

Waterborne Freight Transportation

Bottom Line Report

June 2013



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AMERICAN ASSOCIATION OF
STATE HIGHWAY AND
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Foreword

The AASHTO *Waterborne Freight Transportation Bottom Line Report* presents a comprehensive overview of the United States marine transportation system. It documents the importance of the MTS—ports on three coasts, the Great Lakes, and the inland waterways—to the strength and competitiveness of the nation’s economy. The report details the challenges the system faces; and it offers options to increase investment and better manage the MTS.

The report attempts to answer the following questions:

- What is the marine transportation system?
- Why is the marine transportation system important?
- What are the threats to the continued performance of the marine transportation system?
- What are the alternatives to address these challenges?

AASHTO commissioned the *Waterborne Freight Transportation Bottom Line Report* because the navigable waterways in 38 of the 50 states provide substantial economic benefits to the entire United States. State departments of transportation recognize the significant role the nation’s marine transportation assets play in terms of freight mobility as well as recognize that adverse effects for highways should waterborne freight be diverted.

As important as it is to understand how the marine transportation system works, it is equally necessary to understand the consequences of a marine transportation system that *does not* work.

Decisions made by the private sector, the federal government, and AASHTO members will determine how the national marine transportation system can reach its optimal potential as a premier mode of freight transportation in the coming decades. The time for action is now.

Along with highways, freight railroad networks, and airborne cargo, the marine transportation system is a part of an overall national freight transportation system that must work together to ensure the United States remains a global economic leader.

AASHTO is pleased to offer this report for the use of those who are committed to ensuring the United States has the best transportation system in the world.



Sean T. Connaughton
Secretary of Transportation
Commonwealth of Virginia
Chair, AASHTO Standing
Committee on Water Transportation



Bud Wright
Executive Director
AASHTO



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This report is the result of the efforts of many people. It was initiated by the AASHTO Standing Committee on Water Transportation (SCOWT), which is chaired by Sean T. Connaughton, Secretary of Transportation for the Commonwealth of Virginia. Secretary Connaughton provided the leadership and determination that made the report possible and guaranteed its quality. At critical junctures, SCOWT's Vice-Chair Sharon Balfour, Marine and Rail Administrator for the Louisiana Department of Transportation and Development, contributed her energy, enthusiasm, and wide experience to the process.

In addition, many other SCOWT members commented on drafts of the report and provided material that is included. SCOWT member states demonstrated their belief in the importance of this report through funding commitments that provided necessary resources.

The report was prepared under a contract with Cambridge Systematics, Inc., by a consulting team led by Alan Meyers, Principal.

A number of knowledgeable professionals were consulted, including representatives of the United States Army Corps of Engineers; United States Department of Transportation and its Federal Highway, Rail, and Maritime Administrations; the American Association of Port Authorities; and the National Waterways Conference, who provided valuable advice and input on the scope and direction of the investigation. Their contributions are much appreciated but they should not be held responsible for any of the report's findings or action alternatives.

Executive Summary

From the initial settlement of North America, through colonization and expansion, and to the present day, where and how we live has been determined in large part by waterborne transportation. Today, the United States relies on its Marine Transportation System, or MTS, for access to global markets and global products, and for domestic goods movement as an alternative to congested surface transportation.

The MTS includes facilities on three coasts, the Great Lakes, and the Inland Waterways; it serves every state, either directly by water or indirectly via highway and rail connections; and it supports trillions of dollars in U.S. economic activity annually. The MTS evolved as a decentralized system comprised of many different stakeholders and responsible entities, with funding coming from a variety of public and private sources.

By many measures, the MTS is a great success; it has recovered from the recent recession and is handling near-record freight volumes. But looking forward, the MTS faces critical challenges: decades of insufficient system maintenance, which have left many parts of the MTS inoperable or on the brink of failure; excessive delays in navigation project delivery; inadequate and unpredictable funding for critically needed MTS improvements; lack of a national strategy to ensure the MTS provides the greatest benefit to the nation as a whole; and the fact that there is no locus of responsibility for the well-being of the MTS, and its failure or success.

To promote discussion and action, the American Association of State Highway and Transportation Officials (AASHTO) commissioned this *Waterborne Freight Transportation* report. The report describes the nature, extent, and critical role of the MTS, and offers a number of findings and conclusions for consideration, and possibly adoption, by AASHTO and others.

The main finding is this: with respect to waterborne freight, “business as usual” will lead to unacceptable further declines in MTS condition and performance, and to significant lost opportunities for our nation’s economy. A renewed national commitment to the MTS is urgently required, along with corresponding changes in how to plan for and fund the MTS. Options for change include: 1) federal legislation to achieve full state-of-good-repair for MTS waterways, guarantee full utilization of funds collected for MTS improvements, and significantly improve the cost, speed, and reliability of MTS project delivery; 2) a new Office of Multimodal Freight, under the Secretary of Transportation, empowered and directed to eliminate the current balkanization of MTS planning, funding, and project delivery responsibilities, and advance sound planning and project implementation; and 3) promotion of best practices in MTS planning and investment at the state, regional, and local levels.

Water has been, and remains, a fundamental driving force in shaping the physical and economic development of the United States. Inland rivers and coastal routes were the continent’s primary transportation corridors, long before there were roads. Later, improved harbors and canals were the nation’s first improved freight corridors. Settlement patterns and industrial development naturally followed the coasts and waterways, because they provided access to marine resources and offered the only economically viable means of moving goods. Our first cities were port cities.

With advancing industry and technology and the rise of transcontinental railroads, the critical role of waterways did not diminish: rather, it took on a different and enhanced importance. Railroads built new connections between coastal and inland waterways, promoting the growth of interior cities and fueling America's industrial revolution. Later as the U.S. highway network developed, population and production centers moved off the waterways but did not lose their need for waterborne transportation. Truck-only local services, combined rail-truck long-haul services, and advanced logistics practices evolved to ensure these growing inland markets remained connected to the water.

Today, America's Marine Transportation System (MTS) remains a critical element of our domestic transportation infrastructure and our primary gateway for global trade. The MTS includes navigable waterways and public and private ports on three coasts (Atlantic, Pacific, and Gulf), the Great Lakes, and inland waterways. It also includes, by extension, the use of inland highway and rail connections that connect ports with inland markets, ensuring access to the water for shippers and receivers in all 50 states. The MTS includes 8,197 cargo-handling docks, 179 ports handling more than 250,000 tons annually, and 52 ports handling containers.

Table ES-1. MTS Volume and Value, 2011

	Domestic	International			Grand Total
		Import	Export	Subtotal	
Tons (millions)	887.9	869.1	610.4	1,479.6	2,367.5
Loaded TEUs (millions)	2.0	17.1	11.7	28.8	30.1
Value (\$ billions)	151.4	1,066.0	473.1	1,539.2	1,690.6

Sources: U.S. Army Corps of Engineers (tons and TEUs) and U.S. DOT Freight Analysis Framework-3 (value).

In 2011, the MTS handled more than 2.3 billion tons of cargo—the equivalent of over 100 million fully-loaded five-axle combination trucks, which would stretch more than 1 million miles if parked end-to-end. The MTS carried more than 1.4 billion short tons of international cargo worth more than \$1.5 trillion dollars; this represents more than 99 percent of U.S. trade tonnage outside of North America. The MTS handled 43 percent of our trade value with all nations, and 69 percent of our trade tonnage with all nations. The MTS also carried almost 900 million tons of domestic cargo worth more than \$150 billion dollars.

The MTS handles raw materials and intermediate products such as petroleum, fuel, agricultural products, building materials, metals and ores, and chemicals; as well as finished products such as automobiles, electronics, machinery, clothing, furniture, and food. Much of our international trade in higher-value finished products is accommodated by intermodal shipping containers, seamlessly exchanged between ships, rail cars, and truck chassis. In 2011, the MTS carried more than 30 million loaded TEUs (20-foot equivalent units) of containerized traffic. Domestic trade is heavily focused on non-containerized commodities—grains, fuels, etc.—in bulk form, but there is increased attention to possibilities for domestic container trade on the coastal and inland waterways. Projections suggest that by 2040, total MTS tonnage will double, while container traffic will grow between three and four times.

