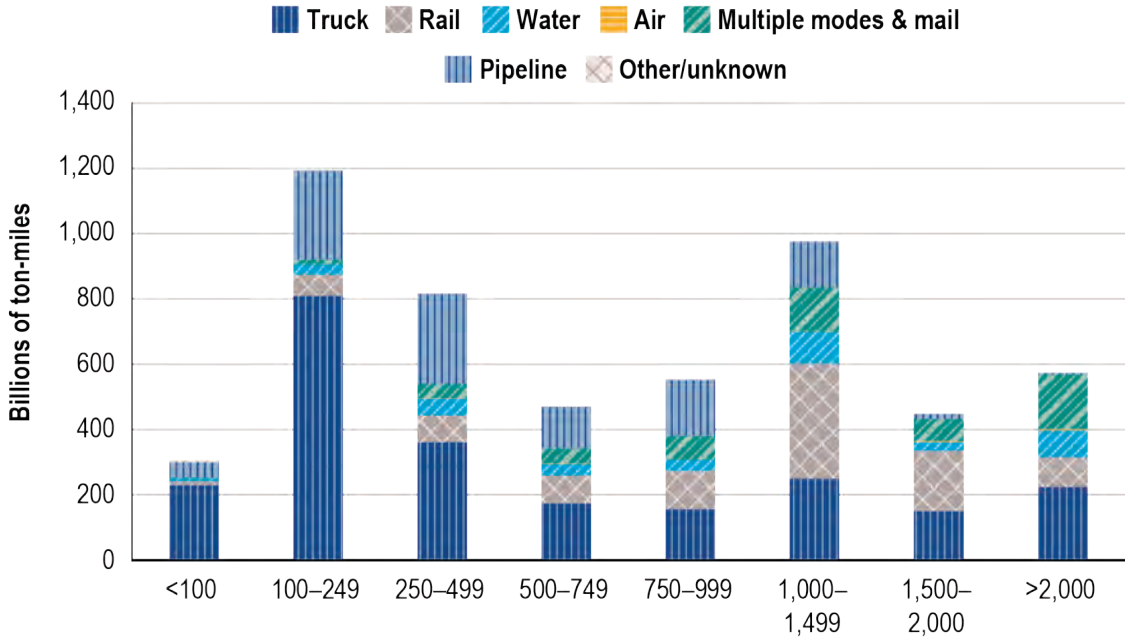
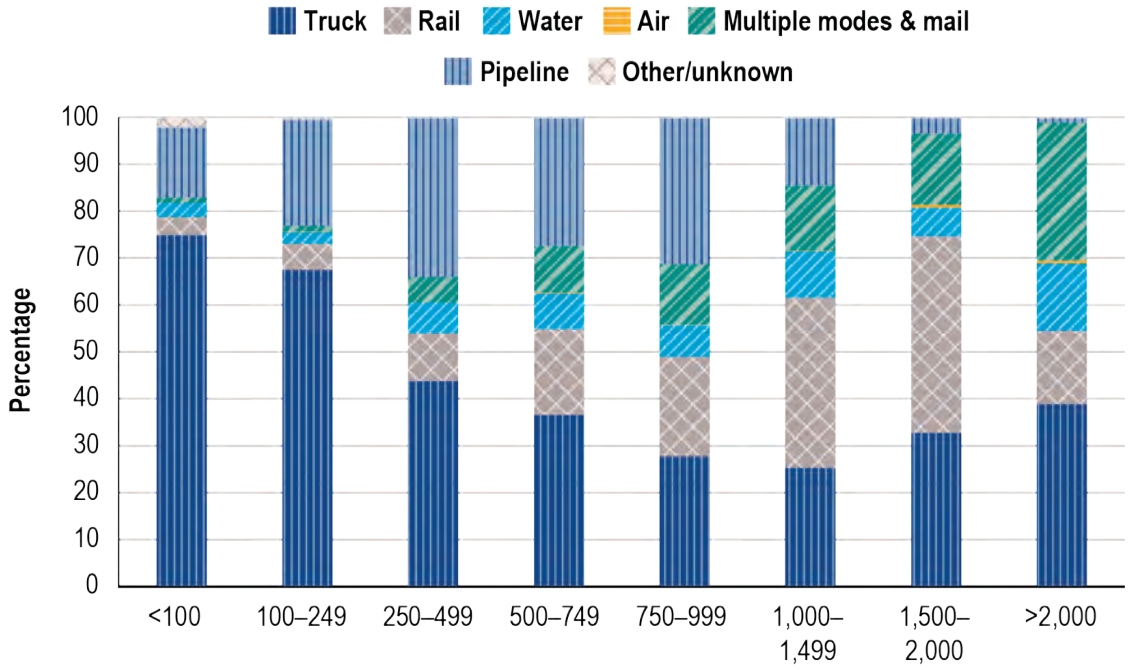


FIGURE 3-2 Continued

**E. Total Ton-Miles by Distance Band: 2022**




**F. Mode Share of Ton-Miles by Distance Band: 2022**




SOURCES: U.S. Department of Transportation, Bureau of Transportation Statistics and Federal Highway Administration, Freight Analysis Framework, version 5.5, October 2022.

rely on multiple modes of transportation, with only nominal instances of air transport. Bulk commodities shipped by air usually consist of higher value specialty products transported in breakbulk form, such as sacks and barrels on pallets.

The standout commodity within this list is "Natural gas and fossil products," representing the largest volume at 23.2 percent of the total top 10 commodity volumes.[3] Pipelines play a crucial role, transporting 2.39 billion tons of coal and petroleum products, accounting for a substantial 77.6 percent of the approximately 3.1 billion tons for this commodity. Gravel, gasoline, nonmetallic mineral products, and cereal grains, ranking second to fourth by weight, are primarily transported by trucks. In fact, the tons moved by trucks for these top 10 commodities alone represent 39.3 percent of the total weight of all commodities.

Shifting focus to the economic value, the top 10 commodities by value altogether account for 61 percent of the total value of all commodities. This list prominently features manufactured goods, marking a significant contrast to the bulk commodities highlighted in the top 10 by weight list (as detailed in Table 3-3). Trucks are pivotal in transporting these high-value commodities, accounting for $8.13 trillion worth of freight, representing 71 percent of the approximately $11.4 trillion total value of the top 10 freight commodities. This also constitutes 43.2 percent of the total value of all commodities. In contrast, the second-ranked category by value, "Multiple modes and mail," carries 15.7 percent of the total value of the top 10 commodities (as depicted in Figure 3-2A and Figure 3-2B).

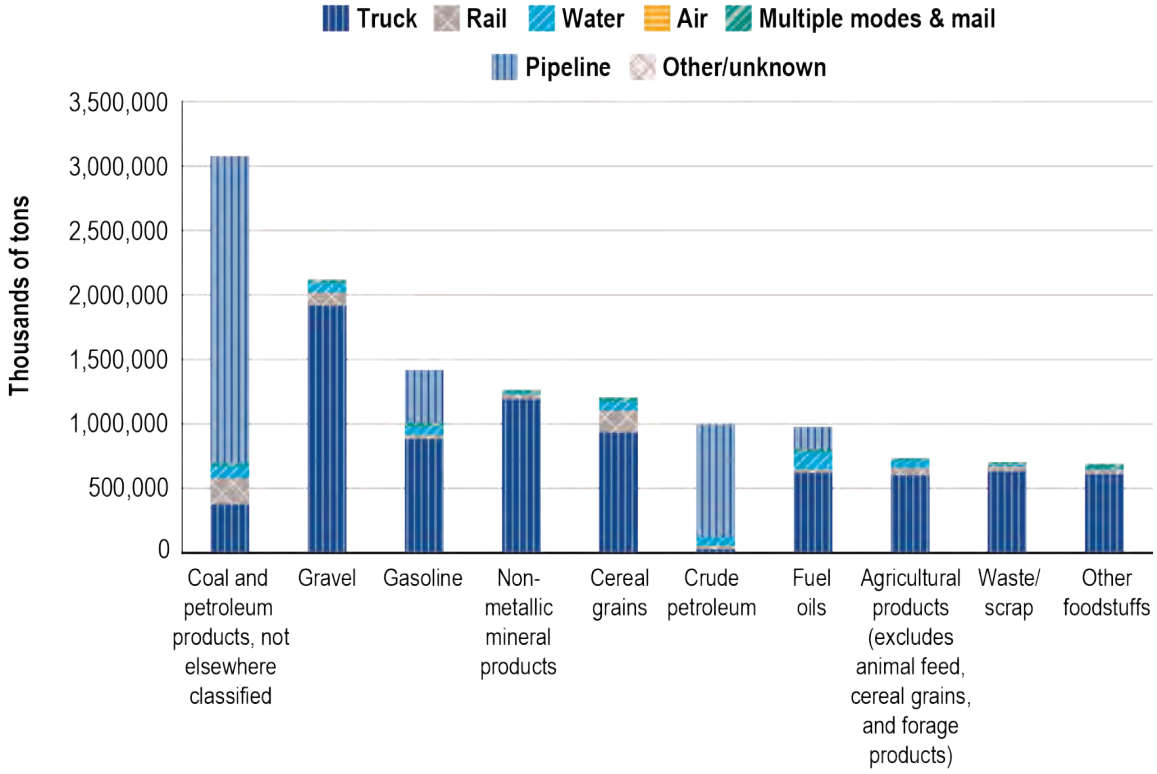
[3] Note the description of Standard Classification of Transported Goods (SCTG) 19 was changed from "Coal, n.e.c. (not elsewhere classified)" to "Natural gas and fossil products" in the FAF 5.5 release to be more consistent with the commodities in this category.

