NATIONAL DREDGING NEEDS STUDY OF U.S. PORTS AND HARBORS

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NATIONAL DREDGING NEEDS STUDY OF U.S. PORTS AND HARBORS

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TABLE OF CONTENTS

List of Tables vii

List of Figures xi

Acknowledgements xv

Executive Summary xvii

I. Introduction 1
- Study Background 1
- Organization of Report 2

II. A Historical Perspective of Waterborne Commerce and Port Development 3
- Early Commerce and Navigation: Colonial America Through 1814 3
  - Economic Growth and Trade in Early America 3
  - Port Development Through 1814 4
  - Changes in Technology and Ship Design: Colonial Era Through 1814 5
- U.S. Growth and Westward Expansion: 1815 – 1880 6
  - Advances in Transportation and Commerce: 1815 – 1880 6
  - Port Growth and Development: 1815 – 1880 8
- The Early Modern Era: 1881 – 1945 11
  - Innovations in Ship Design: 1881 – 1945 11
  - U.S Global Intervention and Trade Policy: 1881 – 1945 11
  - Port Revitalization and Adaptation to New Technology: 1881 – 1945 13
- Post War Years: 1945 – Present 13
- Trade Policy and Global Economic Growth During the Post War Years 13
  - Revolutions in Cargo Handling and Ship Design 16
  - Formation of Carrier Alliances 18
  - Port Infrastructure Development in the Post War Years 18
- Conclusion 19

III. Maritime Stakeholders 21
- Direct Maritime Stakeholders 21
  - Federal and State Agencies 21
  - State and Local Governments 21
  - Ports 22
  - Ocean Carriers 22
  - Shippers 22
  - Inland Modes of Transportation 23
- Indirect Maritime Stakeholders 23
  - American People 23
- Stakeholder Interaction 24
- Conclusion 27

IV. Global Trade Outlook 29
Overview of the Global Economy 29
United States, Canada and Mexico 29
Asia/Pacific 30
Europe 31
South America, Africa and the Mid-East 32
General Patterns of Global and National Maritime Trade 33
U.S. Container Trade: 2000 – 2040 35
U.S. Container Trade: 2000 – 2040 36
U.S. Tanker Trade 2000 – 2040 41
U.S. Tramp Trade: 2000 – 2040 43
Conclusion 46

V. Major Commodity Groups and Commodity Flows in the United States 47
Types and Quantities of U.S. Maritime Commodities 47
Commodity Flow by Trading Partner 53
Commodity Flow by U.S. Coastal Region 57
Atlantic Coast 59
Pacific Coast 61
Gulf Coast 66
Great Lakes 67
Coastal Commodity Flow by Vessel Type 72
Commodity Flows at U.S. Ports 77
Commodity Flows at U.S. Ports on a National Level 77
Commodity Flow at U.S. Ports on a Regional Basis 82
Commodity Flow by Trade Route 86
Conclusion 96

VI. Organization and Operation of the World Merchant Fleet 99
Definition and Composition of the World Fleet 99
General Cargo Fleet 102
Tankers 105
Dry Bulk and Combination Carriers 108
Containerships 110
Draft Characteristics of the World Fleet 117
Profile of the World Fleet Calling at U.S. Ports 119
Composition of the World Fleet Calling at U.S. Ports 119
Physical Characteristics of the World Fleet Calling at U.S. Ports 120
Traffic Analysis of Vessels Calling on the U.S. 124
Transshipment and Hubbing Operations 128
Regional Hub and Spoke Operations 128
Megahub Operations 133
Conclusion 136

VII. U.S. and Foreign Port Infrastructure 137
Infrastructure and Facilities at U.S. Ports 137
Infrastructure Development at U.S. Ports 142

Infrastructure and Facilities at Foreign Ports 144
Selection of Foreign Ports 144
Infrastructure at Foreign Ports 146
Infrastructure Development at Foreign Ports 149
Channel Depth Comparisons: U.S. and Foreign Ports 151
Conclusion 154

VIII. Results of the Fleet and Shipping Forecast 159
Overview of Forecasting Methodology 159
National Level 159
Regional Level 160
Regional Level 161

IX. Dredging Needs Analysis 167
Conceptual Underpinnings of Dredging Needs 167
Methodology 168
Channels Constraints: 2000 – 2020 169

X. Findings and Study Conclusions 179
Key Findings 179
Conclusion 184
Recommendations for Further Study 185

Appendix A Overview of WEFA Global Trade Models A-1

Appendix B Top 150 U.S. Ports by Cargo Tonnage and Cargo Value B-1

Appendix C Foreign Ports C-1

Appendix D Methodology for Forecasts of Future Port Calls and Channel Depth Constraints D-1

Appendix E Calculation of a Hypothetical Light-Loading Scenario E-1

Appendix F Port/Location Channel Depths F-1

Appendix G Analysis of Port Level Constraints G-1

Appendix H Analysis of Vessel Type Constraints H-1

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LIST OF TABLES

Table II-1 Exports of Principal Articles of Domestic Production: 1810 – 1820 4
Table II-2 U.S. Imports by Principal Ports: 1821 – 1860 9
Table II-3 U.S. Exports by Principal Ports: 1821 – 1860 10

Table IV-1 Actual and Projected U.S. International Trade of Goods: 1992 – 2040 35
Table IV-2 Major Trading Partners of the United States by World Region.....38
Table IV-3 Projected Inbound and Outbound Containerized Tonnage by Trading Partner Region: 2000 – 2040.....39
Table IV-4 Forecasted Market Share of U.S. Inbound and Outbound Containerized Cargo By Trading Partner Region: 2000 – 2040.....40
Table IV-5 Projected Inbound and Outbound Tanker Tonnage by Trading Partner Region: 2000 – 2040.....42
Table IV-6 Forecasted Market Share of U.S. Inbound and Outbound Tanker Cargo by Trading Partner Region: 2000 – 2040.....43
Table IV-7 Projected Inbound and Outbound Tramp Tonnage by Trading Partner Region: 2000 – 2040.....45
Table IV-8 Forecasted Market Share of U.S. Inbound and Outbound Tramp Cargo by Trading Partner Region: 2000 – 2040.....46

Table V-1 Top 20 U.S. Maritime Exports by Commodity Weight and Value: 1996 50
Table V-2 Top 20 U.S. Maritime Imports by Commodity Weight and Value: 1996 50
Table V-3 Forecasted Tonnage for Top U.S. Exports.....51
Table V-4 Forecasted Tonnage for Top U.S. Imports.....52
Table V-5 Top U.S. International Maritime Trade Commodities by World Region: 1996 (millions of metric tons).....55
Table V-6 Top U.S. International Maritime Trade Commodities by World Region: 1996 ($ billions).....56
Table V-7 International Maritime Trade by U.S. Coastal Region: 1996 ($ metric tons).....58
Table V-8 International Maritime Trade by U.S. Coastal Region: 1996 ($ billions) 59
Table V-9 Atlantic Coastal Region Top 10 Trade Commodities by World Region Percentage Share of Trade: 1996 (millions of metric tons) 62
Table V-10 Atlantic Coastal Region Top 10 Trade Commodities by World Region Percentage Share of Trade: 1996 (billions of $U.S.) 63
Table V-11 Pacific Coastal Region Top 10 Trade Commodities by World Region Percentage Share of Trade: 1996 (millions of metric tons) 64
Table V-12 Pacific Coastal Region Top 10 Trade Commodities by World Region Percentage Share of Trade: 1996 (billions of $U.S.) 65
Table V-13 Gulf Coastal Region Top 10 Trade Commodities by World Region Percentage Share of Trade: 1996 (millions of metric tons).....68
Table V-14 Gulf Coastal Region Top 10 Trade Commodities by World Region Percentage Share of Trade: 1996 (billions of $U.S.).....69
Table V-15 Great Lakes Region Top 10 Trade Commodities by World Region Percentage Share of Trade: 1996 (millions of metric tons).....70

Table V-16 Great Lakes Region Top 10 Trade Commodities by World Region Percentage Share of Trade: 1996 (billions of $U.S.).....71
Table V-17 Top 10 U.S. Imports and Exports Transported by Containerships: 1996.....73
Table V-18 Top 10 U.S. Imports and Exports Transported by General Cargo Vessels: 1996 .73
Table V-19 Top 10 U.S. Imports and Exports Transported by Dry Bulk Vessels: 1996.....74
Table V-20 Top 10 U.S. Imports and Exports Transported by Tankers: 1996.....74
Table V-21 Top 50 U.S. Ports Based on International Tonnage: 1996 79
Table V-22 Top 50 U.S. Ports Based on International Cargo: 1996.....81
Table V-23 Commodity Flow at U.S. Ports by Coastal Region: 1996 (millions of metric tons).....83
Table V-24 Commodity Flow at U.S. Ports by Coastal Region: 1996 ($ billions).....84
Table V-25 Key U.S. Ports by Cargo Tonnage, Value and Coastal Region.....85
Table V-26 Top 50 Foreign Ports Handling U.S. Cargo: 1996 (millions of metric tons).....88
Table V-27 Top 50 Foreign Ports Handling U.S. Cargo: 1996 ($ billions).....89
Table V-28 Top Five U.S. Imports and Exports at Major Foreign Ports Engaged in U.S. Trade: 1996 91
Table V-29 Top Five Commodities at Major Foreign Ports Engaged in U.S. Trade: 1996 92
Table V-30 Top 10 Foreign Ports by U.S. Coastal Range (millions of metric tons).....94
Table V-31 Top 10 Foreign Ports by U.S. Coastal Range ($ billions) 95

Table VI-1 Landmarks in the Evolution of Containerships: 1972 – 1998 114
Table VI-2 Largest Size of Containership Scheduled for Delivery by the Year 2000.....115
Table VI-3 Changes in Average Freight Rates for U.S. East-West Trade Routes: 1978 – 1998.....116
Table VI-4 Design Draft Characteristics of the World Merchant Fleet: 1998 118
Table VI-5 Design Draft Characteristics of Vessels Calling on U.S. Ports 121
Table VI-6 Maximum Channel Depths at Major U.S. Container Ports 130
Table VI-7 Number of Trade Routes to and from U.S. Ports by Carrier Alliance as of February 1999 132

Table VII-1 Cargo Handling and Vessel Service Facilities at U.S. Port by Coastal Region...138
Table VII-2 Number of Berths, Berth Length and Number of Cranes by Traffic Type for Key U.S. Ports.....140
Table VII-3 Top Foreign Ports Engaged in U.S. Trade by Tonnage and Value: 1996 145
Table VII-4 Top Foreign Ports Serving Multiple U.S. Coastal Regions.....146
Table VII-5 Cargo Handling Facilities at Foreign Ports.....147
Table VII-6 Available Data Regarding Number of Berths, Berth Length and Number of Cranes by Traffic Type for Key U.S. Ports 148
Table VII-7 Vessel Dimensions and Channel Depths for U.S. Ports 152
Table VII-8 Vessel Dimensions and Maximum Channel Depths at Top Foreign Ports.....153
Table VII-9 Traffic and Channel Depth Comparison Between Top U.S. Ports and Foreign Ports by U.S. Coastal Region.....156

Table VIII-1 Projected Number of Calls to and from U.S. Ports by Ship Type: Years 2000, 2010 and 2020 160
Table VIII-2 Projected Number of Calls to and from the Atlantic Coast by Ship Type: Years 2000, 2010 and 2020 162
Table VIII-3 Projected Number of Calls to and from the Gulf Coast by Ship Type: Years 2000, 2010 and 2020 163
Table VIII-4 Projected Number of Calls to and from the Pacific Coast by Ship Type: Years 2000, 2010 and 2020 164
Table VIII-5 Projected Number of Calls to and from the Great Lakes by Ship Type: Years 2000, 2010 and 2020 165

Table IX-1 Projected Constrained Calls for the United States: Year 2000-2020 170
Table IX-2 Projected Constrained Tonnage for the United States: Year 2000-2020 170
Table IX-3 Projected Constrained Calls and Tonnage for the Atlantic Coast by Ship Type with Planned Projects: Year 2000-2020 174
Table IX-4 Projected Constrained Calls and Tonnage for the Gulf Coast by Ship Type: Year 2000-2020 175
Table IX-5 Projected Constrained Calls and Tonnage for the Pacific Coast by Ship Type: Year 2000-2020 175
Table IX-6 Projected Constrained Calls and Tonnage for the Great Lakes by Ship Type: Year 2000-2020 176
Table IX-7 Constrained Containership Calls by Coastal Region with and without Planned Corps Projects: Year 2000 and 2020 177

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LIST OF FIGURES

Figure II-1 Value of U.S. Trade: 1815 – 1880 7
Figure II-2 International Maritime Trade: 1955 – 1996 14
Figure II-3 Real Value of U.S. Traded Goods: 1946 – 1999 15
Figure II-4 Real Value of Foreign Trade as a Percentage of U.S. Gross Domestic Product: 1959 – 1998 15

Figure IV-1 Forecasted U.S. International Trade: 1992 – 2040 35
Figure IV-2 U.S. Imports and Exports of Containership Cargo: 2000 – 2040 36
Figure IV-3 Forecasted Container Trade: Years 2000 – 2040 37
Figure IV-4 U.S. Imports and Exports of Tanker Cargo: 2000 – 2040 41
Figure IV-5 U.S. Imports and Exports of Tramp Cargo: 2000 – 2040 44

Figure V-1 Top 20 Foreign Trade Commodities by Aggregate Weight: 1996 48
Figure V-2 Top 20 Foreign Trade Commodities by Aggregate Value: 1996 49
Figure V-3 International Maritime Trade by World Region: 1996 (millions of metric tons) ..53
Figure V-4 International Maritime Trade by World Region: 1996 ($ billions) 54
Figure V-5 International Maritime Trade by U.S. Coastal Range: 1996 (millions of metric tons) 57
Figure V-6 International Maritime Trade by U.S. Coastal Range: 1996 ($ billions) 58
Figure V-7 Containership Tonnage by U.S. Coastal Range: 1996 75
Figure V-8 Tonnage Transported by Dry Bulk Ships by U.S. Coastal Range: 1996 76
Figure V-9 Tonnage Transported by Tankers by U.S. Coastal Range: 1996 76
Figure V-10 Tonnage Transported by General Cargo Vessels by U.S. Coastal Range: 1996 ...77
Figure V-11 Cargo Tonnage Distribution Among U.S. Ports: 1996 78
Figure V-12 Cargo Value Distribution Among U.S. Ports: 1996 80
Figure V-13 Cargo Distribution at the Top 175 Foreign Ports: 1996 (millions of metric tons) 87
Figure V-14 Cargo Distribution at the Top 175 Foreign Ports: 1996 ($ billions) 87

Figure VI-1 Classification of Vessels in the World Merchant Fleet 100
Figure VI-2 Tonnage Capacity of the World Merchant Fleet by Ship Type: 1999 101
Figure VI-3 Average Annual Capacity Growth in the World Merchant Fleet by Ship Type: 1985 – 1999 102
Figure VI-4 Number of Ships in the World General Cargo Fleet by Size Range: 1999 104
Figure VI-5 Distribution of Tonnage Capacity and Number of Vessels in the World General Cargo Fleet: 1999 104
Figure VI-6 Number of Ships in the World Tanker Fleet by Size Range: 1999 106
Figure VI-7 Distribution of Tonnage Capacity and Number of Ships in the World Tanker Fleet: 1999 107
Figure VI-8 Average Age Distribution in Years of World Tanker Fleet by Ship Size Range: 1999 107
Figure VI-9 Number of Vessels in the World Dry Bulk Cargo Fleet by Ship Size: 1999 108

Figure VI-10 Distribution of Tonnage Capacity and Number of Vessels in Dry Bulk Fleet: 1999 109
Figure VI-11 Average Age Distribution in Years of the World Dry Bulk Fleet By Ship Size: 1999....110
Figure VI-12 Growth in the World Containership Fleet Cargo Carrying Capacity: 1986 – 1999....111
Figure VI-13 Number of Vessels in the World Containership Fleet by Ship Capacity Size Range: 1999 112
Figure VI-14 Distribution of TEU Capacity and Number of Vessels in the World Containership Fleet: 1999 112
Figure VI-15 Average Age Distribution of the World Containership Fleet by Size: 1999 117
Figure VI-16 Number of Vessels in the World Fleet Calling on U.S. Ports by Ship Type: 1996 120
Figure VI-17 Average Size of Vessels Calling on U.S. Ports: 1996 121
Figure VI-18 Tanker Design Drafts: World Fleet and Vessels Calling on the U.S.: 1996....122
Figure VI-19 Dry Bulk Design Drafts: World Fleet and Vessels Calling on the U.S.: 1996 122
Figure VI-20 General Cargo Design Drafts: World Fleet and Vessels Calling on the U.S.: 1996 123
Figure VI-21 Containership Design Drafts: World Fleet and Vessels Calling on the U.S.: 1999 123
Figure VI-22 Number of Vessel Calls at U.S. Ports: 1996....125
Figure VI-23 Inbound and Outbound U.S. Calls for Tankers: 1996 126
Figure VI-24 Inbound and Outbound U.S. Calls for Dry Bulk Vessels: 1996 126
Figure VI-25 Inbound and Outbound U.S. Calls for General Cargo Vessels: 1996....127
Figure VI-26 Inbound and Outbound U.S. Calls for Containerships: 1996 127
Figure VI-27 Number of Trade Routes to and from U.S. Ports by Carrier Alliance as of February 1999 131
Figure VI-28 TEU Throughput at Selected International Transshipment "Megahubs": 1994 - 1997 135

Figure VIII-1 Projected Increase in Annual Number of Calls to and from the U.S. by Vessel Type: Years 2000 - 2020....160
Figure VIII-2 Projected Increase in Annual Number of Calls to and from the Atlantic Coast by Vessel Type: 2000 – 2020....161
Figure VIII-3 Projected Increase in Annual Number of Calls to and from the Gulf Coast by Vessel Type: 2000 – 2020....162
Figure VIII-4 Projected Increase in Annual Number of Calls to and from the Pacific Coast by Vessel Type: 2000 – 2020....163
Figure VIII-5 Projected Increase in Annual Number of Calls to and from the Great Lakes by Vessel Type: 2000 – 2020....164

Figure IX-1 Illustration of Channel and Ship Characteristics 169
Figure IX-2 Constrained Calls with and without Planned Corps Construction Projects: Year 2000-2020 171
Figure IX-3 Constrained Calls by Coastal Region with and without Planned Corps Projects: Years 2000-2020....172

Figure IX-4 Constrained Containership Calls by Coastal Region with and without Planned Corps Projects: Year 2000 and 2020.....177

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EXECUTIVE SUMMARY

INTRODUCTION

Section 402 of the Water Resources Development Act of 1992 (WRDA 1992), P.L. 102-580, authorized the U.S. Army Corps of Engineers (USACE) to conduct the *National Dredging Needs Study of U.S. Ports and Harbors* (NDNS). In particular, WRDA 1992 directed the Corps to conduct a study to assess the status of international maritime trade and its impact on U.S. deep draft ports and harbors, with an emphasis on Federal navigation channels. The NDNS was initiated in response to the growing concern of many maritime stakeholders regarding the availability of adequate harbor depths at U.S. ports. This report is the final document produced as part of the Corps of Engineers work in response to Section 402 (WRDA'92).

The NDNS provides an overview of international maritime trade and its impact on U.S. ports and harbors. The NDNS is intended to shed light on the status of international maritime trade and related issues facing U.S. ports, including current and future channel depth constraints. The information presented is intended to serve as a guide for policy and planning. The study is not intended to select or recommend development of specific port areas.

Consistent with the requirements of Section 402, the purpose of the study is to analyze future demand for channel deepening (dredging needs) at major U.S. ports. Dredging needs are defined in terms of vessel calls constrained due to the lack of adequate channel depth rather than in terms of quantities of dredged materials. Estimating dredging needs requires an understanding and analysis of the role that ports play in the broader U.S. and world commodity markets. Information and analysis regarding foreign trade, U.S. and foreign port infrastructure and the status of the world fleet are necessary.

The study purposes include the following:

(1) An overview and analysis of international trade on a global, national and regional level,

(2) A description and analysis of the types and sizes of ships in the world merchant fleet including an examination of *existing* vessel traffic and channel depths at U.S. deep draft ports,

(3) An assessment of the national waterside infrastructure needs and a comparison of drafts at U.S. and selected world ports,

(4) A projection of *future* vessel traffic at U.S. deep draft ports, and lastly

(5) Identification of potential national dredging needs based on future vessel traffic.

Factors that affect ports, such as changes in the global economy and technological advances in the world merchant fleet, are the primary forces guiding port infrastructure

development. Port planners and managers may not have the ability to manipulate patterns of trade, but they are capable of improving infrastructure to meet the future demands of shippers and carriers. Opportunities for U.S. ports are going to be largely dependent upon the ability to recognize and react to changes in the shipping industry and world commodity markets. With the growing power of computer and information technology, a plethora of data regarding maritime transportation are available for analyses. Access to such data and the conclusions drawn from them will be vital for the future competitiveness of U.S. ports.

KEY FINDINGS

A series of interrelated and iterative tasks were accomplished to meet the legislative mandates of WRDA1992. Strategic maritime data containing over 2,000,000 records were initially collected and compiled into the NDNS database. These data show the amounts and types of commodities that flow through Federally maintained harbor channels, as well as the types and sizes of ships that carry these commodities by trade direction and trade partner. Other activities included a study of global trade patterns, an assessment of historical trends in the world merchant fleet, a study of the current composition of the world merchant fleet, and an analysis of the development and status of U.S. and world ports in terms of cargo volume and infrastructure. Each of the above activities facilitated the development of a commodity and fleet forecast that projected how the sizes and types of ships will change over time as global trade expands. Commodity and fleet forecasts allowed the estimation of future vessel traffic at U.S. ports according to ship type and size. Lastly, a methodology was developed to compare current and future vessel traffic against planned channel deepening projects. This provided the basis for analyzing dredging needs.

1. Overview and Analysis of International Trade on a Global, National and Regional Level

Analysis of international trade on a global level emphasizes the growing importance of maritime trade to the Nation's economy. Foreign commerce makes up about 27 percent of Gross Domestic Product (GDP) and is worth roughly $1.5 trillion. Study forecasts indicate that foreign cargo traffic will more than double by the year 2020. By 2040, imports and exports are expected to increase eightfold. Although bulk commodities such as crude petroleum, grain and coal will remain important to the U.S. economy, container shipping will be the leading growth area for increases in global trade. Because the U.S. is the world's number one market for containerized commodities such electronics, machinery and other manufactured goods, continued growth is expected. Increases in container shipping has largely been spurred by economic expansion in many Asian countries, most notably China, Japan, Korea and Malaysia.

The NDNS began with a port-wise and coastal study of international trade in terms of cargo value and tonnage on national and regional levels. There are approximately 9,300 commercial harbor and waterway piers, wharves and docks in the United States. One hundred fifty (150) deep draft ports account for more than 99 percent of foreign waterborne trade. About

75 percent of international tonnage and almost 90 percent of international cargo value flows through 25 ports.

International commodity flows to and from the Pacific Coast are substantial in terms of monetary value. Pacific Coast ports account for slightly less than 43 percent of all foreign maritime trade based on dollar value. Ports along the Pacific Coast handle a wide range of goods such as grain and crude petroleum; however, high value containerized freight is the most important cargo for major Pacific Coast ports. About 60 percent of containership cargo measured in dollars, most of which is imported from Asia flows through the Pacific Coast. Pacific Coast ports will continue to benefit from trade with Asia, and cargo volumes will increase as economies in nations such as China continue to develop.

Ports along the Atlantic Coast account for 30 percent of foreign waterborne trade based on tonnage and about 38 percent in terms of value. Atlantic Coast ports handle about 70 percent of the Nation's coal exports, 60 percent of exported refined petroleum, 30 percent of imported crude petroleum and about one-half of containerized tonnage. Europe has traditionally been the main source of container trade along the Atlantic Coast. However, throughout the 1990s, containership traffic from Asia to the Atlantic Coast has increased and continued growth is expected. Two primary factors have contributed to growing containership traffic on the Atlantic Coast. The first has been the gradual eastward shift of Asian manufacturing centers to Southeast Asia, East China and the Indian Subcontinent. Growing congestion on the U.S. transcontinental east-west rail network (i.e. the U.S. "land-bridge) is acting as a catalyst as well. As trade with Asia continues to swell, rail connections and transfers are becoming increasingly strained, resulting in delays and higher costs for shippers. Some container carriers have responded by rerouting Asian cargo on an all water route through the Suez Canal rather than land-bridging it across the continental United States.

Ports along the Gulf Coast account for about 50 percent of total foreign waterborne trade by weight, but only around 18 percent based on value. Trade along the Gulf Coast is characterized by large amounts of bulk commodities such as grain, crude petroleum and chemicals. Because of its proximity to major inland waterways, the Gulf Coast will continue to serve as a vital point of entry and exit for bulk commodities.

2. Description and Analysis of the Types and Sizes of Ships in the World Merchant Fleet, Including an Examination of Current Vessel Traffic with Channel Depths at U.S. Deep Draft Ports.

There are four basic types of merchant vessels: dry bulk ships, tankers, general cargo ships and containerships. Tankers and dry bulk ships transport about two-thirds of U.S. imports and exports when measured by weight. Coal, ores, chemicals, agricultural goods and crude or refined petroleum are the primary commodities shipped in tankers and dry bulk ships. Over the past twenty years or so, the size of the largest tankers and dry bulk ships has remained more or less constant, and there does not appear to be a trend toward larger vessels.

General cargo vessels are ships designed to carry non-bulk, non-containerized freight. They transport about 15 percent of foreign trade based on value and 5 percent in terms of tonnage. General cargo ships are relatively small and are not growing in size. Their numbers have declined in recent years, as containerships have become the primary method of transporting non-bulk dry cargo (e.g., manufactured and semi-manufactured goods).

Containerships are growing in terms of both fleet capacity and vessel size. Their share of the world fleet's cargo-carrying capacity increased 8.8 percent per annum from 1985 to 1999 making containership fleet capacity the fastest growing for any type of vessel. Containerships are also becoming increasingly larger. Containership size is generally measured by the number of containers that a vessel can carry expressed in twenty-foot equivalent units (TEUs). In the 1980s, containerships of 2,000 to 3,000 TEUs were considered the norm. Since then, deregulation of the transportation industry, consolidation among containership companies and growing volumes of container trade have spawned a race among major carriers to build larger vessels in pursuit of lower costs and increased competitiveness. Today, companies are introducing "megaships" that range from 6,000 to 7,500 TEUs, and plans are underway for vessels of 10,000 to 12,000 TEUs. Fully loaded by weight, megaships require channels of 50 feet or more. In the U.S., only a handful of ports currently meet this requirement. Container traffic to and from the U.S. travels on three primary trade routes. About 90 percent flows through ports along the Atlantic and West Coasts and originates or is destined to Asia and Europe. Gulf Coast container shipments account for most of the remainder.

3. Assessment of the National Waterside Infrastructure Needs and a Comparison of Drafts at U.S. and Major World Ports.

To assess national waterside infrastructure needs the ports along each U.S. coastal region were evaluated to compile a listing of "key" U.S. ports. The criteria for selection as key ports were the amounts of cargo handled at each port measured by value and tonnage. The same process was used to identify major foreign ports that trade with each U.S. coastal region. Key U.S. and foreign ports were analyzed based on the status of their cargo handling facilities and current channel depths.

Major port development is taking place around the world in response to growth in container shipping and larger containerships, as well as growth in dry and liquid bulk shipping. Ports are investing heavily in dockside infrastructure, such as expanded berths, newer and larger cranes, improved intermodal capabilities, and deeper channels. U.S. ports appear to be keeping pace with their foreign counterparts with regard to dockside infrastructure. Many major container ports in the U.S. are developing new terminals and implementing massive projects to reduce port congestion and accommodate megaships that are wider, longer, and deeper, and that require quick turnaround times to remain profitable.

Although U.S. ports are currently comparable to foreign ports in terms of dockside infrastructure, channel depth remains an obstacle. This is particularly true for ports along the Atlantic Coast that expect to service new generations of containerships. Today, megaships are being deployed on east-west routes that service Asia, Europe, and the U.S. Foreign ports on

these routes have deepened or are planning to deepen harbor channels to 50 to 53 feet (16 meters). In the U.S. channels designed for containerships along the Atlantic Coast are currently 45 feet or less, while channels at major Pacific Coast container ports are at least 50 feet deep.

4. Projection of Future Vessel Traffic at U.S. Deep Draft Ports

Vessel demands on the Nation's ports system will grow, as commodity flows increase. The total number of annual vessel calls to and from the U.S. is expected to more than double by the year 2020 from about 114,500 in the year 2000 to approximately 261,000 in the year 2020. Containership traffic is expected to experience the greatest percentage and numerical increase. Between 2000 through 2020 containership calls are projected to increase at a 5.5 percent annual rate and grow from about 42,000 to almost 121,000 annually. Containerships are expected to account for the majority of increased calls (54 percent). Projections indicate that the greatest increase in containership traffic will occur along the Atlantic Coast. General cargo traffic is expected to grow by 28 percent as well; however, containership traffic will increase at a much faster rate as more and more general cargo is shipped in containers rather than as break-bulk freight**.** Dry bulk traffic is expected to more than double by 2020. Exports of grain and coal, the primary U.S. commodities transported on dry bulk ships, are not forecast to grow as much as non-bulk commodities. Tanker calls are anticipated to double by 2020, reflecting strong growth in imported crude petroleum.

On a regional level the greatest increase in vessel traffic is expected to occur along the Atlantic Coast. By 2020 total calls to and from Atlantic Coast ports are forecast to increase 129 percent from about 55,100 in 2000 to approximately 126,300 in 2020. Containerships are expected to grow the fastest in the region – about 5.4 percent annually.

Annual calls to the Gulf Coast ports are forecast to increase 136 percent from 28,900 in 2000 to about 68,100 in 2020. Tanker calls along the Gulf Coast are expected to more than double by 2020, signaling strong growth in trade of crude and refined petroleum, petrochemicals, and other industrial chemicals. Dry bulk traffic is anticipated to increase as world demand for bulk agricultural commodities, e.g., grain and oilseeds, and U.S. imports of ores from South America and Africa increase. From 2000 to 2020 containership calls to and from Gulf Coast ports forecast to increase from about 3,900 in 2000 to 18,500 in 2020. Projected growth will result in large part from increased container trade with nations in Africa and particularly Latin America.

Annual vessel traffic along the Pacific Coast is forecast to increase 122 percent from 27,000 vessel calls in 2000 to about 60,000 in 2020. Annual containership traffic is estimated to increase by about 25,000 calls. Most of this growth is attributed to anticipated increases in trade with Asia and the east coast of South America.

Annual calls to and from the Great Lakes region are projected to increase by only about 2,800 (from 3,400 to 6,200) by the year 2020. Almost all of the increased traffic on the Great Lakes is expected to consist of dry bulk vessel calls.

5. Dredging Needs Analysis

A methodology was developed to assess the growing demand for channel depth at the Nation's deep draft ports. Demand was measured as the number of "constrained" vessel calls to and from Federally maintained channels. A ship's need for channel depth is based on its dimensions, the most important of which is its design draft. A ship's design draft refers to the depth at which it rests in the water when it is fully loaded to tonnage capacity. To estimate current and anticipated usage rates of channels, vessel design drafts corresponding to projected vessel calls were compared with channel depths to determine which calls, and associated cargo tonnage, exceed channel depths. Cases in which vessel design drafts, plus a safety clearance, were greater than channel depths are "constrained" movements. Constrained movements indicate a potential need for deeper channels.

Two scenarios were analyzed. The first assumes that "planned" deepening projects occur, while the second assumes that planned projects are not implemented. Planned projects are those that have undergone feasibility study requirements, and are scheduled to begin at some point during the dredging needs study horizon (i.e., 2000 – 2020). Planned projects have received Congressional authorization; however, funding has not been appropriated and construction has not yet begun.

For the year 2000, total calls were estimated at approximately 114,500 per year. The NDNS model indicates that about 27,600 (24 percent) of these calls were constrained. Projections show that total calls will grow to about 261,000 in the year 2020, of which approximately 33,400 (13 percent of total calls) could be constrained with planned projects. This reflects an average annual growth rate of constrained calls of about 1 percent. In absence of planned deepening projects, constrained vessels calls are expected to be significantly greater. The total number of constrained calls in 2020 would be about 65,000 (25 percent of total calls), which represents an average annual growth rate of 4.4 percent. These results highlight the importance of long-term planning efforts of the Corps.

While constraints were measured for all types of vessels, containerships are the most important with respect to dredging needs. The dredging needs model estimates for the year 2000 about 11,300 containership calls would have been constrained. This equates to 25 percent of total containerships calls (114,500) in 2000. If planned projects are constructed, this is expected to increase to about 33 percent in 2020. However, if planned projects are not implemented, about 65 percent of containership calls will be constrained. Ports along the Atlantic Coast are expected to experience the greatest increase in constrained containership traffic. With planned projects in 2020, the distribution of constrained calls by coastal region is: Atlantic Coast (52 percent), Pacific Coast (31 percent), Gulf Coast (11 percent) and Great Lakes (6 percent). Even without planned projects, Atlantic Coast ports are expected to see more than one-half of all constrained containership calls in 2020. Thus, it appears that harbor channels along the Atlantic Coast that handle large volumes of container trade have the greatest potential need for channel deepening.

Conclusions

Economic forces that impact maritime navigation are numerous and complex. When changes occur, they do not happen quickly but gradually, over time. Port planning, including channel construction requires a long-term perspective to understand and accommodate changes in the navigation industry. Capital must be raised, environmental and economic impacts must be assessed, and the lengthy construction process must take place. Thus, the ability of planners and port masters to recognize and anticipate changes in navigation is crucial.

In response to Section 402 of WRDA 1992, the National Dredging Needs Study of Ports and Harbors (NDNS) has represented a multiyear multiproduct effort to develop and analyze strategic maritime information regarding the status of U.S. deep draft ports. The NDNS sheds light on several critical issues. By far, the most important is the growing reliance of the U.S. economy on foreign maritime trade and the need for adequate infrastructure to maintain a seamless flow of cargo between the U.S. and its trading partners. As foreign trade grows, the maritime transportation system, which naturally links nations of the world economy, will become increasingly vital to maintaining economic growth and national prosperity. Over 90 percent of foreign trade flows through coastal harbors and navigation channels constructed, operated and maintained by the Corps.

Total nationwide vessel calls in 2000 were estimated to be approximately 114,500, of which about 27,600 or 24 percent would have been constrained. In the absence of planned deepening projects, however, constrained vessel calls in 2020 are projected to be significantly greater, about 65,000 or 25 percent of the 261,000 total calls. That represents an average annual growth rate of 4.4 percent. The constrained foreign trade flows would adversely impact upon the growth of the Nation's economy.

On the other hand, the construction of planned projects will greatly enhance the ability of the Nation's ports to manage growing volumes of foreign trade. This is particularly true with respect to the increasing draft requirements of containerships, which are critical from the perspective of dredging needs. Projections show that with planned projects approximately 33,400 vessel calls or 13 percent of the 261,000 total calls would be "constrained" in 2020. This reflects an average annual growth rate of constrained vessel calls of about 1 percent.

Completion of planned projects nationwide by 2020 would reduce constrained calls by 49 percent compared to 2020 without projects. Planned projects would achieve the largest reduction in constrained calls on the Pacific Coast (down 63 percent), while the reductions on the Gulf and Atlantic Coasts (down 50 and 48 percent respectively) would be close to the national average.

Additional channel deepening projects would be needed to eliminate these 33,400 constrained vessel calls in 2020 that would comprise 13 percent of total calls. Furthermore, new projects should be planned to meet the growth in commodity and vessel traffic that is projected to continue between 2020 and 2040.

Recommendations for Further Study

The NDNS database represents a comprehensive source of data for planning purposes because of the extent of port, vessel, and trade characteristics that were gathered as part of this study. It is a valuable tool that can be used to identify reconnaissance-level port studies in high constraint areas where studies or projects are currently not planned, particularly for ports that handle high volumes of containership cargo. In addition, the database serves as a comprehensive, centralized source of information to support feasibility studies and other analyses conducted by the Corps field offices.

Efforts should be made to further develop and enhance the NDNS database for use as an on-going analytical instrument for regional and strategic planning. Potential activities could include updating the database on an annual basis to account for changing patterns of trade and trends in the merchant fleet. Understanding the true economic impacts of channel constraints requires information on how transportation costs are affected if constraints are reduced or eliminated. Thus, the NDNS database could be linked to ocean-going voyage costs to develop generalized reconnaissance-level benefit estimates of potential deepening projects. It could also be used to identify the expected aggregate increase in transportation costs that would occur if planned projects are not constructed.

Another important effort could include refinements and extensions of the dredging needs analytical model. Database records are limited to baseline Waterborne Commerce data that reflect tonnage loaded or unloaded at a port of call. Refined characterization of depth constraints would come from data regarding activity occurring during a voyage or rotation of multiple port calls. This would require tracking a vessel's movements in the U.S., identifying the foreign port from which the vessel sailed, and lastly identifying the foreign port the vessels call on after leaving U.S. waters. Identifying these voyages and associated costs would allow a mapping of hypothetical routes and associated costs, constraints and numerous other analytical scenarios, thereby improving the strategic and analytical capabilities of the model.

Another modification of the model would involve developing and applying a system of mathematical equations for estimating constraints that account for the fact that ships sometimes sail light loaded for reasons other than depth constraints.

Lastly, efforts could be made to link commodity forecasts and deep draft vessel calls forecasts to the inland transportation system. Such a linkage would allow identification of the Nation's intermodal network, port hinterlands, and the origin or destination of inland commodity flows. That would allow analyses of inland capacity limitations and ripple effects of relieving waterside constraints.

I. INTRODUCTION

STUDY BACKGROUND

Section 402 of the Water Resources Development Act of 1992 (WRDA 1992), P.L. 102-580, authorized the U.S. Army Corps of Engineers (USACE) to conduct the *National Dredging Needs Study of U.S. Ports and Harbors* (NDNS). In particular, WRDA'92 directed the Corps to conduct a study to assess the status of international maritime trade and, its impact on U.S. deep draft ports and harbors with an emphasis on Federal navigation channels. The NDNS was initiated in response to the growing concern of many maritime stakeholders regarding the availability of adequate harbor depths at U.S. ports. This report is the final document produced as part of the Corps of Engineers work in response to Section 402 (WRDA'92).

Study Purpose

The NDNS provides an overview of international maritime trade and its impact on U.S. ports and harbors. The NDNS is intended to shed light on the status of international maritime trade and related issues facing U.S. ports, including current and future channel depth constraints. The information presented is intended to serve as a guide for policy and planning. The study is not intended to select or recommend development of specific port areas.

Consistent with the requirements of Section 402, the purpose of the study is to analyze future demand for channel deepening (dredging needs) at major U.S. ports. Dredging needs are defined in terms of "vessel calls constrained due to the lack of adequate channel depth" rather than in terms of quantities of dredged material. Estimating dredging needs requires an understanding and analysis of the role that ports play in the broader U.S. and world commodity markets. Information and analysis regarding foreign trade, U.S. and foreign port infrastructure and the status of the world fleet is necessary.

The study purposes include the following:

(1) An overview and analysis of international trade on a global, national, and regional level,

(2) A description and analysis of the types and sizes of ships in the world merchant fleet, including an examination of *existing* vessel traffic and channel depths at U.S. deep draft ports,

(3) An assessment of the national waterside infrastructure needs and a comparison of drafts at U.S. and selected world ports,

(4) A projection of *future* vessel traffic at U.S. deep draft ports, and lastly

(5) Identification of potential national dredging needs based on future vessel traffic.

The USACE through its Institute for Water Resources (IWR) implemented and directed the *National Dredging Needs Study of Ports and Harbors* with the assistance of Planning and Management Consultants, Ltd. (PMCL), WEFA Inc., Michael L. Sclar Associates, Inc. and Enterprise Information Systems, Inc. This report discusses each of these topics and identifies potential dredging requirements in terms of "constrained vessel calls" based on forecasted changes in trade and growth in the world merchant fleet.

ORGANIZATION OF REPORT

The remainder of this report is organized into eight chapters. Chapter II presents a historical overview of maritime trade and port development. Chapter III introduces the wide range of maritime stakeholders in the United States. Chapters IV and V focus on analyses of trade patterns on a global, national, regional, and port level. Discussions take into account current and future perspectives of U.S. international maritime trade. Chapter VI presents a comprehensive overview of the status of the world merchant fleet, including analyses of trends toward larger vessels and operational changes in the fleet that are affecting ports and their infrastructure. Chapter VII summarizes the status of U.S. port infrastructure and compares U.S. ports with major foreign ports engaged in trade with America. Chapters VIII, IX, and X present the results of procedures developed to estimate future vessel traffic at U.S. ports and potential dredging needs that may result from increases in traffic

II. A HISTORICAL PERSPECTIVE OF WATERBORNE COMMERCE AND PORT DEVELOPMENT

EARLY COMMERCE AND NAVIGATION: COLONIAL AMERICA THROUGH 1814

Early America was a time of great change and struggle. Not only did American colonists fight two wars for independence with England, but they also struggled to unite into a federation of states. After America achieved complete sovereignty, it grew rapidly. Settlement west of the Appalachian Mountains increased; and in the 1800s, the U.S. expanded its territories in the Great Lakes region, the central section of the continent west of the Mississippi River and in the lower Mississippi River region. Westward expansion gave the Nation control of the central river system that provided a faster way to ship goods to and from the interior of the continent than was possible over land.