The MTS is so fundamental to the U.S. economy, so embedded in the chain of domestic and global production and consumption, that without the MTS the economies of every state and the nation would be structurally different. While the full value of the MTS has yet to be quantified, recent studies have examined its major components:

- **Great Lakes.** “Great Lakes–St. Lawrence Seaway shipping is one of the key drivers of the U.S. and Canadian economies. The industry creates 227,000 jobs in the two countries, and produces business revenues of \$35 billion... It also supports the economic health of North America’s industrial heartland and a consumer market of more than 100 million people. To keep their businesses running, U.S. and Canadian electric utilities, steel mills, construction companies, mining companies, manufacturers, and farmers all depend on the 164 million metric tons of cargo delivered by Great Lakes vessels every year. These cargoes become the automobiles North Americans drive, the office buildings they work in, the energy that heats their homes, the salt that keeps roads safe, and the food they put on the dinner table. Marine transportation on the Great Lakes–Seaway System provides \$3.6 billion (U.S.D) in annual transportation cost savings compared to the next least expensive all-land transportation alternative. This enhances the global competitiveness of North American products and industries and keeps the cost of consumer goods down.”¹
- **Inland Waterways.** “In 2006, Ohio River Basin commercial navigation users saved \$3.1 billion by using the Ohio River System (ORS) waterway to ship coal, steel, chemicals and other commodities by barge. For the entire U.S. inland river system, using an estimated \$10–\$12 per ton shipper savings, national transportation shipper savings would be in the neighborhood of \$7.0 billion... A University of Tennessee Center for Transportation Research study found that barge navigation on the ORS navigable channel contributed a total of \$497 billion in sales and 80,000 annual jobs to the nation’s economy. This \$497 billion in sales, discounted over 44 years at 3 percent, yields an annual \$20.5 billion (of this, \$3.1 billion is shipper savings, leaving \$17.4 billion for the annual economic impact).”²
- **Deep Water and Coastal Ports.** “[Deep water] public ports contribute significant benefits to local and regional economies, including generating business development and job opportunities. Commercial port activities in 2007 created employment opportunities for more than 13.3 million Americans, including nearly 12 million who were employed in exporter/importer-related businesses and support industries throughout the U.S. Business activities related to waterborne commerce contributed approximately \$3.15 trillion overall to the U.S. economy, and those same businesses paid nearly \$212.5 billion in Federal, state, and local taxes. Seaport activities alone in 2007 accounted for \$31.2 billion in Federal, state, and local tax revenues.”³

1 *The Economic Impacts of the Great Lakes–St. Lawrence Seaway System.* Martin Associates; October 18, 2011.

2 *Toward a Full Accounting of the Beneficiaries of Navigable Waterways.* University of Tennessee Center for Transportation Research, January 2011.

3 *The Local and Regional Economic Impacts of the U.S. Deepwater Port System, 2007.* Martin Associates; June 6, 2008.

Table ES-2. Summary of Available MTS Economic Impact Estimates

	Jobs (Direct, Indirect, Induced)	Annual Impacts (Billions of Dollars)		
		Wages	Revenues	Transport Savings
Great Lakes (U.S.) (2011)	128,227	9.7	18.1	2.0
Ohio River System (2011)	80,000	–	17.4	3.1
Other Inland Waterways (2011)	–	–	–	3.9
Deep Water and Coastal (2007)	1,325,531	95.3	100.1	–
U.S. Importers and Exporters (2007)	11,995,102	554.2	3,055.4	–

Sources: Martin Associates, University of Tennessee Center for Transportation Research.

Freight movement over the MTS provides other important benefits—reductions in highway congestion, transportation costs, rail system congestion, fuel consumption, and air emissions—worth billions of dollars annually to the U.S. economy. Other extremely valuable benefits of the MTS include, but are not limited to: military mobilization and resupply; passenger transportation; commercial fishing; shipbuilding; vessel repair, maintenance, and servicing; construction and salvage; offshore oil and gas exploration; offshore pipeline and telecommunications system construction and maintenance; law enforcement; incident management and environmental/emergency response; marine research; hydropower; municipal water; irrigation water; flood control; and recreational fishing and boating.

The basic shape of the MTS was initially defined by the location of protected, deep natural harbors and reliably navigable inland waterways. Over the years, these first-generation assets have been improved, new deepwater ports and terminals have been constructed, and new waterway mileage has been added to the system. But unlike the U.S. highway system, which largely emerged as the result of coordinated planning and close partnership between federal and state governments, the MTS has evolved without larger-scale coordinated policy and planning.

- The federal government—acting principally through the U.S. Army Corps of Engineers—has been primarily responsible for constructing and maintaining a set of federally-authorized navigation channels. Corps appropriations for navigation projects have, over the past decade, averaged \$1.5 to \$2 billion per year.⁴ Costs for deep-draft improvements are typically shared with local sponsors.
- Multi-state authorities, state agencies, regional authorities, and local governments have built marine terminals, often in direct competition with neighbors. Private industries have also built their own marine terminals, typically to accommodate the movement of bulk materials. A survey by the American Association of Port Authorities found that U.S. ports and their partners plan to invest \$46 billion in MTS infrastructure by 2017.⁵
- Local, regional, and state planners, recognizing the economic benefits of port operations as well as their potential impacts on transportation systems, communities, and the environment, have

⁴ *U.S. Port and Inland Waterways Modernization: Preparing for Post-Panamax Vessels*. U.S. Army Corps of Engineers; June 20, 2010.

⁵ <http://www.aapa-ports.org/Press/PRdetail.cfm?itemnumber=18583>.

provided landside connections and made land use decisions affecting port development and expansion.

- Railroads have developed lines and services to connect marine terminals with inland and cross-country markets. The railroads compete with each other, but they also cooperate with each other and the public sector on projects of mutual benefit (such as Southern California’s Alameda Corridor and Chicago’s CREATE).
- Ocean and waterway carriers select ports of call based on the particular port arrangements (location, accessibility, vessel size capacity, terminal operating cost structure, etc.) that allow them to profit from the customer services they provide.
- Freight shippers and receivers have developed privately-owned logistics infrastructure—warehouse/distribution centers, manufacturing/processing plants, etc.—either at ports or at inland locations connected to ports via rail and/or truck.

The common theme in MTS development has been market opportunism, from both the private and public sectors. Ports and related infrastructure and services develop and evolve independently, to capture, maintain, and grow specific market niches. There is no “master plan” for the MTS; each port, stakeholder, and region pursues its own business mission. The result is that the MTS is, as some have described it, a “collection of competitors.”

Overlaid on this competitive structure is a significant federal role. The maintenance and improvement of federal waterways is the responsibility of the U.S. Army Corps of Engineers (Corps). The work of the Corps is funded from the Harbor Maintenance Trust Fund (supported by an ad valorem fee on imports and domestic traffic), the Inland Waterways Trust Fund (supported by a fuel tax on inland waterway traffic), annual general fund appropriations, and cost-sharing with local sponsors. Needed highway connections, and in some cases support for rail connections, are generally provided by state and regional governments through the allocation of federal and non-federally sourced transportation funds. Major MTS projects require extensive environmental studies and regulatory approvals at the federal, state, and local levels. While the MTS is not planned at the federal level, the competitive aspirations of ports and stakeholders may be significantly facilitated, limited, or managed by the availability of project funding and approvals at the federal level.

Other types of collaboration are essential. Traditionally, ports work closely not only with their Corps Districts, but also with their local and regional and state governments, their railroads, and other stakeholders. Ports often work together on projects and issues of mutual interest. In recent years, there have been efforts to bring together the full range of public and private sector stakeholders through the Committee on the Marine Transportation System (CMTS) and the MTS National Advisory Committee (MTSNAC).

The MTS has been fundamental to the economic success of the nation. It has been highly adaptable and responsive to changing market conditions and needs; it has given producers in every state efficient access to global markets; it has provided consumers in every state with efficient access to global products; and it has dramatically reduced the nation’s surface transportation costs and ton-mileage. But the very success of the MTS has masked serious underlying structural problems. In recent years—with growing demand, rising transportation and project development costs, increased

attention to environmental issues, and stronger global competition, these structural problems have become more evident. If left unaddressed, they pose critical threats to the long-term health of the MTS and the nation as a whole.