Table 3-3 **Top 10 Commodities by Weight and Value: 2022**

| Commodities by weight | Thousands of tons | Commodities by value | Billions of 2017 dollars |
|---|---|---|---|
| Coal and petroleum products, not elsewhere classified | 3,079,613 | Electronics | 1,906,463 |
| Gravel | 2,122,077 | Motorized vehicles | 1,535,728 |
| Gasoline | 1,413,907 | Mixed Freight | 1,511,774 |
| Non-metallic mineral products | 1,261,901 | Pharmaceuticals | 1,412,866 |
| Cereal grains | 1,202,542 | Machinery | 1,212,237 |
| Crude petroleum | 1,094,889 | Miscellaneous manufactured products | 851,417 |
| Fuel oils | 973,066 | Plastics/rubber | 789,608 |
| Agricultural products (excludes animal feed, cereal grains, and forage products) | 727,759 | Gasoline | 757,659 |
| Waste/scrap | 696,821 | Coal and petroleum products, not elsewhere classified | 734,099 |
| Other foodstuffs | 684,677 | Other foodstuffs | 731,852 |
| TOTAL, Top 10 | 13,257,251 | TOTAL, Top 10 | 11,443,703 |
| TOTAL of all commodities | 19,715,704 | TOTAL of all commodities | 18,799,297 |
| Top 10 share of TOTAL | 67.2% | Top 10 share of TOTAL | 60.9% |

SOURCE: U.S. Department of Transportation (USDOT), Bureau of Transportation Statistics and Federal Highway Administration, Freight Analysis Framework, version 5.5.1, August 2023.

Figure 3-3 **Tonnage of Top 10 Domestic Commodities by Mode: 2022**



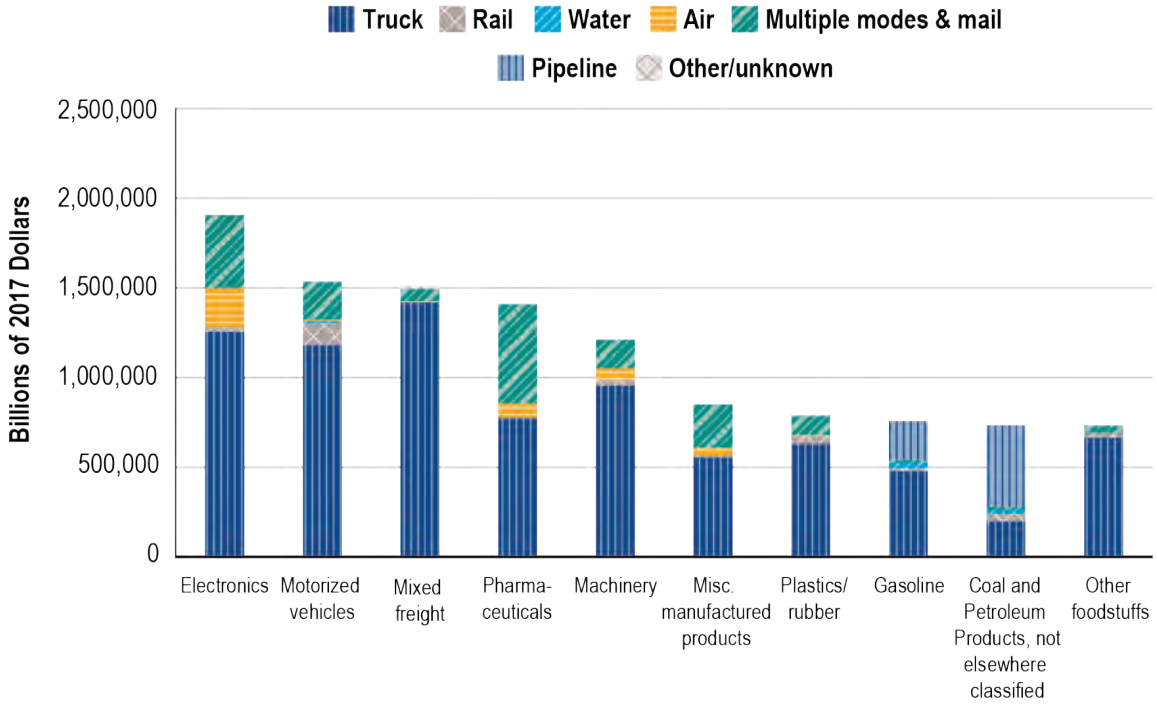

SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics and Federal Highway Administration, Freight Analysis Framework, version 5.5.1, August 2023

## International Freight

The nominal value of international freight, the sum of import and export values shown above in Table 3-2, is estimated at $3,923 billion in 2022. This is an increase of $362 billion from 2021. Though international freight holds a relatively small share of total U.S. freight value of $18.95 trillion in 2022, the 20.1 percent share underestimates the true importance of international freight. International freight is handled in the Nation's maritime ports, land borders, and airports, so there is a high concentration of logistics activities in these areas. This is especially true for the coexistence of the maritime ports of Los Angeles and Long Beach in the same metropolitan area.

Table 3-4 delineates U.S. international freight by geography and mode. Vessels played a significant role in transporting goods between the United States and Asia, with a total value of $1,219,767 million in 2022, reflecting an increase of $174,000 million compared to 2021. In this landscape, vessel transport claimed a substantial 60.5 percent market share in 2022, a 2.2 percent growth from the previous year. On the other hand, air transport lost market share for U.S.-Asian routes, declining from 37.5 percent in 2021 to 35.2 percent in 2022. The value of air transport, with a relatively modest $37,000 million increase from the previous year, amounted to $708,985 million in 2022. Similar dollar amounts were transported by vessel and air (44.8 vs. 48.6 percent) between the United States and Europe.

Figure 3-4 **Value of Top 10 Domestic Commodities by Mode: 2022**




SOURCE: U.S. Department of Transportation (USDOT), Bureau of Transportation Statistics, and USDOT, Federal Highway Administration, Office of Freight Management and Operations, Freight Analysis Framework, version 5.5.1, August 2023.

Table 3-4 **Value of U.S.-International Freight Flows by Geography and Transportation Mode: 2022 (Millions of 2017 Dollars)**

| | Mode | | | | | | |
|---|---|---|---|---|---|---|---|
| Geography | Truck | Rail | Pipeline | Air | Vessel | Other | TOTAL |
| Canada | 411,976 | 118,839 | 134,430 | 37,461 | 43,462 | 44,967 | 791,133 |
| Mexico | 535,951 | 91,391 | 14,728 | 20,385 | 95,372 | 15,684 | 773,512 |
| Asia | NA | NA | NA | 708,985 | 1,219,767 | 86,481 | 2,015,233 |
| Europe | NA | NA | NA | 591,094 | 545,162 | 80,000 | 1,216,256 |
| Other | NA | NA | NA | 105,220 | 377,848 | 20,988 | 504,056 |

KEY: NA = not applicable.

NOTE: Transportation mode in this table represents the mode by which freight arrived to or departed from the United States, therefore truck, rail, and pipeline are only available for U.S. freight flows with Canada and Mexico.

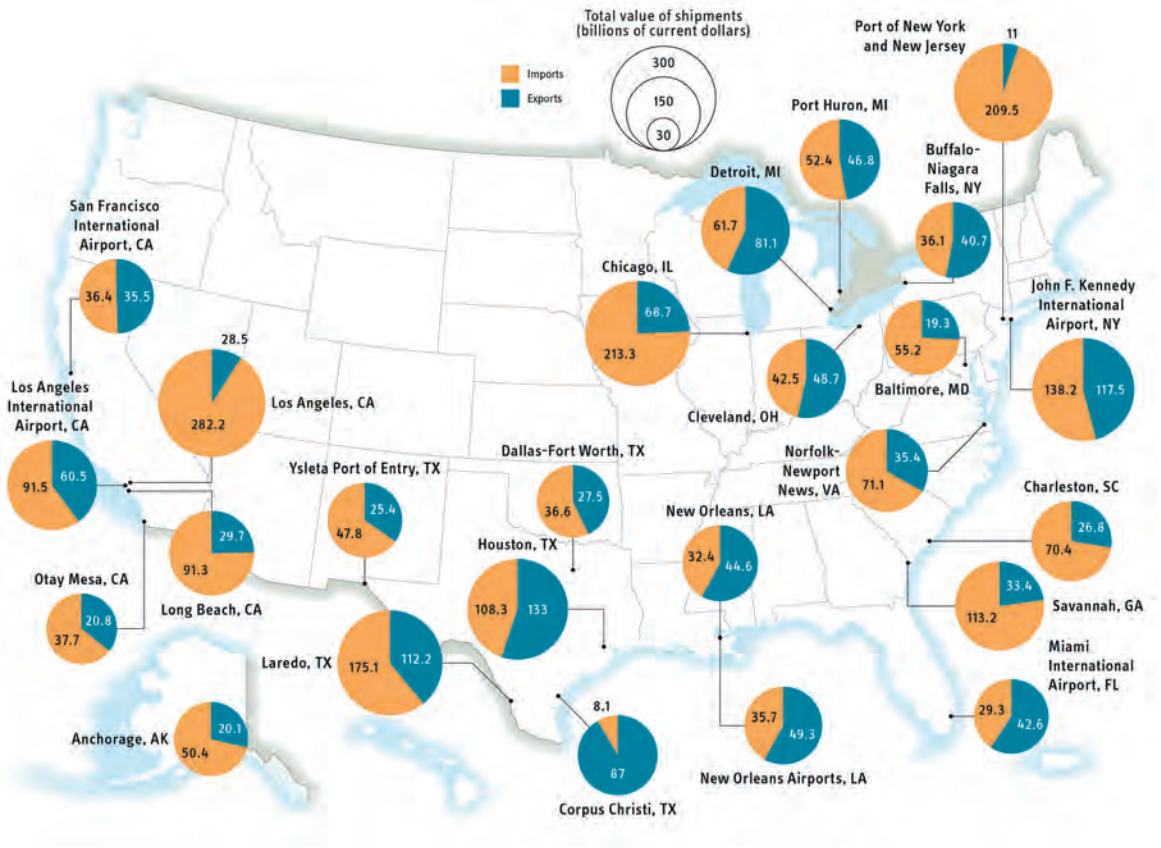
SOURCES: **Truck, Rail, and Pipeline:** U.S. Department of Transportation, Bureau of Transportation Statistics, TransBorder Freight Data, available at www.bts.gov/transborder; **Air, Vessel, and Other:** U.S. Department of Commerce, Census Bureau, *USA Trade Online*, https://usatrade.census.gov/ as of August 2023.