Economic Growth and Trade in Early America

During the colonial era, the American economy was based on agriculture. As farms grew in size and were able to accumulate surpluses and harvest cash crops, exports of tobacco, wheat, rice, indigo and cotton increased. By the middle of the 17th century, colonial plantations were producing large amounts of crops primarily for Europe. America was rich in other natural resources such as timber and animal fur that were in great demand by European consumers. As the colonial economy flourished, trade was facilitated by waterways and ports. At the time, most people lived near navigable waterways, and the fastest and cheapest way to transport agricultural goods from inland areas to coastal areas was by water. Coastal trade was also an integral link for foreign commerce in New England and the middle colonies. Producers shipped inland goods to smaller "feeder" ports, which in turn transferred goods to larger ports such as New York, Boston and Philadelphia.

For the most part, commerce and economic growth increased during the early industrial period. Agricultural goods, fur, timber and raw material for manufacturing were America's top exports. Leading imports were manufactured goods, iron implements, textiles and leather goods. The busiest ports on the East Coast were New York, Boston, Philadelphia, Baltimore, Savannah and Norfolk. By the end of the 18th century, Charleston and New Orleans also became active ports. Table II-1 shows the top exports in the early years of the 19th century. Leading exports were agricultural goods such as corn, wheat, and cotton and some raw manufacturing goods. Top imports included manufactured goods, iron and coopers products and leather goods.

TABLE II-1

EXPORTS OF PRINCIPAL ARTICLES OF DOMESTIC PRODUCTION: 1810 – 1820 (NOMINAL $ U.S.)

Year	Agricultural		
	Corn	Wheat	Cotton
1810	$1,138,000	-	$15,108,000
1815	$1,140,000	-	$17,529,000
1820	$330,919	$16,663	$22,308,667
Year	**Manufacturing**		
	Copper Products	**Iron Products**	**Wood Items**
1810	$17,426	$130,106	-
1815	$16,426	$154,825	-
1820	$18,547	$46,552	$3,510,774

Source: Department of Commerce and Labor

Port Development Through 1814

The Colonial period witnessed the beginnings of ports and the shipping industry in the United States. Early explorers of the New World discovered a plethora of natural harbors along the Atlantic Coast that offered rare combinations of extensive shelter and adequate water depths. Because of their access to the sea, harbors offered prime locations for new settlements. Economic growth and commerce in early colonial settlements provided the foundation from which the ports of today developed.

Success or failure of colonial ports depended not only on location, but also on the ability of ports to handle ships and goods. Atlantic Coast harbors were typically surrounded by wetlands, and ships had to carry materials ashore by small boats. To rectify the situation, there was an almost immediate need for dock construction so ships could anchor directly offshore. As commerce further developed, port owners recognized the need for centralized storage, and warehouses began to appear at ports. Other structures were soon added next to docks such as smithy shops, rope shops and shipbuilding enterprises.

In the years following the American Revolution, cities began to develop ports through the construction of new wharves and docking facilities. Improvements were important because ports that could not provide adequate services, particularly inland ports, were bypassed for those that could. For example, in 1737 marshlands along the East River were filled to provide a deep harbor along piers and to form a mercantile district along New York's Water Street. Development of port facilities helped make New York the most prosperous port in the 18th century.

Dredging also emerged as an important issue in the 18th century. For example, the East River in New York was crudely dredged to remove shoals and rock encroachments in an effort to encourage the movement of ships on the river. Other early American ports were not as fortunate.

Many were situated along major streams and rivers where extensive plowing of cotton and tobacco fields resulted in large-scale erosion. By the end of the era, sedimentation of river systems had become a major concern to settlers and port owners. Prosperous inland ports, such as Dover, Delaware on the St. Jones River, and Bladensburg on the Anacostia River, could no longer accept anything but the shallowest drafts of ships. At the same time, inland transportation networks were developing rapidly. Overland routes allowed a more efficient link to and from coastal harbors. This trend resulted in a centralization of shipping to select ports, such as New York, Philadelphia and Baltimore.

Changes in Technology and Ship Design: Colonial Era Through 1814

In the late colonial era and early 1800s, shipping had become a lucrative business, and its earnings played a vital role in the development of U.S. industry. American vessels were world renowned for speed and efficiency. Ship owners could command preferential freight rates, and thus they secured most of the direct transatlantic foreign trade. A prominent reason for their early success was the ability of Americans to build high quality, inexpensive vessels. Foreign navigation laws were another factor. America's cost advantage in shipbuilding enabled it to establish a policy of free navigation. British shipbuilders, however, faced high costs due to the depletion of timber stands in Europe and high duties on building materials. To protect them, the British government denied registry to American-built vessels. While this aided the British shipbuilding industry, shipping operations suffered by competing against American transportation rates.

Growth of commerce during the colonial period transformed not only ports but also sailing ships. Waterborne trade increased greatly with the opening of all-sea routes from Europe around the Cape of Good Hope to the Far East, and across the Atlantic to the New World. More trade encouraged the construction of larger merchant ships. The caravel sailing ships of the 17th and 18th centuries, particularly those of the British and Dutch East India companies, were the epitome of shipbuilding art. Known as *East Indiamen*, some of these ships were more than 200 feet long, more than 50 feet wide, greater than 2,000 deadweight tons and had up to five decks.

From 1750 to 1814, the Nation witnessed many important industrial advances that led to a transformation in ships and ports. Two innovations, the steam engine and the making of iron with coal, probably had the greatest effect. By the end of the 18th century, French, Scottish and American inventors were trying to apply the steam engine to navigation. A major breakthrough came when John Wilkinson designed a machine that improved the accuracy with which steam engine cylinders were bored. Combining steam with cast-iron blowing cylinders produced a more powerful draft in the blast furnace than older bellows. By the beginning of the 19th century, the compact, high-pressure steam engine paved the way for the construction of steamboats and steam locomotives. By the middle of the 19th century, steam navigation was replacing the sailing vessel, with many new ships built of iron rather than wood.

U.S. GROWTH AND WESTWARD EXPANSION: 1815 – 1880

The 19th century was a time of growth and opportunity for the United States. Settlers immigrated to the Midwest, the Great Plains and as far as California. Several new states were created, and from 1820 to 1860, the population of the West climbed from just more than two million people in 1820 to almost 13 million by 1860. The population of the entire U.S. increased from about 7.25 million people in 1812 to more than 23 million by 1852. The Nation's economy was evolving as well. Industrial production grew, and the rich soils of the Midwest and Great Plains produced an abundance of agricultural goods. As the country expanded westward, so did the port system. Ports along the Gulf and Pacific coasts developed to service these new areas. The growth of the transportation system played a significant role in the development of ports, as producers in the newly settled interior of the country could now ship their products to a port. The goods could then be shipped to markets in other areas of the United States or to foreign consumers. As production and trade increased, so did the importance of ports to the U.S. economy.

Advances in Transportation and Commerce: 1815 – 1880

As the Nation grew and produced more goods, the need for improved transportation increased. Advances in transportation provided a more efficient way of carrying goods from the interior of the Nation to domestic and foreign markets. Canals, steamboats and railroads allowed producers to ship commercial crops more easily to ports. By the eve of the Civil War, the railroad network was more than 30,000 miles long. By 1860, the railroad was the predominant mode for moving inland cargo. Railroads had a great influence on U.S ports because they expanded the market area that could be served by a port. People and goods were now able to travel to and from ports easier, faster and from farther away. Canals also aided westward settlement and helped link East Coast ports with the western frontier. The canal age, however, did not last long, as canals were superseded in importance by railroads by the mid-19th century.

As ports and commerce grew, there was also a need for larger ships with greater cargo capacity. Shipbuilders began producing larger vessels that carried from four to seven masts. Similarly, the demand for faster ships led to the design of the slender, square-rigged crafts known as Clipper Ships. The best of the clippers could reach speeds of 18–20 knots. Many were aptly christened with such names as the *Lightning* and the *Flying Cloud*. A day's run of 436 miles, set by the *Lightning*, was so fast that many modern steamers have yet to match it. Clippers ran regular routes between Europe, the Americas and China carrying mail, official government cargo and ambassadors. However, the carrying capacity of clippers was restricted by their fine, sharp lines and V-bottom hulls. The only way to make clipper ship voyages profitable was to fill their hulls with very high-value, low-density cargo, such as tea, spices and silks. The British tea trade placed such a high premium on speed that clipper ships remained in service long after dependable, but slower, steamships became available. Another significant improvement to ships was a new propeller design based on the principle of the Archimedes screw. Within a few years, improved propellers were in use on steamships and naval vessels built

throughout Europe and the United States. The new designs added thrust, speed and maneuverability.

Advances in transportation during the early and middle 1800s coincided with increased foreign commerce. Figure II-1 presents the dollar value of imports and exports in the U.S. from 1815 to 1880. Exports rose from $53 million in 1815 to $836 million in 1880. During the same period, volume of imports grew from $113 million to $668 million. From 1834 to 1860, the number of vessels that entered ports more than doubled. From 1815 to 1860, export values of corn, wheat and cotton increased, as did export values of copper, iron and wood products. By 1860, cotton exports accounted for more than 57 percent of all U.S. exports. The Civil War had a direct impact on trade. Following the outbreak of war, President Abraham Lincoln imposed a naval blockade on southern seaports. The blockade effectively halted most cotton shipments to Europe, as well as the importation of munitions, clothing and medical supplies. The war and blockade affected northern ports as well. The declines in the shipments of cotton to textile manufacturing regions of New England, cash crops to northern cities and manufactured goods to southern cities negatively influenced northern port activity during the war years. The value of cotton exports fell from almost $192 million in 1860 to less than $7 million in 1865. It was not until after the war in 1866 that trade reached and ultimately exceeded pre-Civil War levels.

Figure II-1: Value of U.S Trade: 1815 – 1880 (millions of nominal $U.S. dollars)

Source: Historical Statistics of the United States, Colonial Times to 1970, Part 2, pp. 885-6.

Port Growth and Development: 1815 – 1880

All established ports grew during this era, but the Port of New York began to dominate shipping markets during the 1840s. However, growth in the value of exports and imports was not limited to New York. The most noticeable increase was in exports at cotton ports such as New Orleans. In addition, exports from Charleston, Savannah and Mobile surpassed those of Boston, Philadelphia and Baltimore. The growth in the Nation's port activity during this period is presented in Tables II-2 and II-3.

Immigration during the 19th century was closely tied to the development of U.S. ports. Immigration affected ports in two ways. First, as people immigrated, they tended to concentrate in port cities, which grew to become centers of commerce and industry. Secondly, as immigrants moved westward, cities developed in the interior of the nation. As these cities grew, so did the demand for goods that could not be produced locally. Port cities were able to supply goods to meet these growing demands. Growth was not, however, limited to ports on the East Coast. Settlement of the West and South led to the growth and development of ports along the Gulf and Pacific Coasts. The Pacific Coast was rapidly settled during this period, with San Francisco Bay as the center of activity. Port facilities and the town of San Francisco developed concurrently.

Dredging improved during the 19th century. In 1824, Congress enacted the Passage of the Road and Canal Act, which gave the Corps responsibility for improving the flow of inland waterway transportation. Since then, the Corps has strongly supported the development of dredging technology. During this period, dredges were built for or purchased by the Corps. For example, in 1826, the Corps purchased a steam-powered ladder bucket to dredge the Delaware River Harbors, and a steam dredger to remove shoals at Ocracoke Inlet, North Carolina. During the 1830s and onward, there were continual improvements to dredging. A major milestone came with the development of the suction dredge in the 1850s. The ladder, spoon and suction dredges developed during the first half of the 19th century all contain the basic engineering elements used by dredges today.

TABLE II-2

U.S. IMPORTS BY PRINCIPAL PORTS: 1821 – 1860 (THOUSANDS OF TONS)

Year	Top General Cargo Ports					Top Cotton Ports				Others				
	TOTAL U.S.	New York	Boston	Philadelphia	Baltimore	New Orleans	Charleston	Savannah	Mobile	Searsport, ME	Portland, ME	Salem, MA	Norfolk	San Francisco
1821	846	(170)	(160)	(74)	(72)	(81)	(49)	(35)	-	Figures in parenthesis are state rather than port totals, but were almost the same				
1822	888	(240)	(184)	(85)	(65)	(51)	(46)	(20)	(4)					
1823	894	(226)	(202)	(78)	(62)	(69)	(53)	(24)	(4)					
1824	952	(247)	(187)	(81)	(62)	(87)	(57)	(29)	(12)					
1825	973	(294)	(177)	(88)	(68)	(72)	(45)	(16)	(6)					
1826	1047	274	139	87	72	72	56	21	14	-	-	-	-	
1827	1055	287	123	78	59	97	64	29	17	12	40	17	18	
1828	1018	284	117	88	60	116	50	20	17	12	34	17	9	
1829	1003	270	122	73	58	100	51	20	17	14	30	18	11	
1830	1099	305	113	77	61	118	72	26	15	24	26	17	14	
1831	1204	333	126	80	65	131	53	28	21	53	33	13	17	
1832	1342	400	157	81	71	125	52	29	22	69	40	16	23	
1833	1608	420	178	92	82	133	49	31	21	101	37	16	21	
1834	1642	443	183	83	65	136	54	26	18	101	33	14	18	
1835	1993	465	194	78	63	156	53	35	30	65	30	10	19	
1836	1935	534	224	84	70	146	56	32	31	69	30	10	14	
1837	2065	579	242	91	96	136	58	32	27	75	25	14	14	
1838	1895	422	198	83	77	182	64	46	39	69	33	10	14	
1839	2116	563	230	111	78	183	54	29	39	67	30	15	14	
1840	2289	545	245	87	82	255	60	63	66	80	24	18	19	
1841	2368	547	291	99	89	264	54	46	60	58	27	14	21	
1842	2242	570	276	94	86	255	63	40	57	57	26	20	16	
1843	1678	312	144	47	51	351	79	61	105	39	14	11	9	
1844	2894	576	288	89	82	310	74	46	80	58	29	18	13	
1845	2946	579	308	91	80	363	71	48	110	59	34	20	7	
1846	3110	655	318	88	89	315	56	57	77	72	37	23	9	
1847	3321	853	325	139	123	402	74	48	59	70	28	20	42	
1848	3798	932	432	119	102	366	61	37	61	59	35	26	13	
1849	4368	1117	451	142	110	425	98	64	87	74	41	33	9	
1850	4348	1145	478	132	99	349	96	57	96	58	64	36	20	130
1851	4993	1448	512	1159	113	328	92	47	55	62	67	47	12	245
1852	5292	1699	518	178	128	423	101	49	87	77	57	40	20	238
1853	6281	1755	582	183	119	511	94	52	79	106	62	45	12	252
1854	5884	1840	653	191	156	492	89	53	86	115	43	39	57	208
1855	5945	1735	707	185	165	435	88	47	69	107	67	38	45	172
1856	6872	1681	682	173	153	663	121	70	169	128	53	43	32	168
1857	7186	2035	714	189	163	612	126	108	107	82	69	43	84	149
1858	6605	1694	665	156	156	583	126	66	115	74	74	36	73	147
1859	7806	1890	734	180	189	659	129	86	131	69	89	34	62	221
1860	8275	1973	718	185	186	632	126	92	160	73	115	31	67	235

Compiled from annual *Reports on Commerce and Navigation* nine-month period: shift from Sept 30 to June 30 as end of fiscal year. Figures in parentheses, 1821-25, are state rather than port totals, but were almost the same. *See notes, Table IV-8. Albion, Robert G. 1939. *The Rise of the New York Por*t. Charles Scribner's Sons, New York, New York.

TABLE II-3

U.S. EXPORTS BY PRINCIPAL PORTS: 1821 – 1860 (THOUSANDS OF TONS)

Year	Top General Cargo Ports					Top Cotton Ports				Others				
	TOTAL U.S.	New York	Boston	Philadelphia	Baltimore	New Orleans	Charleston	Savannah	Mobile	Searsport, ME	Portland, ME	Salem MA	Norfolk	San Francisco
1821	888	(168)	(130)	(73)	(66)	(74)	(64)	(56)						
1822	911	(203)	(141)	(76)	(68)	(58)	(63)	(43)	(2)					
1823	929	(216)	(143)	(80)	(70)	(84)	(78)	(47)	(2)					
1824	1021	(240)	(139)	(82)	(79)	(76)	(79)	(48)	(8)					
1825	1055	(275)	(150)	(84)	(70)	(77)	(74)	(28)	(10)					
1826	1052	227	94	73	64	91	82	44	17					
1827	1111	262	89	72	70	120	93	50	16	23	42	18	19	
1828	1048	242	92	67	64	124	73	31	20	21	47	15	17	
1829	1077	233	92	57	61	120	90	55	19	22	37	17	19	
1830	1105	243	93	67	58	142	72	58	26	33	38	19	15	
1831	1244	276	102	72	75	150	77	48	25	54	42	16	23	
1832	1362	309	148	60	64	147	89	63	31	67	43	20	30	
1833	1639	333	157	71	71	146	86	62	38	101	42	17	40	
1834	1711	329	156	62	58	183	100	60	39	101	41	15	30	24
1835	2031	366	181	68	63	196	82	56	45	65	44	14	28	19
1836	1990	401	204	64	57	195	96	66	52	67	53	15	27	24
1837	2022	410	184	63	74	221	88	61	64	72	50	17	24	17
1838	2012	346	163	62	66	259	106	80	82	63	46	13	24	17
1839	2089	446	195	77	68	232	81	48	65	61	45	16	23	20
1840	2353	408	181	83	93	350	105	86	118	79	38	16	20	24
1841	2371	405	234	83	87	317	87	55	83	56	42	16	25	31
1842	2276	451	225	78	82	317	95	61	89	57	41	18	22	25
1843	1792	285	140	47	56	373	112	84	135	39	28	14	19	14
1844	2917	498	257	79	91	338	93	62	101	61	42	20	21	24
1845	2984	483	266	76	92	373	117	75	142	70	40	19	20	18
1846	3189	553	290	84	119	348	75	58	97	75	50	23	23	29
1847	3378	758	281	143	169	440	91	55	66	75	44	23	53	24
1848	3865	788	394	98	120	436	89	49	116	68	47	27	24	28
1849	4429	931	414	120	149	487	143	84	148	79	60	34	24	27
1850	4361	982	437	111	126	369	121	72	112	63	77	35	26	24
1851	5130	1230	494	140	105	421	138	69	121	66	77	45	26	24
1852	5230	1279	510	139	128	544	140	61	163	81	69	40	24	22
1853	6065	1384	590	151	143	630	131	81	143	108	77	45	23	27
1854	6019	1598	613	170	191	603	123	68	118	125	56	37	31	24
1855	6179	1445	687	142	158	604	140	93	145	123	103	40	33	28
1856	7000	1520	647	129	159	773	161	87	213	142	84	43	19	36
1857	7070	1756	666	141	188	728	143	120	156	97	104	38	22	47
1858	6802	1460	612	119	164	733	145	88	149	83	116	35	26	53
1859	7915	1476	642	125	171	808	161	138	206	81	130	30	25	53
1860	8789	1678	633	135	174	894	179	149	255	91	155	32	23	51

Compiled from annual *Reports on Commerce and Navigation* nine-month period: shift from Sept 30 to June 30 as end of fiscal year. Figures in parentheses, 1821-25, are state rather than port totals, but were almost the same.

Source: Albion, p. 392

THE EARLY MODERN ERA: 1881 – 1945

By the start of World War I, the United States had developed from an agrarian to an urban society. The western frontier had vanished, and the Nation was settled from coast to coast. Expansion of railroads made transportation much faster and easier than before, opening the newly settled Midwest and western territories. During the period following the Civil War, the United States began to reemerge as a dominant supplier of international goods. It was not, however, a time without major events affecting the Nation and the world. From 1881–1945, the United States experienced several major swings in foreign trade as the Nation experienced two world wars and the Great Depression. In addition, the United States underwent several periods of shifts in trade and international policy. The early modern era also saw improvements in ship propulsion and progress in transportation technology in the area of cargo handling. The United States port system underwent a period of revitalization and development in the late 19th and early 20th centuries.

Innovations in Ship Design: 1881 – 1945

Advances in shipping had direct effects on trade. New types of engines allowed shippers to transport goods from one country to another in a shorter period. During the last quarter of the 19th century, marine engines steadily improved as screw propellers replaced paddle wheels. Most were compound engines of various sorts, in which steam was used first in high-pressure cylinders and then in one or more low-pressure cylinders. The final form of the marine steam engine was the triple or quadruple expansion engine. In 1884, a British engineer, Sir Charles Algernon Parsons, invented a turbine-driven generator. He then turned his attention toward ship propulsion systems. Parsons devised his first turbine-propelled vessel, the *Turbinia*, in 1897. This design greatly increased speed and was later adopted by the British for use in their military and merchant fleets. The steam turbine was a success, but it was not as economical as the triple-expansion reciprocating engine. The advent of oil as a fuel changed this. In 1902, Rudolf Diesel patented a diesel engine that was to become the mainstay of modern ship propulsion.

U.S Global Intervention and Trade Policy: 1881 – 1945

U.S. domestic and foreign policy greatly influenced trade and shipping in the early modern era. During the late 19th and early 20th centuries, the United States experienced swings in how it dealt with international affairs, ranging from intervention to isolation. The country went through periods when high tariffs were placed on imported products to protect domestic industries, while at other times tariffs were lowered in an attempt to reduce the cost of living for American people. It was also a time in which the United States government passed a series of laws to improve the condition of the Nation's navigable waterways in an effort to promote commerce.

From the 1890s to about 1920, the Federal government also became increasingly active in trade policy. As American industrial productivity grew, business interests realized the potential to explore foreign markets. At the same time, actions were taking place to restrict imports in an attempt to protect established industries, foster infant industries and create new industries. Tariffs resulted in an increase in domestic retail prices. However, in 1913 President Woodrow Wilson signed the Underwood Tariff, which substantially reduced tariff rates on important raw materials, foods, cotton, woolen goods, iron, steel and many other items. However, after World War I, protectionist trade policies began to reemerge. In 1922 and 1930, legislation was enacted that raised the level of tariffs to new heights. Perhaps the most famous, the Smoot-Hawley Act of 1930, implemented such high tariff rates that other nations imposed retaliatory duties on U.S. goods. In light of the economic malaise of the late 1920s and early 1930s, rise of protectionist policies in many countries exacerbated declines in incomes and international trade. Another reversal in U.S. trade policy occurred after Franklin D. Roosevelt took office. In 1934, Congress enacted the Reciprocal Trade Agreements Act, which gave the president authority to undertake tariff-reduction agreements with other countries. Subsequent trade agreements reduced U.S. tariffs and culminated in the General Agreement on Tariffs and Trade in 1947.

Other policy developments that had a profound effect on shipping occurred in the late 1800s and early 1900s. President Wilson signed the Panama Canal Treaty, which allowed the United States to construct and operate a waterway through the Isthmus of Panama. The canal linked the Pacific Ocean and Caribbean Sea, and greatly reduced the time it took for ships to travel from one coast of the U.S. to the other and from the East Coast of the U.S. to Asia. By cutting out the long loop around South America, carriers saved travel distances of anywhere between 17 percent to 59 percent and reduced fuel consumption from 50 percent to 70 percent depending on the tonnage, speed and destination of the vessel. Other important events included the Spanish American War and the annexation of the Hawaiian Islands in 1898. After the Spanish American War, the United States emerged with a protectorate over Cuba and an island empire consisting of the Philippines, Puerto Rico and Guam, which all became trading partners of the U.S. The annexation of Hawaii provided an important trade link to markets of the Far East. Two years later, the U.S. announced its "Open Door Policy," and pledged to support Chinese independence and equal access for all nations to Chinese markets, including equal tariffs, harbor duties and railway rates.

On the domestic front, the government sought to improve national infrastructure. In 1876, Congress passed the River and Harbor Act (RHA), which appropriated funds to improve and develop waterways. The intention of the RHA was to provide a cheaper shipping alternative to the railroads. In subsequent years, Congress enacted extensions of the RHA, which allocated funds to waterway development, prohibited tolls on the waterways and authorized establishment of harbor lines. In 1890, Congress authorized the Corps to issue permits for construction on navigable waters outside of the newly established harbor lines. The River and Harbor Act of 1892 took a further step by preventing the Corps from undertaking works that benefited private interests by prohibiting dredging inside of harbor lines. The 1899 River and Harbor Act expanded the permit program to include "obstructions" to navigation and prohibited depositing material into the waterways.

Port Revitalization and Adaptation to New Technology: 1881 – 1945

The late 19th and early 20th century was a time in which United States ports were undergoing revitalization and development. Older ports needed to keep up with changes occurring in the shipping industry, while other ports were in earlier stages of development. During the late 19th century, ports tried to adapt to the changes in ship design. Many ports on the eastern seaboard were too shallow to accommodate large vessels with deep drafts. Without deep channels, they could not compete, and many fell into disuse.

Prior to 1945, an overriding concern of ports had been to provide adequate facilities for larger ships. However, after World War II, ports focused on advances in handling cargo. Each development was associated with a specific trade. For example, the coal trade needed larger cranes, hoists and conveyors; the grain trade demanded grabs and elevators; the machinery trade could not function without the largest cranes ever used on commercial docks; and the meat trade relied on overhead conveyors. Ports also altered mechanisms for moving cargo off ships and onto other forms of transportation. As of 1945, most goods came and went in human-sized boxes, barrels and packages that were loosely packed in sheds, on quays and in holds. Cargo handling was labor intensive and slow. Rates of cargo handling remained stationary, averaging 400 tons per day with a high of 1,200 tons per day when the cargo was homogeneous.

POST WAR YEARS: 1945 – PRESENT

Events in the years following World War II have perhaps had the greatest effect on international economics, trade and the shipping industry. After the war, industrialization spread from the United States and Western Europe to other parts of the globe. The world has also seen tremendous economic growth, particularly among Western democracies and Asian nations. In addition, many nations of the world have made substantial efforts to reduce or eliminate trade barriers. All of these factors have contributed to the development of a global economy that is dependent upon global trade. Changes in trade, ship design and cargo handling have changed the U.S. port system considerably. Ports have developed both on land and on waterways to move increasing amounts of cargo and accommodate larger ships.

TRADE POLICY AND GLOBAL ECONOMIC GROWTH DURING THE POST WAR YEARS

After World War II, many governments reduced, and in some cases eliminated, trade barriers. In 1947, with the passage of the General Agreement on Tariffs and Trade (GATT), twenty-three European nations agreed to lower tariff and non-tariff restrictions on trade. Among participating nations, GATT reduced tariffs on industrial products by more than 90 percent. In 1993, the Uruguay Round of GATT lowered trade barriers for textiles, apparel, intellectual property and agricultural goods. In addition to GATT, other institutions have been created to

promote trade and economic development. In 1948, the Organization of American States was established to provide a regional multilateral consultative body in the Western Hemisphere. Within Europe, the Marshall Plan led to the formation of the Common Market. Several regional trade blocs have also been established, including the European Economic Community, the European Free Trade Association and the North American Free Trade Agreement.

Since World War II many nations have industrialized, particularly those in Asia and Latin America. Industrialization and widening access to international markets has led to economic growth in many regions. Growth in some Asian countries has outpaced the rest of the world. From 1960 to 1993, eight of the ten fastest growing economies were located in or near the continent of Asia. Latin America also experienced strong growth in the 1960s and 1970s. Growth in Latin America slowed in the 1980s for a variety of reasons, but has increased during the 1990s. Economic growth in the U.S. has also increased steadily since 1945.

Economic growth, technological advances and liberal trade policies have all led to a growing volume of waterborne commerce handled by U.S. ports since 1946. From 1960 to 1995, real world output increased at an annual rate of 3.8 percent, while international trade increased at an annual rate of 6.1 percent. Foreign commerce of the U.S. increased from 245 million tons in 1955 to 1,073.5 million tons in 1996 (Figure II-2). Figure II-3 displays the real value of U.S. foreign trade from 1946 through 1999. In 1946, the value of foreign commerce was $88.2 billion, but by 1996 this had increased by a factor of almost 20 in real inflation-adjusted terms to an astonishing $1,451.5 billion. This represents an annual growth rate of about 6 percent over the 50-year period. Not only has trade value grown, but it has also become an increasingly important engine for economic growth. For example, as shown in Figure II-4, exports and imports accounted for only 8 percent of gross domestic product (GDP) in 1959, but by 1999 foreign trade comprised almost 27 percent of GDP.

Figure II-2. International Maritime Trade: 1955 – 1996 (millions of metric tons)

Source: United States Army Corps of Engineers

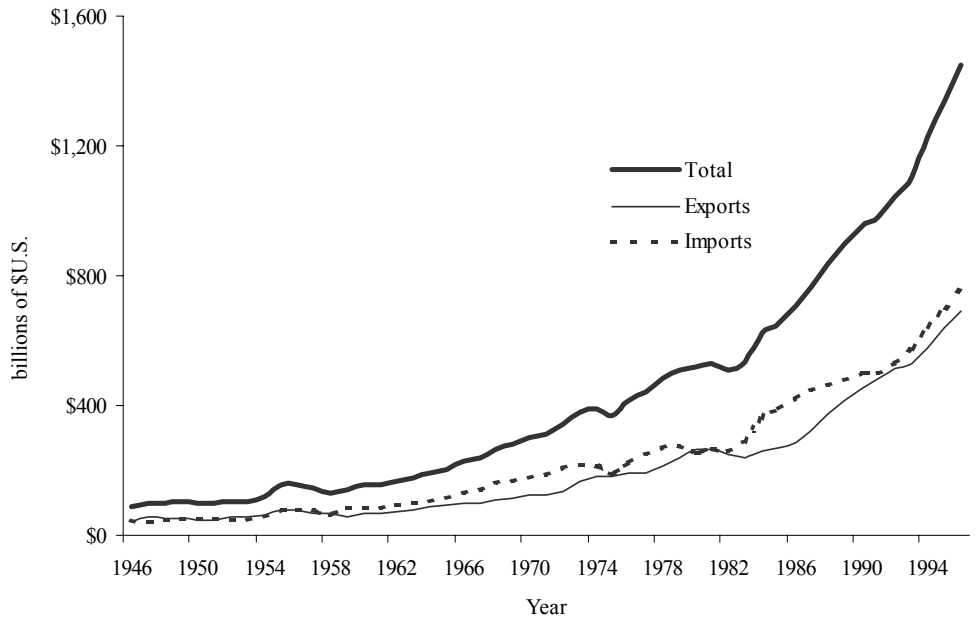

Figure II-3. Real Value of U.S. Traded Goods: 1946 – 1999 (billions of 1996 $U.S.)

Source: U.S. Bureau of Economic Analysis

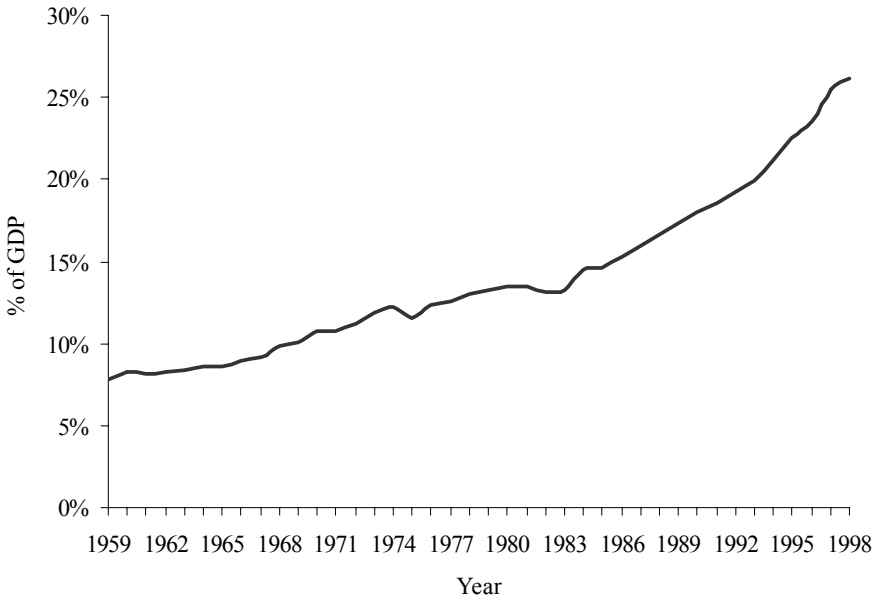

Figure II-4. Real Value of Foreign Trade as a Percentage of U.S. Gross Domestic Product: 1959 – 1998 (billions of 1996 $U.S.)

Source: Based on data from the U.S. Bureau of Economic Analysis

Revolutions in Cargo Handling and Ship Design

Increases in trade have changed the way goods are shipped and handled. The greatest revolutions in the history of modern cargo handling and ports were, (1) loading of cargo on wooden pallets, "palletization," (2) loading of ships with vehicles or "roll-on, roll-off" (Ro-Ro), and (3) containerization. Palletization owes its origins to two inventions, the forklift and truck banding. In the 1950s, ports began to use trucks to move cargo on docks. It was a logical extension to strap drums, boxes and other loose items to a wooden pallet, which a crane could unload, move and stack in the truck. The concept of Ro-Ro has its origins in World War II. During the invasion of Normandy, tanks and other vehicles were driven onto vessels and driven off directly on shore at a port. All that was necessary in ports was the addition of an angled quay so that ships could be loaded via the stern or bow and, in tidal water, a floating pontoon or adjustable ramp. Application of Ro-Ro to commerce began in 1950s. The first generation of Ro-Ro ships had doors on the sides of their hulls through which cargo in special containers and vehicles passed over ramps into the ship. The second generation of Ro-Ro vessels had their own ramps.

While palletization and Ro-Ro were important, perhaps the most consequential change in cargo transportation has been the so-called "container revolution." Prior to containerization, cargo was transported via truck or rail to a terminal where it would be unloaded on docks, handled by item or pallet and loaded onto a ship. The ship would then set sail, and at the next port cargo was unloaded, placed on docks or in warehouses and eventually loaded onto a trailer or railcar for transport to its next destination. Time delay, risk of damage and pilferage of cargo were common in the shipping process. By about 1950, many in the shipping industry began to realize that some form of containerization was needed.

Malcom McLean was the first to successfully combine containerized cargo with sea and land transportation. In 1955, he purchased a small tanker company and adapted its ships to transport general cargo in the form of truck trailers. The company was renamed SeaLand, and its maiden voyage between Newark and Houston, TX, heralded the beginning of the container revolution. With a background from the trucking industry, McLean's approach was to consolidate the cargo transportation process. Cargo would be loaded onto a trailer, placed on a ship and upon its arrival, the trailer would be unloaded and attached directly to a truck for delivery to its final destination.

Since the late 1960s, containerization has developed on an international scale. Its advantages for the shipping industry are numerous. Space and time are critical elements of cargo transportation. In the shipping industry, vessels generate income when they are at sea. Time spent handling cargo in port, loading and unloading, is a cost to the carrier. With conventional methods, the average loading rate of a ship is 10 tons per hour. A 35-ton container, however, can be loaded or unloaded from a container ship in three minutes. This reduction in loading time dramatically shortens the time a container ship must stay in port. Containers also utilize space efficiently because they are uniform in size. Break-bulk or general cargo can be non-uniform in size and weight, adding to the time of placing cargo in the ship to properly distribute weight of the load and to accommodate the size of cargo. Shippers, carriers and consumers also benefit from cargo security. Once it is loaded and sealed in containers, cargo is not breached until it

reaches a final destination. This reduces a carrier's responsibility for damage to cargo and lessens risk of pilferage while in transit. There are reductions in claims filed for losses and damages, and cargo is delivered in good condition, all of which benefits the shipper and the consumer. Lastly, use of containers increases the types of cargo that can be transported and aids in handling of cargo. Containers protect delicate cargo and refrigerated containers preserve perishable cargo that could otherwise not be shipped.

Containerization has changed the structure of the world fleet. The first containership in 1956 carried only 58 containers. Container vessels that followed were general cargo ships or tankers that were modified for containers by fitting holds with cell guides and by reinforcing decks. Containers were stacked side-by-side and on top of each other in holds and on decks of ships. Terminals were not equipped to handle loading and unloading containers, so cranes were installed onboard ships to load and unload containers, which sacrificed container stowage space. In 1969, the first generation of fully containerized ships was completed. Because many terminals had installed dockside cranes to unload containers, these ships did not need onboard cranes. The vessels offered speeds of 23 to 27 knots and could carry between 1,000 to 1,200 containers. Between 1969 and 1971, 10 cellular container ships were introduced into service.

After the 1960s, containerships continued to grow in size. Decisions to use large containerships were based on tradeoffs between size and speed. Large ships were slower, but they could carry more containers. Increased ship capacities lowered unit transportation costs, which often offset the costs of reduced speed. In the 1970s, the second generation of containerships was introduced with capacities between 1,500 and 3,000 twenty-foot equivalent units (TEUs). These ships averaged 740 feet in length, 95 feet in width and had drafts of around 37 feet. The third generation ships in the mid-1980s had capacities of 2,500 to 4,500 TEUs. Known as "Panamax" vessels, these were designed to meet the maximum dimensions that a ship could have in order to sail through the Panama Canal. On average, Panamax ships were 900 feet long, 105 feet wide and had drafts of 41 feet. In 1984, American President Line began a regular double-stack container train service between Los Angeles, Chicago and New York, which made the Canal much less important for liner shipping. Rather than sail through the Canal, it was now cost effective for ships to unload containers at either coast and use rail service to traverse the continental United States. The fourth generation of containerships, "post-Panamax" vessels, appeared during the late 1980s and were able carry 3,500 to 5,000 TEUs. These ships are too large to pass through the Panama Canal. In 1996, Maersk Line introduced two post-Panamax vessels with 6,000 TEU capacities, marking the move to the fifth generation of containerships. Several carriers have followed with ultra-large "megacontainerships."

In general, economic pressure and technological advances have influenced the trend toward larger ships during the post war years, not only with respect to containerships, but also with regard to tankers. The size of tankers has grown since World War II. Shortly after the war, England built several 12,000-ton ships, and the United States constructed a series of 16,800-ton vessels. "Supertankers," with a capacity of 24,900 tons, emerged in 1949. In the late 1950s and 1960s, the Japanese began to produce supertankers of 100,000 tons, and then even larger ships of 250,000 to 275,000 tons, known as very large crude carriers (VLCCs). Economic success and reasonably safe operation of supertankers led to larger vessels such as the ultra-large crude carriers (ULCCs) with tonnages up to 400,000.

Formation of Carrier Alliances

As container services increased in the 1970s and 1980s, shippers wanted voyages to be more frequent. Competition by carriers for the increased demand for shipping resulted in numerous liner companies offering the same services on identical routes. At the same time, many carriers were purchasing larger vessels to lower unit costs. The end result was an oversupply of ship space in an already crowded market. In an attempt to control cost and increase efficiency, operators began the "rationalization" of their ships. Carriers wanted to avoid sailing a vessel unless it was full of cargo. Empty container slots do not generate revenue and are a cost to the carrier. Rather than sailing ships that were partially full, carriers began renting space to each other. This eased competition, reduced costs and benefited all of the carriers involved. Eventually, carriers formed partnerships that were based not only on slot sharing, but also on co-investments in ships and terminals. However, unlike mergers, each company remained separate, with individual marketing and management departments. In general, many alliances have combined their containership fleets, eliminated duplicate voyages, increased frequency of voyages, expanded global coverage, made efficient use of available space and increased their share of the market.

Port Infrastructure Development in the Post War Years

Growing ship capacities combined with increases in global trade and advances in cargo handling have forced ports to invest in infrastructure. Port facilities of the 1940s were not adequate to handle new ships and cargo that emerged in the post war years, particularly containerized cargo and petroleum. To handle container cargo, ports and terminals must be equipped with special cranes that can lift huge weights and deposit them directly into a ship's hold or onto a container-carrying truck or railroad car. If ports wished to handle petroleum, they required special unloading equipment such as pumps, pipe lines and dock lengths to accommodate large vessels. For ports to accommodate large container ships and petroleum tankers, improvements not only had to be made on land, but also within waterways. Large container and petroleum ships needed drafts deeper than earlier vessels did, which required ports to increase channel depth.

A good example of the need for infrastructure development is the Port of New York. After World War II, The New York Port Authority aptly recognized that containerization would have momentous impact on the future of shipping. They also realized that their port lacked sufficient berthing space and other facilities to allow for the rapid transportation of goods. Between 1946 and 1977, the City of New York, the Port Authority and private industry instituted a massive reconstruction program and invested $700 million in port renovation. Construction included 120 new berths, five modern container terminals and 72 berths for conventional break-bulk cargo handling. Some ports such as the Port of New York/New Jersey have also had to constantly dredge their channels to maintain an acceptable channel depth for new ships with deeper drafts. In a similar situation, the Maryland General Assembly created the Maryland Port Authority (MPA). The MPA acted swiftly to renovate their facilities, first in 1959 with the construction of the Dundalk Marine Terminal, followed by the renovation of the Locust Point

Terminal in 1964 and the Canton Yards in 1967. The intent of the MPA was to improve their facilities sufficiently to draw cargo from the Port of New York/New Jersey and to provide facilities for the rapid transport of cargo to adjacent rail lines.