- **Basic waterway maintenance needs are not being met.** The U.S. Army Corps of Engineers is responsible, among other things, for maintaining federal navigation channels at authorized navigable depths. For years, appropriated funding for the Corps' annual work programs has fallen far short of requested and required amounts, resulting in a critical backlog of unfunded maintenance dredging projects and a significant amount of waterway system mileage operating at less than authorized depths. Failure to maintain authorized waterway depths means lighter vessel loadings and increased shipping costs; in the most extreme cases, some shallow-draft waterways have become completely inoperable. A recent study by the Texas Transportation Institute found that losing just one foot of navigable depth from the Houston ship channel results in added costs of around \$375 million per year.⁶ Similarly, the Corps faces a critical backlog of projects to modernize antiquated locks and dams. The MTS includes 238 lock chambers with an average age of 58 years; out-of-service times are increasing every year, costing U.S. shippers millions in delays, light-loaded vessels, and other costs. According to a recent report by the American Society of Civil Engineers, in 2010, delays on the inland waterway system cost users \$33 billion, while insufficient harbor depths cost users around \$7 billion.⁷
- **Needed navigation projects are often delayed for years, even decades.** Project studies can take many years, even spanning decades, before reaching conclusions and allowing projects to advance. And even after being authorized, federal funding may never materialize. A decentralized MTS responds well to market-based opportunities at the local and regional level—but does not deliver projects efficiently because regulatory and funding authority is balkanized across dozens of stakeholders and multiple levels of government. Critically needed projects tend to advance sluggishly, and in some cases do not advance at all.
- **Funding for critical MTS expansion needs is inadequate and uncertain.** Normal maintenance and limited expansion of terminals, landside access infrastructure, and vessel berths is typically accomplished through a combination of port revenues, state and regional contributions, and private participation. But major navigation projects generally require special funding arrangements: revenue bonds, significant state and regional funding, and federal support. However, appropriations for the Corps for both construction and maintenance projects have consistently fallen far short of the levels needed to implement authorized projects and adequately maintain the system. As a result, huge work backlogs have accumulated, and in the absence of action the backlog will only continue to grow. In light of the massive funding shortfalls for federal navigation construction and maintenance projects, improving the reliability and quantity of federal funding available for these purposes is absolutely essential.

6 "Measuring the Economic Effect of a Lack of Maintenance Dredging of Ship Channels." Paper submittal to the 93rd Annual Transportation Research Board Meeting by James Kruse and Annie Protopapas of the Texas Transportation Institute.

7 *Failure to Act: The Economic Impact of Current Investment Trends in Airports, Inland Waterways, and Marine Ports Infrastructure*. American Society of Civil Engineers, September 2012. Analysis by EDR Group, Inc.

- **National investments in the MTS are not being effectively targeted to meet national needs and provide national benefits.** The nation as a whole derives benefit from the MTS, and it is reasonable to expect that national investments should be clearly tied to the achievement of national benefits. Yet port and MTS planning at the national level is, apart from national defense issues, non-existent. Ports, regions, and railroads pursue MTS improvements independently, to fulfill their own local or regional or business missions. Federal studies and investments are responsive to local requests, but are not targeted to maximize MTS benefits for the nation as a whole. What the nation needs from its MTS, and what it should expect from its MTS investments, has not been defined.
- **Responsibility for the well-being of the MTS and accountability for its failure or success is widely diffused.** Underlying each of these problems—inattention to basic maintenance, inadequate funding, inefficient program delivery, and inattention to the national interest as a whole—is the fact that there is no locus of responsibility for its well-being, its vitality, its future, and for ensuring the nation receives the best possible return from its investments in the MTS.

Embracing business as usual will inevitably lead to significant further declines in MTS condition and performance, and to lost opportunities for our transportation system and economy. Those who consider these outcomes to be unacceptable must argue that a renewed national commitment to our MTS is urgently required, along with corresponding changes in how to plan and fund the MTS.

MTS stakeholders would agree that decisive and positive action now will yield unprecedented benefits. With recovery underway, global trade is again nearing record levels. Following national policy direction, many states are setting explicit goals to dramatically increase their export business as a means of balancing trade and growing their economies. With growing highway congestion, waterborne transportation becomes an even more attractive transportation alternative. Waterborne trade and transportation will be cornerstones of the 21st century economy.

However, there is not a solid consensus among all MTS stakeholders on the best way to proceed. Therefore, to promote discussion and action, AASHTO developed this first-ever *Waterborne Freight Transportation* report. The report describes the nature, extent, and critical role of the MTS, and offers the following alternatives for action:

1. **Pass federal legislation to improve the reliability of MTS funding and achieve full state-of-good-repair for MTS waterways by the year 2020.**
 - a. Congress should direct the U.S. Army Corps of Engineers to prepare a comprehensive inventory and plan to address the nation's deferred navigation system maintenance needs—locks and dams, inland waterways, Great Lakes channels, and coastal port channels—by the year 2020. The plan should specify the funding requirements and processes, and as part of its direction, Congress should make clear its intent to fully fund the identified need. This plan could be adopted as part of the Water Resources Development Act (WRDA) or in parallel.
 - b. The administration's decision to "fast track" a number of critical Corps projects was encouraging.⁸ As a follow-up, Congress and the administration should advance a new Water Re-

8 July 19, 2010. The "We Can't Wait" initiative addresses Corps projects at the ports of Savannah, New York/New Jersey, Miami, Jacksonville, and Charleston.

sources Development Act, featuring comparable attention to fast-tracking and streamlined project delivery. The new WRDA should include an update of the Corps' benefit-cost evaluation methods, which are currently tonnage-dependent, to allow for consideration of a broader range of local, regional, and national benefits. The new WRDA should also identify full funding strategies for authorized projects, based on trust fund proceeds, anticipated general fund appropriations, and new funding sources.

- c. Legislation should advance to require full utilization of Harbor Maintenance Tax (HMT) funds, and to exclude domestic container traffic from the HMT as a means of promoting domestic "Marine Highway" services.

2. Establish a new Office of Multimodal Freight, under the Secretary of Transportation, that would have as one of its responsibilities elimination of the balkanization of MTS planning, funding, and project delivery.

- a. The Secretary of Transportation should act to create a new Office of Intermodal Freight within the U.S. Department of Transportation. The mission for the new Office would be to promote efficient freight movement via all modes, including water, and to promote the health of all freight transportation systems, including the MTS. The Office would be empowered to cooperate with and coordinate the actions of the multiple federal agencies responsible for MTS planning and project delivery, and to receive guidance from the full range of public and private MTS stakeholders. To be clear, the intent is not to federalize MTS planning—rather, it is to ensure that MTS improvements identified and implemented at the local, regional, and state levels have an effective champion at the federal level, providing what some have called "stewardship of the whole."
- b. Upon establishment, the new Office should act to identify, evaluate, and promote proposals for increased MTS funding and improved funding reliability. A full range of possibilities, such as taxes, user fees, federal solutions, local approaches, and private contributions should be examined.
- c. Upon establishment, the new Office should immediately act to provide guidance to national freight planning activities required under MAP-21 surface transportation program legislation. This guidance should include: enhanced stakeholder coordination, building on prior CMTS and MTSNAC activities; creation of a system map and classification of MTS facilities, analogous to the National Highway System and the National Freight Network (consisting of highways) required under MAP-21; preparation of a formal *MTS Condition and Performance Report*, comparable to the report prepared for the National Highway System; preparation of a comprehensive Economic Impact report addressing the benefit of the MTS to the nation, and the costs to the nation of failing to maintain and expand it; a comprehensive approach to environmental analysis and mitigation strategies to facilitate MTS improvements; and preparation of a long-range vision plan for national MTS development and investment to meet national transportation and economic development objectives.