Figure 3-5 reveals the significance of the Nation's top 25 gateways for the year 2022, where 17 of them handled more imports than exports. The top gateway position was held by Los Angeles, CA, which handled values of $282.2 billion and $28.5 billion in freight exports and imports. Los Angeles's imports exceeded second-ranked gateway Laredo, TX, by $107.1 billion while trailing the same gateway in exports of $83.7 billion.

On the land border front, Laredo, TX, took the top spot as the number one land gateway, with international freight valued at $287.3 billion, which also aligns with the overall high trade volumes between the United States and Mexico. Though ranked as the number 5th gateway, Houston, TX, served as the United States' primary export gateway, boasting an export value of $133.0 billion, followed by John F. Kennedy International Airport with an export value of $117.5 billion.

The leading maritime gateway was the Port of Los Angeles, which saw export and import freight throughput valued at $310.7 billion. Remarkably, the Port of Los Angeles also clinched the title of the foremost import gateway, handling imports valued at $282.2 billion, surpassing the Houston gateway by approximately $173.8 billion.

Figure 3-5 **Top 25 U.S. International Freight Gateways by Freight Value: 2022**




SOURCES: Air: U.S. Department of Commerce, U.S. Census Bureau, Foreign Trade Division, USA Trade Online, available at https://ustrade.census.gov as of Dec. 6, 2023. Land: U.S. Department of Transportation, Bureau of Transportation Statistics, North American Transborder Freight Data, available at https://www.bts.gov/transborder as of December 2023. Water: U.S. Department of Commerce, U.S. Census Bureau, Foreign Trade Division, USA Trade Online, available at https://usatrade.census.gov as of December 2023.

## U.S. North American Freight

Canada and Mexico, our neighbors to the north and south, play a pivotal role in U.S. trade as the top two U.S. trade partners in 2022 (Figure 3-1). Trade with these nations relies on an array of transportation modes, including trucking, pipelines, and rail (Figure 3-6). In 2022, the total freight flow between the United States and Canada amounted to $792.7 billion, marking a 19.3 percent increase from the $664.2 billion recorded in 2021. On the southern border, the U.S.-Mexico freight flow reached $779.3 billion in 2022, reflecting a substantial 17.9 percent surge from the $661.2 billion reported in 2021.

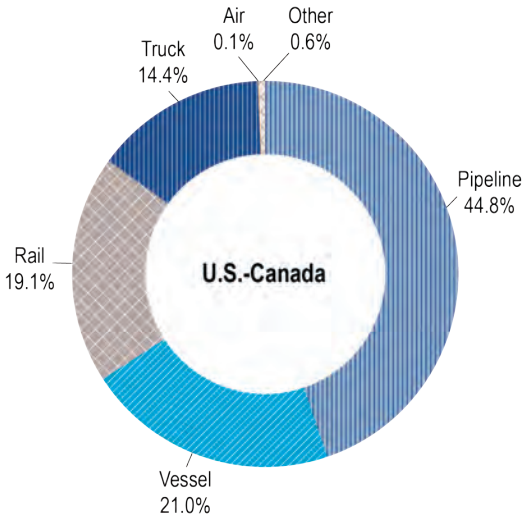
U.S.-Canada trade includes the substantial use of pipelines for transporting crude oil, natural gas, and refined petroleum products. In 2022, pipelines carried 44.8 percent of the total freight weight. This dominance far surpassed other modes, with vessels and rail capturing 21.0 percent and 19.1 percent, respectively (Figure 3-6). Trucking emerged as the fourth most influential mode in U.S.-Canada trade, commanding a 14.1 percent share of the overall freight weight.

In stark contrast, in U.S.-Mexican trade in 2022, vessels held a commanding position, accounting for 58.4 percent of trade, followed by trucking with a 32 percent share of the total freight weight. Rail transportation came next in line, capturing a 9 percent market share. Meanwhile, air freight played a relatively minor role in both U.S.-Canada and U.S.-Mexico trade flows, constituting a mere 1 percent share of the overall freight weight.

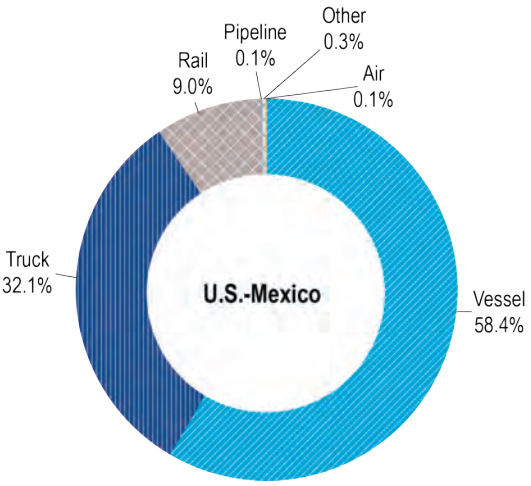
Inbound trucks and trains crossing the Texas border in 2022 moved about 47.7 million and 16.4 million tons, respectively. Ten states—Texas, Illinois, Michigan, California, New Jersey, Ohio, Florida, Georgia, Tennessee, North Carolina—accounted for 91.6 percent of all

Figure 3-6 **Modal Shares of U.S. Trade with Canada and Mexico: 2022**

**A. Modal Shares in U.S.-Canada Trade in Short Tons, 2022; Total Short Tons = 442.3 Million**




**B. Modal Shares in U.S.-Mexico Trade in Short Tons, 2022; Total Short Tons = 400.3 Million**




NOTE: *Other* includes imports into free trade zones, mail, and unknown.

SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, Transborder Freight Data, available at https://www.bts.gov/transborder as of September 2023.

freight moved. In 2022, about 22.8 million and 17.2 million tons were moved on inbound trucks and trains, respectively, across the Michigan border. In addition to Michigan, this freight was destined to six other states—Minnesota, Ohio, Indiana, Illinois, Texas, and California and accounted for 78.8 percent of all freight moved [FAF, USDOT BTS and FHWA 2022].

## Shifts in Containerized Freight

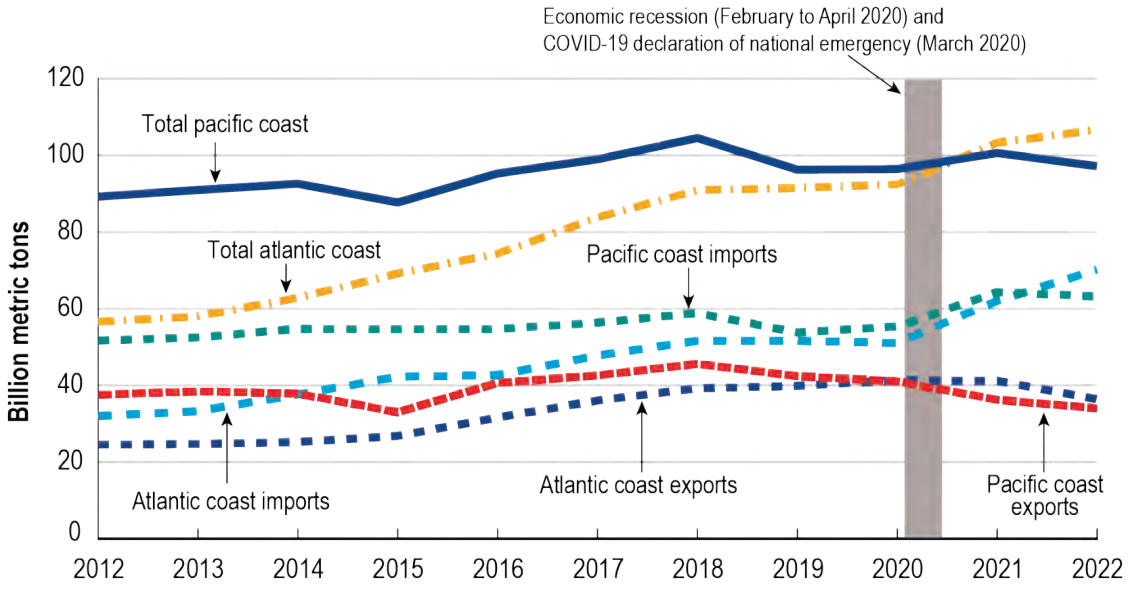
The U.S. west coast to U.S. east coast supply chain shift of Middle Eastern and Asian countries[4] containerized imports and exports observed in 2021 became even more pronounced in 2022, as carriers continued to take advantage of improved capabilities of the Suez Canal and U.S. east coast ports, leading to greater connectivity to liner shipping networks of U.S. east coast ports, as discussed herein.

As Figure 3-7 shows, U.S. west coast ports historically served as the gateway for imported containerized Asian cargoes, despite the larger U.S. east coast populations. However, the U.S. east coast has shown continuous growth of Asian imports and growth in exports over the past 10 years, ultimately surpassing U.S. west coast ports in 2022. U.S. east coast ports imported 70.2 billion metric tons in 2022 compared to 63.2 billion imported metric tons for the U.S. west coast ports the same year.

Export volumes also show a decline in market share for U.S. west coast ports in 2022, with U.S. east coast ports and U.S. west coast ports handling 36.5 and 34.0 billion tons, respectively. Notably, both coasts show a decline in export volumes since COVID-19 year 2020.