Port modernization was not confined to the Atlantic Coast. In 1946, San Francisco began a $20 million development program that included the $6 million Mission Rock terminal with a 29-acre docking facility. Oakland was the first port on the West Coast to build terminals for containerships. By the late 1960s, Oakland was the second largest port in the world in container tonnage and second only to New York in the acreage of its container terminal. Infrastructure improvement to handle containerized cargo also occurred at other ports along the Atlantic, Gulf and Pacific Coasts. In the early 1960s, the ports of Long Beach and Los Angeles also began to receive containerships. Today, the Port of Long Beach is the number one container port in the United States, moving 4.4 million TEUs.[1]

Another major change for ports was the construction of the interstate highway system and the development of the modern railroad system. In 1956, Congress allocated Federal funds for a system of four-lane superhighways that vastly improved land transportation. As international trade increased throughout the 20th century, the ability to move goods to and from port facilities became very important. The interstate system allowed the transportation of goods from one place to another in less time than on two-lane roads. Access to the interstate highway system became an important part of a port's ability to attract cargo. Railroads had a major impact on ports of the United States. As the railroad system matured and expanded across the Nation, products could be moved from ports to inland markets faster and more efficiently. Railroads and interstates have provided the foundation for an extensive intermodal nexus in the United States, which, in turn, has greatly expanded market areas and increased opportunities for commerce at ports.

CONCLUSION

Examining what has happened to ports in the past provides insight into the future of the United States port system. The main factors that affected ports and their development in the past–trade, geography and technological advances–will continue to be forces guiding future port development. Today, changes in the world fleet and shifts in global economies have increased demands for port services and improved port infrastructure. The United States needs to maintain its competitive position in the global marketplace by providing an efficient port system fully capable of meeting the challenges of the modern global marketplace. Failure to do so will not only affect those directly and indirectly associated with ports, but would also have broader implications for the Nation as a whole.

[1] American Association of Ports Authorities, 1999 data.

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III. MARITIME STAKEHOLDERS

Harbors and ports have a significant impact on many segments of the United States population. To address port planning and construction and understand the needs of harbors and ports, maritime stakeholders must be identified. The term "stakeholder" can have different definitions and interpretations depending on context. However, for the sake of this discussion, stakeholders are defined as those who are involved with ports in some way, or those who are affected by economic or structural changes in the port system.

Citizens involved in port functions have varying degrees of interaction, and maritime stakeholders can be directly or indirectly affected by changes to harbors or port surroundings. Direct maritime stakeholders contribute a great deal to the success and development of ports, and many depend upon ports for their prosperity and development. Direct maritime stakeholders include Federal and state agencies, state and local governments, ports, ocean carriers, shippers, and owners and operators of inland transportation systems. Participants in the port community can also be direct maritime stakeholders who depend on other members of the port community for their success and development, and not on the port itself. For this discussion, indirect maritime stakeholders include the American people, industry associations and private support industries.

DIRECT MARITIME STAKEHOLDERS

Federal and State Agencies

Federal and state agencies enforce environmental laws and policies. In the United States, public ports are governed by state and local governments, with Federal and state agencies enforcing laws enacted by Congress and state legislatures. Currently, the United States does not have a national port planning policy or a Federal agency that oversees all port activities. Individually, not collectively, Federal and state agencies execute waterway and harbor improvements authorized and funded by the U.S. Congress. In addition, they enforce dredging laws and regulations governing dredging, disposal of dredged materials and preservation of wetlands. The most prominent Federal agencies are the U.S. Coast Guard, the U.S. Army Corps of Engineers, the Maritime Administration (MARAD), the Environmental Protection Agency (EPA), the U.S. Fish and Wildlife Service, the National Marine Fisheries Service (NMFS) and the Coastal Resources Management.

State and Local Governments

State and local governments are maritime stakeholders as owners of seafloors within the Nation's harbors. They are responsible for managing navigable waters in the best interest of the

people they represent. Navigable waters provide water transportation access to ports. Various interest groups, constituents of taxpaying port districts and communities in general benefit from the actions taken by state and local governments.

Ports

Public port agencies oversee harbor development and manage port operations. They function in the public's interest with particular attentiveness to new ideas and opportunities and to changes in the community's values to ensure that public interests are accurately represented. Traditional operations of public ports include cargo handling, generating revenue, and satisfying regulators and interest groups. Ports generate operating revenues from leases and port-related services. Funds for capital development are raised through taxes or tax-backed bonds, tax-exempt revenue bonds, fees, grants and cost sharing of port improvements.

Public port agencies can be referred to by a variety of names such as port authorities, dock boards, harbor commissions, transportation departments, navigation or terminal districts, city bureaus or divisions. There are two types of management designs for public port agencies: (1) operating ports or (2) landlord ports. Operating ports are agencies that physically build, operate and have ownership of port infrastructure. Public ports that are built and leased to a private company for operation are considered landlord ports. Major responsibilities of port administrations are to manage real estate activities, land use and environmental developments, and fiscal investments.

Ocean Carriers

Ocean carriers are major stakeholders because they provide water transportation of cargo from port to port. The product offered by ocean carriers is space on their vessels, and the demand for ship space is influenced by consumer demand. The volume of trade on a trade route affects the size of ships needed to provide service and determines prices charged by the carrier. The more cargo transported, the cheaper the price of transportation. Ships are the most visible users of ports and harbors.

Shippers

As the customers of ocean carriers, shippers are also maritime stakeholders. Shippers are interested in the condition of their cargo upon delivery and the cost to transport it. The mode of transportation selected for moving cargo depends on the type, value and demand for the cargo. If demand is high, delivery time is usually the determining factor. The fastest service is normally provided by airplanes, but at a high price. The cheapest method of transporting cargo is by water; however, this is the slowest mode. A combination of water and land transportation services produces acceptable delivery times and affordable prices. Shippers select modes of

transportation that meet their requirements of delivering goods that are in demand. The speed at which a shipper can have goods delivered at the lowest cost determines the price they will charge consumers. The type of intermodal facilities available at ports determines where shippers can utilize land-bridge transportation systems. Ports with well-developed intermodal capacity are more attractive to shippers who desire intermodal capabilities.

Inland Modes of Transportation

Inland modes of transportation are major stakeholders because cargo must be moved to and from inland areas. This is accomplished either by rail, road or by water. A major factor in determining the mode of inland transportation is the final destination of cargo and the distance that it has to travel. Studies have found that the cost of moving containers up to 400 miles is always lowest by truck, while moving containers between 400 and 700 miles is usually the lowest by rail. Railroads are an efficient method of land transportation when containers are hauled double-stacked on railcars at high volumes over long distances. The advantage rail service has over truck delivery of containers is that double-stack railcars can carry higher volumes of containers at a lower operating cost. The limitation is the availability of double-stack services with access to ports. Existing transportation infrastructure can dictate which inland modes of transportation are used. Rail lines and highways must be in place before a railcar or truck can provide service to a facility, either at the port or at a distribution center. It requires financial investments and commitments to construct and maintain these systems.

In other world regions such as Europe, shipment of containers via barge to and from inland destinations has become increasingly popular in recent years. In the U.S., the greatest success has been on the Columbia River in the state of Washington, and there are efforts underway on the Intracoastal Waterway. In general, there is a growing interest in transporting containers on barges in the U.S.; however, the practice is still relatively limited.

INDIRECT MARITIME STAKEHOLDERS

American People

The American people are financial supporters and beneficiaries of port development. As citizens they benefit from laws and guidance dictated by Congress, as taxpayers they help fund projects authorized by Congress. As consumers they benefit from the opportunity to purchase imported goods delivered at ports. On the export side, producers gain by selling more goods and generating more profit. In turn, they pass on savings to consumers or reinvest the monies into improving their businesses. Revenues generated from taxes and tariffs at U.S. ports also contribute to port development.

Increased public interest in environmental issues has resulted in political and social awareness of the importance of fish and wildlife, clean air and water, and access to waterfronts.

Congress has responded by enacting legislation aimed at protecting and preserving natural resources that could be damaged in the wake of economic development. Major environmental legislation that has had a significant impact on the health of harbor environments are the National Environmental Policy Act of 1970, the Coastal Zone Management Act and the Water Pollution Control Act of 1972. Specific to harbor dredging is Section 404 of the Water Pollution Control Act that authorizes the Corps to review the discharge of dredged or fill material into the waters of the United States.

Other indirect maritime stakeholders are associations formed by port authorities and shippers. Many groups within the port community have formed associations that represent to Congress their interests and concerns on legislative actions and regulatory policies. For example, shippers have formed associations that represent their interests in dealing with carriers for service contracts to consolidate freight for time and volume discounts.[2] Specific examples of maritime organizations include:

- The Connecticut Maritime Association,
- Maritime Association of New York/New Jersey,
- American Association of Port Authorities,
- International Association of Port Authorities,
- Pacific Maritime Association,
- Intermodal Association of North America,
- Maritime Exchange for the Delaware River and Bay,
- The U.S. North Atlantic Ports Association, and
- Lake Carriers Association.

Indirect maritime stakeholders also include private support industries that are companies or individuals located within a harbor. They contribute to the movement of cargo by acting as intermediaries for other maritime stakeholders. Examples of private support industries are tug operators, shipbuilding and repair, agents and forwarders, custom brokers and chandlers.

STAKEHOLDER INTERACTION

It is important to understand how stakeholders influence ports and each other. Ports rely on shippers and carriers for their prosperity and survival. Shippers and carriers in turn are dependent upon commodity demand and trade for their success. Services that ports offer to carriers include navigable waters that provide access to cargo handling facilities. Adequate roads and rail lines are necessary for efficient movement of cargo into and through a port. Stoppages caused by backlog or inadequate infrastructure result in decreased turnaround time and delays in cargo delivery. Thus, shippers have a stake in the ability of a port to handle cargo efficiently, and if a port cannot meet this demand, shippers may take their business elsewhere. In the same respect, carriers choose ports that meet their requirements. For a port to compete, it must have adequate infrastructure capable of accommodating expected volumes of freight. Cargo flow can

[2] Association members cannot combine in such a way that would affect stable rate structures, and they cannot boycott carriers.

be hindered if ports lack adequate rail and road connections. In fact, rail has become an increasingly important component of U.S. maritime trade. On transpacific and transatlantic trade routes, ocean carriers have reduced time and costs of cargo transport through the use of the U.S. land-bridge system. Rather than sailing through the Panama Canal, many ocean carriers discharge cargo at one U.S. coast and use rail to ship it across the continental United States. Cost efficiency is achieved through the use of large containerships that are physically restricted from entering the Panama Canal because of their width and draft.

Ports also interact with state and local governments. Public port agencies are created as political subdivisions of the state, such as special districts or parts of a county or municipal government. Structure and authority of public ports are established under state laws and are not consistent throughout the Nation. Ports have both public and private enterprise features. Public aspects of port management stem from ownership of the port by state and local governments. A characteristic of ports being public entities is the limitation of financial and development ventures by Federal and state laws that do not always apply to private companies. However, a benefit of being a public entity is that Federal income tax and property tax do not apply to port development projects. Because of government involvement, public ports tend to take less financial risk than private businesses. The private aspect of ports that distinguish them from other state agencies is that management often operates independently. Money can be raised from private sources so that revenues can be retained and reinvested, and often there is no dependence on tax revenues. State and local governments authorize the power and responsibilities of ports, making them the source to which ports are held accountable.

U.S. ports can operate as landlord, operator or landlord and operator ports. Landlord ports own terminal facilities and lease them to other entities, including private terminal operating companies or carrier lines. The ports of New York/New Jersey, Philadelphia/Camden, New Orleans, Long Beach, Los Angeles, Oakland, Seattle and Tacoma are landlord ports. Operator ports are ones that own and operate terminal facilities. Examples include Boston, Charleston, Port Everglades, Savannah, Corpus Christi and Mobile. Some ports are both landlords and operators of port facilities. In these instances, they own and operate terminals and act as landlords for companies that operate terminal facilities. Governing bodies at the ports of Baltimore, Jacksonville, Tampa, Baton Rouge, Houston and Portland function as landlords and operators of terminal facilities.

The management structures of port governing bodies are not consistent from port to port. Several different types of management structures are used, ranging from state agencies to city boards. The port governing body of the Maryland Port Administration is the Maryland Port Commission, which is made up of a seven-member board chaired by the Maryland Secretary of Transportation. Port governing bodies that are agencies of state governments include Boston's Massachusetts Port Authority, the South Carolina State Ports Authority, the Virginia Port Authority, the Georgia Port Authority and the Alabama State Docks Administration. These agencies administer all ports within their state, and in some cases the states have defined statewide port plans that may include policies for port development. Port governing bodies administered by a board of commissioners include the Port Authority of New York/New Jersey, the Delaware River Port Authority of Pennsylvania and New Jersey, the South Louisiana Port Commission and the Port of Portland Commissioners. State governors appoint board members. For port authorities with jurisdiction in multiple states such as the Port Authority of New York/

New Jersey, governors from each state appoint members to the board. Port governing bodies can also be established and managed at the county level. For example, the Tampa Port Authority is a department of the Hillsborough County government.

Other ports are governed by a combination of state and city or county and city agencies. The Jacksonville Port Authority is a seven-member board with four members appointed by the governor and three members by the mayor. The Port of Miami is a department of the Miami-Dade County government, and the Greater Baton Rouge Port Commission is a department of the parish and city. The Port of Corpus Christi Commission is a seven-member board with three members appointed by the City Council and four appointed by the County Commissioner Court.

Several Federal and state agencies interact with ports through the regulation and monitoring of activities concerning environmental laws and policies. These Federal agencies must interact and communicate to ensure environmental laws and policies are enforced. Individual states have their own agencies that are also involved in executing waterways and harbor improvements. Some general categories of state agencies include submerged land ownership, fish and game agencies, water quality, coastal management and transportation and commerce. Commitment and interaction among Federal and state agencies is necessary to effectively implement port improvements. Each project presents new and different challenges that should be addressed.

Federal and state agencies interact with Congress by enforcing Federal environmental laws and policies that are a result of increased environmental awareness and concern. The National Environmental Policy Act (NEPA) authorizes Federal and state agencies to implement mitigation and permit-processing policies. Agencies are required to consider environmental consequences of their decisions when implementing NEPA. This is accomplished by considering alternative actions and interacting with other agencies and the public to determine opinions and possible conflicts in the preparation of an environmental impact statement. The Water Pollution Control Act of 1972 assigned the Corps the water quality statutory responsibilities of issuing permits and applying EPA-proposed discharge criteria. The NEPA of 1970 requires the Corps to protect fish and wildlife and consider general environmental factors.

Environmental concerns have contributed to the development of Federal regulatory policies that influence the activities of ports. The Corps is responsible for dredging and maintaining navigable waterways. Navigation improvements are performed only when they are justified through benefit-cost analyses. Ports contribute to Corps dredging and filling activities through cost sharing. MARAD issues technical reports that are useful to port officials when making decisions and abiding by Federal guidelines. The U.S. Coat Guard installs navigational aids to provide safety and the capability to navigate waterways. The functions of these Federal agencies directly impact the activities of ports. Difficulties can be encountered in the regulatory process due to the involvement of multiple governmental agencies. Potential obstacles can occur between Federal functions when Federal subsidies conflict with Federal environmental rules.

The most significant interaction is between ports and the American people. Economic benefits realized as a result of port improvements can affect the entire Nation. This is achieved by supporting existing businesses, attracting new businesses and generating revenue from fees and port-activity tariffs that are reinvested into port development. As a publicly governed body,

a port must be developed in the public's best interest. The trade stimulated from port development will benefit consumers and citizens. Consumers will have more goods from which to choose from that have lower transportation prices. Ideally, the lower transportation cost will be passed on to the consumer as a lower retail cost.

Harbor improvements benefit all Americans indirectly through cheaper consumer goods and facilitate international trade by providing shippers with improved infrastructure. Congress is responsible for maintaining navigation facilities. Projects to improve port facilities must first be assessed in terms of environmental and economic impacts. Once approval for a project is released, then Congress must make appropriations available to construct the improvement.

National security is another important aspect of port development. During a time of national crisis the volume of supplies needed for the protection of our national interests must be received and transported in the most timely and efficient manner. This requires landside terminal capabilities and port facilities that are accessible to ships. Adequately dredged harbors are required to meet national security demands.

Port development includes deepening channels as well as improving landside services, such as terminal and cargo handling facilities, that can increase the cargo handling capacity of a port. The additional support industries in a port region increase employment opportunities in the area. Lands adjacent to ports must be managed effectively to ensure they are used and preserved properly. Port development requires large financial investments and usually has significant environmental impacts that affect the decision-making process. With port development comes higher land values adjacent to the port and additional revenues generated from property and sales taxes. In answering to the governing bodies and the prominence of environmental awareness, ports are forced to make sound management and development decisions.

CONCLUSION

The importance of foreign trade to the economy of the United States has contributed to the significance of harbor access and development issues. Changes in the shipping industry, particularly growth in containerization and the emergence of larger containerships, have increased channel deepening needs. As the Nation undertakes new port planning and improvement activities, maritime stakeholders will have a great impact on these activities. Maritime stakeholders have diverse interests, but they must work together to improve the port system of the United States.

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IV. GLOBAL TRADE OUTLOOK

OVERVIEW OF THE GLOBAL ECONOMY

Developments in the world economy directly influence demand for shipping services. Periods of global recession can result in less demand, while economic growth generally leads to increases in demand. Over the past decade, most industrialized economies have prospered and grown. From 1991 to 1997, growth in world economic output (real gross domestic product) averaged about 2.9 percent annually, reflecting continuous expansion in North America and signs of economic recovery in Europe and Japan. Revitalization in Europe and Asia has come on the heels of one the most tumultuous economic events since the Great Depression. Between June 1997 and August 1998, national currencies throughout Asia experienced large declines in value ranging from 500 percent in Indonesia and 55 percent in South Korea. A direct result of the "Asian Crisis" was an economic recession that affected many nations–particularly South Korea, Indonesia, Thailand and Malaysia.

In the wake of the Asian currency crisis, industrial countries with significant trade links in Asia expected to experience adverse effects on growth. Weak currencies in Asia, coupled with austerity measures and realignment of banking sectors, slowed economic activity and growth. This led to a reduction in Asia's demand for imports. Lower demand affected not only the volume of trade but also commodity prices, particularly commodities for which Asian countries are an important part of world demand. Asian economies consume substantial amounts of raw materials. From 1991 to 1997, Asian imports of grain, minerals, coal, oil and iron increased from 544 million tons to 902 million–about 36 percent of world trade growth of these commodities.[3] As Asian demand plummeted, commodity prices fell sharply. According to the World Trade Organization, in 1998 oil prices dropped by 30 percent, and prices of non-oil primary commodities fell by 15 percent.[4] Prices of agricultural commodities and manufactured goods also declined, but not as sharply. By 1998, growth in many nations slowed in response to lower demand in Asia, and predictions for 1999 were dim at best. But today, with the exception of Japan and, to a lesser extent, Europe, growth in major world economies appears to have gained momentum despite the crisis.

United States, Canada and Mexico

The U.S. economy has experienced acceleration in private consumption and continued double-digit investment growth. Productivity growth has been strong, running about 3 to 4 percent, particularly in high technology industries. Declining commodity prices and the appreciation of the dollar have helped stifle inflation and kept interest rates low. Continued

[3]Fairplay International Shipping Weekly, January 27, 2000.

[4]At the time of writing, crude petroleum prices had declined. Since then, prices of crude have risen sharply. Any further rise in oil prices could also have a significant dampening effect on the U.S. economy.

expansion hinges on the conditions that American consumers do not rapidly reverse their historically low savings rates, and that any stock market correction does not stifle investor and consumer confidence. By any measure, the market is overvalued, and a surge in inflation is a distinct possibility given tight labor markets.

Growth in Canada was down to about 1.2 percent in 1996, but rebounded quickly in 1997 after Canada's provincial governments instituted tax reforms that cut rates by 7 percent in 1996 and 15.5 percent in 1997. Tax cuts in conjunction with reductions in combined programs and capital spending increased Canadian GDP to 3.5 percent by the end of 1997. Canada, however, was not immune to the Asian currency crisis. Like many other nations, low prices of bulk commodities such minerals, ores and grains affected some sectors of the Canadian economy in late 1997 and 1998. Nevertheless, today, Canada is doing well. In 1999, its economy grew at 4 percent, reflecting a rebound in commodity prices, increased consumer spending and healthy export trade with the United States. As the Canadian dollar continues to weaken, exports to the U.S. should increase. Sound monetary policy by the Bank of Canada has resulted in low inflation, about 1 percent.

Mexico has more or less recovered from a modest contraction after the peso devaluation in 1994. In 1995, Mexican GDP plummeted about 2 percent; however, the government's economic recovery plan provided necessary short-term measures to cope with Mexico's financial crisis and has enabled the country to continue its economic expansion over the longer term. The lower value of the peso has made Mexican goods significantly more competitive on world markets.

Asia/Pacific

Japan continues to feel the effects of the Asian crisis despite a surge in real GDP in 1996. Unfortunately, most of this increase was due to fiscal stimulus, and the effect was short lived. Low levels of domestic consumption and cuts in government spending have dampened the rebound, and by early 1997, growth plummeted to 0.9 percent. Japan's financial problems are much more severe than those of other East Asian economies. Japanese banks are plagued by a rash of loan defaults and remain reluctant to provide new loans, and credit continues to drop. Also, the limited restructuring that has taken place in Japan's financial and corporate sectors has stifled consumer spending and reduced the efficiency of government stimulus policy. Until significant reforms are met in Japan's corporate and financial sector, growth will likely be weak in the short term.

Other nations in Asia and the Pacific are rebounding from the Asian slump. Fueled by export-led growth in China, Malaysia and the Philippines, GDP grew at an annual average rate of 6.3 percent in East Asia from 1991 to 1997. Surging stock markets, combined with substantial reforms in banking sectors, have lowered capital costs and stimulated business development. The Asian Development Bank raised 1999's regional growth forecast to 5.7 percent from 2.3 percent in 1998. South Korea experienced the most impressive recovery, with growth at about 7 percent in 1998. Malaysia, which saw a 7.5 percent contraction in 1998, recorded a 5-percent

growth rate in 1999. Indonesia–one of the nations most affected by the Asian crisis–recovered from a 13.2 percent decline in 1998 to a negative 1 percent in 1999. Hong Kong rebounded from a contraction of 5.1 percent in 1998 to an increase of 1.9 percent in 1999.

China continues to be an important global market. For the past 20 years, it has experienced the fastest growth, reaching 9.7 percent in 1996. Growth is expected to remain at about 8 percent through 2001. China has been affected by the Asian recession. In 1998, Chinese exports stagnated after gaining about 20 percent the year before. China is one of the few nations in Asia that has not devalued its currency. As a result, competing products from other Asian countries are cheaper, and Chinese exports have become harder to sell. An added worry for China is its overstaffed and inefficient state sector, which is still mired in its command-and-control past. According to Chinese officials, state firms will lay off more than three million Chinese employees by the end of the year 2000. Foreign investment in China, another important engine of economic growth, has also declined. Long-term prospects in China are vague. Optimists see China as one of Asia's "tiger" economies where supercharged expansion and gradual political liberalization will continue unfettered. Pessimists, on the other hand, warn of potential political turmoil, hyperinflation and excessive population growth.

India hopes to increase its share of world trade by tapping into markets in Africa and Latin America. To remove infrastructure bottlenecks that could thwart its efforts, India's government has attempted to increase coordination among civil departments responsible for railways, ports and aviation. India has also eliminated trade barriers on selected imports. In an effort to modernize local textile and garment industries, India's finance minister reduced customs and excise duties on crude oil, petroleum products, computers and industrial equipment. An increase in India's manufacturing capacity coupled with its low labor costs could result in the shift of some textile bases from Asia to the Indian Subcontinent.

Australia's economy has outperformed expectations and appears to have weathered any spillover affects of the Asian crisis. Strong consumer demand appears to be the primary catalyst, and Australian exporters have been able to tap into non-Asian markets. New Zealand felt the brunt of the Asian crisis. Drought conditions, low consumer demand and falling commodity prices have exacerbated the situation.

Europe

An export-driven rebound in Germany indicates that the worst of the European slowdown may be over. A weak Deutschemark has had a positive effect on European growth. Consumption and inflation have remained low in Germany, and there has not been a need to raise interest rates to offset currency depreciation. Growth in the United Kingdom has been strong through the early and mid 1990s, but it slackened somewhat in 1998. Domestic consumption is expected to decline because of more stringent monetary policies among member nations of the European Union. Specifically, the budgetary constraints of the Maastricht Treaty

may result is austere fiscal policies including higher taxes.[5] The situation in Eastern Europe is not as optimistic. With the exception of Poland, Hungary and the Czech Republic, economic conditions in Eastern Europe have deteriorated, particularly in Russia. On average, Russia has experienced an economic contraction of negative 7.2 percent from 1991 to 1997. Problems in Russia result from multiple internal sociopolitical frailties compounded by fallout from the Asian currency crisis, especially the collapse of commodity prices.

South America, Africa and the Mid-East

Although emerging markets in Latin America have been affected by the Asian currency crisis, growth in some important economies has been strong. In Argentina, GDP grew at an average rate of 5.6 percent from 1991 through 1998. Brazil averaged about 3 percent during the same period. Latin America has generally been coping well with the economic malaise that followed the Asian crisis. Significant progress has been made with structural reforms, especially in public financial sectors. In many cases, economic performance in Latin America attests to the success of these policies, particularly a return to low inflation–often in the single-digit range–and stronger external positions in world markets.

Following an extended period of economic decline during the 1980s and the first half of the 1990s, Africa has begun to make significant economic progress. Growth averaged 4 percent annually between 1996 and 1998–about two points higher than the first half of 1990s. Growth slowed to about 3.2 percent in 1998, due in large part to the Asian crisis. Reduced commodity prices have affected the export earnings of African and Mid-Eastern countries. In addition to the 11 member countries of OPEC, eight other countries in both regions rely on petroleum exports for more than 50 percent of export earnings. More than twenty countries depend on agricultural commodities for at least 35 per cent of export earnings.[6] Decline in agricultural prices affected these countries, but less dramatically than the oil exporters for two reasons. First, agricultural product prices did not fall as much as oil prices, and second, exporters of agricultural products usually depend less on a single commodity than do petroleum exporters.

Africa deserves special attention as an emerging market. Africa is a huge potential market with over 700 million consumers and, aside from China, may be one of the largest growth opportunities for U.S. exporters and investors in the future. U.S. foreign direct investment in Africa has averaged a 29 percent rate of return on book value since 1990. In contrast, Asia and Latin America averaged 14 and 12 percent, respectively.[7] Many governments in Africa are earnestly instituting programs to facilitate growth and commerce. Projects to upgrade infrastructure are underway, including the expansion of seaports, airports, roads and railways.[8]

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[5] The Treaty of Maastricht stipulates that members of the European Union must adhere to several economic and monetary requirements. For example, to maintain price stability, the long-term interest rate must not exceed by more than two percentage points the average long-term interest rates of the three member nations with the lowest inflation rates. The treaty also states that the average budget deficits cannot exceed 3 percent of a nation's GDP. Only two nations satisfy this requirement–Ireland and Luxembourg. Hence, other nations such as Germany and Italy may impose policies to reduce their budget deficits.

[6] World Trade Organization, "Press Release." 16 April 1999.

[7] United Nations Conference on Trade and Development, World Investment Report 1998: Trends and Determinants. 1998.

[8] African Development Bank, 1999 Annual Report: Infrastructure Development in Africa. 1999.

Many African governments are modernizing by adding capacity to telecommunications systems and privatizing state industries.

GENERAL PATTERNS OF GLOBAL AND NATIONAL MARITIME TRADE

Global trade is one the more dynamic components of the world economy. From 1991 to 1998, international trade grew at about twice the annual rate of real world economic output–6 percent versus 3 percent. Further expansion of the world economy will likely average about 3 percent per year well into the first half of the 21st century.[9]

In addition to economic development, much of the boom in world trade can be attributed to changes in the global marketplace. Improved access to international markets has had a major impact. Although governments in some nations are still hostile to property rights and freedom of exchange, much of the world has opened its doors to trade. For example, 11 members of the European Union have created a single internal European market with the Euro as their official currency.[10] Mediterranean nations (EUROMED) have agreed to institute free trade by 2010. The Uruguay Round of trade agreements, NAFTA and strong momentum for trade liberalization throughout Latin America have fostered free trade. Formation of the *Mersocur* pact among Brazil, Argentina, Uruguay and Paraguay has eliminated tariffs on most products traded among these nations. The 18 nation members of the Asia Pacific Economic Cooperation (APEC), including China, Japan and the United States, agreed in 1994 to eliminate barriers to trade. China's entry into the World Trade Organization will greatly boost export opportunities for many nations including the United States. Under the agreement, the U.S. will maintain the same tariffs on Chinese imports that it has had in place since the 1980s, but on a permanent basis rather than through annual renewals. However, restrictions on imported clothing and textiles will be lifted, allowing China to compete freely in U.S. markets. The agreement should result in an immediate increase of $3.1 billion in U.S. exports to China.[11]

Changing patterns of international business investment have supported the boom in world trade. Large-scale foreign investments that began in earnest in the mid-1980s with the first round of outsourcing and downsizing in the U.S. manufacturing industry have helped propel growth in maritime shipping. Production of manufactured goods is far less integrated than in the past. There are more steps in the production process, many of which occur in different countries. For example, a product marketed in Europe may have been assembled in the United States with components made in Asia. The implications for the maritime transportation system are clear.

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[9] Projections of future commodity flows are an essential component of the *National Dredging Needs Study* (NDNS). Trade forecasts were developed by WEFA, Inc. These forecasts provided the foundation of a procedure developed to estimate future vessel traffic at U.S. ports presented in Chapter VI of this report. Appendix A provides an overview of the forecasting methodology.

[10] Adoption of a single currency facilitates trade through the elimination of exchange rate volatility and reduces transaction costs. Other nations are considering similar strategies. Ecuador, Argentina, Mexico and Canada have all considered adopting the U.S. dollar as their national currency.

[11] Zhang Shuguang, Zhang Yansheng and Wan Zhongxin, *Measuring the Costs of Protection in China,* Institute for International Economics, Washington, November 1998.

Manufactured goods and their components must be transported internationally, and one of the fastest and most cost-effective ways to do so is by containership.

From 1990 to 1995, the volume of world container trade grew at an average annual rate of 6.5 percent. Strong trade growth, an expected surge in world trade due to lower prices in Asia, and the collapse of Asian imports and intra-Asian trade supported a 7.3 percent real growth rate in the value of global container trade from 1995 through 2000. Between 2000 and 2020, growth is expected to drop slightly to about 5 percent. Other types of cargo are forecast to increase at a lesser rate over the entire forecast period, since many heavier commodities are experiencing slower growth rates. From 1995 through 2040, forecasts indicate that real growth in non-containerized cargo will be about 2 percent less per year than for the container trade. Asia's container exports to the U.S. have increased from 1997 to 1999 because of declining prices of Asian goods and strong U.S. demand. The extent of price declines and their impact on Asian exports has been obscured because much of what is produced in Asia for export is contracted for in advance by U.S. importers. Thus, in the short term, trade is dependent more upon market growth and less on relative prices.

On a national level, international trade has grown steadily over the last decade and will likely increase in the future. When measured in constant prices, annual U.S. exports in 1996 were worth nearly $600 billion, and imports were worth approximately $700 billion. As indicated in Table IV-1 and Figure IV-1, from 1992 to 1996, the value of U.S. exports grew at an annual rate of around 7 percent, and the value of U.S. imports increased at a rate of 8 percent. Forecasts suggest that export growth may slow to just over 6 percent per year through 2010. Imports are expected to increase at a rate of five percent per year. In 1996, the gap between imports and exports was 21 percent. By 2010, the difference is expected to narrow to 6 percent, and by 2040, U.S. exports are likely to exceed imports. Growth in U.S. exports is projected to be 4.7 percent, and import growth is anticipated to be 3.9 percent per year.

Throughout the forecast period, the trade imbalance between imports and exports should narrow, and by 2040 the value of U.S. exports is expected to surpass imports. The primary underlying reason is that as economies in developing nations grow, consumers in these countries will demand more U.S. exports. Foreign demand for U.S. exports will grow faster than the rate at which the U.S. imports goods from developing nations. This reflects relative stages of economic development in the United States and its trading partners. The U.S. economy will continue to grow, and Americans will become wealthier, but demand for imported consumer goods will grow more slowly than it will in developing nations. In other words, consumers in developing nations will become more like the U.S. consumers of today, and U.S. consumers will increasingly shift wealth into services rather than commodities. Take Africa for instance. Today, the majority of Africa's population does not have the consumption opportunities available to most Americans. For example, there are more telephones in Manhattan than there are in all of Sub-Saharan Africa. About half of Africans are under the age of 15 years, and most do not have abundant supplies of consumer goods.[12] However, as Africa's economy develops in the next 20 years or so, incomes will rise, and consumers will increasingly be able to afford more consumer goods. With a young population of 700 million people, this may translate into a huge demand for foreign imports.

[12] Mclymont, R., "Opportunity Beckons in Africa for Business." Journal of Commerce, 06 Dec 1999.

TABLE IV-1

ACTUAL AND PROJECTED U.S. INTERNATIONAL TRADE OF GOODS: 1992 – 2040 ($U.S. BILLIONS, BASE YEAR OF 1987)

Imports	Actual		Forecast	
	1992	1996	2010	2040
Annual value ($1987 billions)	$516	$703	$1,434	$4,550
Average annual growth rate	–	8.0%	5.2%	3.9%
Exports	**Actual**		**Forecast**	
	1992	**1996**	**2010**	**2040**
Estimated annual value ($1987 billions)	$441	$577	$1,352	$5,322
Average annual growth rate	–	6.9%	6.3%	4.7%

Source: WEFA, Inc.

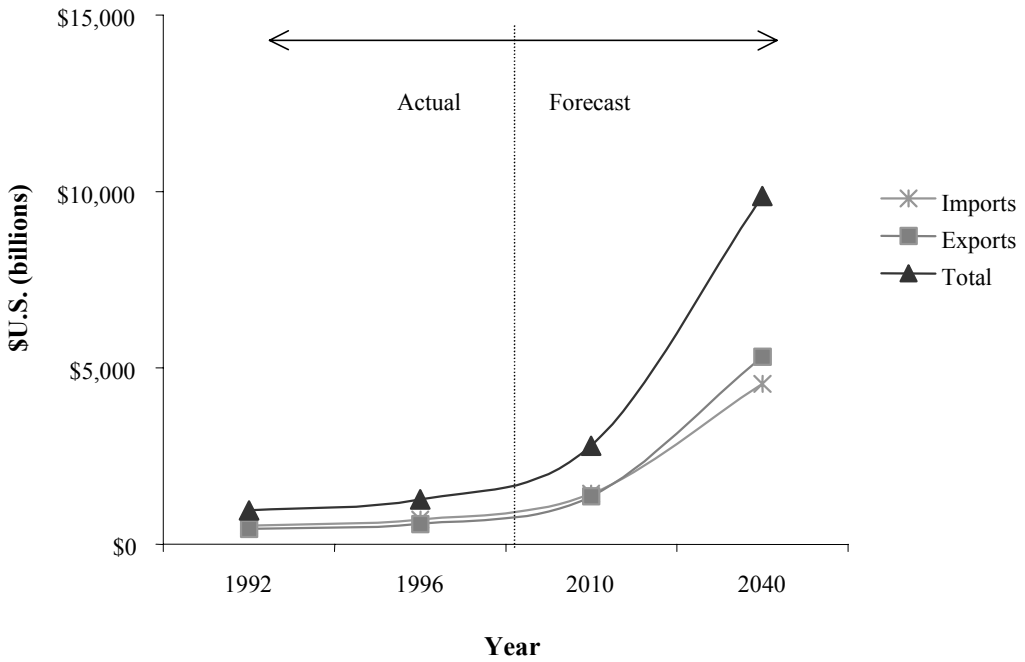
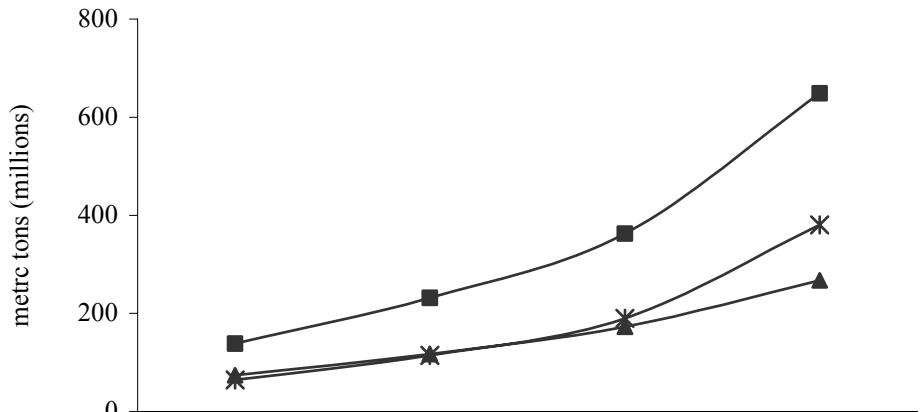


Figure IV-1. Forecasted U.S. International Trade: 1992 – 2040 (billions of 1987 $ U.S.)

Source: WEFA, Inc.

U.S. Container Trade: 2000 – 2040

Figure IV-2 displays projections for U.S. container trade through the year 2040. In the future, container trade is expected to grow significantly. Forecasts suggest that by the year 2020, container tonnage will triple, and by 2040 container trade is expected to increase by a factor of 7 to about 650 million metric tons–an average annual growth rate of 3.9 percent. Direction of container trade should remain balanced until well into the next century, when exports are expected to exceed imports.[13] Stronger export growth in the years 2000 through 2020 will be partly due to the importance of developing nations in Africa, the Mid-East, Latin America and the Indian Subcontinent. In general, there is a close relationship between regional economic development and container trade. As developing nations grow and prosper, incomes rise and people are able to consume more manufactured goods that are predominantly transported by containerships. Similarly, as developing nations increase manufacturing capacity and develop infrastructure, there is a greater need for raw materials such as iron and steel, aluminum and wood. Thus, economic growth in developing nations will contribute to stronger growth in U.S. containerized exports. Increased growth is expected to come from a recovery in the U.S. export performance in semi-manufactured commodities (iron and steel, aluminum, paper, wood, etc.).



	year 2000	year 2010	year 2020	year 2040
Imports	73.74	117.47	173.03	267.46
Exports	64.54	114.43	189.57	380.80
Total	138.28	231.90	362.61	648.26

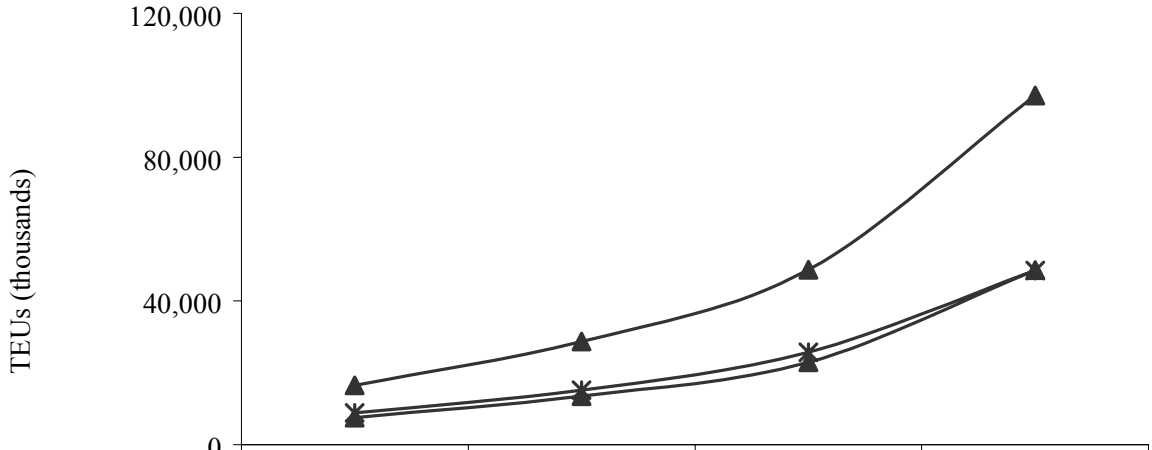
Figure IV-2. U.S. Imports and Exports of Containership Cargo: 2000 – 2040 (millions of metric tons)

Source: WEFA, Inc.

[13] It is true that the U.S. is a net importer of containerized cargo on a per unit and value basis. However, in terms of tonnage, container trade is more or less balanced. The closeness of trade direction in terms of tonnage reflects the different densities of commodities imported and exported. Exports from the U.S. often include heavy commodities such as food and scrap metal. Imports are usually greater in volume but less dense commodities such as consumer electronics and clothing. Chapter 5 of this report discusses the types of commodities transported on containerships in detail.

Exports of containerized cargo to developed nations will consist largely of refrigerated agricultural goods (e.g., meat and dairy products), machinery and synthetic resins.

Figure IV-3 displays forecasted TEU throughput in the U.S. for the years 2000 through 2040. The NDNS covers the longest historical and projected period available in published form. As with tonnage growth, TEU throughput in the U.S. is expected to increase significantly in the 21st century. In 2000, estimates suggest that 16.5 million loaded TEUs will flow through the Nation's ports. This amount is expected to grow to almost 50 million in 2020 (an average annual growth rate of about 5.6 percent) and to nearly 100 million by the year 2040 (an average annual growth rate of 4.5 percent).[14]



	Year 2000	Year 2010	Year 2020	Year 2040
Imports	8,908.49	15,150.82	25,733.94	48,492.64
Exports	7,595.49	13,583.59	22,952.96	48,624.78
Total	16,503.98	28,734.41	48,686.90	97,117.42

Figure IV-3: Forecasted Container Trade: Years 2000 – 2040 (thousands of TEUs)

Source: WEFA, Inc.