3. Identify and promote "best practices" for MTS planning and investment at the state, regional, and local levels. The MTS is not a federal system—it is a shared responsibility of private stakeholders and public partners at all levels of government. States have an important role in the

planning, improvement, and operation of the MTS. Today, each state addresses MTS issues and investments according to its own practices, needs, and resources. To accomplish this objective, “state of the practice” guidance should be developed by AASHTO and provided to state, regional, and local MTS stakeholders. “Fast track” guidance should be developed immediately to assist states in developing waterborne freight performance measures and MTS project recommendations for inclusion in MAP-21-compliant state freight planning activities, as input to the National Freight Strategy.

Table ES-3. Summary of Action Alternatives

Issues	Action Alternatives
Basic waterway maintenance needs are not being met.	Direct the Army Corps to develop a plan to address the nation’s MTS maintenance backlog, and ensure funding to eliminate the backlog by the year 2020.
Needed projects are often delayed for years, even decades.	Develop and adopt new Water Resources Development Act, focusing on upgraded project benefit-cost analysis and project-delivery streamlining.
Funding for critical MTS expansion needs is inadequate and uncertain.	Pass legislation requiring full utilization of HMT funds, with HMT exemptions for domestic Marine Highway services.
National investments in the MTS are not targeted to national needs and national benefits.	Establish new Office of Multimodal Freight, empowered to coordinate and advance MTS planning and projects: – Improved MTS funding strategies – Stakeholder coordination – Map and classification of MTS facilities – MTS Condition and Performance Report – MTS Economic Impact evaluation – Environmental Analysis and Mitigation strategy – Long-range national MTS vision
No locus of responsibility for the well-being of the MTS and accountable for its failure or success.	Promote best practice guidance for state, regional, and local MTS planning and investment, including “fast track” guidance for MAP-21 input and compliance.

All of the world’s industrial economies understand a simple fact: efficient transportation means lower costs and greater reliability for freight shippers and receivers, so that goods can be produced and purchased less expensively, which translates directly into a stronger competitive position in the global marketplace. Western Europe has been a highly integrated maritime economy for centuries, and developed along river and canal connections; today, their inland waterways serve much the same purpose as the U.S. rail system. Asian ports, following dramatic growth in the economies of Japan, Korea, and most recently, China, now dominate the list of the world’s largest container ports. Expanding economies in India and Brazil are being served by major port expansion programs (\$60 billion in India and \$17 billion in Brazil, according to the American Association of Port Authorities).⁹ Closer to home, Canada and Mexico have invested in marine terminals and rail connections that compete directly with U.S. ports for overseas trade, even as they provide better opportunities for increased waterborne trade within North America itself.

The United States has enjoyed a long period of unchallenged global economic dominance, during which it could afford to develop and fund the MTS on an incremental, piecemeal basis, without the benefit of firm funding commitments and an overarching national strategy. That time is ending. The nation faces great challenges but also great opportunities; and how effectively those challenges are met will define, to a significant degree, the economic future of the nation.

9 <http://www.aapa-ports.org/Press/PRdetail.cfm?itemnumber=18583>

1.0 Water Shaped the Nation

Throughout world history, access to navigable bodies of water has driven human settlement. In North America, waterways originally used for commerce and travel by Native Americans later determined the physical and economic development of the United States. With the rise of multi-modal transportation and logistics chains, the fact that every American, and every American industry, continues to remain dependent on water is sometimes obscured. As a starting point for a larger consideration of the MTS, it's worth thinking about how waterborne freight shaped the growth of the nation, and what it means for continued growth in the future.

■ 1.1 Waterborne Freight in the Age of Sail

At the time of the American Revolution, it cost as much to move a ton of goods 30 miles inland as to move it across the Atlantic.¹⁰ Given that waterborne transportation was the only commercially viable means of transporting passengers and freight over significant distances, the colonial economies of the 18th century were built around natural harbors and easily navigable rivers. Natural and artificial waterways served as the nation's first superhighways. The most successful cities in the early United States grew around natural harbors such as New York, Baltimore, and Charleston, along the Great Lakes, and on navigable inland rivers like the Columbia, Ohio, Missouri, and Mississippi.

Much of the interior of the United States is not directly accessible by water, and the nation's first major transportation infrastructure projects were waterway improvements—not only improvements to harbors and piers, but also an extensive system of canals. The establishment by Thomas Jefferson of the U.S. Army Corps of Engineers in 1802 was a key development in creating a national transportation strategy for the early United States. New York's Erie Canal helped make New York City a preeminent trading and financial services port. By 1851, a network of 36 canals served New England, the Mid-Atlantic, the Midwest, and other regions.¹¹

With the Louisiana Purchase and the opening of the American west, historic colonial ports grew and new international gateway ports emerged along the Atlantic, Gulf, and Pacific coasts.

10 McPherson, J. M. *The Battle Cry of Freedom: The Civil War Era*. Oxford University Press, New York and Oxford, 1988, p. 11.

11 Waugh, Jr., R. G. "Canal Development in Early America." Board of Engineers for Rivers and Harbors, Fort Belvoir, Virginia. From the U.S. Army Corps of Engineers *History of the Commercial Waterways and Ports of the United States*, Volume 1.

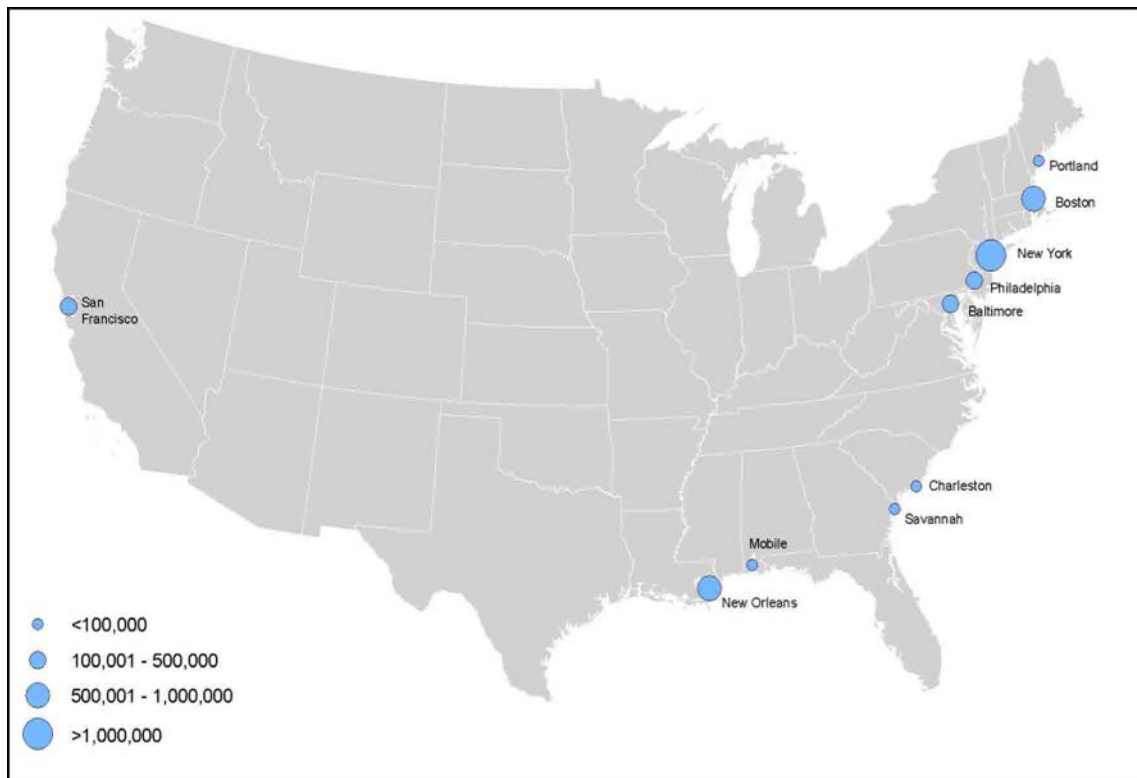
Coastal ports were America's first cities:



Source: Bureau of the Census data.

Figure 1-1. Top 18 U.S. Cities by Population Rank (1800)

By the mid-1800s, major international gateway seaports were established on three coasts:



Source: Bureau of the Census data.