[4] The U.S. Census Bureau combines Middle Eastern and Asian countries as Asia; the following countries are included in Asia: Asia Near East includes Bahrain, Gaza Strip, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syria, United Arab Emirates, West Bank Administered by Israel, and Yemen; Asia-South includes Afghanistan, Bangladesh, India, Nepal, Pakistan, and Sri Lanka; Asia-Other includes Bhutan, Brunei, Burma, Cambodia, China, Hong Kong, Indonesia, Japan, Korea-North, Korea-South, Laos, Macau, Malaysia, Maldives, Mongolia, Philippines, Singapore, Syria, Taiwan, Thailand, Timor-Leste, and Vietnam.

Figure 3-7 **U.S. East Coast and West Coast Asian Containerized Freight Volumes: 2012–2022**




SOURCE: U.S. Department of Commerce, Census Bureau, Economic Indicators Division, available at http://usatrade.census.gov as of November 2023.

The overall U.S. east coast ports' share of container volumes was even more pronounced in 2022. U.S. east coast ports container volume surpassed that of U.S. west coast ports for the first time in 2021 after showing 10 years of continuous growth since 2012. In 2021, U.S. east coast ports and U.S. west coast ports handled 103.3 billion tons and 100.6 billion tons, respectively. The gap favoring U.S. east coast ports widened in 2022, with U.S. east coast ports handling 106.7 billion tons versus 97.2 billion tons for U.S. west coast ports.

Figure 3-7 also reflects the pandemic-related surge of Asian imports from 2020–2021, with the U.S. east coast ports showing 21.4 percent growth versus the west coast ports' growth of 16.2 percent. U.S. east coast average annual growth rates, referred to as CAGR,[5] over the period 2011–2021 are higher at 7.4 percent than the west coast's average annual growth rate of 3.5 percent. Further, average annual growth rates for the two-year period following COVID-19 year 2020 show dramatic differences, with U.S. Atlantic coast ports averaging growth rates of 7.5 percent versus 0.5 percent for U.S. west coast ports for the same two-year period.

The Liner Shipping Connectivity Index (LSCI), developed by the United Nations Conference on Trade and Development (UNCTAD) in 2004, serves as an important metric for evaluating the extent of connectivity between countries, ports, and the global shipping network. Ports that achieve high LSCI scores enjoy a notable advantage, as they can provide a wider array of shipping options to shippers in comparison to ports with lower network connectivity.

Figure 3-8 presents the U.S. ports having the top 20 LSCI scores, reflecting data for the years 2021 and 2022. These scores are calculated as averages derived from quarterly reports in each respective year. The success of U.S. east coast ports in securing a larger share of the Asian market can be attributed, at least in part, to their ability to establish more robust connections with global shipping networks from expanded capacity and capability to handle larger vessels

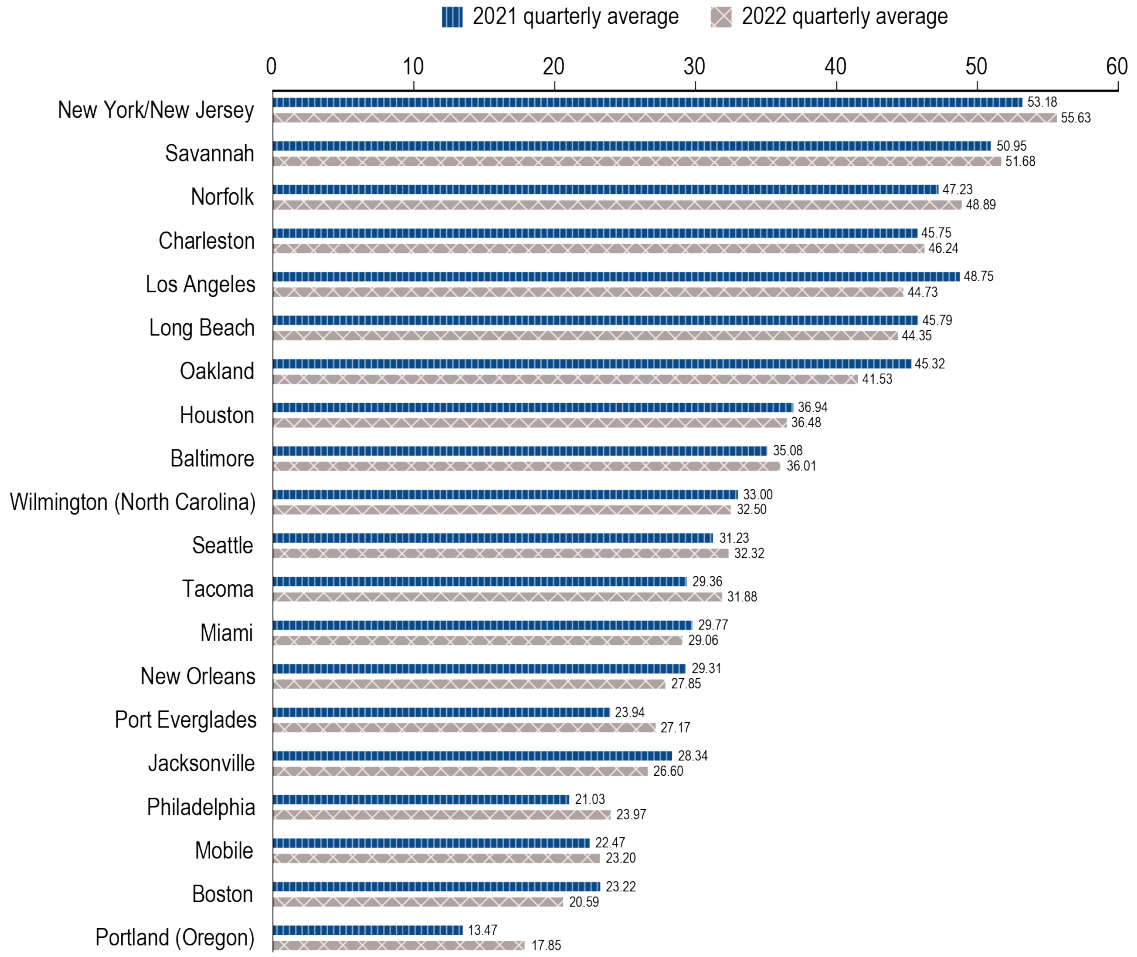
In 2022, several U.S. east coast ports—New York/New Jersey, Savannah, Norfolk, and Charleston—secured the top four positions in terms of connectivity. Remarkably, six other U.S. east coast ports also made it to the top-20 list. Meanwhile, on the U.S. west coast, ports such as Los Angeles, Long Beach, and Oakland, ranked fifth, sixth, and seventh, respectively, were joined by three other U.S. west coast ports in the top 20.

The prevalence of U.S. east coast ports in the top 20 can be attributed to supply chain shifts from the U.S. west coast to the U.S. east coast. These east coast ports have significantly expanded their capacity and capabilities in recent years to meet the growing demands of shipping lines. Additionally, the inclusion of four U.S. gulf coast ports (Houston, New Orleans, Mobile, and Tampa) in the top 20 reflects their noteworthy port improvements. These improvements have been rewarded with the presence of neo-Panamax vessels transiting the Panama Canal, as shipping lines seek alternative intermodal connections compared to west coast options.

Overall, 11 of the top 20 connected ports have improved their scores from 2021 to 2022, with 7 of these improvements occurring among U.S. east coast ports. However, U.S. west coast ports, including Los Angeles, Long Beach, and Oakland, experienced declines in their scores during this period. Los Angeles recorded the most significant decline (4.02) among the top 20 connected ports and lost its 2021 place as the third highest LSCI port. On a positive note, ports like Portland (OR), Tacoma, and Seattle

[5] CAGR is the Compound Annual Growth Rate, which is the average annual growth rate over a period longer than one year; here, we determine the CAGR for the period 2011–2021.

Figure 3-8 U.S. Top 20 Container Port Liner Shipping Connectivity Index: 2021 and 2022




SOURCE: United Nations Conference on Trade and Development, Liner Shipping Connectivity Index, 2021, available at https://unctadstat.unctad.org/wds/TableViewer/tableView.aspx?ReportId=92 as of September 2023.

demonstrated higher scores in 2022 compared to their 2021 ratings, likely attributable to freight diversions from Los Angeles, Long Beach, and Oakland.

## Freight Transportation Performance

The Nation's freight transportation network is a complex system with numerous nodes and links, each capable of becoming a bottleneck that can impact overall freight transportation performance. The COVID-19 pandemic brought heightened attention to these supply chain bottlenecks. An effective way to gauge supply chain performance is by examining the movement of marine containers as they traverse various links (such as ships, roads, rail, and barges) and nodes (including marine terminals, customs, border posts, free zones, and distribution centers). These links and nodes are also important within port areas, where container ships navigate between the port's entrance buoy to berths and containers are loaded, discharged, stored, and processed through gate facilities. The supply chain disruptions experienced

recently have placed substantial stress on many of these nodes and links throughout the network, some of which are monitored by the Bureau of Transportation Statistics with the use of various freight performance indicators.