[14] A recent report published by the U.S. Department of Transportation (DOT) projected that TEU throughput in the U.S. will grow at a rate of between 7 and 8 percent through the year 2002. Projections of the NDNS study are more modest; however, the forecasts are calibrated over a much longer period. See, U.S. Department of Transportation, An Assessment of the U.S. Marine Transportation System: A Report to Congress. September 1999.

Table IV-2 lists primary regions and the most important countries within each region. Tables IV-3 and IV-4 display forecasted inbound and outbound container tonnage and historical and forecast market shares of containerized trade according to major trading partners of the United States. In general, forecasts suggest strong growth in the total volume of containerized trade, and a substantial shift in importance of U.S. trade partner regions. Containerized tonnage from all regions of the world is expected to increase substantially. In terms of total volume, trade partners in the Asia/Pacific region are expected to remain the principal source of container trade, although trade with developing nations in Africa, South America and the Mid-East should increase as well.

TABLE IV-2

MAJOR TRADING PARTNERS OF THE UNITED STATES BY WORLD REGION

World Region	Leading Trade Partners in Each Region	
Asia (includes Pacific Rim nations and the Indian Subcontinent)	Hong Kong	Philippines
	South Korea	Singapore
	Taiwan	Thailand
	China	Malaysia
	Japan	Indonesia
	India	Vietnam
Canada/Mexico/Central America	Canada	Mexico
	Guatemala	Costa Rica
	Caribbean Basin	Honduras
Europe	Germany	Belgium
	Italy	France
	United Kingdom	Spain
	Netherlands	Austria
	Switzerland	Sweden
	Russia	Norway
South America	Venezuela	Chile
	Argentina	Colombia
	Brazil	Peru
Africa	Nigeria	South Africa
	Gabon	
Mid-East	Saudi Arabia	Israel
	Egypt	Kuwait
	United Arab Emirates	
Australia	Australia	New Zealand

Source: WEFA, Inc.

TABLE IV-3

PROJECTED INBOUND AND OUTBOUND CONTAINERIZED TONNAGE BY TRADING PARTNER REGION 2000 – 2040 (MILLIONS OF METRIC TONS)

World Region	Inbound Containerized Tonnage				
	year 2000	year 2010	year 2020	year 2040	% Annual Growth
Asia	33.89	60.49	95.56	151.22	3.8%
Europe	22.46	29.93	38.67	51.55	2.1%
South America	7.59	12.00	17.33	32.12	3.7%
Canada, Mexico, Central America	6.13	9.00	12.47	18.74	2.8%
Africa	1.53	2.40	3.43	4.99	3.0%
Australia	1.31	1.98	2.97	5.12	3.5%
Mid-East	0.68	1.40	2.23	3.17	3.9%
Other	0.145	0.2606	0.3913	0.5488	3.4%
Total	73.74	117.46	173.03	267.46	3.3%
World Region	**Outbound Containerized Tonnage**				
	year 2000	**year 2010**	**year 2020**	**year 2040**	**% Annual Growth**
Asia	33.01	57.30	94.37	201.01	4.6%
Europe	13.05	21.91	33.97	56.18	3.7%
South America	6.79	12.97	22.52	45.65	4.9%
Canada, Mexico, Central America	5.38	10.85	19.34	39.38	5.1%
Africa	1.83	3.41	5.81	12.41	4.9%
Australia	1.97	2.91	3.93	6.11	2.9%
Mid-East	2.32	4.70	8.97	18.80	5.4%
Other	0.19	0.38	0.67	1.26	4.8%
Total	64.54	114.43	189.57	380.80	4.5%

Source: WEFA, Inc.

Container exports to all regions should increase; however, several important changes are anticipated in the distribution among trading partners. In terms of inbound container shipments, there will likely be a shift towards Asia, South America and the Mid-East. In Asia, China should become increasingly important as its manufacturing capacity increases. Today, about 17 percent of container tonnage originates in China, and over the forecast period this is expected to grow to almost 30 percent. Other important growth areas in Asia for imported container tonnage are Thailand, Malaysia, the Philippines and the Indian Subcontinent. The growing significance of the Asia/Pacific region reflects existing volumes of Asia/Pacific trade, and the increasing competitiveness of Asian countries as producers of consumer goods for American markets. However, Japan and South Korea are expected to lose market shares of inbound container cargo. Today, Japan accounts for 17 percent and South Korea accounts for about 6 percent. In the long term, both nations are projected to see shares of container exports to the U.S. drop significantly. By 2040, Japan's share is forecast to drop by 14 percent, and South Korea's should decline by

TABLE IV-4

FORECASTED MARKET SHARE OF U.S. INBOUND AND OUTBOUND CONTAINERIZED CARGO BY TRADING PARTNER REGION 2000 – 2040 (MILLIONS OF METRIC TONS)

World Region	Market Share of Inbound Containerized Tonnage				
	year 2000	year 2010	year 2020	year 2040	Change
Asia	46.0%	51.5%	55.2%	56.5%	10.5%
Europe	30.5%	25.5%	22.3%	19.3%	-11.2%
South America	10.3%	10.2%	10.0%	12.0%	1.7%
Canada, Mexico, Central America	8.3%	7.7%	7.2%	7.0%	-1.3%
Africa	2.1%	2.0%	2.0%	1.9%	-0.2%
Australia	1.8%	1.7%	1.7%	1.9%	0.1%
Mid-East	0.9%	1.2%	1.3%	1.2%	0.3%
Other	0.2%	0.2%	0.2%	0.2%	0.0%
Total	100.0%	100.0%	100.0%	100.0%	
World Region	**Market Share of Outbound Containerized Tonnage**				
	year 2000	**year 2010**	**year 2020**	**year 2040**	**Change**
Asia	51.1%	50.1%	49.8%	52.8%	1.7%
Europe	20.2%	19.1%	17.9%	14.8%	-5.4%
South America	10.5%	11.3%	11.9%	12.0%	1.5%
Canada, Mexico, Central America	8.3%	9.5%	10.2%	10.3%	2.0%
Africa	2.8%	3.0%	3.1%	3.3%	0.5%
Australia	3.0%	2.5%	2.1%	1.6%	-1.4%
Mid-East	3.6%	4.1%	4.7%	4.9%	1.3%
Other	0.3%	0.3%	0.4%	0.3%	0.0%
Total	100.0%	100.0%	100.0%	100.0%	

Source: WEFA, Inc.

about 3 percent.[15] South America should also see strong growth in container exports to the United States–particularly the nations of Brazil, Peru and Chile.

Outbound container tonnage is expected to grow more than inbound tonnage. Exports to Asia are forecast to increase from about 30 million tons in the year 2000 to slightly more than 200 million tons by 2040. Although all regions should see substantial increases, the greatest growth areas in terms of total exported container tonnage are expected to be the Mid-East and the region of Canada/Mexico/Central America. It should be noted that growth in outbound container trade to some nations, primarily manufacturing centers, may not reflect commodity value. Rather, much of it will be in the form of lower value commodities such as scrap metals and waste paper.[16] In contrast, shipments to Asia include higher value commodities such as refrigerated meat and dairy products, beverages and synthetic resins.

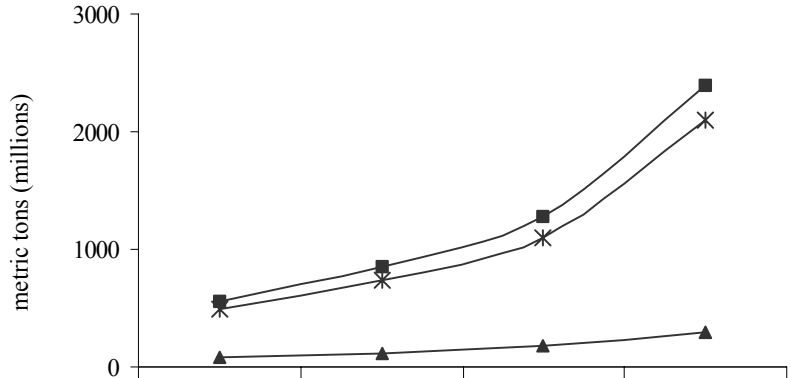
[15] One the primary reasons for growth in these regions is a general shift in manufacturing centers from Northern Asia to China, Southeast Asia and the Indian Subcontinent. The importance of this with respect to U.S. ports is discussed in detail in Chapter V of this document.

[16] When containerships call on U.S. ports, there is often a shortage of premium outbound cargo. Rather than sail with empty ship space, containerships leaving the U.S. will attempt to fill containers with whatever cargo is available, regardless of value. In the transportation industry, this practice is often referred to as "back haul."

Based on market share, there should be a general shift away from Europe and Australia. Asia's share is expected to remain more or less constant over the forecast period. Europe's stake in the market should decline by about 5 percent in the long term.

U.S. Tanker Trade 2000 – 2040

In the 21st century, cargo transported by tankers is expected to shift more toward imports as U.S. oil consumption increases. As shown in Figure IV-4 and Table IV-5, at projected growth rates, total imports of liquid bulk trade moving in tankers will increase to more than 2.1 billion metric tons by 2040–almost 88 percent of all U.S. imports based on tonnage. Principal sources of inbound tanker trade (i.e., crude petroleum) will continue to be South America, Africa and Mexico. Distribution of inbound tanker tonnage among trading partners is expected to shift substantially toward Africa and South America (see Table IV-6). The Mid-East is expected to become less important with respect to tanker imports in the long term, and Europe's share will decline as oil deposits in the North Sea deplete. Asian demand for U.S. tanker exports has declined recently due to the Asian economic crisis.[17] In the long term, however, Asia and Europe will continue to consume more U.S. liquid bulk commodities, but at slower rates than South America, Africa and the Mid-East.



	year 2000	year 2010	year 2020	year 2040
Imports	486.79	739.39	1101.79	2103.39
Exports	75.81	117.26	180.65	287.05
Total	562.61	856.65	1282.45	2390.44

Figure IV-4. U.S. Imports and Exports of Tanker Cargo: 2000 – 2040 (millions of metric tons)

Source: WEFA, Inc.

[17] Most U.S. outbound tanker cargo is in the form of refined petroleum and petrochemical products. In the future, this is not likely to change.

TABLE IV-5

PROJECTED INBOUND AND OUTBOUND TANKER TONNAGE BY TRADING PARTNER REGION: 2000 – 2040 (MILLIONS OF METRIC TONS)

World Region	Inbound Tanker Tonnage				
	year 2000	year 2010	year 2020	year 2040	% Annual Growth
South America	139.54	206.56	311.73	702.68	4.1%
Africa	103.84	159.81	256.02	731.44	5.0%
Canada, Mexico, Central America	94.33	142.72	207.72	265.30	2.6%
Mid-East	79.69	129.25	180.58	196.59	2.3%
Europe	53.12	73.67	101.63	137.18	2.4%
Asia	13.92	23.90	39.35	64.98	3.9%
Australia	1.83	2.67	3.64	4.10	2.0%
Other	0.528	0.828	1.124	1.119	1.9%
Total	486.79	739.39	1101.79	2103.39	3.7%
World Region	**Outbound Tanker Tonnage**				
	year 2000	**year 2010**	**year 2020**	**year 2040**	**% Annual Growth**
Asia	23.43	34.21	46.88	66.58	2.6%
Europe	18.32	19.19	21.72	31.27	1.3%
Canada, Mexico, Central America	18.29	36.98	68.52	111.65	4.6%
South America	9.06	15.40	23.03	33.94	3.4%
Africa	2.31	4.95	9.54	21.39	5.7%
Mid-East	2.18	3.76	7.06	15.35	5.0%
Australia	2.03	2.32	3.07	5.71	2.6%
Other	0.20	0.44	0.83	1.16	4.5%
Total	75.81	117.26	180.65	287.05	3.4%

Source: WEFA, Inc.

TABLE IV-6

FORECASTED MARKET SHARE OF U.S. INBOUND AND OUTBOUND TANKER CARGO BY TRADING PARTNER REGION: 2000 – 2040 (MILLIONS OF METRIC TONS)

World Region	Market Share of Inbound Tanker Tonnage				
	year 2000	year 2010	year 2020	year 2040	Change
South America	28.7%	27.9%	28.3%	33.4%	4.7%
Africa	21.3%	21.6%	23.2%	34.8%	13.5%
Canada, Mexico, Central America	19.4%	19.3%	18.9%	12.6%	-6.8%
Mid-East	16.4%	17.5%	16.4%	9.3%	-7.1%
Europe	10.9%	10.0%	9.2%	6.5%	-4.4%
Asia	2.9%	3.2%	3.6%	3.1%	0.2%
Australia	0.4%	0.4%	0.3%	0.2%	-0.2%
Other	0.1%	0.1%	0.1%	0.1%	0.0%
Total	100.0%	100.0%	100.0%	100.0%	
World Region	**Market Share of Outbound Tanker Tonnage**				
	year 2000	**year 2010**	**year 2020**	**year 2040**	**Change**
Asia	30.9%	29.2%	26.0%	23.2%	-7.7%
Europe	24.2%	16.4%	12.0%	10.9%	-13.3%
Canada, Mexico, Central America	24.1%	31.5%	37.9%	38.9%	14.8%
South America	12.0%	13.1%	12.7%	11.8%	-0.2%
Africa	3.1%	4.2%	5.3%	7.5%	4.4%
Mid-East	2.9%	3.2%	3.9%	5.3%	2.4%
Australia	2.7%	2.0%	1.7%	2.0%	-0.7%
Other	0.3%	0.4%	0.5%	0.4%	0.1%
Total	100.0%	100.0%	100.0%	100.0%	

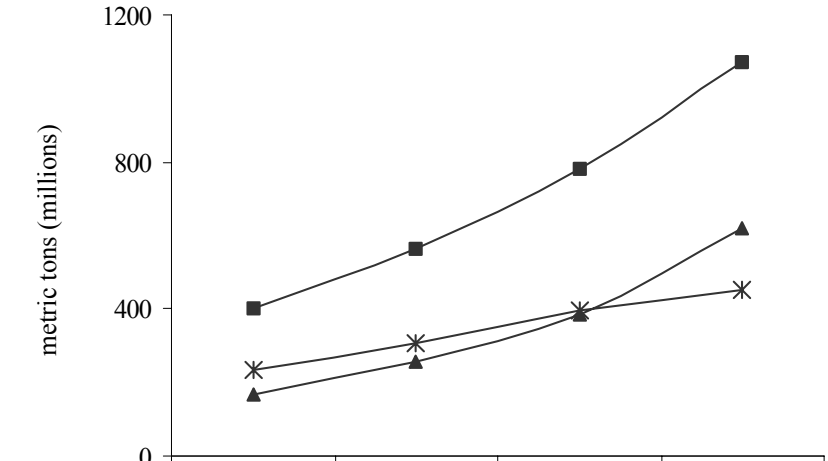
Source: WEFA, Inc.

U.S. Tramp Trade: 2000 – 2040

In contrast to vessels operating as "liner" services, which offer fixed itineraries and established rates available to all customers, "tramp" services refer to ships that sail without fixed itineraries, schedules or charter contracts. Tramp vessels operate like a rental car agency, where a ship, like a car, is hired or chartered for a single voyage or period. Types of ships that operate as tramps are generally ships that carry break-bulk cargo and dry bulk vessels designed to carry grain, coal, ore or fertilizers.[18] Tramp service is well suited for agricultural trade, as supply and demand for agricultural goods are often seasonal and vary according to geography and weather patterns. Most of the world's grain and animal feed are transported by tramps.

[18]Break-bulk cargo refers to freight that is not in bulk form (e.g., oil or coal) and is not transported in containers. Traditionally, most non-bulk cargo was shipped as break-bulk freight. See Chapters 5 and 6 of this report for a comprehensive discussion of the different types of commodities and cargo.

Forecasts indicate that tramp trade should grow substantially in the 21st century (see Figure IV-5). By the year 2020, inbound tramp tonnage should begin to exceed outbound shipment, and by 2040, about 58 percent of tramp tonnage is expected to be in the form of imports. Growth in outbound tramp tonnage should be sluggish, reflecting slower growing markets for bulk commodities and a continued shift of break-bulk commodities into containers. For example, bagged grain is a much more important container export than commonly realized. In 1996, nearly 765,000 metric tons of bagged grain was exported from the United States in containers. By 2020, this is expected to grow to about 1.1 million tons. Containers are also becoming an increasingly popular method of transport for other traditional break-bulk agricultural cargoes including bananas.



	year 2000	year 2010	year 2020	year 2040
Imports	168.24	254.14	385.01	622.22
exports	235.02	309.16	394.96	450.71
Total	403.27	563.30	779.96	1072.93

Figure IV-5. U.S. Imports and Exports of Tramp Cargo: 2000 – 2040 (millions of metric tons)

Source: WEFA, Inc.

Tables IV-7 and IV-8 summarize projected inbound tramp cargo by trading partner. The U.S. should see the greatest increase from South America. From the year 2000 through 2040, tramp imports from South America are forecast to increase by almost 500 percent to about 233 million tons. In the long term, Canada, Mexico, Central America and South America should remain the primary origin of inbound tramp shipments. However, there is expected to be a shift toward trade routes from South America. By 2040, nations in South America–primarily Brazil and Venezuela–should capture about 15 percent of the inbound tramp market. Nations in Asia and the Pacific will likely continue to be the leading source of U.S. tramp exports (e.g., grain and

TABLE IV-7

PROJECTED INBOUND AND OUTBOUND TRAMP TONNAGE BY TRADING PARTNER REGION: 2000 – 2040 (MILLIONS OF METRIC TONS)

World Region	Inbound Tramp Tonnage				
	year 2000	year 2010	year 2020	year 2040	% Annual Growth
Canada, Mexico, Central America	72.73	102.32	136.98	165.43	2.1%
South America	39.75	66.28	110.47	233.15	4.5%
Europe	21.57	31.76	52.56	86.87	3.5%
Asia	17.37	28.95	45.99	60.77	3.2%
Africa	8.59	11.16	16.51	31.02	3.3%
Australia	7.34	12.04	19.87	41.31	4.4%
Mid-East	0.82	1.52	2.44	3.31	3.6%
Other	0.07	0.12	0.20	0.37	4.3%
Total	168.24	254.14	385.01	622.22	3.3%
World Region	**Outbound Tramp Tonnage**				
	year 2000	**year 2010**	**year 2020**	**year 2040**	**% Annual Growth**
Asia	76.73	100.16	122.04	153.51	1.7%
Europe	73.46	82.44	92.17	68.89	-0.2%
Canada, Mexico, Central America	40.99	56.94	79.05	68.45	1.3%
South America	18.73	29.09	39.62	52.88	2.6%
Africa	15.27	24.63	36.39	59.97	3.5%
Mid-East	8.39	13.89	22.84	43.13	4.2%
Australia	1.30	1.73	2.37	3.17	2.3%
Other	0.16	0.28	0.48	0.72	3.8%
Total	235.02	309.16	394.96	450.71	1.6%

Source: WEFA, Inc.

other dry bulk agricultural goods). Throughout the forecast interval, Asia's market share of U.S. tramp exports should remain stable at about 32 to 34 percent. Exports of dry bulk and other goods transported by tramps are forecast to shift towards emerging markets in Asia, Latin America, Africa, the Mid-East and the Indian subcontinent. Regions with mature economies will likely lose market share. For example, Europe's share is predicted to decline by nearly 16 percent by 2040.

TABLE IV-8

FORECASTED MARKET SHARE OF U.S. INBOUND AND OUTBOUND TRAMP CARGO BY TRADING PARTNER REGION: 2000 – 2040 (MILLIONS OF METRIC TONS)

World Region	Market Share of Inbound Tramp Tonnage				
	Year 2000	year 2010	year 2020	year 2040	% Change
Canada, Mexico, Central America	43.2%	40.3%	35.6%	26.6%	-16.6%
South America	23.6%	26.1%	28.7%	37.5%	13.9%
Europe	12.8%	12.5%	13.7%	14.0%	1.2%
Asia	10.3%	11.4%	11.9%	9.8%	-0.5%
Africa	5.1%	4.4%	4.3%	5.0%	-0.1%
Australia	4.4%	4.7%	5.2%	6.6%	2.2%
Mid-East	0.5%	0.6%	0.6%	0.5%	0.0%
Other	0.0%	0.0%	0.1%	0.1%	0.1%
Total	100.0%	100.0%	100.0%	100.0%	-
World Region	**Market Share of Outbound Tramp Tonnage**				
	year 2000	year 2010	year 2020	year 2040	% Change
Asia	32.6%	32.4%	30.9%	34.1%	1.5%
Europe	31.3%	26.7%	23.3%	15.3%	-16.0%
Canada, Mexico, Central America	17.4%	18.4%	20.0%	15.2%	-2.2%
South America	8.0%	9.4%	10.0%	11.7%	3.7%
Africa	6.5%	8.0%	9.2%	13.3%	6.8%
Mid-East	3.6%	4.5%	5.8%	9.6%	6.0%
Australia	0.6%	0.6%	0.6%	0.7%	0.1%
Other	0.1%	0.1%	0.1%	0.2%	0.1%
Total	100.0%	100.0%	100.0%	100.0%	-

Source: WEFA, Inc.

CONCLUSION

Growing international trade will result in several important trends for the United States. Shifts in the origin and destinations of U.S. imports and exports are likely. Trade between U.S. and Western Europe is mature and is not expected to grow much in the future, while trade with developing nations such as those in Eastern Europe should result in increased cargo flows to and from the Nation's ports. Stronger commerce with Latin America, while benefiting all U.S. ports, will tend to benefit the most ports along the South Atlantic and Gulf Coasts. At the same time, expected rapid growth in trade with nations in Africa, the Mid-East and Indian Subcontinent will benefit ports along the North and South Atlantic Coasts. Another important implication of trade growth is the overall increase in demand for shipping. As volumes of trade increase during the next century, the total capacity of the world merchant fleet will adjust to globalization and large increases in commodity trade. The existing fleet will grow, and many ship owners and operators will likely build larger ships in pursuit of economic efficiency.

V. MAJOR COMMODITY GROUPS AND COMMODITY FLOWS IN THE UNITED STATES

TYPES AND QUANTITIES OF U.S. MARITIME COMMODITIES

Maritime commodities are commonly categorized according to how they are transported. There are two broad types: (1) "general" cargo and (2) "bulk" cargo. Bulk cargo is made up of unpacked homogeneous goods, either liquid or dry. Examples of liquid bulk commodities include crude oil, petroleum products, natural gas, chemicals and crude fertilizers. Common dry bulk commodities are coal, grain, wood and ores.

General cargo refers to commodities not shipped in bulk form. Most general cargo is transported in containers or as "break-bulk" freight. Break-bulk cargo consists of goods that are packed and moved as single parcels. They are usually piled together on pallets or banded together with metal straps. Examples include lumber, steel coils, fruits, vegetables and paper. Break bulk cargo also includes non-bulk commodities that cannot fit into containers due to their size or weight (i.e., "neo-bulk" cargo). Containers are large rectangular or square containers/boxes of a strong structure–lightweight steel or aluminum–that can withstand continuous rough handling from ship to shore and back. Containers open from one side to allow cargo to be stacked and stowed into them. Goods of higher value are often shipped in containers. Containers can be heated, refrigerated, ventilated or specially fitted to carry specific types of cargo. Typical containerized cargo includes consumer goods such as motorcycles, television sets, cassette recorders and packaged liquor. High-value industrial cargo such as agricultural equipment, construction equipment and auto parts are also transported in containers. Refrigerated containerized cargo often includes perishable fruits, vegetables and meat. Perishable items can also be shipped as refrigerated break-bulk cargo.

In 1996, about 1,034 million metric tons of commodities flowed through U.S. ports, at a value of around $627 billion. Figures V-1 and V-2 display the top 20 maritime commodities in the United States. Based on tonnage, the top 20 make up nearly 90 percent of all foreign trade. In terms of value, the top 20 commodities account for about 65 percent of international trade, and with the exception of petroleum-based goods and grain, the remaining cargo are typically general cargo and containerized commodities.

Tables V-1 and V-2 categorize commodities by leading imports and exports. With the exception of China, the U.S. is the world's largest producer of grain. The U.S currently exports approximately 23 percent (86.7 million tons) of its total grain production. Other leading exports include automobiles, coal, food and other agricultural products. By far, the U.S. is the world's largest consumer of energy and thus is the largest importer of crude and refined petroleum. In 1996, the U.S. imported a total of 326 million tons of crude oil and 81 million tons of refined petroleum. Based on weight, crude oil and petroleum account for about 65 percent of all imports, however in terms of dollars they account for only 12 percent.

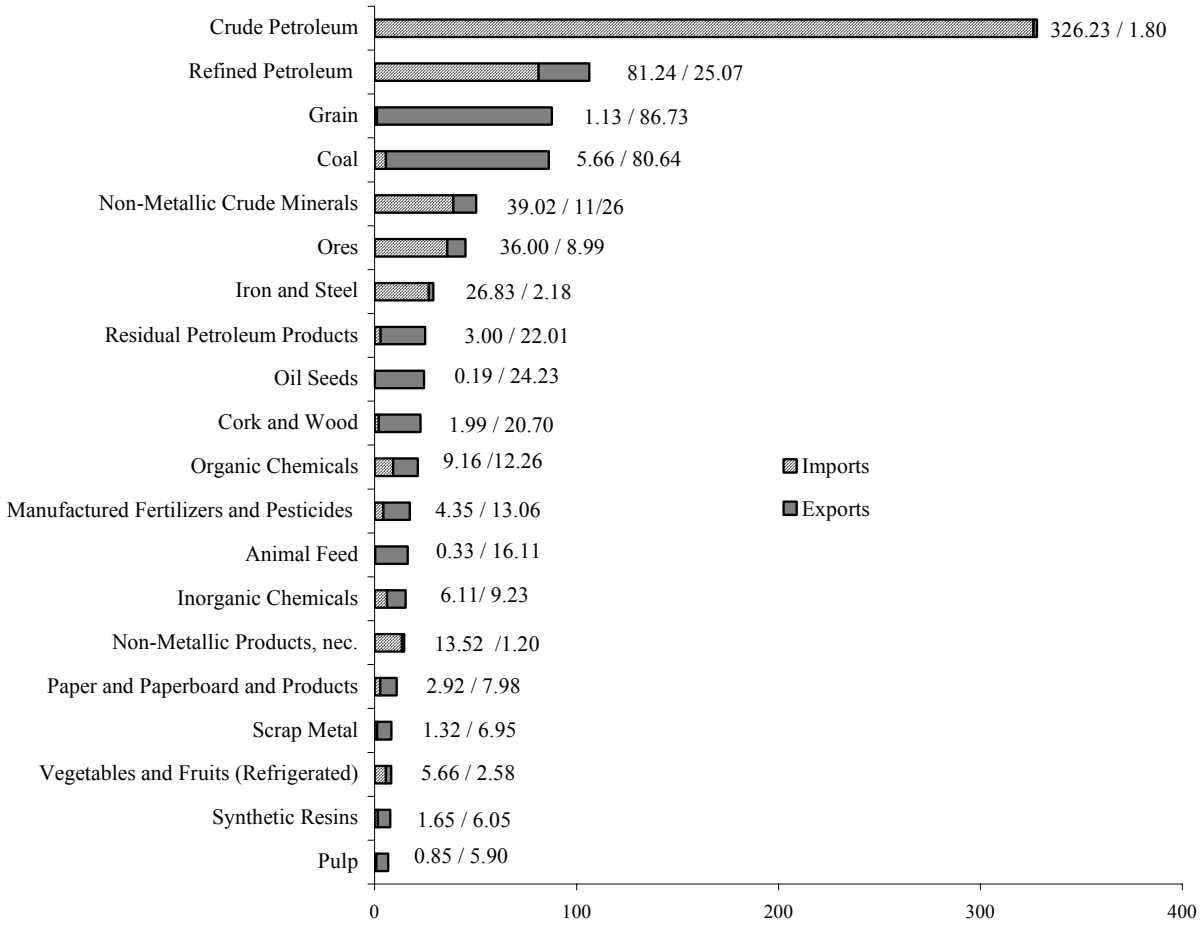


Figure V-1. Top 20 Foreign Trade Commodities by Aggregate Weight: 1996 (millions of metric tons)

Source: PMCL analysis of data from the Waterborne Commerce Statistics Center, 1996
nec. (not elsewhere classified)

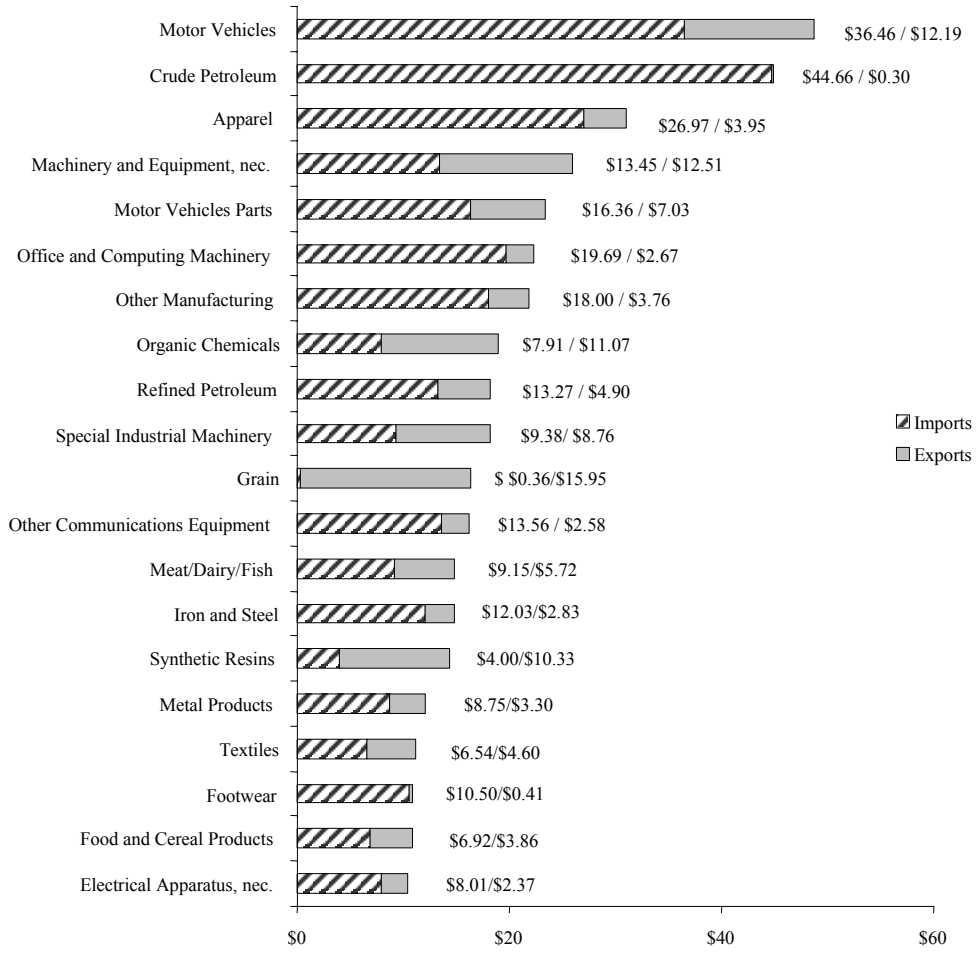


Figure V-2. Top 20 Foreign Trade Commodities by Aggregate Value: 1996 ($ billions)

Source: PMCL analysis of data from the Waterborne Commerce Statistics Center, 1996
nec. (not elsewhere classified)

TABLE V-1

TOP 20 U.S. MARITIME EXPORTS BY COMMODITY WEIGHT AND VALUE: 1996 (MILLIONS OF METRIC TONS AND $ BILLIONS)

Exports by Weight	Metric Tons	% of Exported Tonnage	Exports by Value	$ Billions	% of Exported Value
Grain	86.73	21.2%	Grain	$15.95	6.7%
Coal	80.64	19.7%	Machinery and Equipment, nec.	$12.51	5.3%
Refined Petroleum	25.07	6.1%	Motor Vehicles	$12.19	5.1%
Oil Seeds	24.23	5.9%	Organic Chemicals	$11.07	4.7%
Residual Petroleum Products	22.01	5.4%	Synthetic Resins	$10.33	4.3%
Cork and Wood	20.70	5.1%	Meat/Dairy/Fish	$9.15	3.8%
Animal Feed	16.11	3.9%	Special Industrial Machinery	$8.76	3.7%
Manufactured Fertilizers and Pesticides	13.06	3.2%	Oil Seeds	$7.18	3.0%
Organic Chemicals	12.26	3.0%	Parts of Motor Vehicles	$7.03	3.0%
Non-Metallic Crude Minerals	11.26	2.8%	Paper and Paperboard and Products	$6.87	2.9%
Inorganic Chemicals	9.23	2.3%	Tobacco	$6.61	2.8%
Ores	8.99	2.2%	Chemical Products, nec.	$5.43	2.3%
Paper and Paperboard and Products	7.98	2.0%	Misc.	$5.25	2.2%
Scrap	6.95	1.7%	Refined Petroleum	$4.90	2.1%
Synthetic Resins	6.05	1.5%	Cork and Wood	$4.77	2.0%
Pulp	5.90	1.4%	Textiles	$4.60	1.9%
Waste Paper	4.40	1.1%	Engines and Turbines	$4.33	1.8%
Meat/Dairy/Fish	4.32	1.1%	Apparel	$3.95	1.7%
Vegetables and Fruits (Refrigerated)	2.58	0.6%	Other Food and Cereal Products	$3.86	1.6%
Other Food and Cereal Products	2.52	0.6%	Aircraft	$3.79	1.6%
Total	370.97	90.7%	Total	$148.53	62.4%

Source: PMCL analysis of data from the Waterborne Commerce Statistics Center, 1996
nec. (not elsewhere classified)

TABLE V-2

TOP 20 U.S. MARITIME IMPORTS BY COMMODITY WEIGHT AND VALUE: 1996 (MILLIONS OF METRIC TONS AND $ BILLIONS)

Imports by Weight	Metric Tons	% of Imported Tonnage	Imports by Value	$ Billions	% of Imported Tonnage
Crude Petroleum	326.23	52.2%	Crude Petroleum	$44.66	11.5%
Refined Petroleum	81.24	13.0%	Motor Vehicles	$36.46	9.4%
Non-Metallic Crude Minerals	39.02	6.2%	Apparel	$26.97	6.9%
Ores	36.00	5.8%	Office and Computing Machinery	$19.69	5.1%
Iron and Steel	26.83	4.3%	Other Manufacturing, nec.	$18.00	4.6%
Non-Metallic Products, nec.	13.52	2.2%	Parts of Motor Vehicles	$16.36	4.2%
Organic Chemicals	9.16	1.5%	Communications Equipment	$13.56	3.5%
Inorganic Chemicals	6.11	1.0%	Machinery and Equipment, nec.	$13.45	3.5%
Vegetables and Fruits (Refrigerated)	5.66	0.9%	Refined Petroleum	$13.27	3.4%
Coal	5.66	0.9%	Iron and Steel	$12.03	3.1%
Manufactured Fertilizers and Pesticides	4.35	0.7%	Footwear	$10.50	2.7%
Sugar	4.10	0.7%	Special Industrial Machinery	$9.38	2.4%
Natural Gas	3.89	0.6%	Metal Products	$8.75	2.3%
Residual Petroleum Products	3.00	0.5%	Electrical Apparatus, nec.	$8.01	2.1%
Paper and Paperboard and Products	2.92	0.5%	Organic Chemicals	$7.91	2.0%
Motor Vehicles	2.87	0.5%	Other Food and Cereal Products	$6.92	1.8%
Other Manufacturing, nec.	2.76	0.4%	Textiles	$6.54	1.7%
Metal Products	2.74	0.4%	Electrical Industrial Machinery	$5.84	1.5%
Beverages	2.72	0.4%	Meat/Dairy/Fish	$5.72	1.5%
Other Food and Cereal Products	2.69	0.4%	Radios and Televisions	$5.20	1.3%
Total	581.46	93.0%	Total	$289.22	74.4%

Source: PMCL analysis of data from the Waterborne Commerce Statistics Center, 1996
nec. (not elsewhere classified)

Tables V-3 and V-4 list projected commodity flows for leading U.S. imports and exports through the year 2040. Trade of most leading commodities is expected to grow significantly over the forecast period. Grain exports should double, and exports of refined petroleum are projected to triple by 2040. Paper and paperboard products are expected to quadruple over the forecast period. Coal, non-metallic crude minerals and ores are the only leading exports expected to decline. Coal exports are predicted to decline by about 1.5 percent per annum over the forecast period. Non-metallic minerals should drop by about 1 percent and exports of ores are forecast to decrease about 3.5 percent.

TABLE V-3

FORECASTED TONNAGE FOR TOP U.S. EXPORTS (MILLIONS OF METRIC TONS)

	Forecast				
Commodity Groups	**2000**	**2010**	**2020**	**2040**	**% Annual Change**
Coal	74.79	86.11	88.81	40.89	-1.5%
Grain	111.73	132.3	152.97	194.21	1.4%
Refined Petroleum	31.25	57.79	93.78	142.78	3.9%
Oil Seeds	25.11	26.92	28.33	29.69	0.4%
Residual Petroleum Products	22.73	25.54	33.02	58.96	2.4%
Cork and Wood	22.50	41.35	57.19	56.29	2.3%
Animal Feed	17.86	24.32	30.26	30.94	1.4%
Organic Chemicals	14.49	22.44	30.75	50.45	3.2%
Paper and Paperboard Products	10.00	18.42	30.83	58.87	4.5%
Inorganic Chemicals	9.15	12.67	18.65	30.43	3.0%
Non-Metallic Crude Minerals	8.56	7.64	7.08	5.94	-0.9%
Synthetic Resins	7.92	16.67	32	92.14	6.3%
Ores	7.71	5.01	3.58	1.87	-3.5%
Pulp	7.00	15.46	27.39	44.22	4.7%
Waste Paper	5.74	13.56	26.2	51.44	5.6%
Meat/Dairy/Fish	4.65	6.63	9.32	17.79	3.4%
Other Food and Cereal Products	2.67	4.19	6.8	16.36	4.6%
Refrigerated Vegetables/Fruits	2.61	2.98	3.62	6.36	2.3%
Iron and Steel	2.36	5.43	9.40	11.82	4.1%
Machinery and Equipment, nec.	1.81	3.97	7.94	22.43	6.5%
Special Industrial Machinery	1.28	2.61	4.84	11.78	5.7%
Textiles	1.27	2.24	3.79	6.55	4.2%
Motor Vehicles	0.95	1.53	2.43	5.35	4.4%
Parts of Motor Vehicles	0.95	1.53	2.43	5.35	4.4%
Apparel	0.51	1.22	2.25	3.94	5.2%
Other Manufacturing, nec.	0.45	1.01	1.8	3.17	5.0%
Engines and Turbines	0.37	0.64	1.04	2.39	4.8%
Fertilizers and Pesticides	0.17	0.2	0.24	0.27	1.2%
Tobacco	0.16	0.23	0.3	0.37	2.1%
Office/Computing Machinery	0.15	0.32	0.61	1.6	6.1%
Communication Equipment	0.14	0.28	0.51	1.28	5.7%
Aircraft	0.04	0.09	0.17	0.47	6.4%

Source: WEFA, Inc.