Figure 1-2. Tonnage Entered through U.S. Ports (1853)

■ 1.2 Waterborne Freight in the Age of Rail

When the railroads emerged in the mid-19th century, they functioned as steel tributaries to the existing waterways and connected the vast interior of the country to ports. East–west rail routes were built that complemented the north–south river system—creating the nation’s first integrated freight network. Rather than replacing waterways, railroads allowed the waterways to become even more productive as agricultural and industrial goods were consolidated at river ports and barged to seaports. Urban and industrial centers grew at major inland rail hubs, most of which were located at the confluence of railroads and navigable waterways. This early multimodal linking of barge and rail technology fueled America’s industrial revolution.

Through 1900, all of the top 20 U.S. cities by population were located on navigable water. But unlike 1800, when all 20 were on the Atlantic, by 1900 only eight were on the Atlantic or its tributaries. Five were on the Great Lakes; six were on the Ohio or Mississippi rivers; and one was on the Pacific. These inland cities were not only important ports, but also critical rail hubs.

Great Lakes and river port cities emerged with railroads:



Source: Bureau of the Census data.

Figure 1-3. Top 20 U.S. Cities by Population Rank in the Rail Era (1900)

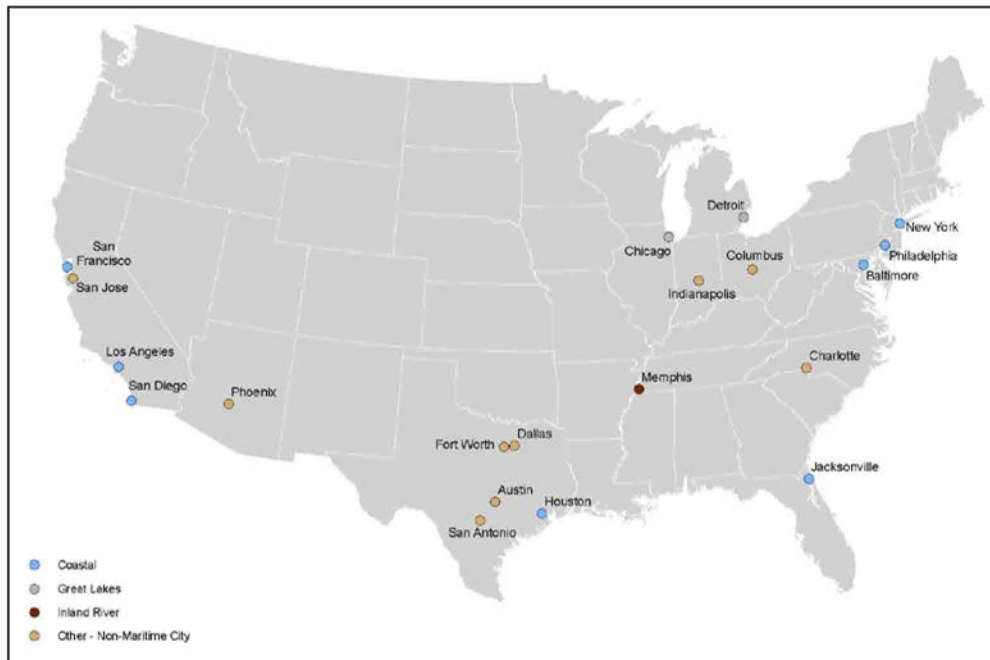
■ 1.3 Waterborne Freight in the Age of Trucking and Intermodalism

The development of truck and highway technologies in the early 20th century freed business and industry again, this time from the need to locate near rail lines and terminals. An east–west and north–south Interstate highway grid was built to connect cities and regional economies. Production and consumption centers migrated outward from city centers, taking advantage of inexpensive land made newly accessible by the trucking and highway systems. Following the widespread adoption of trucks, trucking quickly became the dominant freight mode for serving local and regional markets, as well as a competitive mode for serving long-haul markets.

With the maturation of the nation’s surface transportation network—marked by completion of the interstate highway system and deregulation of the nation’s freight railroads—the next wave of freight innovation and productivity came from the intelligent use of a steel box. The intermodal shipping container is a steel box of standard dimensions, with specially designed corners called “twistlocks” that allow it to be lifted and transferred between ships, railcars, and truck chassis. Previously, marine cargo that could not be shipped in bulk form was mostly moved in small units (bags, pallets, etc.) and stevedored by hand. The container allowed cargo of all kinds to be moved in larger units, by efficient machines, over longer distances, with lower costs and greater security and reliability. Moreover, it allowed cargo to move among and between modes with a minimum of cost, allowing for the use of complex multimodal logistics chains, across state lines, national borders,

and oceans. Products moved through our ports over increasingly long distances inland, sometimes entirely across the country, via rail, truck, or both.

Non-Maritime Cities Emerged with Trucking and Intermodalism



Source: Bureau of the Census data.

Figure 1-4. Top 20 U.S. Cities by Population Rank in the 2010 Census

In 1960, nine of the top ten U.S. cities by population were served by local ports. However, efficient truck and rail connections between U.S. ports and inland markets helped support the rapid growth of non-port cities and urbanized areas. By 2010, only six of the top ten cities, and 11 of the top 20, were served by local ports. These non-port cities still ship and receive marine cargo; but they do it via trucking or combined truck–rail services, often via a complex system of intermediate handling (intermodal transfer facilities, warehouse/distribution, etc.). The same pattern is true when considering Metropolitan Statistical Areas rather than cities. Metropolitan areas like Atlanta, El Paso, and Washington DC–Northern Virginia–Maryland depend on truck and truck-rail services as their marine gateways.

■ 1.4 The Next Era of Waterborne Freight

With respect to waterborne freight, looking backward is easier than looking forward. Prior to their emergence, few could have foreseen the transformative impact that the canal system or the trans-continental railroad, the interstate highway system, or the intermodal shipping container would have on U.S. commerce. But it seems likely we have already entered another era, one in which our infrastructure is largely in place, and largely fixed as to dimension by geography or land use.

In such an era, the challenges of waterborne freight will need to be met less by new building, and more by getting the most from the assets we already have: through operational improvements (information systems, equipment, logistics, productivity, etc.), bottleneck elimination (especially inadequate navigation channels), and selected physical improvements (terminal expansion projects, highway and rail corridor improvements, etc.). Increasingly, investment decisions will need to be supported by plausible, accepted performance metrics that demonstrate economic, transportation, and environmental benefits. We will need to make the best possible case for MTS investments, against a backdrop of increasing land use pressures, environmental concerns, and public funding constraints.

Waterborne trade and transportation have driven the nation's economy since its founding. With near-record activity and prospects for strong continued growth, waterborne freight transportation will continue to shape the nation's economy. Today, every state participates in the global trade economy, and every state is a stakeholder in the success of the waterborne freight system, whether it is served directly by its own ports or indirectly by trucking and rail from other states. Over time, and with the development of inland population centers, waterborne freight transportation and landside transportation have become a single functional system. Problems in any part of the system—gateway ports, inland waterways, critical highway corridors, and critical rail corridors—affect the entire system. If we succeed in meeting the challenges of waterborne freight, we will support the continued vitality of our port cities as well as the inland markets that depend on ports. If we do not, then it is not only port communities that are at risk—it is the nation as a whole.

2.0 MTS Assets

■ 2.1 Definition of the Marine Transportation System

Historically, the nation's marine transportation system, or MTS, consisted of its deepwater harbors and rivers, along with the piers and docks that lined them. Over time, the system expanded to include canals and river ports that integrated railroad operations and trucking operations, and to incorporate global logistics chains. The Marine Transportation System National Advisory Council (MTSNAC) and the Committee on the Marine Transportation System (CMTS)¹² define the MTS as follows:

MTSNAC/CMTS Definition of the MTS

The Marine Transportation System, or MTS, consists of waterways, ports, and intermodal landside connections that allow the various modes of transportation to move people and goods to, from, and on the water. The MTS includes the following:

- 25,000 miles of navigable channels;
- 239 locks at 193 locations;
- Great Lakes;
- St. Lawrence Seaway;
- Over 3,700 marine terminals;
- Numerous recreational marinas;
- Over 174,000 miles of rail connecting all 48 contiguous states, as well as Canada and Mexico;
- Over 45,000 miles of interstate highway, supported by over 115,000 miles of other roadways; and
- Over 1,400 designated intermodal connections.