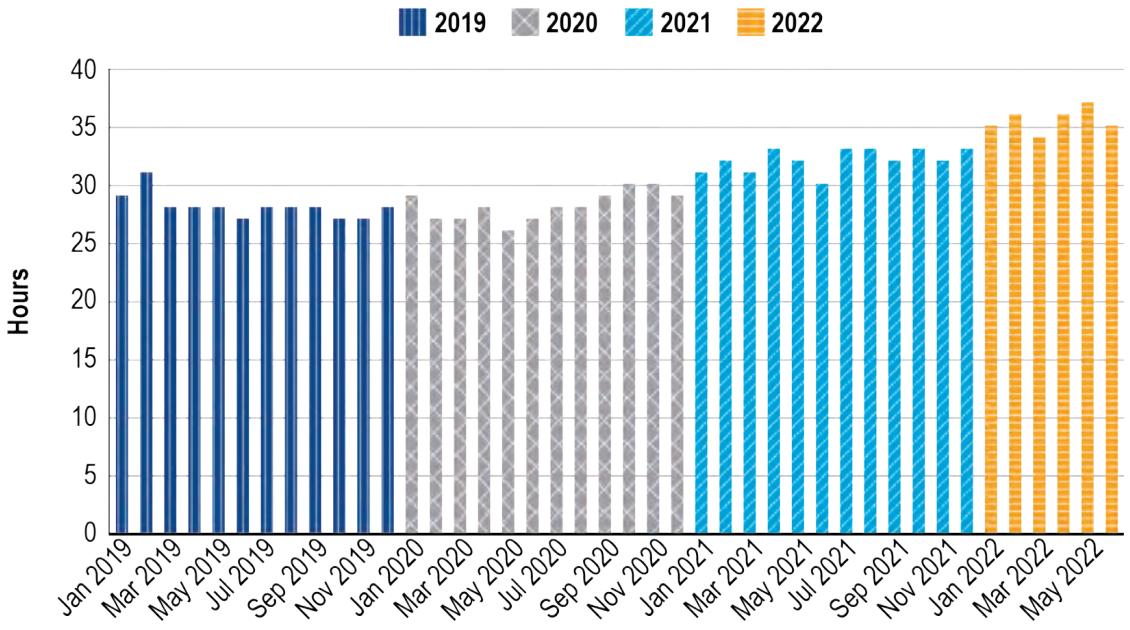
### Container Port Performance

In the port area, there is a range of indicators that can be generated to gauge the performance of marine terminal operations. The ability to collect data related to the time a vessel spends in a port is enabled using the Automatic Identification System (AIS), which identifies the vessel and tracks its speed, direction, and location. The AIS can identify the port or terminal the vessel is calling. BTS uses AIS data to measure the time the vessel spends at the berth, referred to as container-vessel dwell time.

Figure 3-9 shows the average vessel dwell time for the top 25 U.S. container ports. In 2019, 2020, and 2021, the average dwell time was 28.1 hours, 28.2 hours, and 32.1, respectively. The average dwell time continued to increase in the first half of 2022, reaching 35.5 hours, altogether showing a gradual increase due to COVID-19-related demand [USDOT BTS 2022b]. The impact of COVID-19-related demand notwithstanding, dwell time can be affected by the vessel's size and the call size. For container ships, size is indicated by the capacity of the vessel, usually in twenty-foot equivalent units (TEU). Call size refers to the container volume that is loaded onto or discharged from the vessel, also reported in TEU.

Figure 3-10 illustrates the impact larger vessels have had at the United States' largest container

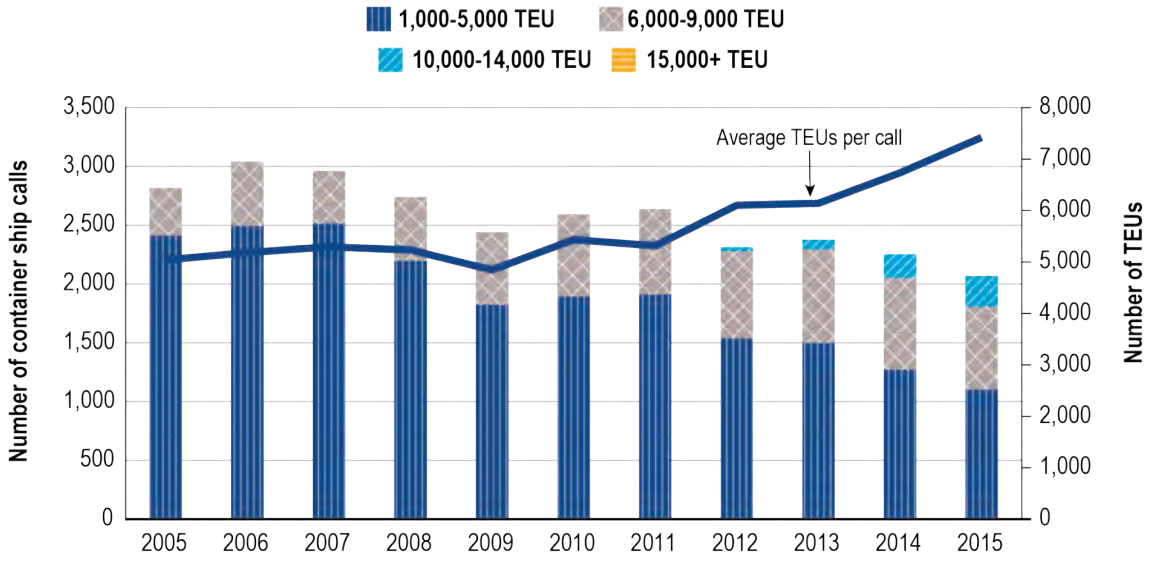
Figure 3-9 **Average Container Vessel Dwell Time for Top 25 U.S. Container Ports: 2019–June 2022**




NOTE: Vessel calls of less than 4 hours or more than 120 hours were excluded as representing calls either too short for significant cargo handling or too long for normal operations.

SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, calculated using AIS data from the U.S. Coast Guard's Nationwide Automatic Identification System (NAIS) archive, processed by the U.S. Army Engineer Research and Development Center, Coastal and Hydraulics Laboratory, through the AIS Analysis Package (AISAP) software application as of October or November 2023.

Figure 3-10 **Vessel Size and Call Trends and Average Container Throughput per Call, Ports of** Los Angeles and Long Beach: 2005–2015




**KEY:** TEU = twenty-foot equivalent unit.

**SOURCES:** Vessel call data and size category from San Pedro Bay Ports Clean Air Action Plan, Bay Wide Ocean-Going Vessel International Maritime Organization Tier Forecast 2015-2050, July 2017, p. 3; TEU volume data from the Port of Los Angeles, Annual Container Statistics, available at https:// www.portoflosangeles.org/business/statistics/container-statistics and Port of Long Beach, TEUs Archive: 1995 to Present by Year, available at https://polb.com/business/port-statistics#yearly-teus; data at both ports as of October or November 2023.

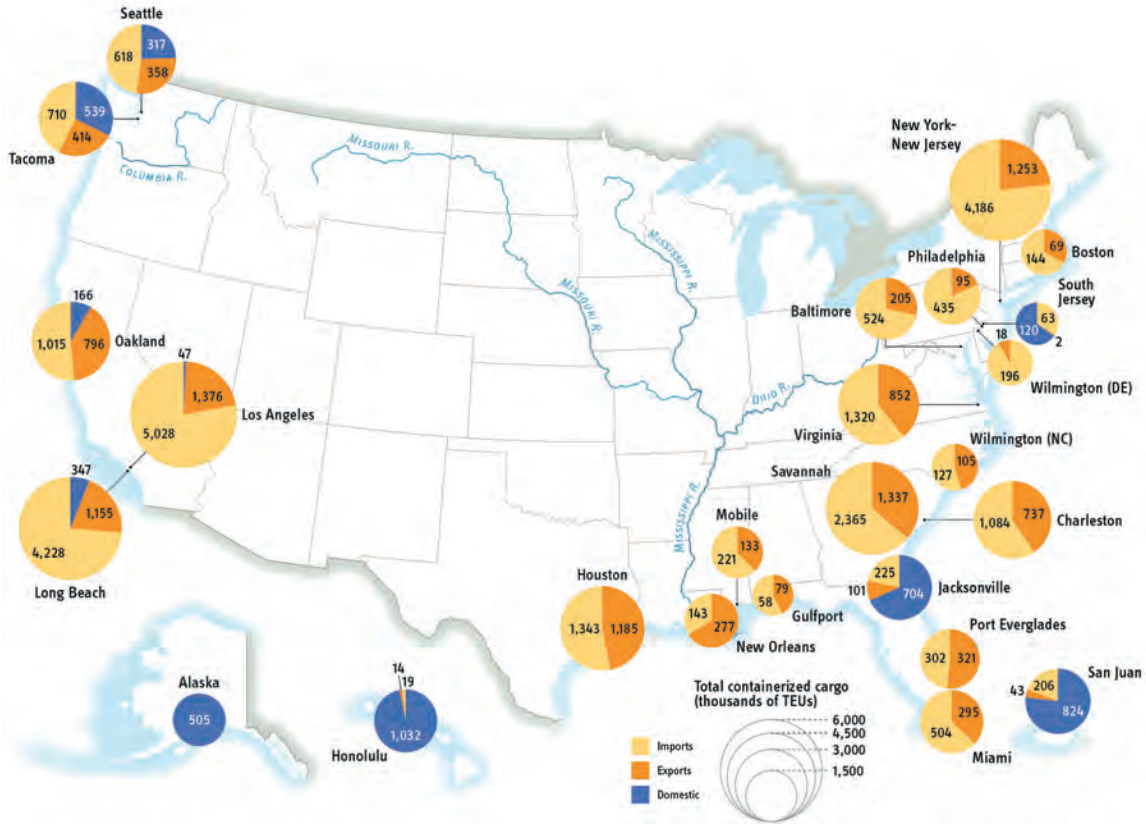
port complex in San Pedro Bay, which includes the ports of Los Angeles and Long Beach.

The figure shows a general decline in the number of ship calls from 2005 to 2015, from 2,817 ship calls in 2005 to 2,070 ship calls in 2015. However, container volume per call, reflected in TEU, increased from an average of 5,039 TEU per call in 2005 to 7,420 TEU per call in 2015 as vessel calls decreased and ship size increased. Given shipping alliance efforts to maximize capacity utilization and the likelihood of even larger vessels increasing their share of total port calls since 2015, it is probable that the average volume per call has since increased in Los Angeles and Long Beach.

Figure 3-11 identifies the top 25 U.S. container ports based on TEU, with the ports of Los Angeles, Long Beach, and New York numbering among the top 3. Only the port of New Orleans, on the lower end of the top 25, handles more exports than imports. Honolulu handles the highest number of domestic containers. Table 3-5 presents the World Bank's global rankings of these ports for each port's overall rank by vessel size category.