TABLE V-4

FORECASTED TONNAGE FOR TOP U.S. IMPORTS (MILLIONS OF METRIC TONS)

Commodity Groups	Forecast				
	2000	2010	2020	2040	% Annual Change
Crude Petroleum	376.27	593.22	847.62	1678.28	3.8%
Refined Petroleum	89.09	104.58	136.53	224.74	2.3%
Non-Metallic Crude Minerals	48.73	59.84	58.09	45.26	-0.2%
Ores	43.99	71.12	113.09	220.58	4.1%
Iron and Steel	34.82	64.27	110.91	207.49	4.6%
Non-Metallic Metal Products	15.93	20.02	25.59	30.00	1.6%
Organic Chemicals	13.64	31.84	57.52	102.27	5.2%
Vegetables/Fruits (refrigerated)	7.05	10.95	14.00	21.40	2.8%
Coal	7.05	10.03	15.00	18.00	2.4%
Inorganic Chemicals	6.47	6.75	8.01	11.45	1.4%
Fertilizers and Pesticides	5.59	6.35	7.86	16.54	2.7%
Sugar	5.22	8.59	10.81	9.67	1.6%
Natural Gas	4.76	7.98	11.61	24.81	4.2%
Other Manufacturing, nec.	4.00	8.31	14.24	19.83	4.1%
Paper and Paperboard Products	3.85	5.85	8.64	18.21	4.0%
Metal Products	3.52	6.5	10.32	14.29	3.6%
Beverages	3.42	4.38	5.19	5.53	1.2%
Motor Vehicles	3.29	3.35	3.34	3.14	-0.1%
Other Food and Cereal Products	2.85	2.59	2.52	3.01	0.1%
Parts of Motor Vehicles	2.78	3.18	3.64	5.24	1.6%
Residual Petroleum Products	2.74	3.89	5.82	15.70	4.5%
Machinery and Equipment, nec.	2.22	3.67	5.25	9.31	3.6%
Meat/Dairy/Fish	1.8	2.69	4.60	11.12	4.7%
Office/Computing Machinery	1.6	3.48	5.81	9.90	4.7%
Textiles	1.55	2.3	3.10	4.02	2.4%
Footwear	1.24	1.19	1.02	1.06	-0.4%
Special Industrial Machinery	1.1	1.49	1.92	2.81	2.4%
Communications Equipment	0.84	1.48	2.19	3.47	3.6%
Electrical Industrial Machinery	0.71	1.54	2.76	5.31	5.2%
Radios and Televisions	0.5	0.91	1.21	1.91	3.4%
Apparel	0.002	0.006	0.012	0.021	6.1%

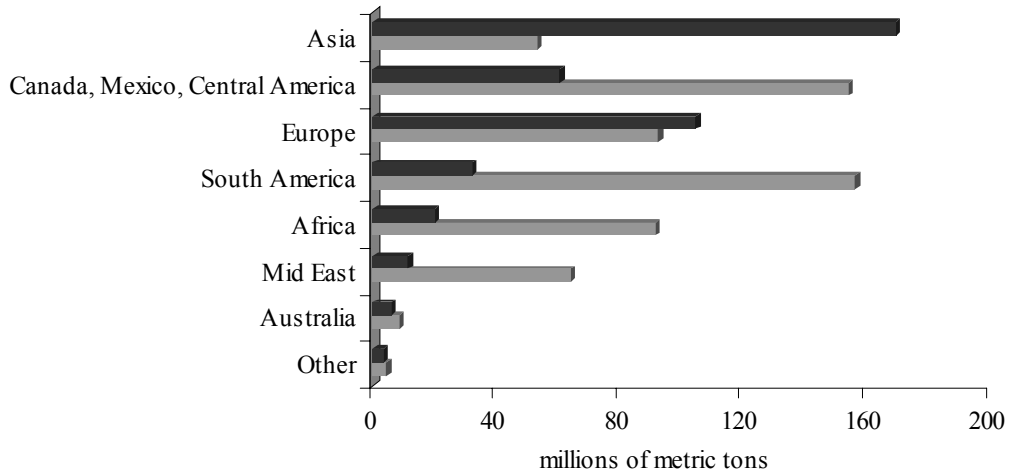
Source: WEFA, Inc.

The greatest growth in terms of percentage increases should be in higher value commodities–primarily semi-manufactured and manufactured goods that are often shipped in containers. For example, imports of apparel are expected to grow at 6.1 percent per year. Imports of industrial machinery, organic chemicals, computers and office equipment are forecast to increase by around five to six percent annually. Imports of iron and steel and residual petroleum are expected to increase by a factor of about 4 to 5 percent per annum through 2040. On the export side, the greatest percentage growth will be in aircraft, synthetic resins, computers, office equipment and industrial machinery.

COMMODITY FLOW BY TRADING PARTNER

The United States has one of the largest consumer markets in the world and trades with many nations. Figures V-3 and V-4 display trade volumes by world region. By the mid 1980s, the leading trading partners of the U.S. shifted from economies in Europe to the Far East, and today Asia is the United States' most important trading partner. In 1996, almost 223 million tons of goods were shipped to and from Asia–about 22 percent of total foreign trade based on weight. Nearly one-half of the $627 billion in U.S. trade flows to and from Asia, particularly the Pacific Rim nations including Japan, South Korea, Taiwan, China and Hong Kong. Europe, Canada, Mexico, Central America and South America are the next largest maritime trading partners of the United States, in terms of both value and tonnage. Africa, Australia and the Mid-East account for a smaller portion of U.S. trade. Based on tonnage, Africa has an 11 percent share of U.S. trade, and the Mid-East has a 7 percent share. The primary export regions of the United States are Asia, Canada/Mexico/Central America and Europe. Main import regions include Asia, Europe, South America and Canada/Mexico/Central America.

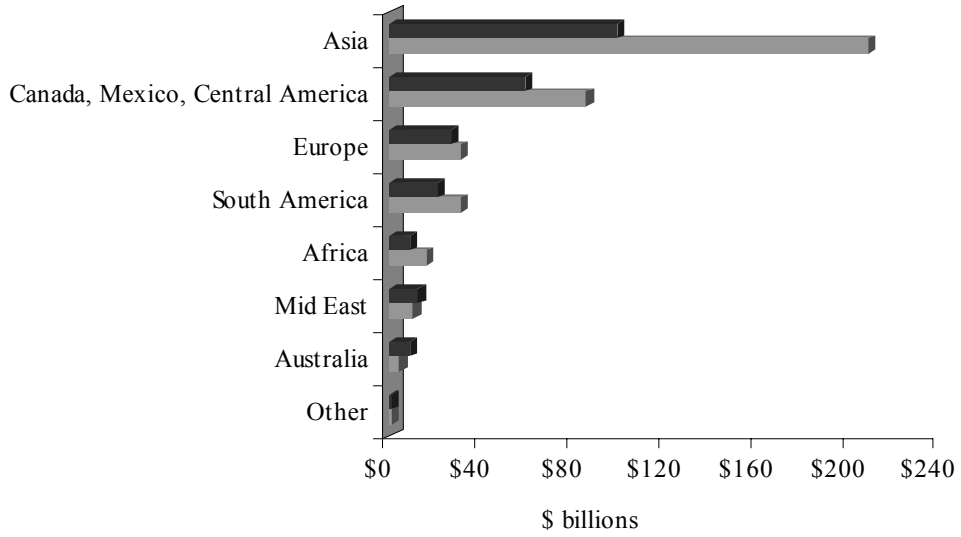
Figures V-3 and V-4 highlight the trade imbalances that exist between the U.S. and its trading partners. With the exception of Australia, U.S. imports exceed U.S exports by trading partner in terms of value. Economic conditions in foreign nations relative to the U.S. are an important factor. Weaker economies in Asia, Europe and Latin America limit consumption of



	Other	Australia	Mid East	Africa	South America	Europe	Canada, Mexico, Central	Asia
Imports	4.41	8.64	64.04	91.72	156.51	92.57	154.15	53.20
Exports	3.63	6.13	11.43	20.10	32.34	104.89	60.72	169.71

Figure V-3. International Maritime Trade by World Region: 1996 (millions of metric tons)

Source: PMCL analysis of data from the Waterborne Commerce Statistics Center, 1996



	Other	Australia	Mid East	Africa	South America	Europe	Canada, Mexico, Central	Asia
Imports	$1.29	$4.49	$10.58	$15.93	$31.01	$31.24	$85.86	$208.57
Exports	$1.19	$9.07	$12.42	$8.91	$21.02	$26.90	$59.45	$99.29

Figure V-4. International Maritime Trade by World Region: 1996 ($ billions)

Source: PMCL analysis of data from the Waterborne Commerce Statistics Center, 1996

many U.S. goods, while the stronger economy of the U.S. encourages imports. Additionally, the U.S. dollar has been rising for over four years. A strong dollar makes U.S. manufactured exports such as cars, clothing and office equipment more expensive for foreign consumers. At the same time, a strong dollar gives Americans greater buying power on the world market. Asian imports of office equipment, computers, motor vehicles and auto parts greatly exceed U.S. exports of the same commodities. Trade with China and Japan accounts for much of the disparity. Although on a lesser scale, the U.S. maintains trade deficits with Europe in terms of value. Imports of crude oil and refined petroleum account for U.S. trade deficits with South America, Mexico, Central America and the Mid-East. South America is the largest exporter of crude petroleum to the U.S., with shipments of almost 90 million tons a year. Mexico and Africa rank second, with close to 60 million tons each.

Based on value, the U.S. maintains trade deficits with most of the world: however, in terms of tonnage, the U.S. is a net exporter of low-value raw materials and agricultural goods (see Tables V-5 and V-6). American exports of coal, timber and agricultural products exceed imports of the same commodities. The U.S. currently ships between 43 and 46 million tons of grain to Europe and Asia but imports only negligible amounts. Asia is also the chief consumer of U.S. cork, wood and coal–between 13.5 and 15 million tons annually. Large amounts of grain, coal and refined petroleum are also exported to Canada and Mexico.

TABLE V-5

TOP U.S. INTERNATIONAL MARITIME TRADE COMMODITIES BY WORLD REGION: 1996 (MILLIONS OF METRIC TONS)

Commodity	Canada/Mexico/ Central America		South America		Europe		Africa	
	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports
Crude Petroleum	68.28	0.04	89.97	-	36.47	-	66.28	-
Refined Petroleum	16.73	10.83	25.27	2.52	14.48	2.51	14.03	0.29
Grain	0.72	10.05	0.01	5.84	0.06	6.30	-	10.30
Coal	0.52	10.86	4.56	6.88	-	42.86	-	3.78
Non-Metallic Minerals	21.76	6.01	3.63	0.30	1.50	1.69	0.17	0.26
Ores	14.85	7.40	11.84	0.04	0.19	0.68	3.80	0.03
Iron and Steel	1.85	0.17	8.92	0.10	12.42	0.44	0.91	0.19
Petroleum Products	0.29	1.47	0.35	0.65	0.20	11.43	0.03	0.83
Oil Seeds	0.03	1.30	0.00	0.46	0.02	8.61	-	0.19
Cork and Wood	0.56	0.32	0.39	-	-	0.08	-	-
Total	125.58	48.45	144.94	16.79	65.34	74.60	85.23	15.86
Commodity	**Asia**		**Australia**		**Mid-East**		**Other**	
	Imports	**Exports**	**Imports**	**Exports**	**Imports**	**Exports**	**Imports**	**Exports**
Crude Petroleum	6.37	1.75	1.08	-	55.88	-	1.80	-
Refined Petroleum	3.34	7.72	0.54	-	4.61	0.70	2.24	0.48
Grain	0.19	46.11	-	0.01	-	4.90	-	1.75
Coal	1.39	15.05	0.15	-	-	1.22	-	-
Non-Metallic Minerals	0.25	2.09	0.03	0.14	0.01	0.13	0.26	0.04
Ores	0.53	0.81	4.30	0.02	-	0.01	-	-
Iron and Steel	4.50	0.89	0.68	0.04	0.01	0.08	-	0.01
Petroleum Products	0.20	5.75	-	0.92	0.45	0.39	-	-
Oil Seeds	-	9.16	-	0.06	-	0.44	-	1.15
Cork and Wood	0.04	13.55	0.14	0.08	-	-	-	-
Total	16.82	102.88	6.93	1.31	60.95	7.88	4.31	3.42

Empty cells = less than 5,000 metric tons. Highlighted cells = greater than 10 million tons.

Source: PMCL analysis of data from the Waterborne Commerce Statistics Center, 1996

Overall, the United States is a net exporter of agricultural commodities and a net importer of finished manufactured goods, and this trend is consistent with patterns of global economic development. Fully industrialized nations with mature economies, abundant natural resources and stable population growth (e.g., the United States) are highly efficient producers of bulk agricultural goods. In developed nations, agricultural production systems are typically mechanized, and production is highly efficient. Thus, nations such as the United States have a comparative advantage over nations without abundant natural resources or ones that are still developing. Today, most U.S. grain is shipped to developing nations in Asia, or to Japan, which has limited agricultural resources. Developing nations, however, have a strong comparative advantage in the production of lower value manufactured commodities, particularly textiles and clothing. For example, as shown in Table V-6, the U.S. imports $18.6 billion worth of apparel from Asia but exports only $500 million. This is primarily a result of significantly lower labor costs in developing countries.

One reason for the U.S. trade deficit is that the U.S. is growing faster than many of its trading partners. Faster growth attracts investment dollars, which, along with rising incomes, allows U.S. consumers to purchase more imports on the global market. In slower-growing economies, demand for imports falls, and capital flows outward to nations with more robust

TABLE V-6

TOP U.S. INTERNATIONAL MARITIME TRADE COMMODITIES BY WORLD REGION: 1996 ($ BILLIONS)

Commodity	Canada/ Mexico/ Central America		South America		Europe		Africa	
	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports
Motor Vehicles	$0.70	$0.55	$0.01	$0.99	$11.19	$3.10	$0.01	$0.23
Crude Petroleum	$8.96	-	$10.76	-	$5.21	-	$9.99	-
Apparel	$4.58	$2.48	$0.23	$0.23	$1.10	$0.19	$0.61	$0.13
Machinery and Equipment	$0.10	$0.71	$0.53	$1.94	$5.06	$2.45	$0.03	$0.54
Parts of Motor Vehicles	$0.02	$0.14	$0.74	$0.99	$3.14	$2.24	$0.04	$0.15
Office/Computing Machinery	-	-	-	$0.03	$0.13	$0.18	-	-
Manufacturing, nec.	$0.01	$0.11	-	$0.24	$0.14	$0.12	-	-
Organic Chemicals	$0.67	$0.59	$0.34	$1.66	$3.43	$3.39	$0.07	$0.15
Refined Petroleum	$2.72	$1.58	$3.75	$0.57	$2.51	$0.56	$2.25	$0.07
Special Industrial Machinery	$0.01	$0.45	$0.13	$2.08	$4.83	$1.44	$0.03	$0.88
Total	$17.77	$6.62	$16.49	$8.74	$36.73	$13.66	$13.02	$2.15
Commodity	**Asia**		**Australia**		**Mid-East**		**Other**	
	Imports	**Exports**	**Imports**	**Exports**	**Imports**	**Exports**	**Imports**	**Exports**
Motor Vehicles	$23.53	$4.17	$0.13	$0.52	-	$2.03	-	$0.05
Crude Petroleum	$0.32	-	-	-	$7.06	-	$0.24	-
Apparel	$18.66	$0.51	$0.03	$0.02	$0.46	$0.03	$0.60	$0.01
Machinery and Equipment	$7.57	$5.14	$0.08	$0.95	$0.10	$1.01	-	$0.02
Parts of Motor Vehicles	$12.12	$2.15	$0.09	$0.77	$0.01	$0.30	-	$0.01
Office/Computing Machinery	$18.15	$0.74	$0.01	$0.06	-	-	-	-
Manufacturing, nec.	$14.34	$1.26	$0.01	$0.13	-	$0.02	$0.02	-
Organic Chemicals	$1.14	$3.00	-	$0.11	$0.44	$0.11	-	$0.01
Refined Petroleum	$0.34	$0.34	$0.08	$0.01	$0.61	$0.13	$0.31	$0.06
Special Industrial Machinery	$1.50	$1.18	$0.02	$0.22	$0.01	$0.45	-	$0.02
Total	$97.68	$18.50	$0.45	$2.78	$8.70	$4.07	$1.17	$0.18

* Empty cells = less than $5.0 million. Highlighted cells = greater than $5.0 billion.
* nec. (not elsewhere classified)

Source: PMCL analysis of data from the Waterborne Commerce Statistics Center, 1996

economies. This largely explains our rising trade deficit with Asia, and it explains why trade deficits tend to expand in times of relative prosperity and contract in times of recession. It is no coincidence that the smallest American merchandise trade deficit since 1982, $74 billion in 1991, occurred during the period's only recession.

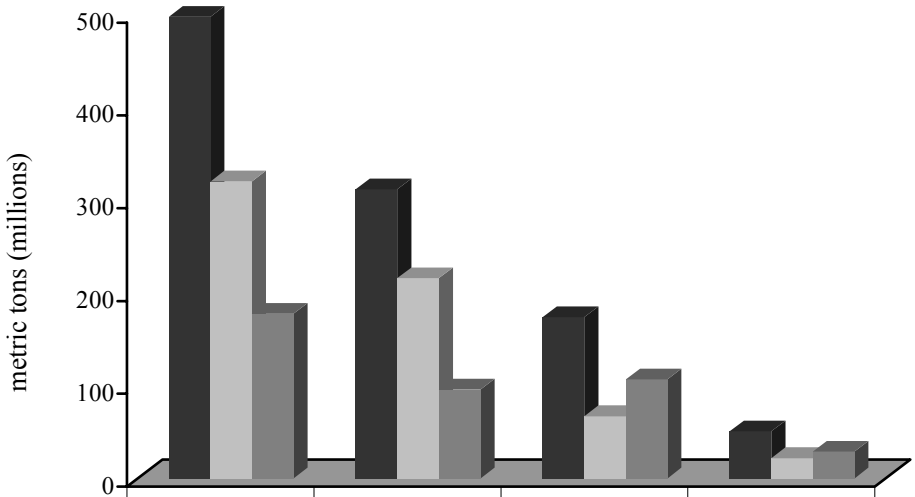
Trade imbalances can affect maritime shippers, particularly container carriers operating on transpacific routes. The recent rash of currency devaluations in Asia has exacerbated trade deficits by lowering prices of imports and increasing the prices of U.S. exports in Asia markets. Consequently, less containerized cargo is leaving U.S. ports, and rates per outbound container have plummeted. Some are reported to be under $200 for a 40-foot container to Asia.[19] To offset lost revenue, some carriers are loading outbound containers with whatever cargo is available or, in some cases, returning to Asia with empty containers. The extent of the U.S. trade imbalance with Asia is demonstrated by the fact that the ports of Los Angeles and Long Beach handled about one million empty containers in 1999, most of which were returned to Asia. From the

[19] U.S. Journal of Commerce: Daily Journal of Trade Logistics, October 1999.

perspective of channel depths, this means that some sail drafts of outbound containerships may be significantly less than inbound containerships. In contrast, some carriers will fill containers with any available cargo including denser, heavier commodities such as bagged grain or animal feed. In this case, containerships may be sailing deeper on the way out.

COMMODITY FLOW BY U.S. COASTAL REGION

Deep draft ports and harbors in the U.S. are usually grouped according to four major coastal regions: the Atlantic Coast, Gulf Coast, Pacific Coast and Great Lakes. Measuring the amounts of commodities that flow through each coastal region provides a better understanding of how trade is concentrated along the U.S. coastline. Figures V-5 and V-6 and Tables V-7 and V-8 summarize the total amounts of international imports and exports that flowed through ports along each coastal region in 1996.



	Gulf Coast	Atlantic Coast	Pacific Coast	Great Lakes
Total	497.63	311.64	174.03	50.89
Imports	320.22	215.82	67.21	21.99
Exports	177.41	95.82	106.83	28.90

Figure V-5. International Maritime Trade by U.S. Coastal Range: 1996 (millions of metric tons)

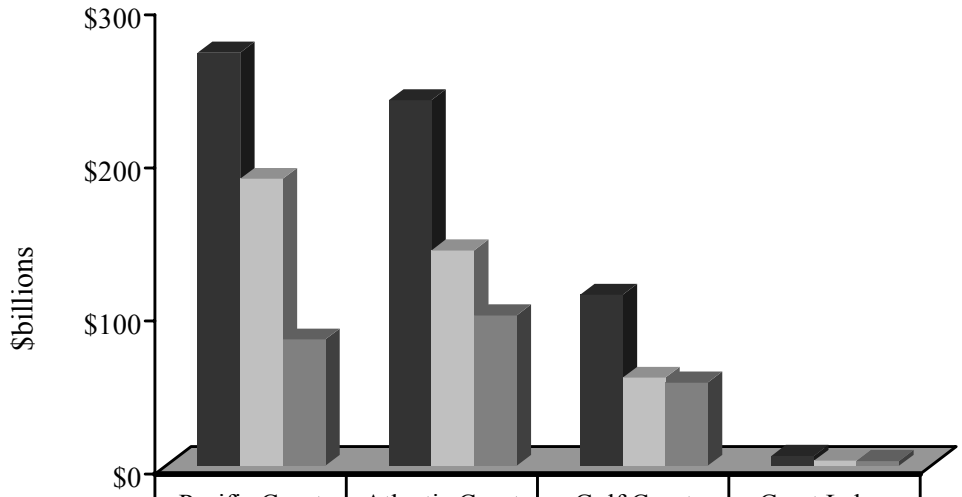
Source: PMCL analysis of data from the Waterborne Commerce Statistics Center, 1996

TABLE V-7

INTERNATIONAL MARITIME TRADE BY U.S. COASTAL REGION: 1996 ($ METRIC TONS)

Coastal Region	Market Share		
	Total	Imports	Exports
Gulf Coast	48.1%	31.0%	17.2%
Atlantic Coast	30.1%	20.9%	9.3%
Pacific Coast	16.8%	6.5%	10.3%
Great Lakes	4.9%	2.1%	2.8%
Total	100.0%	60.5%	39.5%

Source: PMCL analysis of data from the Waterborne Commerce Statistics Center, 1996



	Pacific Coast	Atlantic Coast	Gulf Coast	Great Lakes
Total	$269.97	$238.92	$111.83	$6.48
Imports	$187.46	$140.68	$57.48	$3.34
Exports	$82.50	$98.24	$54.35	$3.14

Figure V-6. International Maritime Trade by U.S. Coastal Range: 1996 ($ billions)

Source: PMCL analysis of data from the Waterborne Commerce Statistics Center, 1996

TABLE V-8 INTERNATIONAL MARITIME TRADE BY U.S. COASTAL REGION: 1996 ($ BILLIONS)			
Coastal Region	Market Share		
	Total	Imports	Exports
Pacific Coast	43.0 %	29.9%	13.2%
Atlantic Coast	38.1 %	22.4%	15.7%
Gulf Coast	17.8 %	9.2%	8.7%
Great Lakes	1.0 %	0.5%	0.5%
Total	100.0 %	62.0%	38.0%

Source: PMCL analysis of data from the Waterborne Commerce Statistics Center, 1996

Atlantic Coast

Today, international maritime trade along the Atlantic Coast is diverse and substantial. When measured in tons, the region accounts for approximately 30 percent of all foreign trade. In terms of dollar value, about 38 percent of all commodities enter and exit ports along the Atlantic. Tables V-9 through V-16 display the leading commodities and trading partners for each coastal region. Ports along the Atlantic handle large volumes of bulk commodities as well as higher value containerized and break-bulk cargo. Common bulk imports include crude and refined petroleum, non-metallic crude minerals and ores. Most of these commodities are imported from Canada, Mexico, Central America, South America and Europe. Almost one-half of imported crude petroleum comes from Africa and about one-third from the North Sea of Europe. Mexico, South America and Europe are also large exporters of refined petroleum. Coal is the leading bulk U.S. export from the Atlantic Coast. In 1996, almost 34 million tons were shipped to Europe, Africa, Asia and South America. By far, most general cargo and container trade along the Atlantic Coast is with Europe and Canada/Mexico/Central America–mostly in the form of imports. Motor vehicles are a major import to Atlantic Coast ports. Europe and Asia supply the majority of motor vehicle imports to the Atlantic Coast.

While Europe is the primary trading partner for the Atlantic Coast in terms of value, Mexico is gaining importance as a new export market. Today, Mexico is the largest consumer of Atlantic Coast manufactured exports. In 1996, nearly $2.4 billion worth of apparel was shipped to Mexico from Atlantic Coast ports. However, transportation between the Northeastern U.S. and Mexican markets continues to be a problem. One of the major factors influencing the growth in this trade lane will be the availability of reliable, cost-effective transportation by land and water. Trade between the Atlantic Coast and countries in South and Central America is also projected to grow, and there are efforts underway to include Caribbean nations under NAFTA, which should benefit Atlantic Coast ports.

Other important changes are taking place in the world economy and in the shipping industry that will likely have a major impact on East Coast ports. Traditionally, Asian cargo destined for East Coast markets is shipped through ports on the West Coast rather than Atlantic Coast ports. Land-bridging has made it cost effective to transport Asian imports by ship to the

West Coast, where they are unloaded and placed onto railcars for shipment across the continental United States. For example, the all-water route from Japan to New York through the Panama Canal is 11,500 miles, while the land-bridge route to New York from Japan is only about 7,500 miles. After its journey across the U.S., cargo can be sold in Atlantic Coast markets or loaded onto ships for shipment on to Europe and other destinations.

Today, changes in the global economy combined with infrastructure problems along the U.S. land-bridge are accelerating further growth in the sizes of containerships. Throughout the 1980s, Japan and Korea were the dominant manufacturing centers in Asia. By the 1990s, the center shifted to Singapore, and today it appears to be moving to China, Southeast Asia and the Indian Subcontinent where textile production and other manufacturing industries are growing. As the center moves further east, it is becoming cost effective to transport U.S.-bound cargo on transatlantic routes rather than on traditional transpacific routes. Growing congestion along the U.S. land-bridge is acting as a catalyst. As trade with Asia continues to swell, rail connections and transfers are becoming increasingly strained, resulting in delays and higher costs for shippers. Some container carriers are responding by rerouting Asian cargo through the Suez Canal on an all-water route rather than land-bridging it across the continental United States. For example, Neptune Orient Lines (NOL) found that it could reach the U.S. Atlantic Coast two to four days faster than it could on its conventional transpacific land-bridge route, without the costs of rail shipment. From 1994 to 1998, container shipments via the Suez Canal to the U.S. East Coast increased from 1.5 to 6 percent. New York, Savannah, Charleston, and Norfolk are benefiting from growing trade routes from Asia through the Suez Canal. About 47 percent of Savannah's container trade is with Asia, and in 1999 container volume at the port increased by 12 percent. A major factor was the move by the carrier NYK Line and its partners in the Grand Alliance to consolidate their all-water Suez services at Savannah.[21]

Many containerships operating on east/west routes from Asia via the Suez are newer and larger. Lower unit costs on large ships allow substantial savings on the all-water route from Asia. The size barrier needed to make the route cost effective is around 6,000 TEUs. Some experts estimate that a shift from a 3,000 TEU ship to a 7,000 TEU vessel would generate a 25 percent reduction in per-unit transportation costs from Hong Kong to New York via the Suez Canal. However, cost reductions gained from the land-bridge route would be just 5 percent for the same vessels.[22] In 1998, Maersk/SeaLand deployed the largest containership ever to call on U.S. ports. The *Regina Maersk* services a west/east route via the Suez Canal. She was built in 1996 and represented the first of a series of 19 of the world's largest containerships. Fully loaded by tonnage capacity, she has a draft of 46 feet and requires water depths of 51 feet.[23] Currently there are no ports along the Atlantic Coast with Federal channels to container facilities that exceed 45 feet.

[21] Mongelluzzo, B. "Ports predict 2000 will see growth across trade lanes." The Journal of Commerce, The Daily Journal of Trade Logistics, 15 February 2000.

[22] Brennan, T. "Suez option to bolster New York." The Journal of Commerce, The Daily Journal of Trade Logistics, 25 March 1999.

[23] In late 1999, Maersk SeaLand agreed to a 30-year concession with the Egyptian government to operate a hub at the Port Said East terminal. The terminal will be able to handle ships of up to 6,000 TEUs, and eventually it will be capable of handling 8,000-TEU ships. The Egyptian government has already started to dredge the harbor at Port Said to 55 feet. Eventually it will be dredged to 60 feet. See Chapter VI of this report for a comprehensive discussion of transshipment operations.

Another separate but related factor that may affect cargo flow along the Atlantic is the growing rail congestion in the Midwestern United States. Rail yards in the Chicago area have become severely strained by rapid growth in intermodal traffic from Asia. A routing shift by the railroads to cities such as Memphis, St. Louis and Kansas City could result in a southward shift in ports of entry from the upper East Coast to the Southeastern Seaboard.

Pacific Coast

By the middle 1980s, the leading trading partners of the U.S. shifted from economies in Europe to the Far East. Consequently, Pacific Coast ports have witnessed steady increases in cargo from Asia. Today, international trade along the Pacific Coast is substantial in terms of monetary value, indicating high volumes of containerized cargo. The Pacific Coast accounts for slightly less than 43 percent of all international commodity trade in terms of dollars. Relative to other coastal regions, the Pacific Coast does not handle large amounts of bulk commodities. Based on tonnage, Pacific Coast ports account for only about 17 percent of all international trade. As shown in Table V-11, most bulk goods traded on the West Coast are U.S. exports of grain, cork, wood, refined petroleum, residual petroleum products, coal and inorganic chemicals. However, Pacific Coast ports do handle significant volumes of crude petroleum imported from South America, Asia and the Mid-East, and large amounts of non-metallic crude minerals and ores shipped from South America, Canada, Mexico and Central America.

Asia accounts for approximately 81 percent of Pacific Coast trade based on value and nearly 60 percent trade in terms of tonnage. As shown in Table V-12, imports of motor vehicles and manufactured goods such as apparel and electronics make up most value-added trade. Interestingly, footwear is a leading import from Asia. Nearly $7.8 billion worth of shoes are imported from Asia. In terms of value, the primary exports to Asia are agricultural commodities such meat, dairy products and fish. Overall, the Pacific Coast is a net exporter of food and raw materials and a net importer of finished manufactured goods.

Absent global catastrophe, Pacific Coast ports will continue to benefit from trade with the Far East, regardless of the inevitable fluctuations in Asian economies. Again, a notable exception is a possible shift of some Asian cargo to transatlantic routes via the Suez Canal. China's entry into the WTO will greatly benefit Pacific Coast ports. China's economists are forecasting an average annual growth rate of 7.5 percent over the next five years, and a major Chinese carrier (China Ocean Shipping Co.) is projecting a 100 percent increase in trade if China is accepted into the WTO.

Although Pacific Coast ports are well positioned as beneficiaries of trade with Asia, further changes in export manufacturing centers could result in new trade routes. As economies in Africa, the Mid-East and South America develop, manufacturing capacities in these regions will increase and combined with low labor costs, these regions could become major producers of manufactured goods for export. If so, trade routes will change, and cargo flows would shift more toward Atlantic and Gulf Coast ports.

TABLE V-9

ATLANTIC COASTAL REGION TOP 10 TRADE COMMODITIES BY WORLD REGION PERCENTAGE SHARE OF TRADE: 1996
(MILLIONS OF METRIC TONS)

		Canada/ Mexico/ Central America		South America		Europe		Africa		Asia		Australia		Mid-East		Other	
Commodity	**Total**	**Imports**	**Exports**	**Imports**	**Exports**	**Imports**	**Exports**	**Imports**	**Exports**	**Imports**	**Exports**	**Imports**	**Exports**	**Imports**	**Exports**	**Imports**	**Exports**
Crude Petroleum	88.14	2.7%	-	16.5%	-	22.8%	-	44.2%	-	2.1%	-	-	-	11.5%	-	0.3%	-
Coal	54.71	-	1.2%	6.1%	9.5%	-	61.6%	-	6.0%	0.1%	13.3%	-	-	0.0%	2.1%	-	-
Petroleum Refineries	50.85	21.9%	1.9%	38.6%	0.4%	21.6%	0.7%	8.7%	0.1%	1.8%	0.4%	-	0.0%	1.9%	0.0%	1.8%	0.2%
Non-Metallic Crude Minerals	19.84	53.3%	1.6%	18.3%	1.2%	7.5%	7.3%	0.8%	0.2%	0.9%	7.3%	0.1%	0.3%	0.0%	0.2%	0.9%	0.2%
Ores	8.61	33.8%	0.0%	44.0%	0.2%	1.1%	0.4%	5.6%	-	0.2%	0.1%	14.7%	0.0%	-	0.0%	-	-
Non-Metallic Products, nec.	5.92	2.1%	2.6%	28.6%	1.2%	60.5%	1.3%	0.1%	0.3%	1.4%	1.0%	0.1%	0.2%	0.1%	0.4%	0.1%	0.1%
Iron and Steel	5.71	8.4%	1.4%	15.2%	1.4%	49.2%	2.5%	3.8%	0.6%	12.6%	3.7%	0.6%	0.3%	0.1%	0.3%	-	0.1%
Paper Products	5.57	8.6%	8.4%	2.1%	12.1%	22.4%	15.3%	0.0%	2.8%	0.7%	21.0%	-	2.0%	0.0%	4.4%	0.0%	0.1%
Organic Chemicals	4.49	22.6%	1.5%	10.9%	4.0%	22.3%	9.3%	1.6%	0.8%	4.0%	8.1%	-	0.6%	13.4%	0.9%	-	0.0%
Vegetables and Fruits	3.75	46.8%	1.5%	31.5%	1.1%	2.1%	6.4%	2.2%	0.1%	0.3%	5.8%	1.2%	0.3%	0.4%	0.4%	-	0.1%

* Empty cells = less than 0.01 percent. Highlighted cells = greater than 15.0 percent.

Source: Waterborne Commerce Statistics Center, 1996
nec. (not elsewhere classified)

TABLE V-10

ATLANTIC COASTAL REGION TOP 10 TRADE COMMODITIES BY WORLD REGION PERCENTAGE SHARE OF TRADE: 1996 (BILLIONS OF $U.S.)

Commodity	Total	Canada/Mexico/ Central America		South America		Europe		Africa		Asia		Australia		Mid-East		Other	
		Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports
Motor Vehicles	$27.05	2.5%	2.0%	0.0%	3.6%	32.7%	10.8%	0.0%	0.8%	37.0%	2.2%	-	0.7%	-	7.5%	-	0.2%
Crude Petroleum	$12.62	2.5%	-	14.3%	-	22.5%	-	46.9%	-	2.1%	-	-	-	11.5%	-	0.3%	-
Apparel	$11.83	37.3%	20.1%	1.7%	1.2%	8.8%	1.5%	4.4%	1.0%	20.4%	0.3%	0.0%	0.0%	2.8%	0.3%	0.2%	0.1%
Machinery and Equipment	$11.59	0.2%	4.5%	3.5%	11.2%	34.4%	16.2%	0.2%	3.2%	7.9%	11.0%	0.1%	1.3%	0.6%	5.8%	-	0.2%
Special Industrial Machinery	$9.35	0.1%	3.5%	1.1%	8.6%	44.6%	10.6%	0.2%	2.7%	15.2%	8.7%	0.2%	2.2%	0.1%	2.0%	-	0.2%
Petroleum Refineries	$8.83	22.5%	3.0%	35.1%	1.0%	23.1%	1.5%	7.2%	0.3%	1.7%	1.0%	-	0.1%	2.2%	0.2%	1.2%	0.2%
Parts of Motor Vehicles	$8.20	0.1%	1.6%	8.9%	11.3%	35.6%	25.3%	0.4%	1.8%	5.9%	1.9%	0.1%	3.5%	0.1%	3.6%	-	0.1%
Organic Chemicals	$6.98	4.7%	1.3%	2.7%	8.0%	35.1%	17.4%	0.6%	1.0%	13.9%	8.8%	0.0%	1.4%	4.4%	0.8%	-	0.0%
Synthetic Resins	$6.60	0.6%	2.9%	2.1%	14.4%	21.5%	29.3%	0.0%	2.6%	6.9%	15.3%	0.0%	2.4%	0.6%	1.3%	-	0.0%
Food Products	$6.41	25.4%	7.8%	13.6%	3.6%	15.2%	10.5%	6.0%	0.6%	9.6%	3.6%	0.2%	0.6%	0.4%	2.7%	-	0.4%

* Empty cells = less than 0.01 percent. Highlighted cells = greater than 15.0 percent.

Source: Waterborne Commerce Statistics Center, 1996

TABLE V-11

PACIFIC COASTAL REGION TOP 10 TRADE COMMODITIES BY WORLD REGION PERCENTAGE SHARE OF TRADE: 1996 (MILLIONS OF METRIC TONS)

Commodity	Total	Canada/ Mexico/ Central America		South America		Europe		Africa		Asia		Australia		Mid-East		Other	
		Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports
Grain	23.76	0.1%	0.2%	-	1.8%	-	2.0%	-	3.5%	0.7%	87.6%	-	0.0%	-	4.1%	-	-
Crude Petroleum	16.30	2.0%	0.2%	27.3%	-	1.2%	0.0%	0.3%	-	25.7%	10.7%	6.6%	-	25.8%	-	-	-
Cork and Wood	15.17	3.7%	2.1%	2.6%	0.0%	0.0%	0.5%	-	0.0%	0.3%	89.3%	0.9%	0.5%	-	0.0%	-	-
Petroleum Refineries	12.95	9.8%	17.7%	9.5%	0.8%	3.0%	0.6%	1.4%	-	7.5%	48.4%	0.6%	0.1%	-	0.0%	0.4%	0.2%
Non-Metallic Crude Minerals	8.22	68.5%	14.9%	-	0.6%	0.1%	1.5%	0.1%	2.6%	0.7%	7.8%	0.1%	1.0%	-	1.2%	1.1%	-
Residual Petroleum Products	7.75	0.3%	4.9%	0.2%	0.9%	0.1%	26.5%	-	-	1.2%	55.6%	-	9.8%	0.6%	-	-	-
Coal	6.84	0.3%	-	-	4.5%	0.0%	-	-	-	8.6%	84.4%	2.2%	-	-	0.1%	-	-
Inorganic Chemicals	4.99	4.5%	3.6%	0.2%	14.2%	0.8%	9.4%	0.0%	3.0%	3.9%	53.3%	0.2%	2.5%	0.3%	4.2%	-	-
Iron and Steel	4.75	6.1%	0.1%	16.1%	0.1%	18.3%	0.2%	0.5%	0.0%	45.0%	4.7%	8.6%	0.4%	0.0%	0.1%	-	-
Ores	4.01	2.8%	0.0%	1.6%	0.5%	0.2%	12.3%	0.3%	0.1%	2.5%	18.8%	60.5%	0.4%	-	-	-	-

* Empty cells = less than 0.01 percent. Highlighted cells = greater than 15 percent.

Source: Waterborne Commerce Statistics Center, 1996

TABLE V-12

PACIFIC COASTAL REGION TOP 10 TRADE COMMODITIES BY WORLD REGION PERCENTAGE SHARE OF TRADE: 1996 (BILLIONS OF $U.S.)

Commodity	Total	Canada/Mexico/ Central America		South America		Europe		Africa		Asia		Australia		Mid-East		Other	
		Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports
Motor Vehicles	$20.14	0.1%	0.1%	-	0.1%	11.7%	0.8%	-	0.0%	67.1%	17.7%	0.6%	1.6%	-	0.0%	-	-
Office and Computing Machinery	$19.31	0.0%	0.0%	-	0.2%	0.7%	0.9%	0.0%	0.0%	94.0%	3.9%	0.0%	0.3%	-	-	-	-
Apparel	$18.03	1.0%	0.5%	0.1%	0.5%	0.3%	0.1%	0.5%	0.0%	90.1%	2.6%	0.2%	0.1%	0.7%	0.0%	3.2%	-
Other Manufacturing, nec.	$16.40	0.0%	0.7%	0.0%	1.5%	0.8%	0.7%	0.0%	0.0%	87.5%	7.7%	0.1%	0.8%	0.0%	0.1%	0.1%	-
Parts of Motor Vehicles	$14.51	0.1%	0.1%	0.0%	0.4%	1.3%	0.3%	0.0%	0.0%	80.2%	13.7%	0.6%	3.3%	-	0.1%	-	-
Other Communications Equipment	$13.63	0.1%	0.2%	-	0.3%	0.3%	0.5%	-	0.0%	90.8%	7.3%	0.0%	0.4%	0.0%	0.1%	0.0%	0.0%
Machinery and Equipment, nec.	$11.48	0.2%	0.5%	0.4%	0.8%	2.5%	1.7%	0.0%	0.1%	57.3%	30.6%	0.6%	4.7%	0.2%	0.5%	-	0.0%
Meat/Dairy/Fish	$8.69	0.7%	0.7%	2.6%	0.1%	1.7%	3.3%	0.1%	0.0%	18.5%	65.7%	5.6%	0.9%	0.1%	0.1%	0.0%	0.0%
Footwear	$7.81	0.0%	0.1%	0.1%	0.5%	0.8%	0.2%	0.0%	0.0%	97.0%	1.0%	0.1%	0.1%	-	0.0%	0.0%	-
Metal Products	$7.10	0.5%	0.3%	0.2%	1.5%	1.8%	0.7%	0.0%	0.0%	78.6%	14.1%	0.6%	1.5%	0.1%	0.1%	0.0%	0.0%

* Empty cells = less than 0.01 percent. Highlighted cells = greater than 15 percent.

Source: Waterborne Commerce Statistics Center, 1996
nec. (not elsewhere classified)

Gulf Coast

When compared to the Atlantic and Pacific Coasts, ports along the Gulf handle considerably less containerized cargo. However, the Gulf Coast accounts for almost half of all international trade in terms of tonnage, which highlights its significant role as a point of entry and exit for bulk commodities (see Table V-13 and V-14). Almost 500 million tons of international cargo flow through Gulf ports. Nearly one-half of this is in the form of crude petroleum imported from Mexico, South America, the Mid-East and Africa. Iron, steel and ores from Latin America, Europe and Africa are also important imports. Grain is the leading U.S. export from the Gulf Coast at about 57 millions tons. Almost one-half of grain shipments go to Asia via the Panama Canal and the remainder is exported worldwide. Most grain is shipped down river from the Midwest and Plains states and exported abroad.

Geographical location has a major influence on the type of cargo at Gulf Coast ports. Many Gulf Coast ports serve as gateways to the United States' vast inland system of navigable waterways that serve as conduits for bulk imports and exports. Because bulk goods are heavy and generally low in value, they are much cheaper to transport via barges rather than on rail or trucks. International bulk cargo is often traded through ports such as New Orleans, where it can be loaded and unloaded onto barges or smaller ships and transported to the central U.S. by way of the Mississippi or other inland waterways. River ports in cities such as Memphis, Tulsa, St. Louis, Chicago and St. Paul, Minnesota serve as inland distribution centers.