Figure 2-1. MTSNAC/CMTS Definition of the MTS

This definition can be expressed as a slightly different formulation, in which the MTS is comprised of three sets of related infrastructure elements:

- **MTS Ports and Terminals**—This consists of “on the ground” assets—the ports, terminals, docks, piers, and other structures and facilities accommodate the transfer of freight and passengers between vessels and land.
- **MTS Waterways**—This consists of “in the water” assets—navigation channels, harbors and bays, turning basins, anchorages, rivers, open water travel lanes, etc.—and associated locks, dams, and other marine structures.

¹² MTSNAC is “a chartered, non-federal body whose purpose is to advise the Secretary of Transportation on MTS issues” (source: www.mtsnac.org). The parallel public-sector involvement is the Committee on the Marine Transportation System, or CMTS. Formation of the CMTS was directed by the U.S. Ocean Action Plan, issued December 17, 2004.

- MTS Surface Transportation Connectors and Corridors—Similar to the National Highway System intermodal connectors, MTS connectors include “last mile” highway, rail, and pipeline connectors. MTS corridors, however, can extend hundreds and even thousands of miles across the country, and coastal ports with inland and coastal cities.

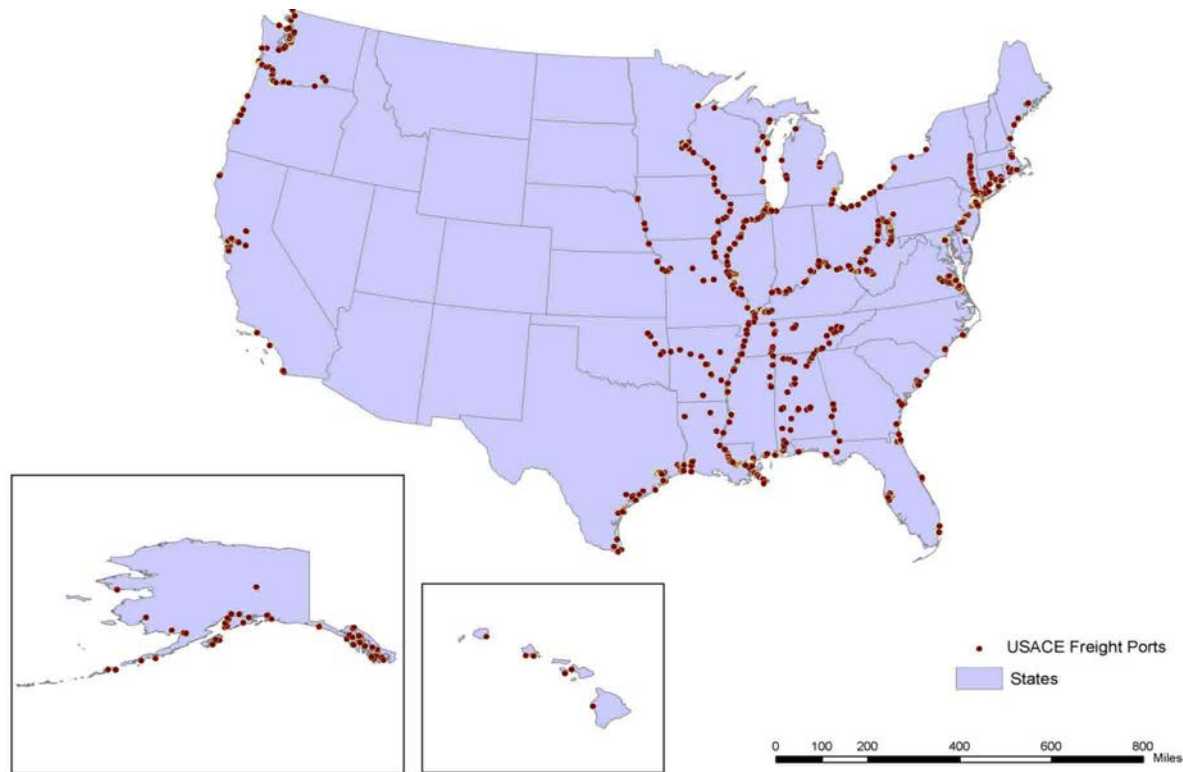
■ 2.2 MTS Ports and Terminals

The MTS waterways serve nearly 8,200 separate commercial cargo-handling docks. These include public facilities (owned and managed by state, regional, and local port departments and authorities), as well as private facilities (common-user terminals and dedicated facilities). According to the American Association of Port Authorities (AAPA), there are 126 public seaport agencies with jurisdiction over 185 ports. These docks and ports are widely distributed over the Atlantic, Pacific, Gulf, Great Lakes, and Inland Waterways.

Table 2-1. Geographic Distribution of MTS Cargo-Handling Docks (2011)

Location	Foreign Only	Foreign and Domestic	Domestic Only	Total
Atlantic	33	560	1,193	1,786
Pacific	24	571	1,101	1,696
Gulf	17	559	1,560	2,136
Great Lakes	3	246	402	651
Inland	0	0	1,928	1,928
Total	77	1,936	6,184	8,197

Source: U.S. Army Corps of Engineers.



Source: U.S. Army Corps of Engineers Facilities Database.

Figure 2-2. Commercial MTS Cargo Facilities

On a tonnage basis, the top three U.S. ports (South Louisiana, Houston, and New York/New Jersey) account for 26 percent of all MTS tonnage. In 2011, 53 ports handled in excess of ten million tons of waterborne cargo.

Table 2-2. Leading U.S. Ports by Tonnage (2011)

Rank	Port	2011 Tons (millions)
1	South Louisiana, LA	246.5
2	Houston, TX	237.8
3	New York, NY and NJ	139.2
4	Long Beach, CA	80.3
5	New Orleans, LA	77.2
6	Beaumont, TX	73.7
7	Corpus Christi, TX	70.5
8	Los Angeles, CA	65.0
9	Huntington, WV—Tristate	58.6
10	Baton Rouge, LA	57.9

Source: U.S. Army Corps of Engineers, Waterborne Commerce of the United States.

Our leading tonnage ports tend to specialize in heavy commodities—like petroleum, chemicals, coal, sand and gravel, grain, etc.—handled in bulk form. But they also handle many other types of

commodities. Different commodities require different types of vessels, marine terminals, and vessel-to-shore transfer operations.

Table 2-3. Vessel/Terminal Types, Transfer Methods, and Commodities

Vessel/Terminal Types	Transfer Methods	Typical Commodities
Liquid Bulk	Liquid material, not packaged, transferred via pipeline	Crude or refined petroleum, chemicals, edible oils, etc.
Dry Bulk	Dry material, not packaged, transferred via conveyor, hopper, etc.	Coal, petroleum coke, salt, sand, gravel, bulk cement, bulk grain, etc.
Breakbulk	Unitized or packaged freight, lifted via shoreside cranes or ship's gear	Lumber, steel, clay, stone, cement, grain or other foods, etc. handled on pallets or in large sacks
Neo Bulk		Logs, steel rolls, or other large/heavy items handled as individual units
Project Cargo		Unusually large or heavy items such as generators, wind turbines, etc.
Roll on–Roll off	Units driven on and off vessels	Autos, trucks, construction equipment, boats on trailers, etc.
Container	Usually lifted via specialized shoreside cranes, but sometimes by ship's gear	Any packaged or unitized commodity shipped within an international shipping container; especially well-suited for high-value, time-sensitive cargo (consumer goods, food products, etc.), but also used for other commodities (cotton, waste paper, automobiles, etc.) which could be moved as break bulk or roll on–roll off.