The World Bank conducts an annual assessment of global container port performance, using indicators that include vessel waiting time (the duration a vessel remains anchored), the time it takes for a vessel to transit from the entrance buoy to the berth, and the vessel's berth time [WBG 2022]. These rankings are indicative of how efficiently these ports manage vessels of various sizes and different call sizes, acknowledging that larger vessels, as measured in TEU capacity, will spend more time at berth. The 2022 assessment draws from vessel AIS data and carrier operational timestamps, covering 350 container ports worldwide, a slight reduction from the 370 ports evaluated in 2021.

Figure 3-11 U.S. Top 25 Container Ports Based on Twenty-Foot Equivalent Units (TEUs): 2020




SOURCE: U.S. Army Corps of Engineers, Navigation Data Center, personal communication, special tabulation, November 12, 2020, and November 2, 2021, as of October or November 2023.

Table 3-5 presents the 2021 and 2022 World Bank container port rankings for the top 10 container volume ports in the United States. Notably, 6 of these top 10 ports improved their overall rankings from 2021. However, in 2022, 8 out of the top10 ports found themselves ranked in the bottom third among the 350 ports evaluated by the World Bank for 2022. These lower rankings reflect the congestion challenges these ports faced as they adapted to shifting demand patterns. As previously mentioned, 11 of the top-20 U.S. ports in terms of the Liner Shipping Connectivity Index improved their connectivity compared to the previous year. This shift of liner carriers to ports with improved connectivity placed some stress on these ports' capacity to handle the increased liner calls. Consequently, this is reflected in longer vessel turnaround times, as evident from the World Bank's rankings.

Despite dropping 26 positions in its World Bank ranking compared to 2021, Virginia emerged as the highest performing U.S. port in 2022. It also secured the top position in each of the five vessel size categories. In contrast, Charleston experienced the most significant drop in overall ranking among the top 10 U.S. ports, falling 211 places from 2021 to 2022. The data also highlight that ports faced greater challenges when serving vessels in the 1,500–5,000 TEU capacity category. For this category, ports averaged a ranking of approximately 248, compared to an average ranking of 176 in the

next highest vessel size category. The best average ranking, 79, was accorded to ports in the >13,500 TEU category. These rankings underscore that not all vessel size categories receive the same level of service, emphasizing the ongoing challenges port operators encounter in efficiently allocating berths and equipment, particularly with multiple vessel calls involving vessels of varying capacities.

### *Rail and Truck Performance*

Figure 3-12 presents the average rail terminal dwell times for the seven major railroads from January 2, 2021, to September 2, 2023. Dwell time refers to the average time in hours a freight car spends within terminal boundaries of the 10 largest terminals for each of the railroads. The measurement of dwell time begins with the train's arrival, customer release, or interchange receipt and ends with the train's departure, a customer receives the car from the railroad, or the freight car is transferred to another railway. Notably, Norfolk Southern (NS), Burlington Northern and Santa Fe Railway (BNSF), and Chessie System and Seaboard Coast Line Railroad (CSX) experienced their highest dwell times the week of December 31, 2022, with dwell times of 35.2, 37.5, and 31.2 hours, respectively. Meanwhile, Kansas City Southern Railway Company (KCS) (32.10 hours), Union Pacific (UP) (29.7 hours), and Canadian National Railway (CN) (23.31 hours) all recorded peak dwell times the week of February 20, 2020. Canadian Pacific (CP) (26.7 hours) reached its highest dwell time the week of March 4, 2023, and UP experienced peak dwell times the week of February 26, 2022.

Table 3-6 presents the average system-wide annual dwell times by railroad and geographic category for the years 2020 to 2022. While all railroads, except for CN and KCS, saw some increases in dwell times from 2020 to 2022, the most significant rise occurred among the Eastern railroads. Specifically, CSX and NS reported average dwell time increases of 4.94 and 7.33 hours, respectively. This stands

Table 3-5 World Bank Container Port Performance Index Rankings of Top 10 U.S. Container Ports: 2022

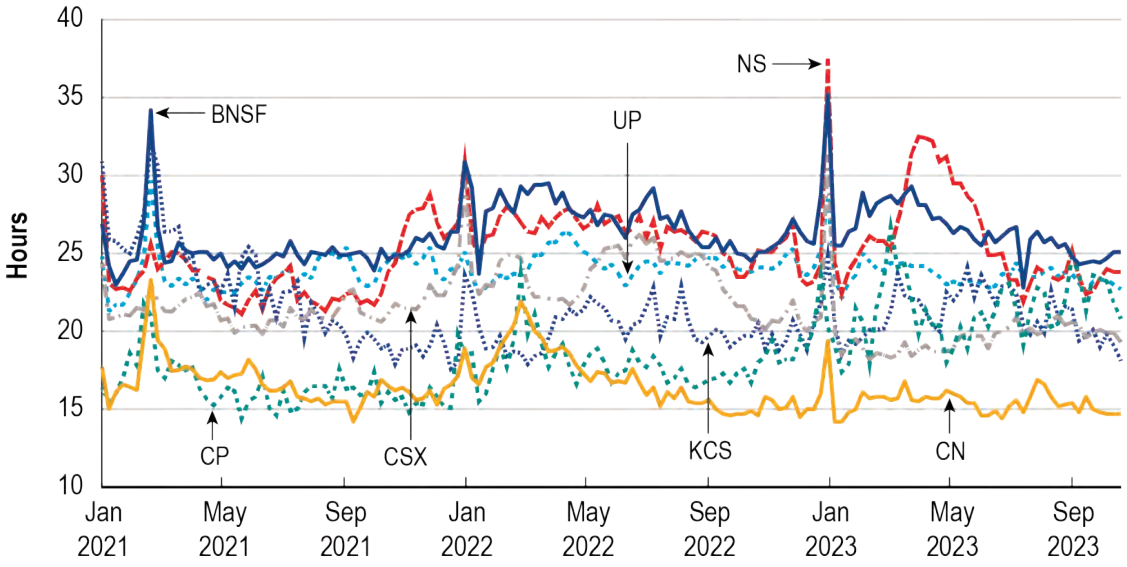
| Port | Overall rank 2021 | Overall rank 2022 | 2022 Rank by vessel size ranges | | | | |
|---|---|---|---|---|---|---|---|
| | | | <1,500 TEU | 1,501–5,000 TEU | 5,001–8,500 TEU | 8,501–13,500 TEU | >13,500 TEU |
| Los Angeles | 370 | 337 | 95 | 283 | 195 | 171 | 96 |
| Long Beach | 348 | 328 | 242 | 329 | 204 | 160 | 103 |
| NY/NJ | 251 | 309 | 204 | 279 | 164 | 156 | 72 |
| Savannah | 367 | 350 | 258 | 326 | 217 | 178 | 105 |
| Houston | 119 | 338 | 189 | 240 | 185 | 177 | 0 |
| Virginia | 23 | 49 | 64 | 63 | 73 | 64 | 55 |
| Oakland | 359 | 345 | 216 | 280 | 189 | 172 | 102 |
| Charleston | 130 | 341 | 150 | 274 | 193 | 167 | 100 |
| Tacoma | 345 | 327 | 0 | 190 | 184 | 163 | 85 |
| Seattle | 336 | 293 | 0 | 214 | 160 | 153 | 69 |

KEY: TEU = twenty-foot equivalent unit.

NOTE: The higher the number for the ranking, the poorer the performance

SOURCE: World Bank, Container Port Performance Index 2022, available at https://openknowledge.worldbank.org/entities/publication/6a51b12c-77cd-4236-be5b-13e468fe0cca as of September 2023.

Figure 3-12 **Average Rail Terminal Dwell Time in Hours: January 2, 2021–September 2, 2023**




SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, Freight Indicators, available at https://www.bts.gov/freight-indicatorsas of September 2023.

in contrast to the Western and Central railroads, where dwell time increases ranged from 0.38 to 2.93 hours.

The shift of Asian container trade to U.S. east coast ports, which increased container volumes, has spurred greater demand for rail freight movements among the Eastern railroads. This has led to increased pressures on intermodal rail operations, resulting in extended dwell times at Eastern railroad terminals. The data indicate that the average dwell time for 9 out of 10 major CSX terminals increased from 2021 to 2022, and 7 out of NS's 10 major terminals also experienced increased dwell times [BTS Freight Indicators 2023]. Among the 18 major Eastern railroad terminals reporting 2022 data, only one showed a dwell time decrease that year. Notably, CSX's Louisville terminal witnessed the most significant increase in dwell time among the 70 major terminals of the 7 railroads, rising from 24.3 hours in 2021 to 37.0 hours in 2022.

As previously noted, the growing share of Asian cargo flowing through east coast ports has increased congestion in these ports, as evidenced by vessel dwell times. This not only leads to more time spent by vessels in port, but also requires a larger number of trucks to

Table 3-6 Average Railroad System-Wide Annual Dwell Time Hours: 2020–2022

| | Average dwell times (hours) | | |
|---|---|---|---|
| Railroad system | 2020 | 2021 | 2022 |
| Western railroads | | | |
| BNSF | 26.62 | 25.32 | 27 |
| UP | 22.87 | 23.8 | 24.3 |
| Central railroads | | | |
| CP | 15.27 | 16.5 | 18.2 |
| CN | 17.07 | 16.7 | 16.8 |
| KCS | 20.31 | 22.5 | 20.2 |
| Eastern railroads | | | |
| CSX | 18.26 | 21.6 | 23.2 |
| NS | 18.77 | 23.9 | 26.1 |

SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, Freight Indicators, available at https://www.bts.gov/freight-indicators as of September 2023.

deliver the increased volume of containers along the U.S. east coast and to inland destinations, including the Midwest. As explained in TSAR 2022, this shift is primarily attributed to the expanded capabilities of the Suez Canal and several east coast ports to accommodate larger vessels.