Trade in the Gulf Coast is concentrated within a few bulk commodities, primarily crude petroleum and grain. Therefore, Gulf Coast ports are more vulnerable to fluctuations in world commodity markets. For example, in 1973, the Arab oil embargo effectively halted flows of crude oil from the Mid-East. Consequently, ports along the Gulf saw a significant decline in tanker traffic and revenues. In contrast, the embargo had less of an impact on coastal regions that handle a wider range of cargo such as the Atlantic Coast. Ports along the Atlantic deal in substantial volumes of crude petroleum, about one-quarter of total U.S. imports and exports. However, as a percentage of total tonnage, crude petroleum accounts for only about 28 percent of Atlantic Coast trade. In contrast, crude petroleum makes up about two-thirds of trade on the Gulf Coast in term of both value and tonnage.

Although the Gulf Coast currently has a relatively small share of the container market, it will likely grow as north-to-south trade routes develop between the U.S. and Latin America.[24] Over the next decade, NAFTA should result in more container trade along the Gulf Coast as well, and if the U.S. embargo on Cuban trade is lifted, the Gulf Coast should have tremendous opportunities for growth. In September of 1999, the U.S. Senate passed a measure to reduce restrictions on food exports to Cuba that will give shippers of bulk goods an excellent opportunity to expand their markets. The amendment will allow the sale of agricultural products to Cuba, and allow U.S. banks and other institutions to finance bulk-food exports. Among those benefiting would be U.S. agricultural producers and Gulf Coast ports. Before Fidel Castro came

[24] Americana Ships and Stevedoring Services of America signed an agreement in April of 2000 to develop a 300-acre container terminal at the Port of Texas City, TX, which has traditionally been a tanker port. The facility will be able to handle ships drawing up to 50 feet of water.

into power, Cuba was a very important trading partner for Gulf Coast ports such as New Orleans. When trade restrictions are lifted, Cuba should become an important consumer market in the long term, and in the short term, Cuba will need to rebuild its dilapidated infrastructure. For U.S. ports, this translates into more business, particularly in the form of exported bulk, neo-bulk and break-bulk cargo.

Great Lakes

The Great Lakes system includes Lakes Ontario, Erie, Huron, Michigan and Superior; their connecting waters and the St. Lawrence River. It is one of the largest concentrations of fresh water on the earth. The St. Lawrence Seaway provides access to oceangoing deep draft vessels to the industrial and agricultural heartland of the North American continent, and thus provides ports in Canada and the United States a vital link to international markets. The Seaway extends from the Atlantic Ocean to Duluth, Minnesota, on Lake Superior, a distance of more than 3,700 kilometers (2,300 miles) of navigable waters.

Relative to other coastal regions, ports along the Great Lakes handle small amounts of international cargo in terms of both tonnage and value. Only about 5 percent of total U.S. foreign trade based on weight and 1 percent based on value flows through ports along the Great Lakes. Bulk cargo accounts for most of the annual tonnage in the Great Lakes. Principal bulk commodities are grain, iron ore, coal, coke, petroleum and chemicals. Iron ore produced in Minnesota, Labrador, Quebec and Ontario is the largest traded commodity, with about 6.3 million metric tons exported from Great Lakes ports and 5.1 million metric imported. Coal is an important U.S. export from the Great Lakes, much of which is mined in the Appalachians. Agricultural goods are important exports from the Great Lakes. Grain and oilseeds are transported via the St. Lawrence Seaway to the Atlantic Ocean and shipped abroad. Steel and machinery are the leading general cargo. Based on tonnage, about 80 percent of trade in the Great Lakes is with Canada and 12 percent with Europe. However, in terms of value, imports from Europe account for nearly 60 percent of total trade in the Great Lakes. Most of this is in the form of imported iron and steel.

TABLE V-13

GULF COASTAL REGION TOP 10 TRADE COMMODITIES BY WORLD REGION PERCENTAGE SHARE OF TRADE: 1996
(MILLIONS OF METRIC TONS)

Commodity	Total	Canada/ Mexico/ Central America		South America		Europe		Africa		Asia		Australia		Mid-East		Other	
		Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports
Crude Petroleum	223.55	29.3%	-	31.7%	-	7.2%	-	12.2%	-	0.2%	-	-	-	18.6%	-	0.7%	-
Grain	57.73	0.1%	16.7%	0.0%	8.9%	0.1%	8.4%	-	15.2%	0.0%	43.8%	-	-	-	6.7%	-	0.1%
Petroleum Refineries	41.84	8.9%	17.9%	10.6%	5.3%	7.4%	4.9%	22.5%	0.6%	3.5%	3.0%	1.1%	0.0%	8.7%	1.6%	3.1%	0.9%
Ores	19.81	33.7%	5.2%	35.5%	0.0%	0.3%	0.6%	19.1%	0.1%	2.1%	0.2%	3.0%	0.0%	-	0.1%	-	-
Oil Seeds	19.39	0.1%	6.6%	0.0%	2.4%	0.1%	40.1%	0.0%	1.0%	0.0%	47.3%	-	0.3%	-	2.2%	-	-
Coal	14.32	-	1.7%	1.9%	9.6%	-	63.9%	-	3.3%	5.1%	14.1%	-	-	-	0.4%	-	-
Residual Petroleum Products	14.30	0.5%	3.4%	2.3%	4.1%	1.3%	65.0%	0.2%	5.6%	0.8%	10.1%	0.0%	1.2%	2.8%	2.7%	-	-
Iron and Steel	14.18	6.6%	0.6%	31.4%	1.9%	35.5%	1.9%	4.8%	1.1%	11.0%	3.2%	1.6%	0.0%	0.0%	0.5%	-	-
Organic Chemicals	13.34	7.8%	8.7%	3.8%	11.8%	6.0%	16.8%	0.6%	0.7%	1.6%	37.3%	-	1.4%	2.9%	0.3%	-	0.1%
Manufactured Fertilizers	12.60	7.0%	6.7%	0.5%	16.9%	10.3%	1.8%	1.0%	1.9%	0.2%	42.4%	-	10.0%	1.5%	-	-	-

* Empty cells = less than 0.01 percent. Highlighted cells = greater than 15 percent.

Source: Waterborne Commerce Statistics Center, 1996

TABLE V-14

GULF COASTAL REGION TOP 10 TRADE COMMODITIES BY WORLD REGION PERCENTAGE SHARE OF TRADE: 1996
(BILLIONS OF $ U.S.)

Commodity	Total	Canada/Mexico/ Central America		South America		Europe		Africa		Asia		Australia		Mid-East		Other	
		Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports
Crude Petroleum	$29.92	28.9%	-	30.0%	-	7.9%	-	13.6%	--	0.2%	-	-	-	18.8%	-	0.7%	-
Grain	$10.47	0.2%	17.5%	0.0%	9.0%	0.1%	9.2%	-	15.9%	0.1%	39.8%	-	1.4%		6.8%	-	0.1%
Organic Chemicals	$8.11	4.3%	6.3%	1.9%	13.6%	12.0%	26.8%	0.3%	1.0%	2.1%	29.4%	-	0.1%	1.7%	0.6%	-	0.1%
Petroleum Refineries	$6.93	9.0%	18.7%	9.4%	7.0%	6.8%	6.1%	23.4%	0.7%	2.9%	3.6%	1.2%	0.1%	6.0%	1.5%	3.0%	0.7%
Iron and Steel	$6.49	4.8%	1.2%	15.9%	5.9%	35.7%	4.9%	4.6%	2.6%	14.7%	7.1%	1.1%	0.3%	0.1%	1.2%	-	0.0%
Oil Seeds	$5.71	0.7%	7.1%	0.0%	2.3%	0.5%	38.7%	0.0%	0.9%	0.0%	46.7%	-	0.8%	-	2.1%	-	-
Special Industrial Machinery	$3.91	0.1%	3.2%	0.9%	32.9%	16.8%	11.4%	0.1%	16.0%	2.1%	9.5%	0.1%	0.3%	-	6.7%	-	0.0%
Machinery and Equipment, nec.	$3.01	0.3%	4.6%	2.7%	18.4%	25.0%	10.5%	0.1%	5.5%	2.7%	11.8%	0.1%	8.9%	0.1%	9.2%	-	0.1%
Fertilizers/Pesticides	$2.39	5.2%	7.4%	0.6%	18.9%	7.9%	5.0%	1.1%	2.3%	0.3%	46.7%	-	2.8%	1.7%	0.1%	-	-
Synthetic Resins	$2.45	1.0%	10.5%	0.5%	21.4%	12.4%	37.3%	-	4.2%	0.7%	8.6%	0.0%	0.0%	0.2%	3.3%	-	0.0%

* Empty cells = less than 0.01 percent. Highlighted cells = greater than 15 percent.

Source: Waterborne Commerce Statistics Center, 1996
nec. (not elsewhere classified)

TABLE V-15

GREAT LAKES REGION TOP 10 TRADE COMMODITIES BY WORLD REGION PERCENTAGE SHARE OF TRADE: 1996
(MILLIONS OF METRIC TONS)

Commodity	Total	Canada/ Mexico/ Central America		South America		Europe		Africa		Asia		Australia		Mid-East		Other	
		Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports
Ores	12.55	41.0%	50.7%	7.7%	-	0.2%	0.3%	-	-	-	-	0.1%	-	-	-	-	-
Coal	10.44	4.8%	95.3%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Non-Metallic Crude Minerals	10.21	54.6%	43.9%	-	0.1%	0.1%	1.2%	0.1%	-	0.1%	-	-	-	-	-	-	-
Grain	4.74	13.5%	7.6%	-	6.1%	-	20.5%	-	14.4%	-	-	-	-	-	1.6%		36.3%
Iron and Steel	4.38	3.4%	0.0%	8.3%	-	84.9%	0.7%	-	-	2.2%	-	0.6%	-	-	-	0.0%	-
Non-Metallic Products, nec.	2.81	90.1%	6.9%	1.0%	-	2.0%	0.1%	-	-	-	-	-	-	-	-	-	-
Oil Seeds	2.07	-	1.4%	-	-	-	40.9%	-	-	-	1.7%	-	-	-	0.5%	-	55.5%
Residual Petroleum Products	0.91	21.5%	66.2%	-	-	0.2%	9.4%	-	2.7%	-	-	-	-	-	-	-	-
Petroleum Refineries	0.68	85.9%	14.0%	-	-	0.0%	0.1%	-	-	-	0.0%	-	-	-	-	-	-
Briquettes, Lignite, Peat and Coke	0.53	14.3%	73.8%	-	0.1%	-	8.6%	-	-	3.2%	-	-	-	-	-	-	-

* Empty cells = less than 0.01 percent. Highlighted cells = greater than 15 percent.

Source: Waterborne Commerce Statistics Center, 1996
nec. (not elsewhere classified)

TABLE V-16

GREAT LAKES REGION TOP 10 TRADE COMMODITIES BY WORLD REGION PERCENTAGE SHARE OF TRADE: 1996
(BILLIONS OF $ U.S.)

Commodity	Total	Canada/Mexico/ Central America		South America		Europe		Africa		Asia		Australia		Mid-East		Other	
		Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports
Iron and Steel	$1.57	2.1%	0.1%	5.9%	0.0%	85.6%	2.3%	-	-	3.5%	-	0.4%	-	-	-	0.0%	-
Grain	$0.86	12.7%	8.0%	-	6.7%	-	20.7%	-	13.6%	-	-	-	-	-	1.4%	-	37.0%
Oil Seeds	$0.56	0.0%	1.6%	-	0.0%	-	41.6%	-	-	-	1.8%	-	-	-	0.6%	-	54.4%
Ores	$0.44	39.3%	44.0%	3.5%	-	0.2%	11.2%	-	-	0.0%	-	1.9%	-	-	-	-	-
Coal	$0.40	6.0%	94.0%	-	-	-	-	-	-	-	-	---	-	-	-	-	-
Parts of Motor Vehicles	$0.19	3.9%	0.0%	1.7%	6.1%	17.5%	63.1%	-	0.1%	4.1%	3.0%	-	0.4%	-	-	-	-
Machinery and Equipment, nec.	$0.16	28.6%	0.2%	0.3%	0.7%	28.4%	38.5%	-	0.4%	0.1%	1.7%	-	0.4%	-	0.6%	-	-
Non-Ferrous Metals and Products	$0.12	20.8%	-	-	0.5%	70.6%	6.3%	-	0.4%	1.1%	0.1%	0.2%	-	-	-	-	-
Petroleum Refineries	$0.14	79.9%	19.0%	-	0.0%	0.1%	0.8%	-	-	-	0.2%	-	-	-	-	-	-
Metal and Wood Working Machinery	$0.14	4.6%	0.0%	15.3%	0.0%	62.7%	7.6%	-	-	6.8%	3.1%	-	-	-	-	-	-

* Empty cells = less than 0.01 percent. Highlighted cells = greater than 15 percent.

Source: Waterborne Commerce Statistics Center, 1996
nec. (not elsewhere classified)

COASTAL COMMODITY FLOW BY VESSEL TYPE

For the remainder of this report, all vessels are classified according to the type of commodities they are designed to carry.[25] The two broad categories include bulk vessels and general cargo vessels. Bulk vessels are single deck ships that carry homogeneous unpacked cargo loaded through large hatchways or pipelines. "Tankers" carry liquid or gaseous bulk goods such as crude petroleum, petroleum products and natural gas, while "dry bulk" vessels transport commodities such as grains, ores and coal. General cargo vessels include ships designed to carry break-bulk freight and motor vehicles.[26] Containerships carry general cargo, but they are commonly classified as a distinct category of vessel. The category "other" includes an assortment of vessel designs that do not fit precisely in one of the former groupings but can and do transport commercial goods.

By weight, tanker and dry bulk carriers account for about two-thirds of U.S international trade. Over 90 percent of all ores, oil seeds and coal are transported by dry bulk vessels, and over 90 percent of all petroleum products are hauled by tankers. General cargo ships carry a broad array of commodities, including dense items such as iron, steel, sugar, paper products and perishable items such as fruits and vegetables. About half of all fruits and vegetables and almost 70 percent of all automobile imports and exports to the U.S. are transported by general cargo vessels (e.g., automobile carriers). Containerships account for only about 7 percent of trade in terms of weight; however, in terms of value they carry about 55 percent of imports and exports. Modern containerships are built for speed and efficiency, and items transported on containerships are usually high-value and high-volume goods, and many are time sensitive (e.g., refrigerated fruits and vegetables). For example, Tables V-17 through V-20 present the top 10 types of commodities transported by different vessel types. Containerships transport large amounts of manufactured commodities such as consumer goods, electrical equipment, automobile parts and industrial machinery.

Note that some of the goods exported from the United States on containerships are low-value commodities such as waste paper and animal feed. Again, this reflects the large trade imbalance that exists between the U.S. and Asia. The United States imports more containerized goods than it exports; thus when containerships call on U.S. ports, there may be a shortage of premium outbound cargo. Rather than sail with empty ship space, containership operators leaving the U.S. often attempt to fill containers with whatever cargo is available. To accomplish this, they must offer lower rates than they would charge for inbound U.S. cargo. In the transportation industry, this practice is referred to as "back haul." For ports, this means that departing containerships are often loaded with lower value, higher density cargo such as animal feed, which tends to push containerships to deeper drafts.

[25] Chapter IV presented forecasts for "tramp" which is a type of service rather than a distinct type of vessel. This classification was necessary because of data requirements for the forecasting methodology employed in Chapter IV.

[26] There are additional classifications of cargo ships. See Chapter VI of this report for a detailed profile and discussion of the world merchant fleet.

TABLE V-17

TOP 10 U.S. IMPORTS AND EXPORTS TRANSPORTED BY CONTAINERSHIPS: 1996 (MILLIONS OF METRIC TONS)

Imports	Metric Tons	Percentage of Commodity Transported by Containerships	Exports	Metric Tons	Percentage of Commodity Transported by Containerships
Other Manufacturing, nec.	2.53	91.8%	Synthetic Resins	4.33	71.5%
Metal Products	2.18	79.7%	Paper and Paperboard Products	4.08	51.1%
Vegetables and Fruits (refrigerated)	2.09	36.9%	Waste Paper	3.71	84.4%
Beverages	2.07	76.3%	Animal Feed	3.14	19.5%
Parts of Motor Vehicles	1.91	82.1%	Meat/Dairy/Fish	2.27	52.6%
Other Food, Cereals, Composite Food Products	1.54	57.3%	Cork and Wood	2.08	10.1%
Iron and Steel	1.54	5.7%	Vegetables and Fruits (refrigerated)	1.92	74.5%
Non-Metallic Products, nec.	1.51	11.2%	Organic Chemicals	1.79	14.6%
Apparel	1.43	72.3%	Non-Metallic Crude Minerals	1.63	14.5%
Other Meat/Dairy/ Fish/Fruit/ Vegetables	1.42	68.2%	Pulp	1.45	24.6%

Source: Waterborne Commerce Statistics Center, 1996
nec. (not elsewhere classified)

TABLE V-18

TOP 10 U.S. IMPORTS AND EXPORTS TRANSPORTED BY GENERAL CARGO VESSELS: 1996 (MILLIONS OF METRIC TONS)

Imports	Metric Tons	Percentage of Commodity Transported by General Cargo Vessels	Exports	Metric Tons	Percentage of Commodity Transported by General Cargo Vessels
Iron and Steel	3.51	13.1%	Paper and Paperboard Products	2.32	29.1%
Vegetables and Fruits (refrigerated)	2.92	51.5%	Grain	1.53	1.8%
Motor Vehicles	2.21	77.3%	Meat/Dairy/Fish	1.47	34.0%
Non-Metallic Products, nec.	0.99	7.3%	Pulp	1.45	24.5%
Ores	0.91	2.5%	Non-Metallic Crude Minerals	0.97	8.6%
Non-Ferrous Metals and Products	0.86	48.8%	Motor Vehicles	0.96	73.0%
Non-Metallic Crude Minerals	0.85	2.2%	Synthetic Resins	0.8	13.2%
Paper and Paperboard and Products	0.81	27.9%	Iron and Steel	0.75	34.3%
Other Food, Cereals, Composite Food Products	0.77	28.8%	Other Food, Cereals, Composite Food Products	0.72	28.8%
Sugar	0.51	12.4%	Manufactured Fertilizers and Pesticides	0.68	5.2%

Source: Waterborne Commerce Statistics Center, 1996
nec. (not elsewhere classified)

TABLE V-19

TOP 10 U.S. IMPORTS AND EXPORTS TRANSPORTED BY DRY BULK VESSELS: 1996 (MILLIONS OF METRIC TONS)

Imports	Metric Tons	Percentage of Commodity Transported by Containerships	Exports	Metric Tons	Percentage of Commodity Transported by Containerships
Ores	32.88	91.3%	Grain	81.81	94.3%
Non-Metallic Crude Minerals	30.03	77.0%	Coal	67.70	84.0%
Iron and Steel	20.05	74.7%	Oil Seeds	22.64	93.5%
Non-Metallic Products, nec.	8.89	65.7%	Cork and Wood	17.15	82.9%
Coal	5.40	95.3%	Residual Petroleum Products	15.90	72.2%
Manufactured Fertilizers and Pesticides	2.89	66.5%	Manufactured Fertilizers and Pesticides	11.45	87.7%
Briquettes, Lignite, Peat and Coke	2.16	94.7%	Animal Feed	11.41	70.8%
Sugar	2.14	52.1%	Ores	8.17	90.9%
Residual Petroleum Products	0.81	26.9%	Non-Metallic Crude Minerals	7.13	63.3%
Scrap	0.80	61.1%	Scrap	5.54	79.7%

Source: Waterborne Commerce Statistics Center, 1996
nec. (not elsewhere classified)

TABLE V-20

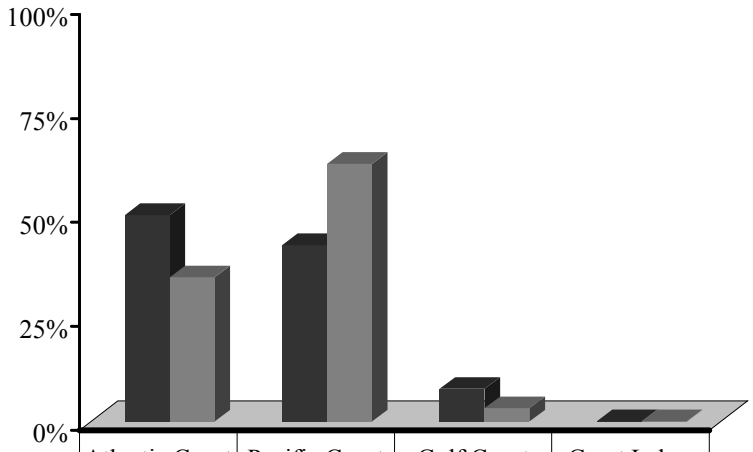
TOP 10 U.S. IMPORTS AND EXPORTS TRANSPORTED BY TANKERS: 1996 (MILLIONS OF METRIC TONS)

Imports	Metric Tons	Percentage of Commodity Transported by Containerships	Exports	Metric Tons	Percentage of Commodity Transported by Containerships
Crude Petroleum	302.04	92.6%	Refined Petroleum	22.70	90.5%
Petroleum Refineries	75.42	92.8%	Coal	11.79	14.6%
Organic Chemicals	7.67	83.8%	Organic Chemicals	9.71	79.2%
Inorganic Chemicals	4.43	72.4%	Residual Petroleum Products	4.99	22.7%
Natural Gas	3.58	92.0%	Inorganic Chemicals	3.54	38.4%
Residual Petroleum Products	1.72	57.3%	Natural Gas	1.94	98.6%
Non-Metallic Crude Minerals	1.50	3.8%	Animal and Vegetable Oils	1.89	79.4%
Ores	1.15	3.2%	Crude Petroleum	1.79	99.5%
Sugar	1.05	25.7%	Grain	1.63	1.9%
Manufactured Fertilizers and Pesticides	0.93	21.5%	Oil Seeds	0.89	3.7%

Source: Waterborne Commerce Statistics Center, 1996
nec. (not elsewhere classified)

Distribution of vessel traffic within the four coastal ranges is consistent with the types of goods traded in each region. Based on tonnage and value, about 90 percent of tanker and dry bulk traffic is concentrated along the Atlantic and Gulf Coasts. Most tankers calling on Atlantic and Gulf Coast ports carry imports of crude petroleum from South America, the Mid-East, Europe and Africa. Dry bulk traffic on the Atlantic and Gulf Coasts consists primarily of vessels carrying exports of agricultural commodities and coal, and imports of non-metallic minerals, ores, iron and steel.

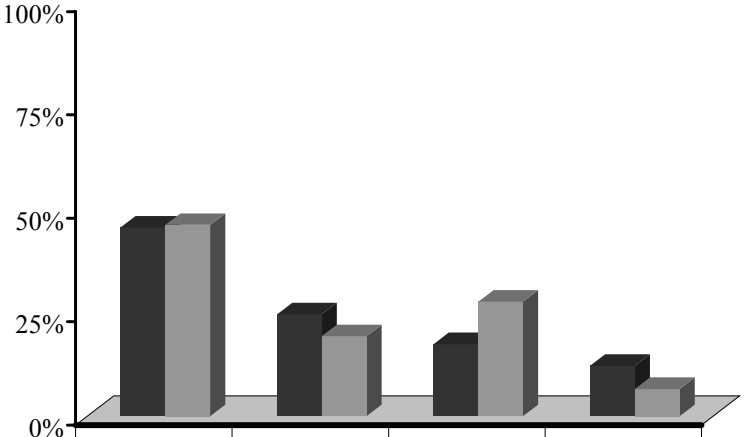
Figures V-7 through V-10 summarize shipments by vessel types along each coastal region. General cargo shipments are highly concentrated along the Atlantic and Gulf Coasts, about 91 percent of tonnage and 80 percent of value. Based on value, Atlantic Coast ports lead, with approximately 64 percent of all general cargo traffic. The majority of this originates or terminates in Europe, South America and Africa. General cargo shipments along the Gulf Coast consist primarily of vessels from Africa and South America carrying break-bulk cargo such as fruits and vegetables. The Pacific and Atlantic Coasts are the principal connections for containerships. On a tonnage basis, containership trade is more or less evenly distributed among the two regions. However, in terms of value, Pacific Coast ports lead, with about a 62 percent share of the market, while the Atlantic Coast has about a 35 percent share based on value. Pacific Coast ports account for about 86 percent of Asian container traffic in terms of value and around 68 percent based on tonnage. Most container shipments along the Atlantic Coast currently originate or terminate in Canada, Mexico, Central America, South America and Europe. The Gulf Coast only has about 3 percent of the containership market based on value and about 7 percent based on tonnage. Containership traffic on the Great Lakes is minimal.



	Atlantic Coast	Pacific Coast	Gulf Coast	Great Lakes
metric tons	49.7%	42.4%	7.9%	0.1%
$U.S.	34.7%	62.0%	3.2%	0.1%

Figure V-7. Containership Tonnage by U.S. Coastal Range: 1996 (metric tons and $ billions)

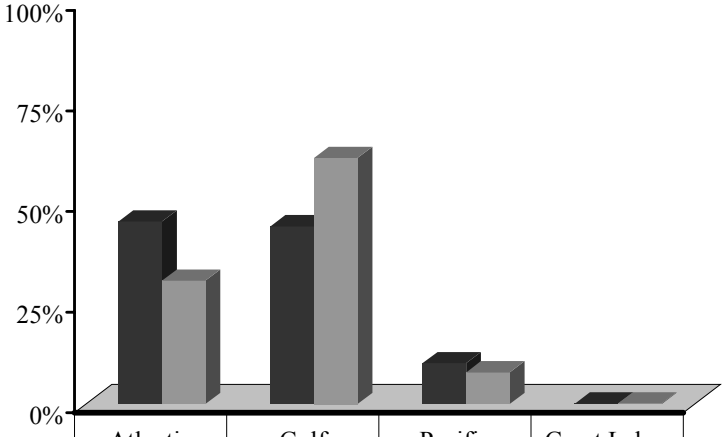
Source: PMCL analysis of data from the Waterborne Commerce Statistics Center, 1996



	Gulf	Atlantic	Pacific	Great Lakes
metric tons	45.6%	24.7%	17.4%	12.2%
$U.S.	46.3%	19.4%	27.7%	6.6%

Figure V-8. Tonnage Transported by Dry Bulk Ships by U.S. Coastal Range: 1996 (metric tons and $ billions)

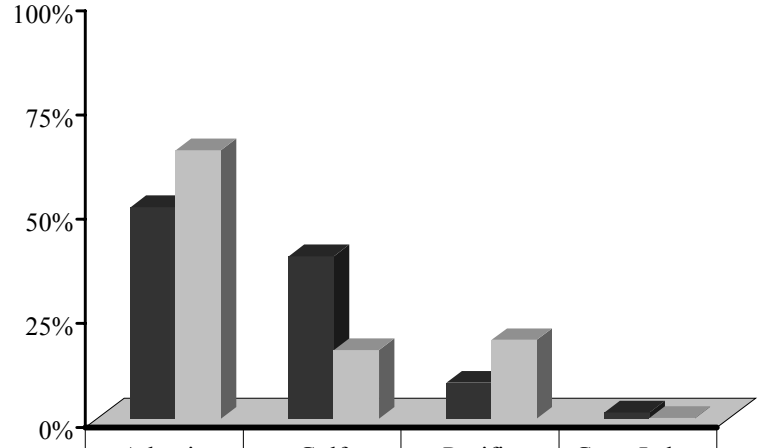
Source: PMCL analysis of data from the Waterborne Commerce Statistics Center, 1996



	Atlantic	Gulf	Pacific	Great Lakes
metric tons	45.4%	44.2%	10.2%	0.2%
$U.S.	30.7%	61.2%	7.9%	0.2%

Figure V-9. Tonnage Transported by Tankers by U.S. Coastal Range: 1996 (metric tons and $ billions)

Source: PMCL analysis of data from the Waterborne Commerce Statistics Center, 1996



	Atlantic	Gulf	Pacific	Great Lakes
metric tons	50.8%	39.0%	8.7%	1.5%
$U.S.	64.4%	16.5%	18.9%	0.2%

Figure V-10. Tonnage Transported by General Cargo Vessels by U.S. Coastal Range: 1996 (metric tons and $ billions)

Source: PMCL analysis of data from the Waterborne Commerce Statistics Center, 1996

COMMODITY FLOWS AT U.S. PORTS

Previous discussions emphasize the large quantities of commodities traded between the United States and the world. Although this information highlights trade differences on a regional basis, a more detailed analysis allows the identification of individual ports that account for the majority of international trade in the United States. Though a large number of ports transport goods both domestically and abroad, most international commerce is concentrated within several ports.

Commodity Flows at U.S. Ports on a National Level

Using shipment data from the Waterborne Commerce Statistics Center, U.S. ports were evaluated based on tonnage of international and domestic cargo. Five hundred seventy-three U.S. ports comprised the universe from which the final 150 ports were selected. Inland ports and ports that showed no recorded tonnage were excluded from the analysis.

One hundred fifty U.S. ports handle slightly more than one billion metric tons of foreign cargo, more than 99 percent of all international maritime trade. As shown in Figure V-11 and Table V-21, cargo is highly concentrated within several ports. When measured by weight, 50 U.S. ports handle approximately 89 percent of international trade, ten ports account for about 45 percent, and 5 handle almost 29 percent. Bulk commodities account for much of the cargo at ports that rank high based on tonnage, and goods such as crude petroleum, coal and grain tend to flow through ports that offer geographical advantages. Ports that ship large volumes of crude petroleum are located near refining centers, and ports that handle large amounts of agricultural commodities are often located at the entrances of large river systems and provide convenient access to inland waterways. Of the top 20 ports based on tonnage, six are located near Gulf Coast oil refineries (e.g., Houston and Port Arthur, TX) and seven are clustered along or near the Mississippi River Delta. Based on tonnage, 13 of the top 20 ports are located along the Gulf Coast. Houston and the Port of South Louisiana account for 15 percent of all international tonnage.

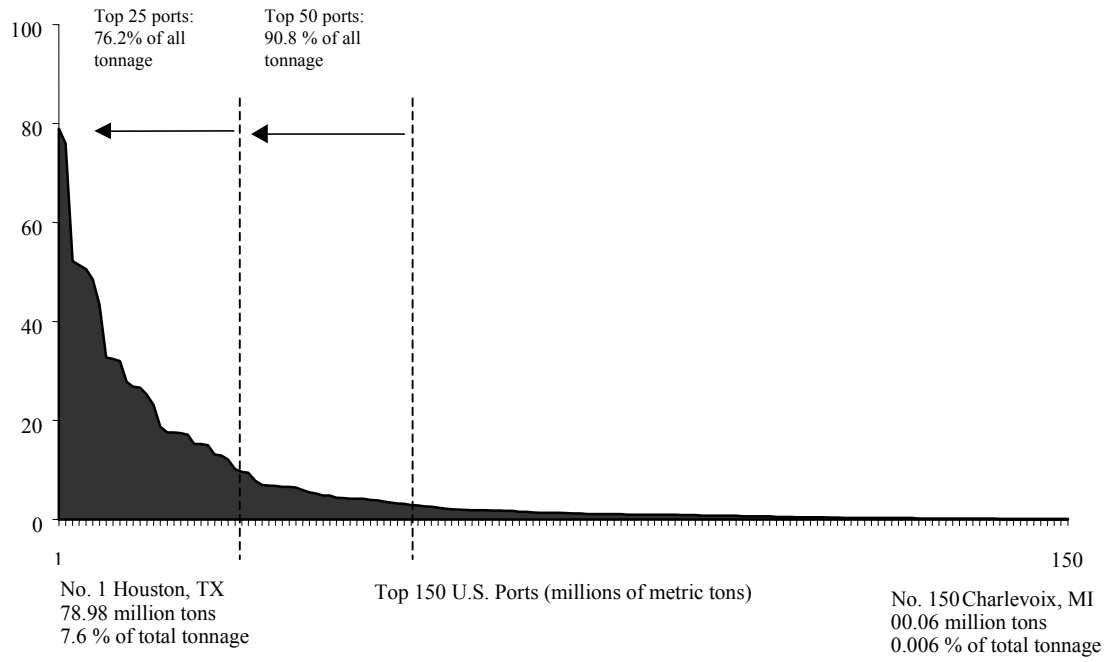


Figure V-11. Cargo Tonnage Distribution Among U.S. Ports: 1996 (metric tons)

Source: PMCL analysis of data from the Waterborne Commerce Statistics Center, 1996

TABLE V-21

TOP 50 U.S. PORTS BASED ON INTERNATIONAL TONNAGE: 1996 (MILLIONS OF METRIC TONS)

Rank	Port	Coastal Region	Metric Tons (millions)	Market Share	Cumulative Market Share
1	Houston. TX	Gulf	78.98	7.6%	7.6%
2	Port of South Louisiana, LA	Gulf	76.00	7.3%	15.0%
3	Corpus Christi, TX	Gulf	51.36	5.0%	20.0%
4	New York/New Jersey	Atlantic	50.68	4.9%	24.9%
5	New Orleans, LA	Gulf	42.55	4.1%	29.0%
6	Norfolk, VA	Atlantic	35.28	3.4%	32.4%
7	Long Beach, CA	Pacific	32.68	3.2%	35.5%
8	Baton Rouge, AL	Gulf	32.47	3.1%	38.7%
9	Texas City, TX	Gulf	32.05	3.1%	41.8%
10	Port Arthur, TX	Gulf	27.81	2.7%	44.5%
11	Baltimore, MD	Atlantic	26.81	2.6%	47.1%
12	Lake Charles, LA	Gulf	26.63	2.6%	49.6%
13	Philadelphia, PA	Atlantic	26.19	2.5%	52.2%
14	Los Angeles, CA	Pacific	25.18	2.4%	54.6%
15	Mobile, AL	Gulf	23.13	2.2%	56.8%
16	Port of Plaquemine, LA	Gulf	18.77	1.8%	58.7%
17	Pascagoula, MS	Gulf	18.41	1.8%	60.4%
18	Caribbean Islands	Atlantic	17.57	1.7%	62.1%
19	Freeport, TX	Gulf	17.42	1.7%	63.8%
20	Beaumont, TX	Gulf	17.07	1.7%	65.5%
21	Newport News, VA	Atlantic	16.91	1.6%	67.1%
22	Seattle, WA	Pacific	15.44	1.5%	68.6%
23	Tampa, FL	Gulf	15.27	1.5%	70.1%
24	Portland, OR	Pacific	15.01	1.5%	71.5%
25	Paulsboro, NJ	Atlantic	13.53	1.3%	72.8%
26	Savannah, GA	Atlantic	13.06	1.3%	74.1%
27	Tacoma, WA	Pacific	12.91	1.2%	75.3%
28	Portland, ME	Atlantic	12.09	1.2%	76.5%
29	Duluth-Superior, MN & WI	Great Lakes	10.12	1.0%	77.5%
30	Charleston, SC	Atlantic	9.60	0.9%	78.4%
31	Boston, MA	Atlantic	9.44	0.9%	79.3%
32	Oakland, CA	Pacific	7.85	0.8%	80.1%
33	Galveston, TX	Gulf	6.95	0.7%	80.8%
34	Port Everglades, FL	Atlantic	6.84	0.7%	81.4%
35	Jacksonville, FL	Atlantic	6.78	0.7%	82.1%
36	Kalama, WA	Pacific	6.56	0.6%	82.7%
37	Matagorda Ship Channel, TX	Gulf	5.94	0.6%	83.3%
38	Detroit, MI	Great Lakes	5.71	0.6%	83.8%
39	Toledo, OH	Great Lakes	5.44	0.5%	84.4%
40	Vancouver, WA	Pacific	5.19	0.5%	84.9%
41	Richmond Harbor, CA	Pacific	4.87	0.5%	85.3%
42	Barbers Point, HI	Pacific	4.81	0.5%	85.8%
43	Marcus Hook, PA	Atlantic	4.69	0.5%	86.3%
44	San Juan, PR	Atlantic	4.34	0.4%	86.7%
45	Miami, FL	Atlantic	4.22	0.4%	87.1%
46	Carquinez Strait, CA	Pacific	4.22	0.4%	87.5%
47	Guayanilla, PR	Atlantic	4.12	0.4%	87.9%
48	Chicago, IL	Great Lakes	3.96	0.4%	88.3%
49	Longview, WA	Pacific	3.90	0.4%	88.7%
50	New Castle, DE	Atlantic	3.89	0.4%	89.0%
	Total - Top 150 U.S. Ports		1027.96	99.4%	
	Total - Top 50 U.S. Ports		920.71	89.0%	
	Total - Top 25 U.S. Ports		753.21	72.8%	

Source: PMCL analysis of data from the Waterborne Commerce Statistics Center, 1996

When measured in U.S. dollars, trade is even more concentrated on a national level. Fifty ports account for nearly 96 percent of trade value, 25 make up about 88.5 percent, and 10 ports handle approximately 66 percent. With just under $87 billion worth of cargo, Long Beach is the number one U.S. port in terms of value. Los Angeles ranks second with almost $73 billion, and New York is third with just under $67 billion. Five of the top ten ports in terms of trade value are located on the Pacific Coast.

Figure V-12 and Table V-22 emphasize the degree of cargo consolidation at major U.S. ports based on value. Structural changes in the shipping industry have had a significant influence on the massing of cargo at select ports. Many carriers are forming alliances or merging to increase profits, reduce costs and strengthen their bargaining power with port operators. As they do so, they are consolidating shipments onto larger vessels and calling on fewer ports known as hubs or load centers. Maersk/SeaLand–one of the largest carriers in the world–recently selected the ports of Los Angeles and New York to serve as regional hubs. Collectively these two ports account for 22 percent of international trade when measured in dollars. Chapter VI of this report provides a comprehensive discussion of the containership industry and its influence on ports operations and development.