Sources: Clockwise from top left: Liquid Bulk Vessel and Terminal, Port of Grays Harbor, Washington, <http://www.portofgraysharbor.com/terminals/terminal2LiquidBulk.php>; Dry Bulk Vessel and Terminal, Duluth-Seaway Port Authority, http://www.duluthport.com/uploads/large/img_port_overview7.jpg; Container Vessel and Terminal, Norfolk International Terminal, <http://www.flickr.com/photos/hamptonroadspartnership/4556209571/>; Neo-Bulk Vessel and Terminal, Port of New Orleans, <http://www.aapa-ports.org/Industry/PhotoGalleryDetail.cfm?itemnumber=17079>; Ro-Ro Terminal, Port of Davisville, Rhode Island, <http://www.quonset.com/transportation/transportation-overview/>

Figure 2-3. Examples of Different Marine Cargo Handling Types and Terminals

Container activity tends to be concentrated at a limited number of ports, due to the expense of developing and maintaining container facilities, the need for extensive inland transportation connections and logistics facilities (such as warehouse/distribution networks), and other factors. Container ports also tend to be located at or near major population centers, where high-value goods are most likely to be consumed or produced. In 2011, 27 U.S. ports handled in excess of 100,000 total TEUs.

Table 2-4. Leading U.S. Ports by Total TEUs (Loads + Empties) (2011)

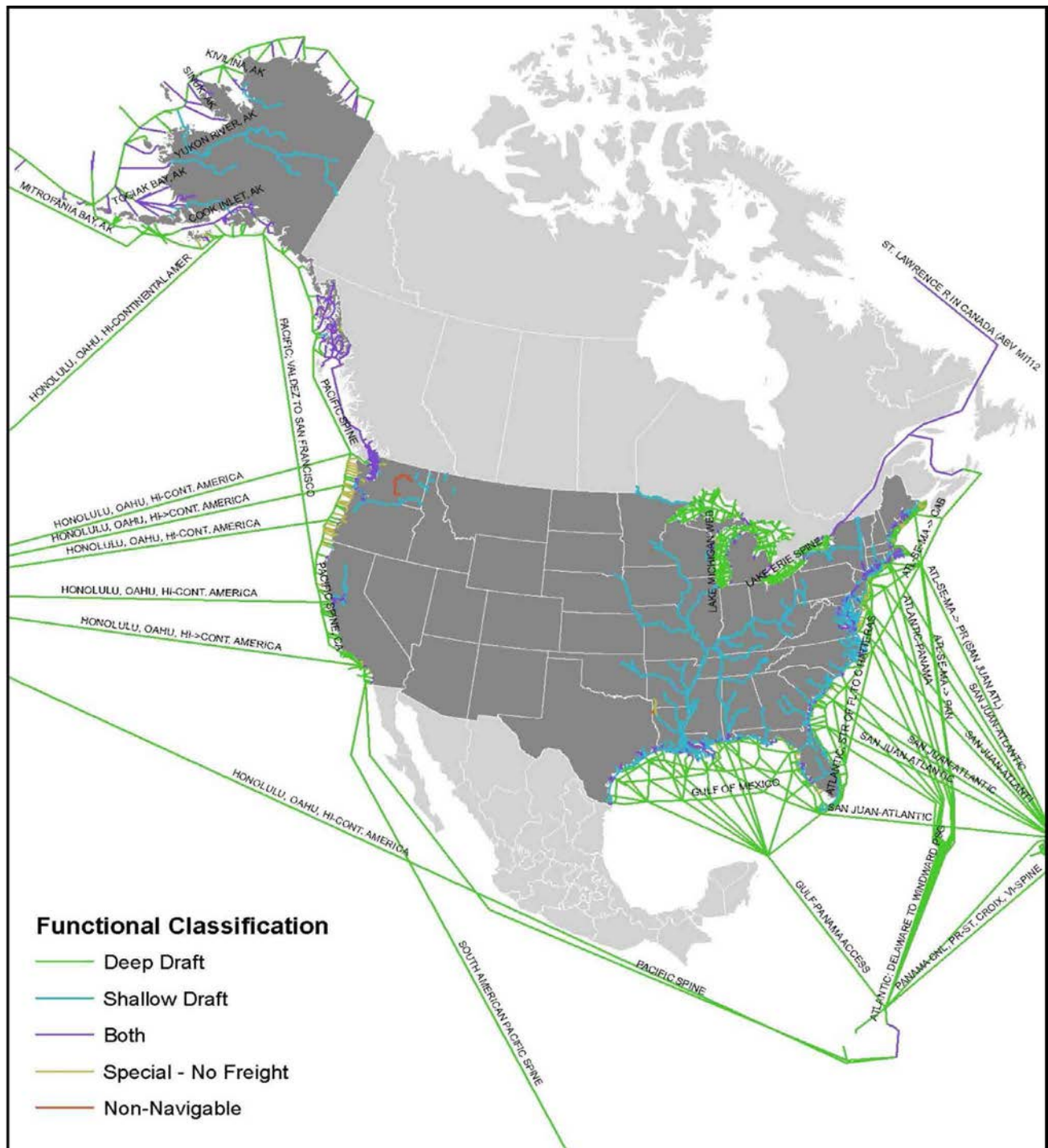
Rank	Port	2011 Total TEUs
1	Los Angeles, CA	7,940,511
2	Long Beach, CA	6,061,091
3	New York, NY and NJ	5,503,485
4	Savannah, GA	2,944,678
5	Oakland, CA	2,342,504
6	Seattle, WA	2,033,535
7	Hampton Roads, VA	1,918,029
8	Houston, TX	1,866,450
9	Tacoma, WA	1,485,617
10	San Juan, PR	1,484,595
11	Charleston, SC	1,381,352
12	Honolulu, HI	938,821
13	Miami, FL	906,607
14	Jacksonville, FL	899,258
15	Port Everglades, FL	880,999

Source: American Association of Port Authorities.

■ 2.3 MTS Waterways

MTS waterways include harbors, harbor channels, bays, sea lanes, lake lanes, rivers, canals, and basins (for turning, anchoring, etc.). They also are found in a variety of configurations and depths ranging from shallow draft (defined by the Army Corps as 12 feet or less) to deep draft (up to 50 feet or more).

Based on the U.S. Army Corps of Engineers National Waterway Network (NWN) database, the physical extent of the MTS within the territorial United States is over 62,000 miles. This includes open water miles within the United States, such as mileage across the Great Lakes and along the ocean coasts. A total of 41 states are directly served by commercially navigable waterways. These waterways are vital to many U.S. industries, not only for the domestic movement of freight (which would otherwise require truck or train transport), but also for moving freight to and from international ports, whether directly (via international vessel) or indirectly (via barge to a U.S. coastal seaport and subsequent transfer to international vessel). For many industries, the Great Lakes and inland rivers are the most cost-effective gateway to international markets.



Source: U.S. Army Corps of Engineers National Waterway Network.

Figure 2-4. Location and Draft of MTS Waterways

Table 2-5. Typology of MTS Waterways

Type	Description
Great Lakes	9,292 total system miles. Includes lakes Superior, Michigan, Huron, Erie, and Ontario, their connecting waterways, and the St. Lawrence Seaway. Great Lakes waterways are mostly deep draft.
Shallow Draft Inland and Intracoastal Waterways	29,382 total system miles. Includes shallow-draft (12 feet or less) segments of rivers, inland waterways, and intra-coastal waterways. Ports on these waterways accommodate barges and other limited-draft vessels. Leading subsystems include the Mississippi River and its tributaries; the Gulf of Mexico (including the Gulf Intracoastal Waterway, Black Warrior, and Tombigbee rivers, Tennessee–Tombigbee waterway, et al.); the Atlantic Intracoastal Waterway; and the Columbia River system.
Deep Draft Coastal and Rivers	23,670 total system miles. Includes deep-draft (more than 12 feet) international trade lanes to and from ports on the Pacific, Atlantic, and Gulf of Mexico coasts; also includes coastwise trade lanes outside of the intra-coastal waterways; also includes deep-draft segments of rivers and inland waterways.