Table 3-7 displays the average truck speeds in the Port of Los Angeles/Long Beach (PLA) and the Port of New York/New Jersey (PNY) for the years 2019–2022. Truck speed refers to the average speed of trucks on the National Highway System within 5 miles of the port. The data indicate that average truck speeds generally increased each year during this period. Notably, PNY trucks tended to travel at lower average speeds than PLA trucks, indicating greater traffic congestion at PNY. Interestingly, both ports saw their highest truck speeds during the second quarter of each year from 2019–2022, suggesting seasonal variability of cargo volumes handled at the ports. However, PLA's average truck speed remained consistently higher than PNY's average truck speed for the same quarter, with PLA's average truck speeds also increasing for each quarter from 2019–2022. The truck speed data indicate higher congestion at PNY.

## Emerging Issues: Disruptions to Supply Chains from Drought

Weather can affect supply by disrupting production of material to be moved, especially in agriculture, as well as disrupting operation of the transportation system. Waterborne commerce is particularly affected by droughts in addition to disruptions from extreme weather events as noted in Chapter 1 State of The System.

The Mississippi River system traditionally serves as a critical artery for transporting goods across the 12 states bordering the Upper Mississippi River system and Louisiana. In 2020 and 2021, the transportation of freight by water saw incremental gains in market share, rising from 56 to 57 percent (as illustrated in Figure 3-13).

Table 3-7 Average Truck Speed in the Port of Los Angeles/Long Beach (PLA) and the Port of New York/New Jersey (PNY): 2019–2022

| Port | Average speed by quarter | | | | Average annual speed |
|---|---|---|---|---|---|
| | 1st | 2nd | 3rd | 4th | |
| **Port of NY/NJ** | | | | | |
| 2019 | 18.14 | 17.80 | 17.86 | 17.76 | 17.89 |
| 2020 | 18.59 | 20.31 | 19.42 | 19.17 | 19.37 |
| 2021 | 19.99 | 19.96 | 19.74 | 19.33 | 19.75 |
| 2022 | 19.90 | 19.33 | 19.60 | 19.00 | 19.46 |
| 2019–2022 average speed by quarter | 19.15 | 19.35 | 19.16 | 18.81 | NA |
| Port of LA/LB | | | | | |
| 2019 | 19.45 | 19.63 | 19.39 | 19.12 | 19.40 |
| 2020 | 19.61 | 20.43 | 19.88 | 20.07 | 20.00 |
| 2021 | 20.87 | 20.65 | 20.28 | 20.38 | 20.55 |
| 2022 | 20.59 | 20.73 | 21.03 | 20.87 | 20.81 |
| 2019–2022 average speed by quarter | 20.36 | 20.60 | 20.40 | 20.44 | NA |

KEY: NA = not applicable.

SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, Freight Indicators, available at https://www.bts.gov/freight-indicators as of September 2023.

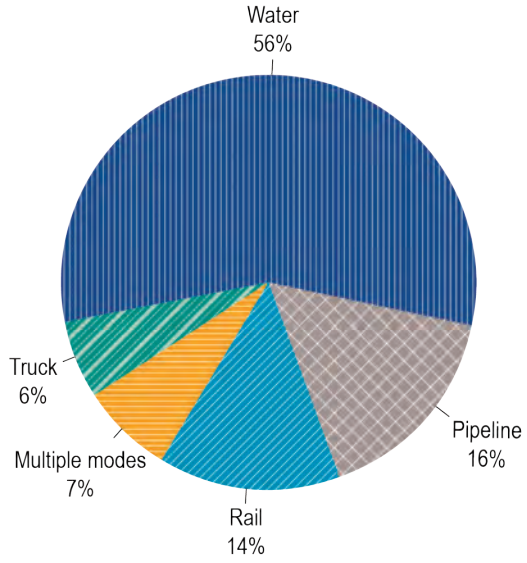
During the same period, market shares in trucking remained relatively stable, while pipeline transport increased by approximately 1 percent. Conversely, rail and multiple modes of transportation experienced declines. These statistics underline the significance of Louisiana as a key hub for facilitating the movement of goods, with nine states contributing to 86.4 percent of inbound shipments to Louisiana and 13.6 percent of outbound shipments from the state.

In 2022, the flow of barges along the Mississippi River was hampered by reduced water levels caused by what is termed a "flash drought." This unusual weather phenomenon, which had previously occurred mainly over the Missouri and Ohio tributaries, now centered itself over the Central United States, affecting the Mississippi River. The flash drought led to increased soil absorption of water and heightened water evaporation, consequently diminishing water levels along the Mississippi River, particularly between Cairo, Illinois and Memphis, Tennessee. As reported in TSAR 2022, these lower river draft conditions prevented barge fleets from operating at full capacity, resulting in a significant surge in barge freight rates. Prices skyrocketed from approximately $11–$12 per ton during the summer of 2022 to over $71 per ton in October 2022.[6] This sudden cost increase prompted some modal shifts, with businesses turning to rail and trucking options.

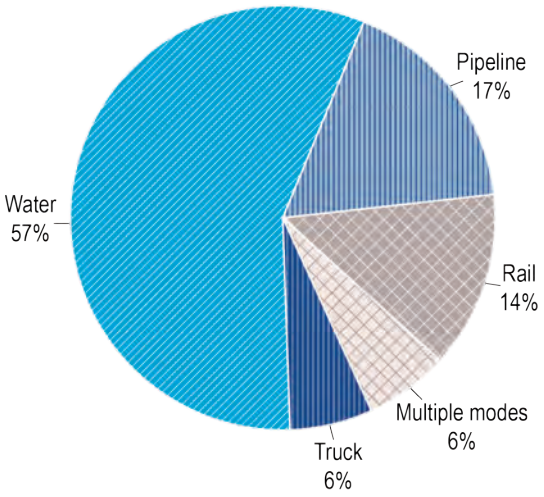
Low water levels became a recurring issue in 2023. While grain shippers and barge operators adapted by reducing barge capacity to prevent barges from becoming stranded, this practice of light-loading caused a further tightening of the barge supply, ultimately leading to even higher freight rates. As of the time of drafting this report, grain barge spot rates have surged by 42 percent compared to the same period in 2022

Figure 3-13 **Percent Tonnage by Mode Between States on the Upper Mississippi River System and Louisiana**

**A. 2020**




**B. 2021**




NOTE: Percentages do not sum to 100 due to rounding.

SOURCE: FHWA/BTS Freight Analysis Framework version 5.4 at www.bts.gov/faf as of December 2022.

[6] InsideLogistics, "Record low water levels on the Mississippi River in 2022 show how climate change is altering large rivers", December 19, 2022, available at https://www.insidelogistics.ca/features/record-low-water-levels-on-the-mississippi-river-in-2022-show-how-cli/ accessed September 7, 2023.

and have risen by 85 percent compared to the average rates over the previous 3 years.[7]

Drought conditions have not only affected the Mississippi River but have also impacted the navigability of other rivers serving as important conduits for freight, such as the Danube, Rhine, Yangtze, Amazon, and Mekong Rivers. While these rivers may not significantly influence U.S. freight movements, the Panama Canal, where 70 percent of its freight is tied to U.S. imports and exports (Table 3-8), has faced ongoing drought-related challenges. Drought-induced reductions in water volumes within Gatun Lake, a critical water source used for meeting the water needs of 50 percent of Panama's population and facilitating vessel transits through the Canal, have compelled the Panama Canal Authority to impose draft restrictions on vessels passing through (Figure 3-14). These restrictions have reduced the allowable draft from 15.24 meters (50 feet) to 13.26 meters (43.5 feet) for Neopanamax locks and from 12.04 meters (39.5 feet) to 11.73 meters (38.5 feet) for Panamax locks between February 2022 and July 2023. Additionally, dry bulk vessels, which normally do not obtain transit reservations and hence are susceptible to extended waiting times when transit restrictions are imposed, experienced waiting times of 282.2 hours and 255.6 hours for northbound and southbound Canal transits, respectively, in August 2023.[8] U.S. shippers importing and exporting bulk commodities, especially those tied to the Mississippi River system, will incur added charges for shipping delays.

The draft restrictions also have significant implications for laden container vessels that cannot meet the new draft requirements. To navigate through the Canal, they must pay additional fees for container discharge, loading, and truck or rail transport. These added costs, along with potential delays, may prompt container ships engaged in the Asian trades to consider alternative routes. Some vessels may divert from U.S. east coast ports to U.S. west coast ports for U.S. intermodal transfers, while others may explore routes using the Suez Canal

Table 3-8 **Panama Canal Cargo Volumes by Principal U.S. Vessel Trade** Routes, Fiscal Year 2022