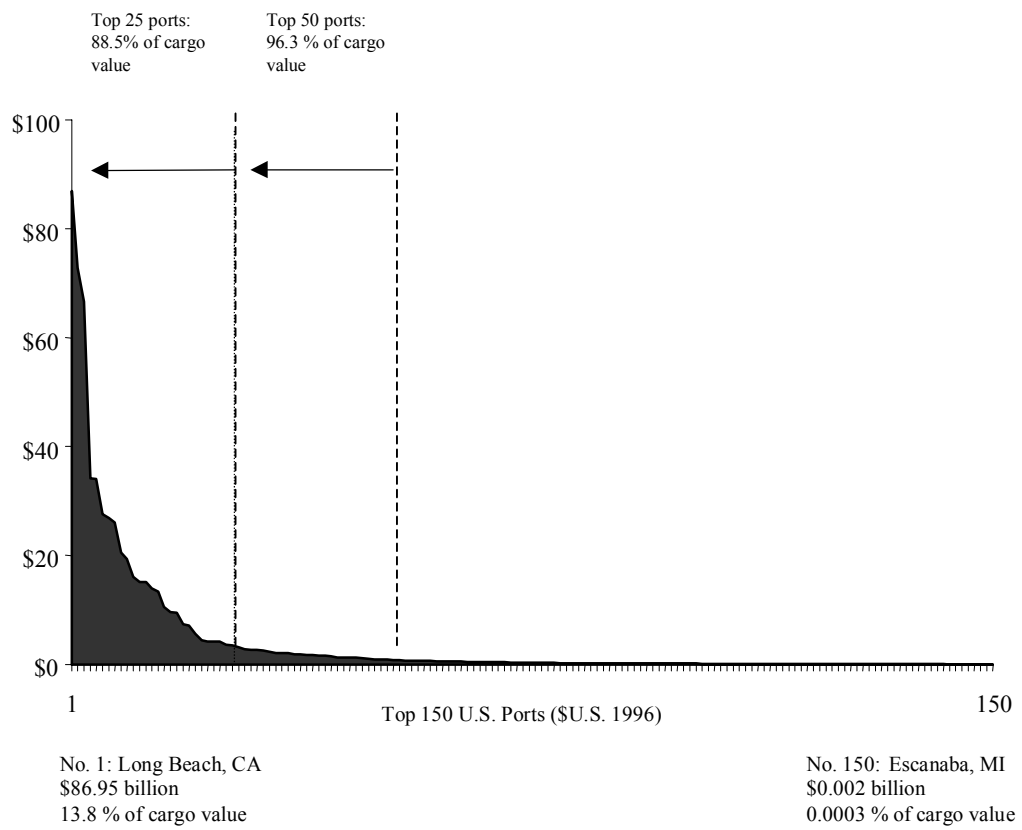


Figure V-12. Cargo Value Distribution Among U.S. Ports: 1996 ($ billions)

Source: PMCL analysis of data from the Waterborne Commerce Statistics Center, 1996

TABLE V-22

TOP 50 U.S. PORTS BASED ON INTERNATIONAL CARGO: 1996 ($ BILLIONS)

Rank	Port	Coastal Region	$ Billions	Market Share	Cumulative Market Share
1	Long Beach, CA	Pacific	$86.95	13.9%	13.9%
2	Los Angeles, CA	Pacific	$72.82	11.7%	25.6%
3	New York/New Jersey	Atlantic	$66.71	10.7%	36.3%
4	Houston, TX	Gulf	$34.14	5.5%	41.7%
5	Seattle, WA	Pacific	$34.08	5.5%	47.2%
6	Oakland, CA	Pacific	$26.83	4.3%	51.5%
7	Charleston, SC	Atlantic	$26.02	4.2%	55.6%
8	Norfolk, VA	Atlantic	$24.58	3.9%	59.6%
9	Tacoma, WA	Pacific	$20.56	3.3%	62.9%
10	Baltimore, MD	Atlantic	$19.31	3.1%	66.0%
11	New Orleans, LA	Gulf	$15.95	2.6%	68.5%
12	Miami, FL	Atlantic	$15.15	2.4%	70.9%
13	Port of South Louisiana	Gulf	$13.91	2.2%	73.2%
14	Savannah, GA	Atlantic	$13.34	2.1%	75.3%
15	Port Everglades, FL	Atlantic	$10.52	1.7%	77.0%
16	Jacksonville, FL	Atlantic	$9.54	1.5%	78.5%
17	Philadelphia, PA	Atlantic	$9.48	1.5%	80.0%
18	Portland, OR	Pacific	$9.47	1.5%	81.5%
19	Corpus Christi, TX	Gulf	$7.13	1.1%	82.7%
20	Baton Rouge, LA	Gulf	$5.64	0.9%	83.6%
21	Wilmington, NC	Atlantic	$4.91	0.8%	84.4%
22	Texas City, TX	Gulf	$4.48	0.7%	85.1%
23	San Juan, PR	Atlantic	$4.21	0.7%	85.8%
24	Port Arthur, TX	Gulf	$4.15	0.7%	86.4%
25	Boston, MA	Atlantic	$4.11	0.7%	87.1%
26	Mobile, AL	Gulf	$3.54	0.6%	87.7%
27	Lake Charles, LA	Gulf	$3.52	0.6%	88.2%
28	Freeport, TX	Gulf	$3.18	0.5%	88.7%
29	Newport News, VA	Atlantic	$3.02	0.5%	89.2%
30	Tampa, FL	Gulf	$2.76	0.4%	89.7%
31	Caribbean Islands	Atlantic	$2.69	0.4%	90.1%
32	Port Hueneme, CA	Pacific	$2.65	0.4%	90.5%
33	Beaumont, TX	Gulf	$2.55	0.4%	90.9%
34	Wilmington, DE	Atlantic	$2.43	0.4%	91.3%
35	Pascagoula, MS	Gulf	$2.42	0.4%	91.7%
36	Carquinez Strait, CA	Pacific	$2.27	0.4%	92.1%
37	Port of Plaquemine, LA	Gulf	$2.08	0.3%	92.4%
38	Richmond, VA	Atlantic	$2.03	0.3%	92.7%
39	Paulsboro, NJ	Atlantic	$1.98	0.3%	93.0%
40	Chester, PA	Atlantic	$1.91	0.3%	93.3%
41	Portland, ME	Atlantic	$1.85	0.3%	93.6%
42	Brownsville, TX	Gulf	$1.80	0.3%	93.9%
43	Galveston, TX	Gulf	$1.76	0.3%	94.2%
44	Detroit, MI	Great Lakes	$1.67	0.3%	94.5%
45	Brunswick, GA	Atlantic	$1.66	0.3%	94.7%
46	Vancouver, WA	Pacific	$1.65	0.3%	95.0%
47	Palm Beach, FL	Atlantic	$1.54	0.2%	95.2%
48	Duluth-Superior, MI & WI	Great Lakes	$1.26	0.2%	95.4%
49	Kalama, WA	Pacific	$1.24	0.2%	95.6%
50	Richmond, CA	Pacific	$1.21	0.2%	95.8%
	Total - Top 150		624.60	99.6%	
	Total - Top 50		598.63	95.8%	
	Total - Top 25		543.99	87.1%	

Source: PMCL analysis of data from the Waterborne Commerce Statistics Center, 1996

Commodity Flow at U.S. Ports on a Regional Basis

Tables V-23 and V-24 display ports along each U.S. coastal region ranked by cargo tonnage and value. As demonstrated, international trade is highly concentrated on a regional basis. Leading ports along each coast handle at least 75 percent of regional tonnage. Along the Atlantic Coast, ten ports account for approximately 84 percent of cargo value and nearly 77 percent of tonnage. Four ports handle almost 50 percent. New York/New Jersey has the greatest market share in terms of value and tonnage. Charleston ranks second in regional value, and Norfolk is third in value and second in tonnage. On the Pacific Coast, trade is more concentrated. Los Angeles and Long Beach account for about 33 percent of tonnage and almost 45 percent of cargo value. Seattle, Portland, Tacoma and Oakland collectively handle about 25 percent of tonnage and 30 percent of trade value. Ten ports along the Gulf Coast account for slightly more than 80 percent of regional trade in both weight and value. Houston, the Port of South Louisiana, Corpus Christi and New Orleans account for almost one-half of international cargo shipped through the region in terms of tonnage and value. Ten ports along the Great Lakes handle 82 percent of international trade. Duluth-Superior, Detroit, Toledo and Chicago have almost 50 percent of the market in terms of tonnage and 70 percent based on value.

Direction of trade is an excellent indicator of the types of commodities that flow through a particular port. For example, at least 85 percent of tonnage is imported at New York/New Jersey, Philadelphia/Camden and Paulsboro (NJ), and at least 80 percent of tonnage is imported at Texas City, Port Arthur and Lake Charles. All of these ports are major importers of crude petroleum. In contrast, nearly 90 percent of tonnage at Newport News and Norfolk is in the form of exports. Both ports are chief exporters of U.S. coal. Similarly, most tonnage at the Port of South Louisiana, Plaquemine (LA), Portland (OR), Vancouver and Kalama (WA) is exports. All of these ports are major exporters of U.S. chemicals and agricultural products such as grains, meat, wood and animal feed.

When measured in dollars, direction of trade is also revealing. On the Pacific Coast, several ports are net importers in terms of value, and each is a leading regional and national container port that handles inbound shipments from Asia. These ports include Los Angeles, Long Beach, Tacoma, Seattle and Oakland. Port Hueneme (CA) is one of the most active Pacific Coast importers of motor vehicles from Asia. In terms of value, almost 90 percent of cargo handled at Hueneme consists of imports. On the Atlantic Coast, several ports are net exporters of value, including Jacksonville, Savannah, Baltimore, Philadelphia, Miami and Charleston. Top general cargo exports from these ports include paper, wood, auto parts, machinery, engines, raw tobacco and meats. Bulk exports consist largely of coal, chemicals and grain. Charleston, Baltimore and Norfolk are net exporters of both value and tonnage.

Along the Great Lakes, direction of trade follows an interesting pattern. Tonnage at each of the top ten ports is heavily weighted towards either exports or imports. For example, at Duluth-Superior, about 90 percent of tonnage is exports, while at Detroit 90 percent is in the form of imports. Primary exports from Duluth-Superior are iron ores, coal and grain. Inbound cargo to Detroit consists predominantly of iron and steel, machine parts, beverages, and automobile parts and engines. Exports at Suluth-Superior include steel and higher value manu-

TABLE V-23

COMMODITY FLOW AT U.S. PORTS BY COASTAL REGION: 1996 (MILLIONS OF METRIC TONS)

Rank	Atlantic Coast	Metric Tons	% Imports	% Exports	Market Share of Regional Tonnage	Cumulative Share
1	New York/New Jersey	50.68	85.7%	14.3%	16.3%	16.3%
2	Norfolk, VA	35.28	15.0%	85.0%	11.3%	27.6%
3	Baltimore, MD	26.81	48.4%	51.6%	8.6%	36.2%
4	Philadelphia, PA	26.19	97.8%	2.2%	8.4%	44.6%
5	Caribbean Islands	17.57	94.9%	5.1%	5.6%	50.2%
6	Newport News, VA	16.91	10.2%	89.8%	5.4%	55.7%
7	Paulsboro, NJ	13.53	98.0%	2.0%	4.3%	60.0%
8	Savannah, GA	13.06	50.7%	49.3%	4.2%	64.2%
9	Portland, ME	12.09	99.4%	0.6%	3.9%	68.1%
10	Charleston, SC	9.60	45.6%	54.4%	3.1%	71.1%
	Total Atlantic Coast	311.64				
Rank	**Gulf Coast**	**Metric Tons**	**% Imports**	**% Exports**	**Market Share of Regional Tonnage**	**Cumulative Share**
1	Houston, TX	78.98	66.7%	33.3%	15.9%	15.9%
2	Port of South Louisiana, LA	76.00	30.0%	70.0%	15.3%	31.1%
3	Corpus Christi, TX	51.36	86.8%	13.2%	10.3%	41.5%
4	New Orleans, LA	42.55	44.4%	55.6%	8.6%	50.0%
5	Baton Rouge, LA	32.47	69.3%	30.7%	6.5%	56.5%
6	Texas City, TX	32.05	93.1%	6.9%	6.4%	63.0%
7	Port Arthur, TX	27.81	87.9%	12.1%	5.6%	68.6%
8	Lake Charles, LA	26.63	84.4%	15.6%	5.4%	73.9%
9	Mobile, AL	23.13	51.5%	48.5%	4.6%	78.6%
10	Port of Plaquemine, LA	18.77	30.9%	69.1%	3.8%	82.3%
	Total Gulf Coast	497.63				
Rank	**Pacific Coast**	**Metric Tons**	**% Imports**	**% Exports**	**Market Share of Regional Tonnage**	**Cumulative Share**
1	Long Beach, CA	32.68	48.8%	51.2%	18.8%	18.8%
2	Los Angeles, CA	25.18	51.5%	48.5%	14.5%	33.3%
3	Seattle, WA	15.44	40.4%	59.6%	8.9%	42.1%
4	Portland, OR	15.01	18.5%	81.5%	8.6%	50.7%
5	Tacoma, WA	12.91	28.7%	71.3%	7.4%	58.2%
6	Oakland, CA	7.85	34.1%	65.9%	4.5%	62.7%
7	Kalama, WA	6.56	0.2%	99.8%	3.8%	66.4%
8	Vancouver, WA	5.19	14.8%	85.2%	3.0%	69.4%
9	Richmond, CA	4.87	62.3%	37.7%	2.8%	72.2%
10	Barbers Point, HI	4.81	85.7%	14.3%	2.8%	75.0%
	Total Pacific Coast	174.03				
Rank	**Great Lakes**	**Metric Tons**	**% Imports**	**% Exports**	**Market Share of Regional Tonnage**	**Cumulative Share**
1	Duluth-Superior, MN & WI	10.12	9.8%	90.2%	19.9%	19.9%
2	Detroit, MI	5.71	89.7%	10.3%	11.2%	31.1%
3	Toledo, OH	5.44	24.4%	75.6%	10.7%	41.8%
4	Chicago, IL	3.96	81.1%	18.9%	7.8%	49.6%
5	Cleveland, OH	3.61	84.7%	15.3%	7.1%	56.7%
6	Ashtabula, MI	3.45	15.6%	84.4%	6.8%	63.4%
7	Sandusky, OH	2.37	0.7%	99.3%	4.7%	68.1%
8	Burns Waterway, MI	2.14	83.3%	16.7%	4.2%	72.3%
9	Conneaut, OH	2.05	3.8%	96.2%	4.0%	76.3%
10	Calcite, MI	1.61	0.4%	99.6%	3.2%	79.5%
	Total Great Lakes	50.89				

Source: PMCL analysis of data from the Waterborne Commerce Statistics Center, 1996

TABLE V-24

COMMODITY FLOW AT U.S. PORTS BY COASTAL REGION: 1996 ($ BILLIONS)

Rank	Atlantic Coast	$Billions	% Imports	% Exports	Market Share of Regional Value	Cumulative Share
1	New York/New Jersev	$66.71	66.8%	33.2%	27.9%	27.9%
2	Charleston, SC	$26.02	52.3%	47.7%	10.9%	38.8%
3	Norfolk, VA	$24.58	44.3%	55.7%	10.3%	49.1%
4	Baltimore, MD	$19.31	58.9%	41.1%	8.1%	57.2%
5	Miami, FL	$15.15	40.9%	59.1%	6.3%	63.5%
6	Savannah, GA	$13.34	52.9%	47.1%	5.6%	69.1%
7	Port Everglades, FL	$10.52	57.0%	43.0%	4.4%	73.5%
8	Jacksonville, FL	$9.54	64.7%	35.3%	4.0%	77.5%
9	Philadelphia, PA	$9.48	66.1%	33.9%	4.0%	81.5%
10	Wilmington, NC	$4.91	33.4%	66.6%	2.1%	83.5%
	Total Atlantic Coast	$238.92				
Rank	**Gulf Coast**	**$Billions**	**% Imports**	**% Exports**	**Market Share of Regional Value**	**Cumulative Share**
1	Houston. TX	$34.14	43.1%	56.9%	30.5%	30.5%
2	New Orleans, LA	$15.95	47.3%	52.7%	14.3%	44.8%
3	Port of South Louisiana, LA	$12.13	22.2%	77.8%	10.8%	55.6%
4	Corpus Christi, TX	$7.13	80.0%	20.0%	6.4%	62.0%
5	Baton Rouge, LA	$5.64	58.8%	41.2%	5.0%	67.0%
6	Texas City, TX	$4.48	89.2%	10.8%	4.0%	71.1%
7	Port Arthur, TX	$4.15	86.9%	13.1%	3.7%	74.8%
8	Mobile, AL	$3.54	43.6%	56.4%	3.2%	77.9%
9	Lake Charles, LA	$3.52	79.6%	20.4%	3.1%	81.1%
10	Freeport, TX	$3.18	78.3%	21.7%	2.8%	83.9%
	Total Gulf Coast	$111.83				
Rank	**Pacific Coast**	**$Billions**	**% Imports**	**% Exports**	**Market Share of Regional Value**	**Cumulative Share**
1	Long Beach, CA	$86.95	73.2%	26.8%	32.2%	32.2%
2	Los Angeles, CA	$72.82	78.3%	21.7%	27.0%	59.2%
3	Seattle, WA	$34.08	66.0%	34.0%	12.6%	71.8%
4	Oakland, CA	$26.83	59.3%	40.7%	9.9%	81.7%
5	Tacoma, WA	$20.56	77.5%	22.5%	7.6%	89.4%
6	Portland, OR	$9.47	41.8%	58.2%	3.5%	92.9%
7	Hueneme, CA	$2.65	89.1%	10.9%	1.0%	93.8%
8	Carquinez Strait, CA	$2.27	39.4%	60.6%	0.8%	94.7%
9	Vancouver, WA	$1.65	27.1%	72.9%	0.6%	95.3%
10	Kalama, WA	$1.24	2.0%	98.0%	0.5%	95.8%
	Total Pacific Coast	$269.97				
Rank	**Great Lakes**	**$Billions**	**% Imports**	**% Exports**	**Market Share of Regional Value**	**Cumulative Share**
1	Detroit, MI	$1.67	55.4%	44.6%	25.8%	25.8%
2	Duluth-Superior, MN & WI	$1.26	22.9%	77.1%	19.5%	45.2%
3	Chicago, IL	$0.92	69.8%	30.2%	14.2%	59.5%
4	Toledo, OH	$0.73	39.0%	61.0%	11.2%	70.7%
5	Cleveland, OH	$0.46	96.6%	3.4%	7.1%	77.8%
6	Buffalo, NY	$0.21	58.1%	41.9%	3.3%	81.0%
7	Burns Waterway, MI	$0.21	77.9%	22.1%	3.2%	84.2%
8	Ashtabula, MI	$0.20	41.4%	58.6%	3.1%	87.3%
9	Milwaukee, WI	$0.15	71.7%	28.3%	2.3%	89.6%
10	Sandusky, OH	$0.09	0.7%	99.3%	1.4%	91.0%
	Total Great Lakes	$6.48				

Source: PMCL analysis of data from the Waterborne Commerce Statistics Center, 1996

factured goods such as cars, machinery and containers of consumer goods. Based on value, almost half of all cargo handled at Detroit is exports.

Table V-25 ranks U.S. ports along each coastline by tonnage and value. A map of the top tonnage ports and top value ports by coastal region was used to compile an inventory of "key" U.S. ports. Ports listed are among the top ten ports in terms of tonnage or value. These ports account for the majority of trade within each coastal region, and will be the focus of further analysis in this study.[27]

TABLE V-25

KEY U.S. PORTS BY CARGO TONNAGE, VALUE AND COASTAL REGION

Coastal Region/Port	Regional Rank		Coastal Region/Port	Regional Rank	
Atlantic Coast	**Tonnage**	**Value**	**Pacific Coast**	**Tonnage**	**Value**
New York/New Jersey	1	1	Long Beach, CA	1	1
Norfolk Harbor, VA	2	3	Los Angeles, CA	2	2
Baltimore, MD	3	4	Seattle, WA	3	3
Philadelphia, PA	4	9	Portland, OR	4	6
Caribbean Islands	5	14	Tacoma, WA	5	5
Newport News, VA	6	13	Oakland, CA	6	4
Paulsboro, NJ	7	17	Kalama, WA	7	10
Savannah, GA	8	6	Vancouver, WA	8	9
Portland, ME	9	19	Richmond, CA	9	11
Charleston, SC	10	2	Barbers Point, HI	10	15
Miami, FL	16	5	Hueneme, CA	31	7
Port Everglades, FL	12	7	Carquinez Strait, CA	11	8
Jacksonville, FL	13	8			
Wilmington, NC	19	10			
Market Share of Atlantic Coast Cargo	78.1%	87.5%	Market Share of Pacific Coast Cargo	77.8%	96.5%
Gulf Coast	**Tonnage**	**Value**	**Great Lakes**	**Tonnage**	**Value**
Houston, TX	1	1	Duluth - Superior, MN & WI	1	2
Port of South Louisiana, LA	2	3	Detroit, MI	2	1
Corpus Christi, TX	3	4	Toledo, OH	3	4
New Orleans, LA	4	2	Chicago, IL	4	3
Baton Rogue, LA	5	5	Cleveland, OH	5	5
Texas City, TX	6	6	Ashtabula, MI	6	8
Port Arthur, TX	7	7	Sandusky, OH	7	10
Lakes Charles, LA	8	9	Burns Waterway, IN	8	7
Mobile, AL	9	8	Conneaut, OH	9	11
Plaquemine, LA	10	14	Calcite, MI	10	18
Freeport, TX	12	10	Buffalo, NY	14	6
			Milwaukee, WI	11	9
Market Share of Gulf Coast Cargo	85.8%	87.4%	Market Share of Great Lakes Cargo	84.1%	91.4%

Source: PMCL analysis of data from the Waterborne Commerce Statistics Center, 1996

[27] Characterizing infrastructure and cargo handling facilities at deep draft ports in the United States is a component of this study. See Chapter VII for a discussion of infrastructure at the ports listed in Table V-25

COMMODITY FLOW BY TRADE ROUTE

Selection of foreign ports presented in this sub-section entailed collecting data for world ports recorded as handling U.S. import or exports in 1996. The term foreign "port" initially comprised any foreign area with a Corps of Engineers waterborne commerce port code, including terminals and locations on the high seas. Also included were many smaller ports located within a country or region. These were aggregated and defined as a specific entity such as "All other Brazilian Ports." Once the universe of foreign ports was defined, the 100 ports that received the most U.S. cargo in terms of tonnage were identified. Next, a similar list of the 100 foreign "ports" that handled the most cargo value destined for the U.S. were identified. These two lists were combined and resorted, and duplicate entries were added in opposite directions to create a list of 175 of the most significant foreign ports or port areas that trade with the U.S. As noted above, the list of the 175 top foreign ports includes records that are not single port entities, but fall under an aggregate port category. Although aggregate "ports" may represent important points of entry and exit for U.S. foreign waterborne commerce, individual ports or terminals that comprise an aggregate port category may be relatively insignificant. As a result, a list of individual ports that handle more than one million metric tons of U.S. cargo was generated from the total list.[29]

Table V-26 presents the top 50 foreign ports ranked by tonnage of U.S. trade. These ports handle about 672 million metric tons of U.S. imports and exports–nearly 65 percent of all U.S. foreign trade. As shown in Figure V-13, cargo is highly concentrated within several large ports. Fifty foreign ports handle 43 percent of U.S. trade and ten handle about 19 percent. Of the top ten, two are in Asia, two are in Europe, one is in Saudi Arabia and the others are located in Latin America. Table V-27 presents the top 50 foreign ports engaged in U.S. trade in terms of commodity value. As is the case in the United States, value-based trade is highly concentrated among several foreign ports (see Figure V-14). For example, 20 foreign ports handle about one half of all U.S. foreign trade, and 10 account for about 38 percent. In total, 50 foreign ports handle nearly 66 percent of U.S. cargo. Based on value, most foreign ports that handle high volumes of U.S. trade are in Europe and Asia. Hong Kong and Tokyo alone account for almost 15 percent in terms of value–about $90 billion.

[29] See Appendix C (Table C-1) for a list of ports that includes aggregate location, and see Table C-2 for a list of individual ports. Data used to generate these lists are those of the Corps of Engineers Waterborne Commerce Statistics Center.

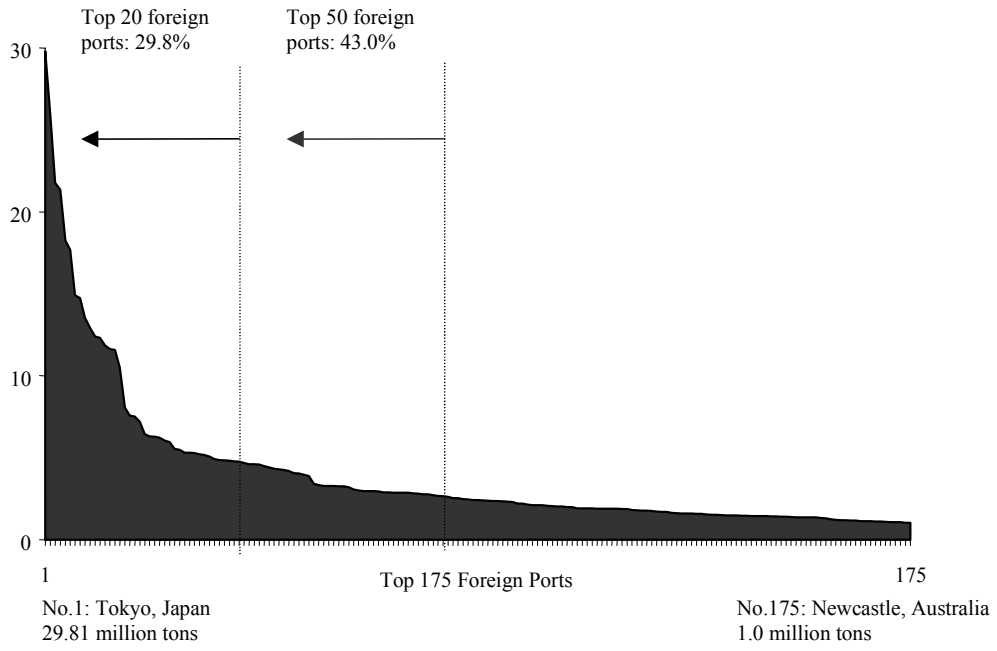


Figure V-13. Cargo Distribution at the Top 175 Foreign Ports: 1996 (millions of metric tons)

Source: PMCL analysis of Waterborne Commerce Statistics Center, 1996

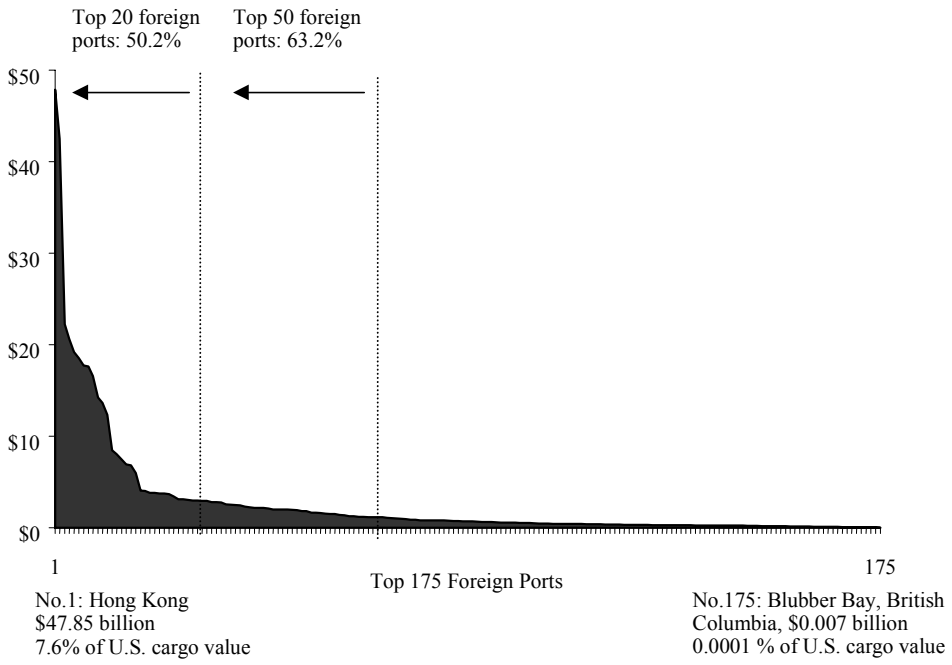


Figure V-14. Cargo Distribution at the Top 175 Foreign Ports: 1996 ($ billions)

Source: PMCL analysis of Waterborne Commerce Statistics Center, 1996

TABLE V-26

TOP 50 FOREIGN PORTS HANDLING U.S. CARGO: 1996 (MILLIONS OF METRIC TONS)

Rank	Port	Nation	World Region	Tonnage (millions of metric tons)	Market Share of U.S. Cargo	Cumulative Market Share
1	Tokyo	Japan	Asia	29.81	2.9	2.9
2	Puerto la Cruz	Venezuela	South America	25.86	2.5	5.4
3	Cayo Arcas	Mexico	North America	21.76	2.1	7.5
4	Ras Tanura	Saudi Arabia	Mid-East	21.37	2.1	9.6
5	Pajaritos	Mexico	North America	18.26	1.8	11.3
6	Rotterdam	Netherlands	Europe	17.68	1.7	13.0
7	Kaohsuing	Taiwan	Asia	14.91	1.4	14.5
8	Dos Bocas	Mexico	North America	14.74	1.4	15.9
9	Puerto Miranda	Venezuela	South America	13.54	1.3	17.2
10	Antwerp	Belgium	Europe	12.91	1.2	18.5
11	Kobe	Japan	Asia	12.40	1.2	19.7
12	Hong Kong	China	Asia	12.31	1.2	20.8
13	Amuay Bay	Venezuela	South America	11.84	1.1	22.0
14	La Salina	Venezuela	South America	11.63	1.1	23.1
15	Inchon	South Korea	Asia	11.57	1.1	24.2
16	Busan	South Korea	Asia	10.50	1.0	25.2
17	Sullom Voe	UK	Europe	8.07	0.8	26.0
18	Escravos Oil Terminal	Nigeria	Africa	7.57	0.7	26.8
19	Cabinda	Angola	Africa	7.51	0.7	27.5
20	Kwa Ibo	Nigeria	Africa	7.19	0.7	28.2
21	Cape Lopez	Gabon	Africa	6.44	0.6	28.8
22	Vera Cruz	Mexico	North America	6.30	0.6	29.4
23	Singapore	Singapore	Asia	6.28	0.6	30.0
24	Mongstad	Norway	Europe	6.22	0.6	30.6
25	Seven Islands, Quebec	Canada	North America	6.05	0.6	31.2
26	Yokohama	Japan	Asia	5.96	0.6	31.8
27	Saint John NB	Canada	North America	5.53	0.5	32.3
28	Cozumel Island	Mexico	North America	5.48	0.5	32.8
29	Shanghai	China	Asia	5.31	0.5	33.4
30	Forcados	Nigeria	Africa	5.30	0.5	33.9
31	Arzew	Algeria	Africa	5.28	0.5	34.4
32	Darien	China	Asia	5.21	0.5	34.9
33	Esmeraldas	Ecuador	South America	5.17	0.5	35.4
34	Tubarao	Brazil	South America	5.06	0.5	35.9
35	Alexandria	Egypt	Mid-East	4.92	0.5	36.3
36	Goto Oil	Neth. Antilles	North America	4.85	0.5	36.8
37	Nanticoke, Ontario	Canada	North America	4.84	0.5	37.3
38	Bajo Grande	Venezuela	South America	4.81	0.5	37.7
39	Amsterdam	Netherlands	Europe	4.78	0.5	38.2
40	Quebec	Canada	North America	4.76	0.5	38.7
41	Hamilton, Ontario	Canada	North America	4.69	0.5	39.1
42	Vieux Fort	Anguilla	North America	4.61	0.4	39.6
43	Taichung	Taiwan	Asia	4.61	0.4	40.0
44	Vancouver, British Columbia	Canada	North America	4.58	0.4	40.5
45	Keelung	Taiwan	Asia	4.48	0.4	40.9
46	Genoa	Italy	Europe	4.40	0.4	41.3
47	Bonny	Nigeria	Africa	4.33	0.4	41.7
48	Santos	Brazil	South America	4.28	0.4	42.2
49	Sault Ste. Marie Ontario	Canada	North America	4.26	0.4	42.6
50	Nagoya	Japan	Asia	4.19	0.4	43.0
	Total Top 50 Ports			444.41	43.0%	
	Total Top 175 Ports			700.71	67.8%	

Source: Waterborne Commerce Statistics Center, 1996

TABLE V-27

TOP 50 FOREIGN PORTS HANDLING U.S. CARGO: 1996 ($ BILLIONS)

Rank	Foreign Port	Country	World Region	Commodity Value ($U.S. billions)	Market Share of U.S. Cargo	Cumulative Market Share
1	Hong Kong	China	Asia	$47.85	7.6	7.6
2	Tokyo	Japan	Asia	$42.48	6.8	14.4
3	Antwerp	Belgium	Europe	$22.23	3.5	17.9
4	Busan	South Korea	Asia	$20.61	3.3	21.2
5	Bremerhaven	Germany	Europe	$19.20	3.1	24.3
6	Yokohama	Japan	Asia	$18.52	3.0	27.2
7	Nagoya	Japan	Asia	$17.75	2.8	30.1
8	Kaohsuing	Taiwan	Asia	$17.62	2.8	32.9
9	Rotterdam	Netherlands	Europe	$16.55	2.6	35.5
10	Kobe	Japan	Asia	$14.21	2.3	37.8
11	Singapore	Singapore	Asia	$13.59	2.2	40.0
12	Keelung	Taiwan	Asia	$12.31	2.0	41.9
13	Felixstowe	UK	Europe	$8.45	1.3	43.3
14	Le Havre	France	Europe	$8.03	1.3	44.5
15	Osaka	Japan	Asia	$7.44	1.2	45.7
16	Shanghai	China	Asia	$6.91	1.1	46.8
17	Toyohashi	Japan	Asia	$6.82	1.1	47.9
18	Bangkok	Thailand	Asia	$5.95	1.1	49.0
19	Santos	Brazil	South America	$4.05	0.9	50.0
20	Manila	Philippines	Asia	$3.98	0.6	50.6
21	Hamburg	Germany	Europe	$3.78	0.6	51.2
22	Puerto Cortes	Honduras	South America	$3.77	0.6	51.8
23	Melbourne	Australia	Australia	$3.73	0.6	52.4
24	Buenos Aires	Argentina	South America	$3.72	0.6	53.0
25	Djakarta	Indonesia	Asia	$3.67	0.6	53.6
26	Santo Tomas	Guatemala	South America	$3.42	0.6	54.2
27	Puerto la Cruz	Venezuela	South America	$3.22	0.5	54.8
28	Bremen	Germany	Europe	$3.10	0.5	55.3
29	Inchon	South Korea	Asia	$3.08	0.5	55.8
30	Judda	Saudi Arabia	Mid East	$3.04	0.5	56.3
31	Sydney	Australia	Australia NZ	$3.00	0.5	56.7
32	Gothenburg	Sweden	Europe	$2.96	0.5	57.2
33	Ras Tanura	Saudi Arabia	Mid East	$2.93	0.5	57.7
34	La Spezia	Italy	Europe	$2.91	0.5	58.2
35	Shimizu	Japan	Asia	$2.90	0.5	58.6
36	Haifa	Israel	Mid East	$2.77	0.5	59.1
37	Pajaritos	Mexico	North America	$2.76	0.5	59.6
38	Jaina	Dominican Repub.	North America	$2.75	0.4	60.0
39	Genoa	Italy	Europe	$2.52	0.4	60.4
40	Port Kelang	Malaysia	Asia	$2.51	0.4	60.9
41	Hamble	UK	Europe	$2.46	0.4	61.3
42	Cayo Arcas Terminal	Mexico	North America	$2.45	0.4	61.7
43	Puerto Limon	Costa Rica	North America	$2.29	0.4	62.1
44	Liverpool	UK	Europe	$2.23	0.4	62.5
45	Chiba	Japan	Asia	$2.17	0.4	62.9
46	Taichung	Taiwan	Asia	$2.16	0.4	63.3
47	Penang	Malaysia	Asia	$2.13	0.4	63.6
48	Rio de Janeiro	Brazil	South America	$2.13	0.4	64.0
49	Livorno	Italy	Europe	$2.08	0.3	64.3
50	Alexandria	Egypt	Mid East	$2.01	0.3	64.7
	Total Top 50 Ports			$399.21	64.7%	
	Total Top 175 Ports			465.20	74.8%	

Source: Waterborne Commerce Statistics Center, 1996

Tables V-28 and V-29 display the predominant types of commodities handled at several leading foreign ports. Ports listed on Table V-29 are not all ranked in the top five in terms of tonnage. Ports such as Puerto La Cruz (Venezuela), Cayo Arca Terminal (Mexico) and Ras Tanura (Saudi Arabia) rank higher; however, virtually all of the cargo handled by these facilities is crude petroleum. In general, top tonnage ports in Latin America, Africa and the Mid-East are exporters of crude petroleum.

Leading ports in Europe and Asia handle a variety of cargoes. At Tokyo, Kobe and Kaohsiung, exports from the United States in terms of weight are mainly bulk raw materials such as agricultural commodities and residual petroleum products. Based on weight, nearly 5 percent of all U.S. exports are shipped to Tokyo. Nearly 20 percent of all U.S. grain and about 13 percent of oil seeds are shipped to Tokyo. Inbound cargo from Tokyo, Kobe and Kaohsiung tend to be high-value manufactured commodities such as automobile parts and other types of machinery and equipment. About 15 percent of imported automobile parts and furniture originate in Tokyo and Kaohsiung. Based on tonnage, exports to European ports such as Rotterdam and Antwerp are also predominantly bulk goods including coal, residual petroleum products, organic chemicals and animal feed. Rotterdam is the destination of approximately five percent of U.S. coal and 10 percent of animal feed and organic chemicals. Almost 10 percent of synthetic resins are shipped to Antwerp. Nearly one-third of all imported beverages to the U.S., including beer and wine, originate in Rotterdam and Antwerp. About 7 percent of imported iron and steel come from Antwerp when measured by weight.

Based on dollar value, Hong Kong and Tokyo are the top-ranked foreign ports. U.S. exports to Hong Kong are primarily higher value bulk, manufactured and agricultural commodities. Hong Kong is the destination of slightly more than 10 percent of communications equipment, paper and synthetic resins (including plastics). Eight percent of U.S. meat and dairy products are shipped to Hong Kong, and 20 percent goes to Tokyo.[30] Almost 25 percent of all U.S. exports of leather products are shipped to Busan, South Korea. Significant amounts of imports to the U.S. originate at the top Asian ports when measured in dollars. Nearly 43 percent of glass and non-metallic manufactured goods ("other manufactured, nec."), 45 percent of imported footwear and 22 percent of apparel come from Hong Kong. Antwerp, Belgium and Bremerhaven, Germany, are major foreign ports for U.S. trade in terms of value. Bremerhaven is the destination of about 15 percent of drugs and medicine and almost 11 percent of U.S. automobile exports. Likewise, nearly 15 percent of imported automobiles originate in Bremerhaven. Europeans are voracious consumers of U.S. tobacco, and nearly 30 percent of U.S. tobacco is shipped to the Port of Antwerp.

[30] Asian nations, particularly Hong Kong and Japan, are grappling with substantial geographical constraints. In Japan, the availability of arable land is steadily receding, and at the same time, Japanese consumers have increased meat consumption. With limited production capacity and high demand, Japan is one of the world's largest importers of meat products.

TABLE V-28

TOP FIVE U.S. IMPORTS AND EXPORTS AT MAJOR FOREIGN PORTS ENGAGED IN U.S. TRADE: 1996 (MILLIONS OF METRIC TONS)

U.S. Exports	Tonnage	% of U.S. Exports	U.S. Imports	Tonnage	% of U.S. Imports
Tokyo, Japan					
Grain	16.27	18.8	Parts of Motor Vehicles	0.34	14.6
Oil Seeds	3.12	12.9	Other Manufacturing, nec.	0.17	6.2
Coal	1.94	2.49	Motor Vehicles	0.17	5.9
Cork and Wood	0.96	4.7	Metal Products	0.16	5.8
Animal Feed	0.89	5.5	Synthetic Resins	0.15	9.1
Total Tonnage: Top 5 Commodities	23.17	5.7	Total Tonnage: Top 5 Commodities	0.99	0.16
Total Tonnage: U.S. Exports to Tokyo	27.09	6.6	Total Tonnage: U.S. Imports from Tokyo	2.72	0.44
Rotterdam, Holland					
Coal	4.24	5.3	Petroleum Refineries	0.70	0.9
Animal Feed	1.65	10.2	Beverages	0.65	23.9
Oil Seeds	1.65	6.8	Organic Chemicals	0.57	6.2
Organic Chemicals	1.05	8.6	Iron and Steel	0.41	1.5
Residual Petroleum Products	1.02	4.6	Crude Petroleum	0.27	0.1
Total Tonnage: Top 5 Commodities	9.60	2.3	Total Tonnage: Top 5 Commodities	2.60	0.4
Total Tonnage: U.S. Exports to Rotterdam	13.54	3.3	Total Tonnage: U.S. Imports from Rotterdam	4.14	0.7
Kaohsiung, Taiwan					
Grain	3.54	4.1	Metal Products	0.61	22.3
Coal	2.04	2.5	Furniture and Fixtures	0.23	14.4
Organic Chemicals	1.43	11.7	Other Manufacturing, nec.	0.17	6.2
Oil Seeds	1.35	5.6	Iron and Steel	0.16	0.6
Refined Petroleum	0.75	3.0	Other Meat/Dairy/Fish/Fruit/Vegetables	0.13	6.2
Total Tonnage: Top 5 Commodities	9.11	2.2	Total Tonnage: Top 5 Commodities	1.30	0.2
Total Tonnage: U.S. Exports to Kaohsiung	12.09	3.0	Total Tonnage: U.S. Imports from Kaohsiung	2.82	0.5
Antwerp, Belgium					
Coal	2.66	3.3	Iron and Steel	1.80	6.7
Residual Petroleum Products	0.69	3.1	Petroleum Refineries	1.36	1.7
Organic Chemicals	0.62	5.1	Organic Chemicals	0.32	3.5
Synthetic Resins	0.52	8.6	Inorganic Chemicals	0.24	3.9
Ores	0.24	2.7	Beverages	0.19	7.0
Total Tonnage: Top 5 Commodities	4.74	1.2	Total Tonnage: Top 5 Commodities	3.91	0.6
Total Tonnage : U.S. Exports to Antwerp	7.34	1.8	Total Tonnage: U.S. Imports from Antwerp	5.57	0.9
Kobe, Japan					
Grain	2.44	2.8	Organic Chemicals	0.14	1.5
Residual Petroleum Products	2.01	9.1	Iron and Steel	0.10	0.4
Coal	1.90	2.4	Parts of Motor Vehicles	0.08	3.4
Cork and Wood	1.80	8.7	Machinery and Equipment, nec.	0.07	4.4
Animal Feed	0.59	3.7	Synthetic Resins	0.07	4.2
Total Tonnage: Top 5 Commodities	8.74	2.1	Total Tonnage: Top 5 Commodities	0.46	0.1
Total Tonnage: U.S. Exports to Kobe	11.48	2.8	Total Tonnage: U.S. Imports from Kobe	0.92	0.1

Source: Waterborne Commerce Statistics Center, 1996
nec. (not elsewhere classified)

TABLE V-29

TOP FIVE COMMODITIES AT MAJOR FOREIGN PORTS ENGAGED IN U.S. TRADE: 1996 ($ BILLIONS)

U.S. Exports	$ Billions	% of U.S. Exports	U.S. Imports	$ Billions	% of U.S. Imports
Hong Kong					
Synthetic Resins	1.1	10.6	Other Manufacturing, nec	7.6	42.2
Paper and Paperboard and Products	0.8	11.6	Apparel	5.9	21.9
Meat/Dairy/Fish	0.7	7.7	Footwear	4.8	45.7
Machinery and Equipment, nec.	0.5	4.0	Communications Equipment	2.3	17.0
Other Communications Equipment	0.3	11.6	Electrical Apparatus	1.9	23.7
Total Value: Top 5 Commodities	3.4	1.4	Total Value: Top 5 Commodities	22.6	5.8
Total Value: Exports to Hong Kong	8.7	3.7	Total Value: Imports from Hong Kong	39.2	10.1
Tokyo, Japan					
Grain	2.8	17.6	Office and Computing Machinery	3.4	17.3
Meat/Dairy/Fish	1.9	20.8	Parts of Motor Vehicles	3.1	18.9
Oil Seeds	0.9	12.5	Communications Equipment	2.6	19.2
Tobacco	0.9	13.6	Motor Vehicles	2.0	5.5
Inorganic Chemicals	0.7	19.2	Manufacturing.	1.8	10.0
Total Value: Top 5 Commodities	7.2	3.0	Total Value: Top 5 Commodities	12.9	3.3
Total Value: Exports to Tokyo	14.1	5.9	Total Value: Imports from Tokyo	28.4	7.3
Antwerp, Belgium					
Tobacco	1.9	28.8	Iron and Steel	1.1	9.1
Synthetic Resins	1.3	12.6	Special Industrial Machinery	0.9	9.6
Organic Chemicals	1.3	11.7	Motor Vehicles	0.9	2.5
Parts of Motor Vehicles	1.0	14.2	Organic Chemicals	0.8	10.1
Motor Vehicles	0.5	4.1	Machinery and Equipment, nec.	0.7	5.2
Total Value: Top 5 Commodities	5.9	2.5	Total Value: Top 5 Commodities	4.4	1.1
Total Value: Exports to Antwerp	12.2	5.1	Total Value: Imports from Antwerp	10.0	2.6
Busan, South Korea					
Machinery and Equipment.	1.1	8.8	Office and Computing Machinery	1.8	9.1
Engines and Turbines	0.6	13.9	Apparel	1.0	3.7
Synthetic Resins	0.5	4.8	Other Manufacturing	0.8	4.4
Meat/Dairy/Fish	0.5	5.5	Other Communications Equipment	0.7	5.2
Leather and Products	0.5	25.4	Textiles	0.5	7.6
Total Value: Top 5 Commodities	3.2	1.3	Total Value: Top 5 Commodities	4.9	1.3
Total Value: Exports to Busan	10.3	4.3	Total Value: Imports from Busan	10.4	2.7
Bremerhaven, Germany					
Motor Vehicles	1.3	10.7	Motor Vehicles	5.5	15.1
Machinery and Equipment	0.3	2.4	Special Industrial Machinery	1.4	14.9
Food, Cereals, Composite Products	0.2	5.2	Machinery and Equipment	1.0	7.4
Drugs and Medicines	0.2	14.8	Parts of Motor Vehicles	0.8	4.9
Special Industrial Machinery	0.2	2.3	Organic Chemicals	0.5	6.3
Total Value: Top 5 Commodities	2.1	0.9	Total Value: Top 5 Commodities	9.1	2.3
Total Value: Exports to Bremerhaven	4.8	2.0	Total Value: Imports from Bremerhaven	14.4	3.7

Source: Waterborne Commerce Statistics Center, 1996
nec. (not elsewhere classified)

Tables V-30 and V-31 summarizes trade routes on a regional basis. Along the Atlantic Coast, ten foreign ports account for 15 percent of cargo tonnage and about 30 percent of value. This reflects the wide range of commodity and vessel traffic at Atlantic Coast ports. A similar situation exists on the Gulf Coast, where the top foreign ports account for only about 30 percent of trade. Commodity flows are more concentrated along the Pacific Coast and Great Lakes. On the Great Lakes, almost 60 percent of trade occurs with only ten foreign ports based on tonnage and 40 percent in terms of on value. Along the Pacific Coast, 40 percent of tonnage and 65 percent of value follow ten trade routes to and from major Asian ports.