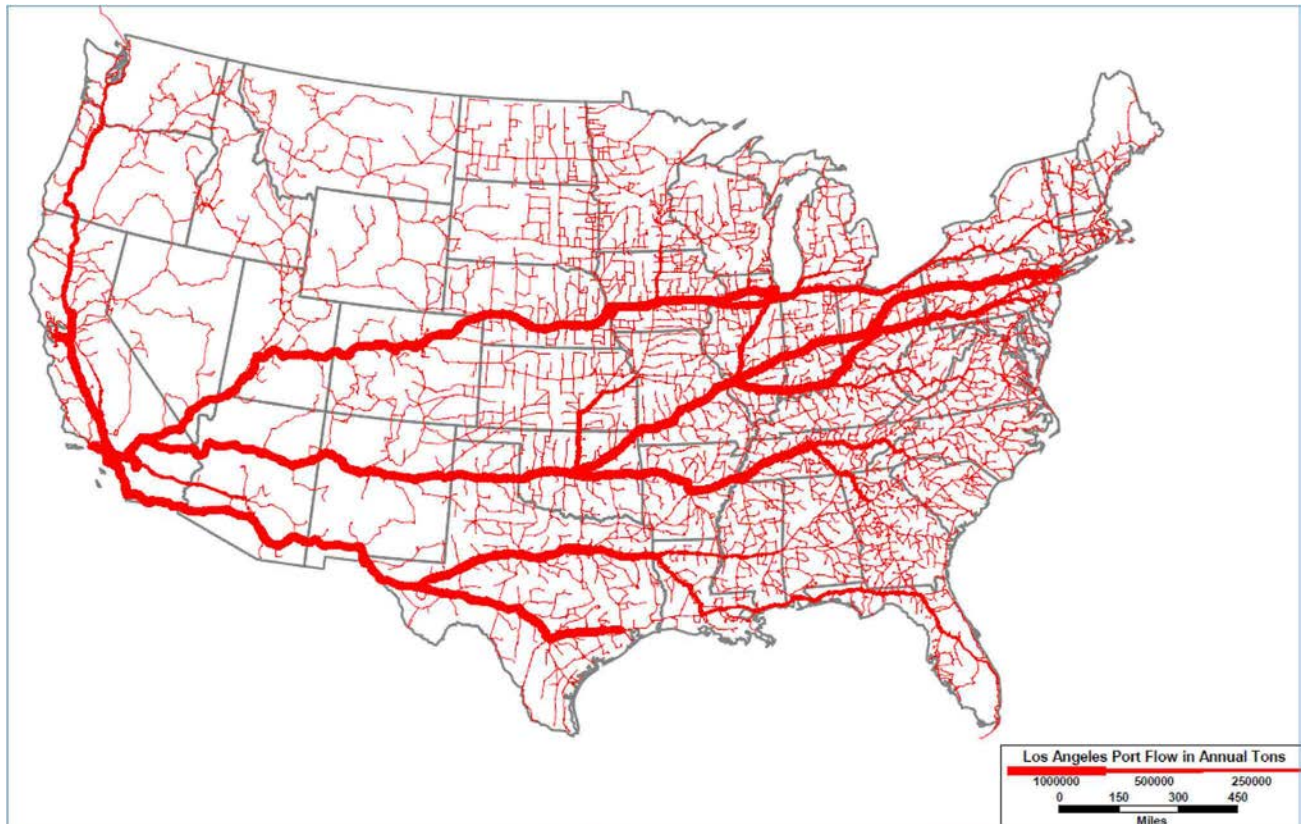
Source: U.S. ACE National Waterway Network and Navigation Data Center.

■ 2.4 MTS Surface Transportation Connectors

The nation's inland transportation network consists of over 141,000 road miles of freight rail lines connecting all 48 contiguous states, as well as Canada and Mexico; over 45,000 miles of interstate highway, supported by over 115,000 miles of other roadways; and over 1,400 designated intermodal connections. Ports depend on these railroads and highways, as well as coastal and inland waterways, to collect and distribute waterborne freight. A few ports utilize pipelines for inland collection and distribution, and are not dependent on the condition of other MTS surface transportation connectors. However, most ports are highly dependent on the condition and availability of highway, rail, and water connections.

The contribution of ports to local highway traffic is an important issue in many communities. Experience suggests that in most urbanized regions, port-related trucks represent a low share of total truck traffic and vehicle miles traveled. However, port-related trucks tend to be concentrated, and highly visible, on a limited number of key corridors, where their impacts may be problematic.

Some ports handle mostly local or regional cargo, while others handle a high percentage of cargo bound for remote, or “hinterland” regions. Local and regional cargo mostly moves by truck, since trucks are generally more efficient at short distances and provide door-to-door service to almost all freight shippers and receivers. At longer distances, typically beyond 400 to 600 miles, intermodal rail becomes increasingly more competitive and can be used as a substitute for long-haul trucking. Most container ports offer intermodal rail connections to inland markets, and some ports—such as Los Angeles/Long Beach—may send 50 percent or more of their containers inland by rail. Other ports receive or ship significant quantities of liquid and dry bulk commodities in long “unit trains” (where all the railcars carry the same commodity) or in “mixed carload” trains (with a mix of different commodities and railcar types).



Source: Analysis of Freight Analysis Framework-3 import/export flow data.

Figure 2-5. Inland Truck Flows to/from Ports of Los Angeles and Long Beach

Many regions are exploring options to make intermodal rail service more competitive at shorter distances. Non-intermodal rail can be competitive at short distances for heavy commodities that are not time-sensitive.

Alternatively, barges can be used as feeders and distributors for short-haul movements within port districts, as well as long-haul movements on coastal and inland waterways. Barges have long proven to be a cost-effective alternative to rail and truck for non-containerized cargo. In recent years, the U.S. DOT Maritime Administration “Marine Highway” program has promoted container on barge services, and has sponsored pilot studies of service development (Marine-5, Marine-95, Marine-55) paralleling U.S. interstate highways.



Figure 2-6. MARAD-Designated Marine Highway Corridors

■ 2.5 The MTS and Global Vessel Routings

The MTS offers a wide choice of ports and terminals to operators of international and domestic freight-carrying vessels. Those operators choose which port(s) to call at based on a number of factors, including reliability, speed, cost, safety, security, value-added service, and contribution to overall profitability and other business objectives.

Ocean carriers have a choice of routes around the globe—they can go around Cape Horn in Africa or the Cape of Good Hope in South America, or through the Suez Canal (linking the Mediterranean and Red Seas via a sea-level channel since 1869), or through the Panama Canal (linking the Pacific and Atlantic Oceans via an above sea-level route since 1914). And once cargo reaches the United States, there are many ways to get it from a gateway port to its ultimate destination. Asian cargo, for example, moves to the United States via each of these methods:

- By ship to the U.S. West Coast, which has ports that can accommodate the very large container-ships being used in Asian services, then inland by truck to local and regional markets or inland by rail “landbridge” to Midwest and East Coast markets.
- By ship to the U.S. East Coast via the Suez Canal. Suez can physically accommodate the largest container ships in service, but U.S. East Coast container ports cannot. From China, Suez is slower

than either landbridge or the Panama Canal, but becomes increasingly competitive from India and other Asian ports west of China.

- By ship to the U.S. East Coast via the Panama Canal. Currently, the Panama Canal is a principal bottleneck in the world's container trade system. Its dimensions limit passage to ships generally not more than 39 feet in depth and 13 containers across—known as “Panamax” dimensions. Historically, this was sufficient, but over the past 10 to 15 years, much of the new containership capacity coming into service has been in “post-Panamax” sizes. Panama is now widening the canal to accommodate next-generation “mega-containerships,” which will allow larger ships to move between China and U.S. East Coast and Gulf Coast ports.
- By feeder vessel. Panama's ports, as well as numerous ports in the Caribbean, accommodate “transload” activity, where cargo is discharged from a large ship and transferred immediately to smaller vessels for the last leg of the marine trip. Even if U.S.-bound cargo leaves China on a very large vessel, a given U.S. port might receive that cargo on a much smaller vessel.

Trades with Europe, the Middle East and Africa, South America, Central America, the Caribbean, Mexico, and Canada are all accommodated by combinations of Atlantic, Pacific, and Gulf routings, some involving the Panama or Suez Canals. The specific trade routes utilized by carriers, and the vessels they deploy on those routes, are matched to the capabilities and the limitations of infrastructure at either end of the trip. Therefore, MTS facilities, needs, and opportunities must be viewed within the context of global markets and operational requirements.