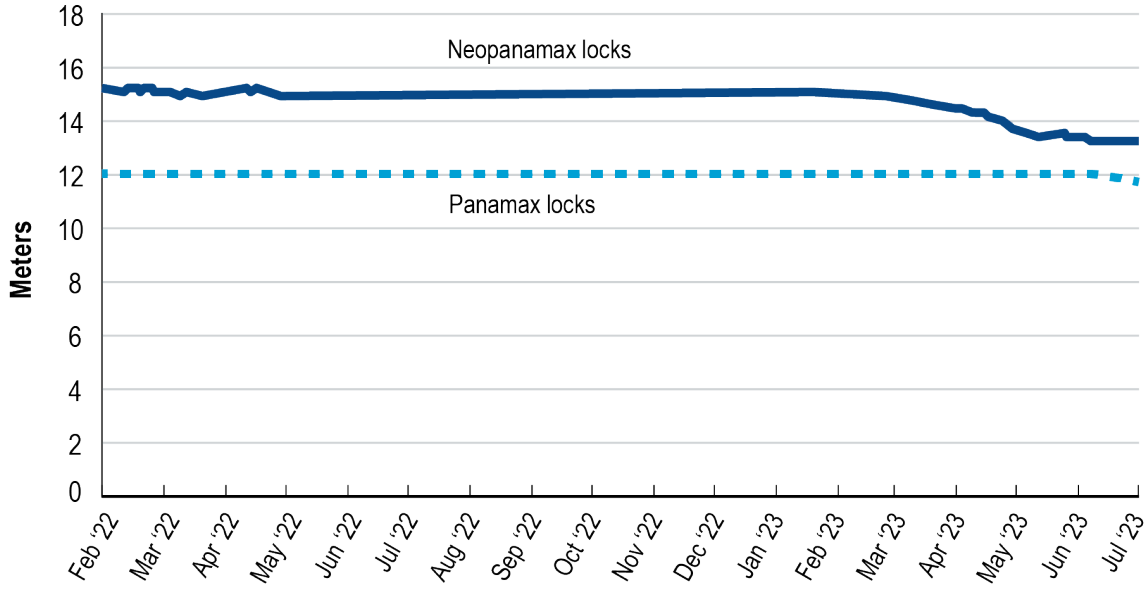
| Vessel trade route | Long tons (thousands) |
|---|---|
| East Coast U.S.—Asia | 121,352 |
| East Coast U.S.—West Coast South America | 39,517 |
| East Coast U.S.—West Coast Central America | 25,194 |
| U.S. Intercoastal, including Alaska and Hawaii | 1,747 |
| Europe—West Coast U.S. | 5,984 |
| East Coast U.S.—Oceania | 4,301 |
| East Coast South America to West Coast U.S. | 1,018 |
| East Coast Central America—West Coast U.S. | 664 |
| West Indies—West Coast U.S. | 757 |
| East Coast U.S.—West Coast Canada | 399 |
| East Coast U.S.—Pacific World | 4,476 |
| TOTAL U.S. vessel trade routes | 205,409 |
| TOTAL Panama Canal transits tonnage | 291,749 |
| Percent U.S transit trade tons | 70.40% |

SOURCE: Statistics and Models Administration, Panama Canal Authority, available at https://pancanal.com/wp-content/uploads/2022/10/Table00.pdf, as of September 2023.

[7] U.S. Department of Agriculture, Grain Transportation Report, August 31, 2023, p. 1, available at https://www.ams.usda.gov/sites/default/files/media/GTR08312023.pdf as of September 2023

[8] Panama Canal Authority, Historical Average Waiting Time for Panama Canal Non-Booked Transits, available at https://bidashboard.pancanal.com/t/TI/views/AverageWaitingTime/AverageWaitingTime?%3AisGuestRedirectFromVizportal&%3Aembed=y, accessed on September 2023. Note the data refer to Nonbooked transits; these are transits that are made without vessel transit reservations and are therefore subject to transit waiting times. Container ships normally obtain reservations and thus would not experience more than nominal waiting. Dry bulk vessels, which carry U.S. grains and other bulk commodities, normally do not acquire reservations and thus are susceptible to extended waiting times when the Canal Authority imposes transit restrictions, that is, the number of transits that are permitted to proceed through the Canal each day.

Figure 3-14 **Vessel Draft Restrictions on the Panama Canal (in Meters) by Locks**




**NOTES:** Panamax and Neopanamax refer to the maximum vessel size that each lock can handle. Panamax vessels typically have maximum dimensions of approximately 965 feet (294.13 meters) in length, 106 feet (32.31 meters) in width, and a draft (the submerged depth of the ship) of about 39.5 feet (12 meters). For container ships, these dimensions will allow vessels of about 4,500-5,000 TEU capacity. Ships that exceed these dimensions transit through the Neopanamax locks. Neopanamax vessels have lengths of up to 1,200 feet (366 meters), widths of up to 160 feet (49 meters), and drafts generally within the range of generally between 39.5+ feet (12+ meters) to 50 feet (15.2 meters).

SOURCE: Panama Canal Authority, Advisory to Shipping, 2022 and 2023, available at https://pancanal.com/en/maritime-services/advisory-to-shipping/ as of September 2023.

as alternatives to maintain cost-efficiency. Such diversions have the potential to impact container volumes handled by west, east, and gulf coast ports as well as rail services, as shipping companies seek the most efficient and cost-effective means of transporting goods.

## Additional Data Needs

In the realm of freight transportation analysis, the pursuit of comprehensive data remains an ongoing endeavor. The latest developments in the transportation sector underline the pressing need for more up-to-the-minute and granular data on freight movements. This necessity extends to a range of aspects, including but not limited to enhancing data on the domestic transportation of U.S. foreign trade, shipping freight costs, and last-mile freight movements. This would enable analysts to gain a clearer view of the freight transportation system's performance.

In a proactive response to filling the domestic transportation data gap relative to U.S. foreign trade, BTS has embarked on a series of initiatives aimed at fortifying the foundation of freight statistics, including improvements in measuring containerized freight volumes and the accessibility and effectiveness of the containerized freight system. Notably, a milestone was reached in June 2022 with the signing of the Ocean Shipping Reform Act (OSRA) into law (Pub. L. 117-146). This legislation, in its Section 16, entrusted BTS with the responsibility to generate statistics concerning total street dwell times, that is, the duration an empty or loaded container or a bare or loaded chassis spends between exiting the gate and returning to the terminal in intermodal

shipping. Moreover, BTS is now responsible for calculating the average out-of-service percentage for the chassis. The data collected by BTS encompass essential details that are needed for these performance measurements, such as information about the chassis and container operators, location data, fleet availability, and usage patterns.

The Freight Logistics Optimization Works (FLOW) initiative has been established as a USDOT/freight industry collaborative effort aimed at optimizing freight logistics.[9] The initiative represents a significant stride forward, offering industry stakeholders the opportunity to make more informed decisions by efficiently sharing and utilizing freight data. As the independent steward of this groundbreaking data-sharing initiative, BTS plays a pivotal role in managing data across a diverse spectrum of privately operated enterprises. These entities encompass shipping lines, ports, terminal operators, trucking companies, railroads, warehouses, and beneficial cargo owners, collectively contributing to the dynamic tapestry of freight transportation.

### *Shipping Freight Cost*

BTS has made significant strides in generating performance and other data related to ports, trucking, rail, and employment figures within the freight transport industry, reported as "Latest Supply Chain and Freight Indicators."[10] While BTS provides cost indicators for specific routes, such as 40-foot container freight rates to Central China and Los Angeles to Shanghai, there is an important need for more comprehensive cost data across various components of the supply chain. Shipping freight costs encompass a range of elements, including freight rates, tariffs, and fees from shipping lines, ports, airports, trucking companies, inland water transport operators, and distribution centers. Enhanced data on these aspects is vital for monitoring cost trends, understanding the impact of events on freight expenses, and supporting policy formulation. Such detailed information would empower stakeholders, including logistics companies, manufacturers, retailers, and policymakers, to make more informed decisions, optimize operations, and contribute to the competitiveness and sustainability of the transportation sector.

### *Last-Mile Freight Movements*

E-commerce has driven a shift in shipment patterns, making last-mile deliveries more complex due to the multitude of delivery locations. The challenges include the need for more deliveries to residential areas, which may not be designed for frequent freight vehicle use, and the requirement for someone to be available to accept packages, potentially leading to missed deliveries and additional trips.

With the growing frequency of curbside deliveries, the designation of delivery locker locations offers a potential solution for last-mile deliveries. These lockers, strategically placed near residential areas, serve as a solution to streamline last-mile deliveries by reducing the number of stops freight carriers need to make. The challenges related to curbside deliveries, including balancing the needs of various transportation users, further highlight the importance of efficient last-mile logistics. This aligns with efforts to optimize the final leg of the supply chain and overcome challenges associated with direct-to-home deliveries.

Though e-commerce demand leveled off in 2022 from its COVID-19 high in 2021, e-commerce deliveries still significantly influence last-mile freight movements by shaping the delivery patterns, creating challenges in residential and

[9] For more information on FLOW, visit https://www.bts.gov/flow.

[10] See Bureau of Transportation Statistics' "Latest Supply Chain and Freight Indicators" at https://www.bts.gov/freight-indicators#freight.

commercial areas, and necessitating innovative solutions like designated locker locations and alternative delivery methods, such as cargo bikes. Understanding and addressing these changes is crucial for optimizing the last-mile in freight transportation infrastructure.

The evolution of e-commerce has intricately reshaped last-mile freight movements, presenting both challenges and opportunities. With a surge in delivery points in residential areas and the necessity for someone to be present for package acceptance, the last mile has become more complex. To effectively monitor and address these dynamics, essential data needs include insights into delivery density, rates of missed deliveries, the utilization of designated locker locations, and the impact of curbside deliveries on transportation users. Metrics on alternative delivery methods, ongoing e-commerce trends, consumer preferences, and the readiness of infrastructure in various areas are important for stakeholders seeking to optimize last-mile logistics. As e-commerce continues to exert a significant influence on last-mile freight, the acquisition and analysis of such data become paramount for informed decision making, route optimization, and the development of innovative solutions to enhance the efficiency and responsiveness of the final leg of the supply chain.

BTS developed a technical report on eCommerce and Home Delivery Logistics in 2023. Both the eCommerce technical report and the Home Delivery Logistics provided findings, a literature review, and identified data gaps and made recommendations for statistical products, and potential data programs that may fill these gaps. These potential data programs and statistical products should provide a timely, accurate, and complete picture of the transportation impacts, including goods movement and travel (both long distance and last-mile) associated with the four aspects of eCommerce.

Based on the literature and sources reviewed to date, it appears that analyzable data on eCommerce and Household Logistics Data and its transportation impacts are scarce. The scarcity of usable statistics implies that a statistical understanding of eCommerce and its transportation impacts will need to be based on inference, comparison, estimation, and modeling. While less satisfying than a comprehensive, data-driven analysis, a well-structured high-level approach should yield valuable policy guidance and information for transportation planners.

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