Locations of foreign ports for each coastal region are consistent with general patterns of trade. Based on tonnage, ports in South America (Amuay Bay, Venezuela), Africa (Escravos Oil terminal, Nigeria) and Europe (Sullom Voe, U.K.) are predominant. With the exception of Antwerp and Rotterdam, crude petroleum and petroleum products are the principal commodities handled by these ports. Although not as significant in terms of tonnage, Bremerhaven, Yokohama, Hong Kong, LeHavre and Felixstowe are important ports in terms of value. All are major container ports. On the Gulf Coast, nine of the top ten foreign ports are significant exporters of crude petroleum. Rotterdam, however, imports substantial amounts of agricultural products and chemicals from Gulf Coast ports. Based on value, Rotterdam ranks number one with about five percent of Gulf Coast trade. Along the Pacific Coast, almost 70 percent of cargo value and 45 percent of tonnage originates or terminates at ten Asian ports. Hong Kong accounts for 15 percent of cargo value. Tokyo is significant in terms of both value and tonnage. Based on weight, Tokyo handles nearly 10 percent of Pacific Coast tonnage and about 14 percent of value.

TABLE V-30

TOP 10 FOREIGN PORTS BY U.S. COASTAL RANGE (MILLIONS OF METRIC TONS)

Rank	Foreign Port Name	Country	World Region	Metric Tons (millions)	% of Regional Tonnage	Cumulative Percentage
Atlantic Coast						
1	Rotterdam	Netherlands	Europe	7.86	2.5%	2.5%
2	Escravos Oil Terminal	Nigeria	Africa	6.78	2.2%	4.7%
3	Cabinda	Angola	Africa	5.22	1.7%	6.4%
4	Cape Lopez	Gabon	Africa	4.99	1.6%	8.0%
5	Antwerp	Belgium	Europe	4.66	1.5%	9.5%
6	Vieux Fort	St. Lucia	North America	4.49	1.4%	10.9%
7	Amuay Bay	Venezuela	South America	3.89	1.2%	12.2%
8	Forcados	Nigeria	Africa	3.30	1.1%	13.2%
9	Saint John, NB	Canada	North America	3.07	1.0%	14.2%
10	Sullom Voe, UK	UK	United Kingdom	3.01	1.0%	15.2%
	Market Share of Top 10 Foreign Ports (Atlantic Coast Cargo)			47.28	15.2%	
	Market Share of Top 175 Foreign Ports (Atlantic Coast Cargo)			170.46	54.7%	
	Total Atlantic Coast Tonnage			311.64	100.0%	
Gulf Coast						
1	Puerto La Cruz	Venezuela	South America	22.59	4.5%	4.5%
2	Ras At Tannurah	Saudi Arabia	Saudi Arabia	18.88	3.8%	8.3%
3	Cayo Arcas	Mexico	North America	18.77	3.8%	12.1%
4	Tokyo	Japan	Asia	14.57	2.9%	15.0%
5	Pajaritos	Mexico	North America	13.10	2.6%	17.7%
6	Dos Bocas	Mexico	North America	11.98	2.4%	20.1%
7	La Salina	Venezuela	South America	9.24	1.9%	21.9%
8	Puerto Miranda	Venezuela	South America	8.20	1.6%	23.6%
9	Rotterdam	Netherlands	Europe	7.63	1.5%	25.1%
10	Kaohsiung	Taiwan	Asia	5.60	1.1%	26.2%
	Market Share of Top 10 Foreign Ports (Gulf Coast Cargo)			130.57	26.2%	
	Market Share of Top 175 Foreign Ports (Gulf Coast Cargo)			427.16	85.8%	
	Total Gulf Coast Tonnage			497.63	100.0%	
Pacific Coast						
1	Tokyo	Japan	Asia	12.73	9.4%	9.4%
2	Hong Kong	Hong Kong	Asia	9.64	7.1%	16.5%
3	Kobe	Japan	Asia	7.21	5.3%	21.8%
4	Kaohsiung	Taiwan	Asia	7.07	5.2%	27.1%
5	Busan	Korea	Asia	5.88	4.3%	31.4%
6	Inchon	Japan	Asia	4.82	3.6%	35.0%
7	Keelung	Taiwan	Asia	3.31	2.4%	37.4%
8	Singapore	Singapore	Asia	3.23	2.4%	39.8%
9	Yokohama	Japan	Asia	2.61	1.9%	41.7%
10	Nagoya	Japan	Asia	2.51	1.8%	43.6%
	Market Share of Top 10 Foreign Ports (Pacific Coast Cargo)			59.01	43.6%	
	Market Share of Top 175 Foreign Ports (Pacific Coast Cargo)			135.43	70.8%	
	Total Pacific Coast Tonnage			174.03	100.0%	
Great Lakes						
1	Nanticoke, Ontario	Canada	North America	4.84	11.3%	11.3%
2	Hamilton, Ontario	Canada	North America	4.49	10.5%	21.8%
3	Seven Islands, Quebec	Canada	North America	2.98	7.0%	28.8%
4	Sault Ste. Marie, Ontario	Canada	North America	2.84	6.6%	35.4%
5	Port Cartier, Quebec	Canada	North America	2.33	5.4%	40.9%
6	Quebec, Quebec	Canada	North America	1.85	4.3%	45.2%
7	Courtright, Ontario	Canada	North America	1.60	3.7%	48.9%
8	Windsor, Ontario	Canada	North America	1.20	2.8%	51.7%
9	Port Arthur, Ontario	Canada	North America	1.16	2.7%	54.4%
10	Antwerp	Belgium	Europe	0.92	2.2%	56.6%
	Market Share of Top 10 Foreign Ports (Great Lakes Cargo)			29.07	56.6%	
	Market Share of Top 175 Foreign Ports (Great Lakes Cargo)			42.80	67.9%	
	Total Great Lakes Tonnage			50.89	100.0%	

Source: Waterborne Commerce Statistics Center, 1996

TABLE V-31

TOP 10 FOREIGN PORTS BY U.S. COASTAL RANGE ($ BILLIONS)

Rank	Port	Nation	World Region	Tonnage	% of Regional Trade	Cumulative Percentage
Atlantic Coast						
1	Bremerhaven	Germany	Europe	$14.94	6.3%	6.3%
2	Antwerp	Belgium	Europe	$12.11	5.1%	11.3%
3	Rotterdam	Netherlands	Europe	$9.97	4.2%	15.5%
4	LeHavre	France	Europe	$6.45	2.7%	18.2%
5	Hong Kong	Hong Kong	Asia	$6.43	2.7%	20.9%
6	Felixstowe	UK	Europe	$6.07	2.5%	23.4%
7	Yokohama	Japan	Asia	$4.78	2.0%	25.4%
8	Santos	Brazil	South America	$4.49	1.9%	27.3%
9	Nagoya	Japan	Asia	$2.70	1.1%	28.4%
10	Buenos Aires	Argentina	South America	$2.69	1.1%	29.6%
	Market Share of Top 10 Foreign Ports (U.S. Atlantic Coast)			$70.62	29.6%	
	Market Share of Top 175 Foreign Ports (U.S. Atlantic Coast)			$147.14	61.6%	
	Total Atlantic Coast Cargo Value			$238.92	100.0%	
Gulf Coast						
1	Rotterdam	Netherlands	Europe	$4.19	3.7%	3.7%
2	Antwerp	Belgium	Europe	$3.71	3.3%	7.1%
3	Puerto La Cruz	Venezuela	South America	$2.97	2.7%	9.7%
4	Tokyo	Japan	Asia	$2.83	2.5%	12.3%
5	Ras At Tannurah	Saudi Arabia	Mid-East	$2.62	2.3%	14.6%
6	Cayo Arcas	Saudi Arabia	Mid-East	$2.16	1.9%	16.5%
7	Pajaritos	Mexico	North America	$2.06	1.8%	18.4%
8	Dos Bocas	Mexico	North America	$1.60	1.4%	19.8%
9	Vera Cruz	Mexico	North America	$1.42	1.3%	21.1%
10	Bremerhaven	Germany	Europe	$1.40	1.3%	22.3%
	Market Share of Top 10 Foreign Ports (U.S. Gulf Coast)			$24.97	22.3%	
	Market Share of Top 175 Foreign Ports (U.S. Gulf Coast)			$66.46	59.4%	
	Total Gulf Coast Cargo Value			$111.83	100.0%	
Pacific Coast						
1	Hong Kong	Hong Kong	Asia	$41.10	15.2%	15.2%
2	Tokyo	Japan	Asia	$36.33	13.5%	28.7%
3	Busan	Korea	Asia	$17.15	6.4%	35.0%
4	Nagoya	Japan	Asia	$14.34	5.3%	40.3%
5	Kaohsuing	Taiwan	Asia	$14.10	5.2%	45.6%
6	Yokohama	Japan	Asia	$12.24	4.5%	50.1%
7	Kobe	Japan	Asia	$11.00	4.1%	54.2%
8	Keelung	Taiwan	Asia	$10.46	3.9%	58.1%
9	Singapore	Singapore	Asia	$10.07	3.7%	61.8%
10	Osaka	Japan	Asia	$5.99	2.2%	64.0%
	Market Share of Top 10 Foreign Ports (U.S. Pacific Coast)			$172.78	64.0%	
	Market Share of Top 175 Foreign Ports (U.S. Pacific Coast)			$260.40	96.5%	
	Total Pacific Coast Cargo Value			$269.97	100.0%	
Great Lakes						
1	Antwerp	Belgium	Europe	$0.81	12.5%	12.5%
2	Port Cartier, Ontario	Canada	North America	$0.42	6.6%	19.1%
3	Port Arthur, Ontario	Canada	North America	$0.23	3.6%	22.7%
4	Nanticoke, Ontario	Canada	North America	$0.20	3.2%	25.9%
5	Ijmuiden	Netherlands	Europe	$0.19	2.9%	28.8%
6	Gand	Belgium	Europe	$0.16	2.5%	31.3%
7	Hamilton, Ontario	Canada	North America	$0.16	2.5%	33.8%
8	Comeau Bay, Quebec	Canada	North America	$0.15	2.3%	36.1%
9	Seven Islands, Quebec	Canada	North America	$0.13	2.0%	38.1%
10	Windsor, Ontario	Canada	North America	$0.12	1.9%	40.0%
	Market Share of Top 10 Foreign Ports (U.S. Great Lakes)			$2.59	40.0%	
	Market Share of Top 175 Foreign Ports (U.S. Great Lakes)			$4.08	62.9%	
	Total Great Lakes Cargo Value			$6.48	100.0%	

Source: Waterborne Commerce Statistics Center, 1996

CONCLUSION

Broad patterns of quantities and types of commodities that flow through particular regions of the United States are apparent. In terms of overall commodities, tonnage flows are dominated by imports of crude petroleum, refined petroleum, ores, minerals, and iron and steel. Primary tonnage exports are grains, coal and oil seeds. When measured by value, waterborne imports and exports are more diverse, and with the exception of crude petroleum, grain and chemicals, they consist of manufactured goods such as motor vehicles, machinery and equipment, and food products. Forecasts indicate that trade in most commodities will increase significantly in the first half of the 21st century. The only notable exception is an expected decline in exports of coal, ores and non-metallic crude minerals.

From a regional perspective, coasts in the U.S. are unique with respect to trading partners and types of goods handled. Ports along the Pacific Coast are major importers of manufactured commodities from nations in Asia including Japan, China, Korea, Hong Kong and Singapore. However, the Pacific Coast is a significant point of exit for U.S. agricultural products. Based on tonnage, slightly more than one-half of U.S. grain exports are shipped to nations in Asia via Pacific Coast ports. Overall, the Pacific Coast accounts for about 43 percent of foreign waterborne commerce when measured in dollars, but only about 17 percent in terms of tonnage. In the future, ports along the Pacific Coast such as Los Angeles, Long Beach, Tacoma, Vancouver, Kalama and Seattle will play a major role in trade with nations in Asia, particularly with respect to imported manufactured goods and exports of agricultural products.

Atlantic Coast ports handle a wide range of goods shipped mostly to and from Europe, Latin America and Africa, ranging from manufactured goods to bulk commodities such as coal. Europe is an important exporter of manufactured goods to the Atlantic Coast. However, Asia is increasingly becoming more important as some trade lanes to and from Asia shift to transatlantic routes via the Suez Canal. Ports including New York/New Jersey, Norfolk, Baltimore, Charleston, Savannah and Jacksonville are very likely to see container shipments from Asia increase as transatlantic trade routes to and from Asia and the Indian Subcontinent develop. Based on tonnage, important commodities include bulk goods such as refined and crude petroleum and coal. Atlantic Coast ports export about 68 percent of U.S. coal, and they import approximately 27 percent of crude petroleum and almost one-half of imported refined petroleum. In terms of total foreign waterborne trade, the Atlantic Coast handles nearly 38 percent of foreign waterborne trade based on value and 30 percent in terms of tonnage.

Gulf Coast ports are major importers and exporters of bulk commodities such as crude petroleum, chemicals and grain. Approximately 68 percent of imported crude petroleum flows through ports along the Gulf Coast, primarily from Mexico, the Mid-East, South America and Africa. Gulf Coast ports handle about 68 percent of grain exports. Gulf Coast ports will continue to serve their role as conduits to the Nation's heartland via the inland waterway system. Bulk commodities will likely dominate traffic. However, Gulf Coast ports can expect to see increasing amounts of container throughput as nations in South and Central America increase their roles as global manufacturing centers. This is particularly true for the Port of Houston and New Orleans.

Although they account for a relatively small share of tonnage and value on a national level, ports along the Great Lakes play a valuable role in trade with Canada. In terms of tonnage, ores, coal and non-metallic crude minerals are important commodities. Based on value, iron and steel imports from Europe and exports of grains and oil seeds are important commodities. Shipment of containerized commodities on the Great Lakes is minimal, comprising only about 0.1 percent of total U.S. containership trade in terms of both value and weight.

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VI. ORGANIZATION AND OPERATION OF THE WORLD MERCHANT FLEET

Trade creates demand for maritime transportation, and to meet this demand, entrepreneurs offer vessel space to those who are willing to pay. Thus, the ships that allow commodities to flow between nations represent the supply side of the maritime transportation market. The operational and physical characteristics of the world's supply of merchant ships are fundamental in the determination of dredging needs.

DEFINITION AND COMPOSITION OF THE WORLD FLEET

Cargo ships are commonly classified according to their size and the types of cargo they are designed to carry. Ship size is usually measured in terms of tonnage. Gross tonnage refers to the volume of all enclosed spaces on a vessel. Gross tonnage is the basis on which rules and safety regulations are applied to vessel operation. In addition, registration and port fees are often based on gross tonnage. Deadweight tonnage (DWT) is a more common commercial measure of a ship's size, and refers to the number of tons (2240 lbs.) of cargo, stores and bunkers (fuel and fuel storage) that a vessel can transport. In general, vessels that rate below 1,000 gross tons are not classified as commercial cargo carriers. Throughout the world today, about 25,000 ships are larger than 1,000 gross tons. Of these, about 15,000 form the majority of the world merchant fleet, *defined for the purposes of this report as all ships with drafts of greater than 20 feet (approximately 10,000 DWT).*

As discussed in Chapter IV of this document, cargo ships are also classified according to the type of goods they are designed to carry. The two broad categories include bulk vessels and general cargo vessels. Bulk vessels carry liquid or gaseous commodities and dry goods such as grains, ores and coal. Ships that haul liquid bulk cargo are referred to as tankers. Oil tankers haul crude and refined petroleum products, and "specialized" tankers carry chemicals or other liquid commodities. Ships that carry dry bulk cargo are commonly referred to as "dry bulk" vessels. Combination carriers are designed to transport either dry or liquid bulk cargo depending upon prevailing markets. General cargo vessels can include ships built to carry break-bulk freight, automobiles and refrigerated goods. Multipurpose ships are general cargo vessels designed to carry break bulk and containerized cargo, while break bulk ships–sometimes referred to as "tweendeck" vessels–are built to carry break bulk freight only. Containerships carry general cargo, but they are usually labeled as a distinct category of vessel. Figure VI-1 shows a general classification of ship types in the world merchant fleet. Each major category of vessel is discussed in detail in subsequent subsections.

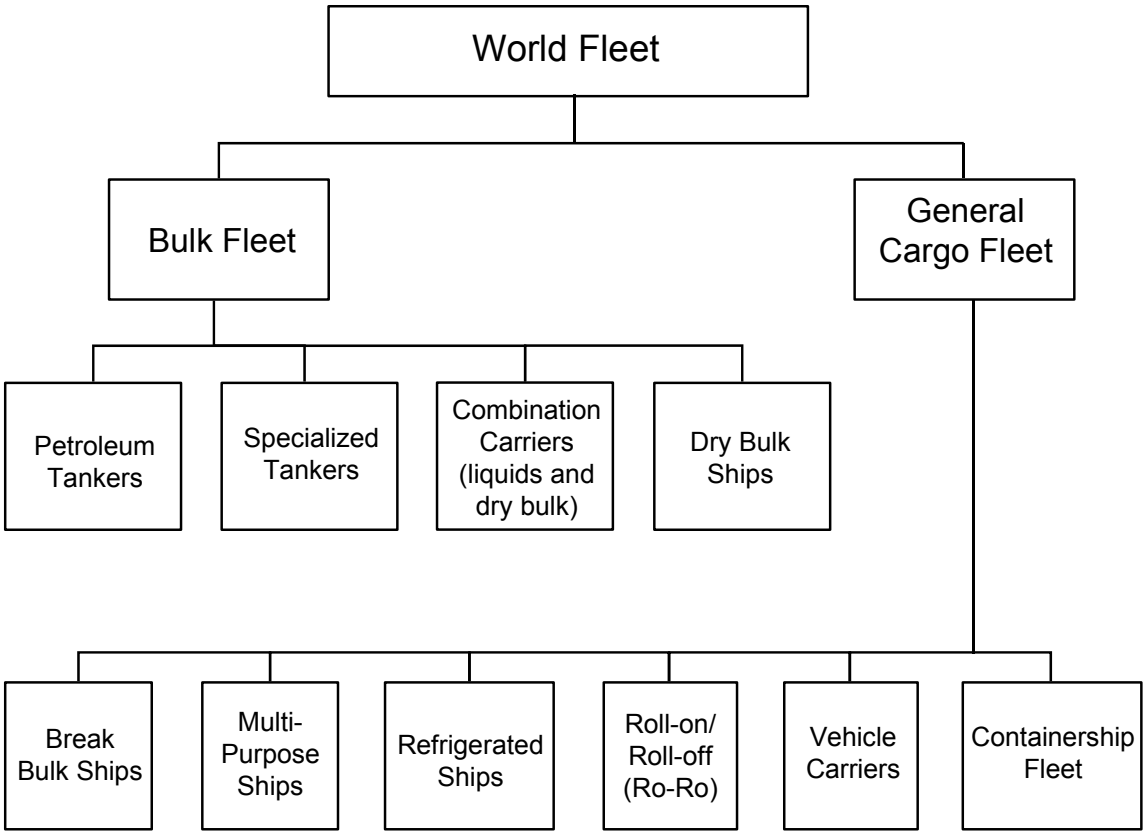


Figure VI-1. Classification of Vessels in the World Merchant Fleet

Figure VI-2 displays the cargo carrying capacity of the world fleet expressed in deadweight tonnage. Tankers and dry bulk vessels dominate the fleet's capacity. Tankers represent about 42 percent of DWT, while dry bulk vessels make up 37 percent. This is a direct result of the enormous international trade of crude petroleum, petroleum products and cargoes such as ores, grains and coal. General cargo vessels usually transport lower density commodities and make up a smaller portion of the fleet's capacity. Containerships account for about 6.9 percent, break bulk vessels make up around 3.3 percent, while automobile carriers have only a 0.7 percent share. Other vessel types are very specialized and fewer in number and comprise a small portion of the fleet.

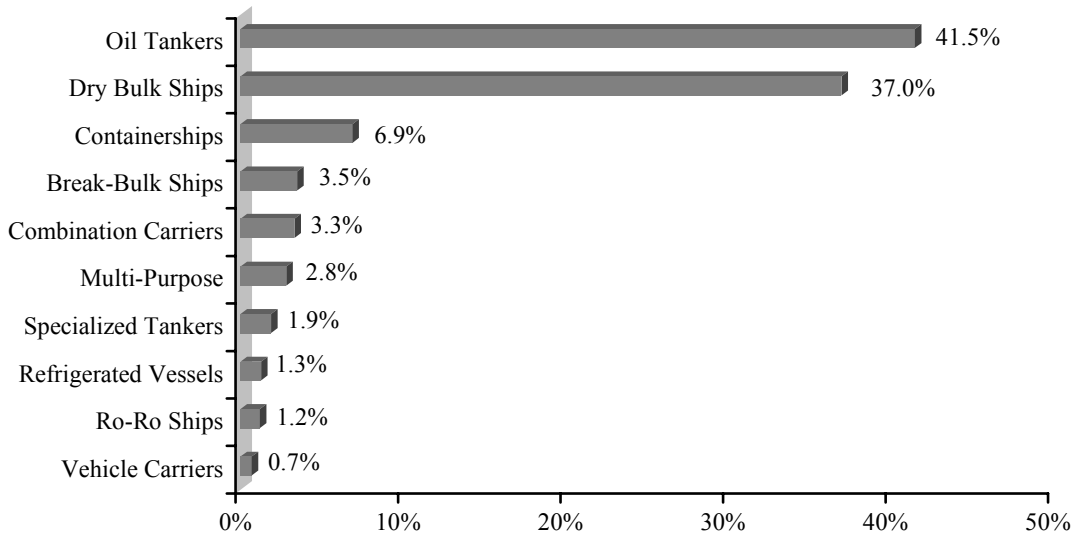


Figure VI-2. Tonnage Capacity of the World Merchant Fleet by Ship Type: 1999 (deadweight tons)

Source: WEFA Analysis of Clarkson Research Data

Types of vessels in the merchant fleet have changed through time as new ships emerge and older, obsolete vessels are scrapped. Ships are constructed to meet expected demand in the shipping market, and the capacity of the world fleet will continue to shift toward faster growing markets. Changes in fleet capacity have favored containerships, specialized tankers and automobile carriers rather than break bulk vessels and combination carriers. As shown in Figure VI-3, the capacity of the containership fleet has increased an average of 8.8 percent each year from 1985 to 1999. However, the capacity of the break bulk fleet has dropped by an average of 6.9 percent per year. The tonnage capacity of oil tankers has changed little over the past 14 years, averaging just 0.4 percent growth. In contrast, growth in specialized tankers has averaged 4.7 percent per year over the same period.

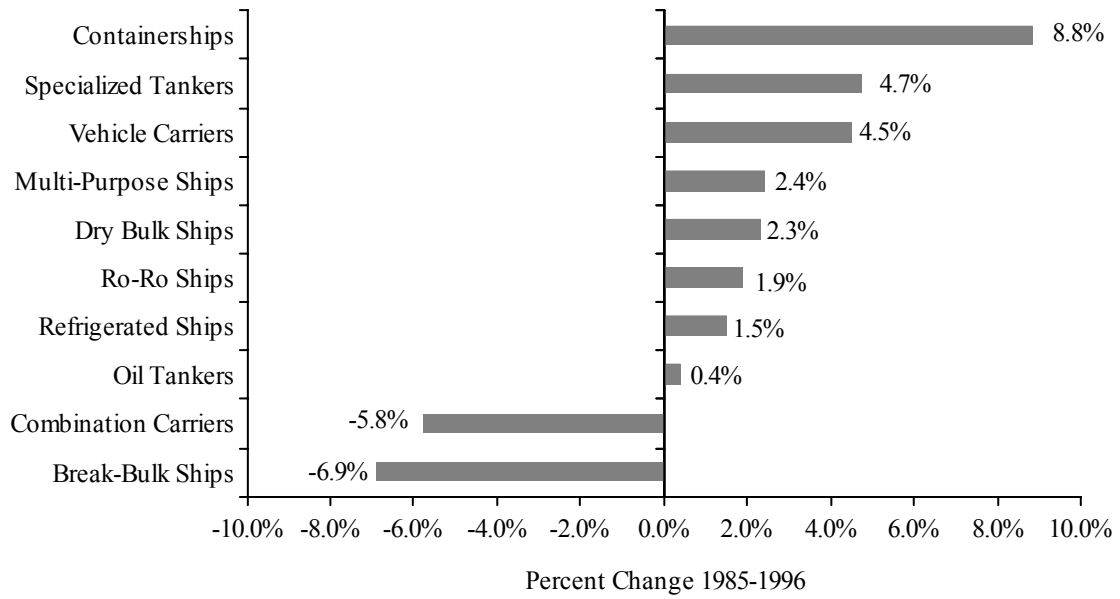


Figure VI-3. Average Annual Capacity Growth in the World Merchant Fleet by Ship Type: 1985 - 1999 (deadweight tons)

Source: WEFA Analysis of Clarkson Research Data

General Cargo Fleet

Of the types of general cargo ships, the most significant in terms of tonnage are break bulk and multipurpose vessels. The term "break bulk" is often used to denote the opposite of containerized cargo. Break bulk vessels, sometimes referred to as "general cargo" or "tweendeck" ships, load and unload bundled or palletized cargo one piece at a time with cranes. Traditional break bulk ships usually have several decks due to the wide range of cargo they handle and the number of ports they service. Most have smaller designs and are fitted with onboard cranes so they can access less advanced ports in developing nations.

From 1986 to 1996, the tonnage capacity of break bulk ships dropped from 42.2 to 22.9 million DWT, more than any other ship type. This trend is expected to continue, as construction of break bulk ships is less than the rate at which they are being scrapped. Other types of vessels such as containerships are faster and more economical, and break bulk vessels are being left with only smaller niche markets. Break bulk vessels that are being built are either very specialized or are designed to have the flexibility to carry a variety of different types of cargo.

Multipurpose vessels are designed to handle and stow a variety of freight, including break bulk cargo and containerized cargo. Although they are not a fast growing component of the

maritime shipping business, the role of multipurpose ships in filling niche markets is firmly established. The ability to carry both containers and break bulk cargo expands the range of commodities that a multipurpose vessel can transport and provides access to markets not available to containerships. For example, some multipurpose ships have heavy lift capabilities for transporting massive, awkwardly shaped items that cannot fit into containers, such as construction components for refineries, chemical processing or industrial plants. Today, there are 1,905 multipurpose ships in the world fleet, with an average age of 14.7 years. The tonnage capacity of the multipurpose fleet has been growing but more slowly than containerships. From 1985 to 1999, growth averaged 2.4 percent each year. In 1998, the capacity of the multipurpose fleet was 18.9 million DWT, which for the first time exceeded the tonnage capacity of the break bulk fleet.

Refrigerated vessels are equipped with cooling systems for carrying perishable commodities such as fruits, vegetables, meat and fish. The basic design of refrigerated ships is similar to that of break bulk vessels. Refrigerated ships have several decks with separate compartments for storing different types of cargo at various temperatures. Cargo spaces are insulated, normally with aluminum or galvanized steel, to help maintain desired temperatures. There are now 1,383 refrigerated vessels in the world fleet, with an average age of 17 years. Tonnage capacity of refrigerated vessels has been growing slowly. From 1985 to 1999, annual tonnage additions to the fleet have averaged only 1.5 percent. Many shippers (vessel customers) now prefer the more competitive rates and efficient services of containerships that can carry perishable items in refrigerated containers. Because of the high value and time sensitivity of perishable cargo, container carriers have targeted the refrigerated ship business with new designs. Today, reefer capacity aboard containerships exceeds the total capacity of the world refrigerated vessel fleet. In the future, containerships will likely gain more of the refrigerated market.[31] Nevertheless, conventional refrigerated ships should continue to be the most cost effective during peak seasonal demand for perishable cargo shipment. Thus, their future role in the world fleet is most likely assured, even if it diminishes somewhat.

Automobile carriers and Ro-Ro ships serve specific niche markets for motor vehicles and other wheeled cargo. Ro-Ro refers to a system of loading and unloading a ship whereby cargo is driven on and off ramps attached to the ship or pier. Low-density and special handling requirements of wheeled vehicles make this a profitable market. In general, the auto-carrier and Ro-Ro market is growing. The industry is consolidating, and competition is relatively limited. Capacity growth in the automobile carrier fleet has averaged 4.5 percent per year from 1985 to 1999. The Ro/Ro fleet is growing more slowly, averaging 1.9 percent per year.

Figures VI-4 and VI-5 demonstrate that the general cargo fleet is largely composed of relatively small vessels. About 64 percent of the cargo carrying capacity of the general cargo fleet is concentrated in vessels ranging from 10,000 to 20,000 DWT. In terms of the number of vessels, approximately 78 percent fall into the 10,000 to 20,000 DWT range. Vessels greater

[31] In 1999, Dole Fresh Fruit International introduced the first containership dedicated to carrying only refrigerated containers. The *Dole Chile* has a capacity of 2,046 TEUs and features two onboard gantry cranes that give it an advantage at less developed ports in South America where the ships will be used to transport bananas to North America. See, "Fairplay: The International Shipping Weekly." Vol. 337, Issue 6064, p. 63, November 11, 1999.

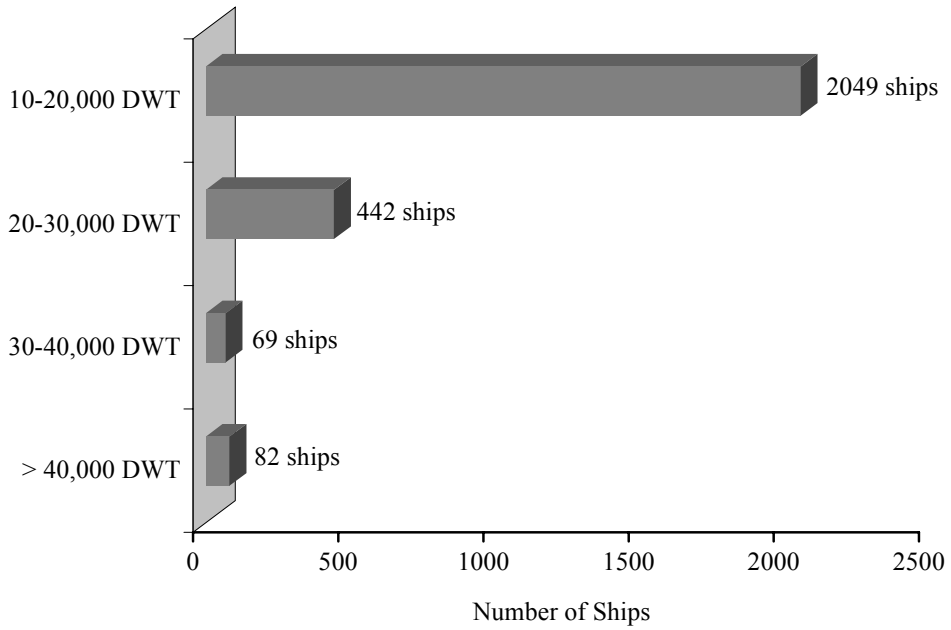
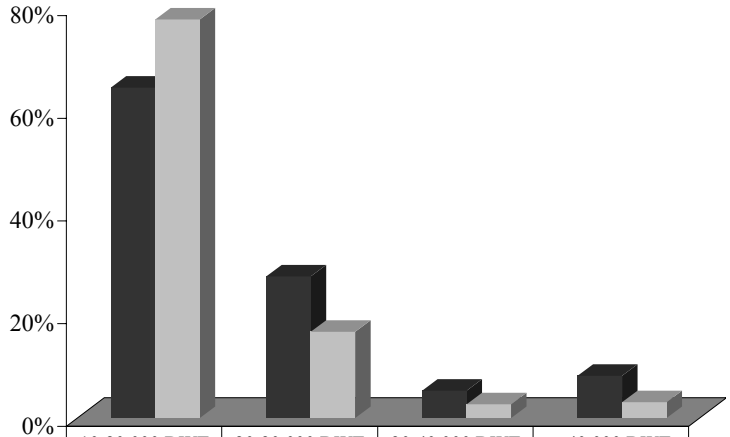


Figure VI-4. Number of Ships in the World General Cargo Fleet by Size Range: 1999 (deadweight tons)

Source: PMCL analysis of data from the Fairplay Ships Register



	10-20,000 DWT	20-30,000 DWT	30-40,000 DWT	> 40,000 DWT
Share of General Cargo Fleet Capacity (% of DWT)	64.3%	27.5%	5.3%	8.2%
Number of Ships (% of General Cargo Fleet)	77.6%	16.7%	2.6%	3.1%

Figure VI-5. Distribution of Tonnage Capacity and Number of Vessels in the World General Cargo Fleet: 1999

Source: PMCL analysis of data from the Fairplay Ships Register

than 40,000 DWT occupy only about 8 percent of the general cargo fleet's capacity and around three 3 in terms of vessel number.

Tankers

Tankers carry liquid bulk cargo such as oil and chemicals. The two principal types include petroleum tankers and specialized tankers. Specialized tankers are ships that carry industrial chemicals, and ships equipped with specially-lined interiors that enable them to haul a variety of commodities such as molasses, wine and water. Petroleum tankers can be further categorized by vessels that carry crude oil and refined petroleum products ("product" tankers). Markets for liquid bulk products are well established, and with the exception of large crude oil and petroleum tankers, the average sizes of tankers are closely matched to the markets they serve. In general, specialized tankers are smaller than oil tankers.

Crude oil tankers are some of the largest cargo ships in the world. Construction of oil tankers peaked during the 1970s with the introduction of Ultra-Large Crude Oil Carriers (ULCCs). Since the 1970s, there has not been a trend toward larger oil tankers due to environmental and economic factors. With capacities of over 300,000 DWT, ULCCs are simply colossal. Consequently, they have very limited operational abilities both in ports and at sea–a factor that has contributed to several major oil spills around the world. The most infamous occurred when the *Exxon Valdez* ran aground in Alaska's Prince William Sound in 1989 and spilled over 11 million gallons of crude oil into the ocean. The spill in Alaska prompted the U.S. Congress to enacted pollution control legislation in 1990 that requires all tankers trading in the United States to have two steel hulls rather than one.[32] The grounding of the *Exxon Valdez* and its associated costs have influenced the construction of double-hulled tankers that are on average smaller than supertankers built in the 1970s. Collapse of oil prices in the 1980s also had a major impact on the cessation of ULCC construction. Declining oil prices could no longer justify the high capital and operational costs of ULCCs. Today, 52 ULCCs are operational, but none have been constructed in the past 14 years.

Product tankers ("Panamax" and "Handymax" class tankers) are smaller ships that carry petroleum from refineries to distribution points closer to end user markets.[33] Product tankers traditionally range in size from about 10,000 to 80,000 DWT. Today, there are 2,456 product tankers in the world fleet. The comparatively small size of product tankers results from general trading practices, end market volume limitations and the need to access storage facilities and refineries. Panamax and Handymax tankers are often used to transfer crude oil from large tankers that cannot enter harbors at U.S. ports because of draft constraints. Some developed countries, such as the U.S., are importing increasing amounts of refined petroleum rather than crude oil. However, markets for imports exist only to fill the unmet demand of domestic refining

[32] See Public Law 101-380, the Oil Pollution Act of 1990 (OPA 90). OPA 90 specifically states that single-hull tankers of 5,000 gross tons or more will be excluded from U.S. waters after 2010 unless they are equipped with a double bottom or double sides, in which case they may be permitted to trade to the United States through 2015, depending on their age. An exemption allows single-hull tankers trading in the United States to unload their cargo offshore at deepwater ports or in designated areas through 2015.

[33] "Panamax" refers to the largest sized vessels that can pass through the Panama Canal fully loaded (approximately 80,000 DWT). "Post-Panamax" are vessels that exceed the maximum dimensions of the Canal. Handymax tankers are similar to Panamax tankers, however they primarily transport petroleum products rather than crude petroleum.

capacity. In addition, environmental requirements for fuel quality in many countries limit foreign imports. In general, market limitations will restrict further growth in the product tanker fleet to rates that reflect growth in energy consumption.

Figure VI-6 displays the number of vessels in the tanker fleet as of 1999. Figure VI-7 compares the number of vessels in each size range and their cargo carrying capacity as a percentage of the tanker fleet. As shown, most of the tanker fleet capacity is concentrated in the larger ULCC and VLCCs (i.e. Very Large Crude Oil Carriers) class of tanker. These 438 vessels make up about only 12 percent of the tanker fleet by number of ships, but account for about 40 percent of tanker capacity. Handymax tankers with capacities of between 10,000 and 60,000 DWT are the smallest size category and make up 57 percent of the total tanker fleet in terms of number of ships, and about 20 percent of DWT capacity. Panamax tankers, 60,000 to 80,000 DWT, make up about 9 percent of ships, but only 7 percent of DWT. Aframax tankers ranging in size from 80,000 to 120,000 DWT comprise about 15 percent with 577 ships, and about 17 percent of DWT. Suezmax ships are the next-largest grouping, with sizes ranging from 120,000 to 200,000 DWT. They comprise 9 percent of the fleet with 321 ships, and 14 percent of capacity.[34]

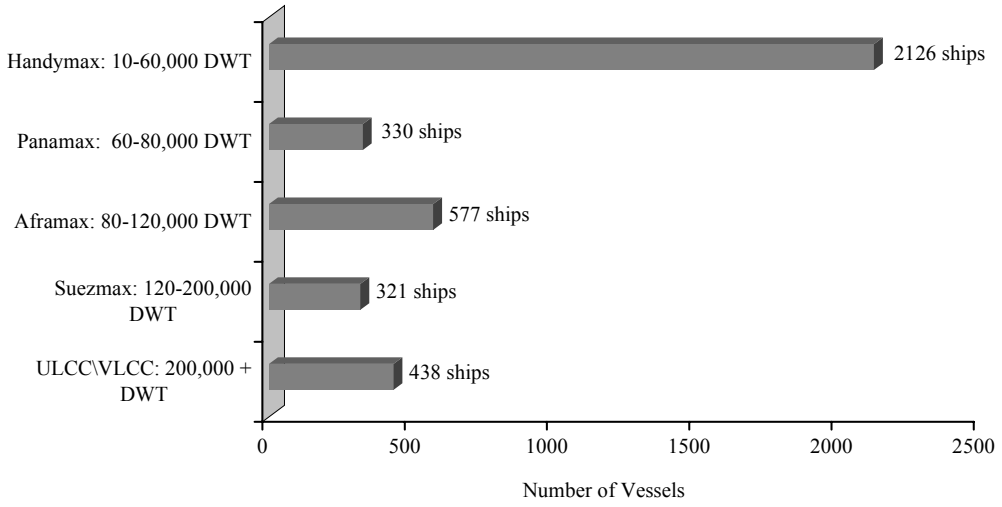
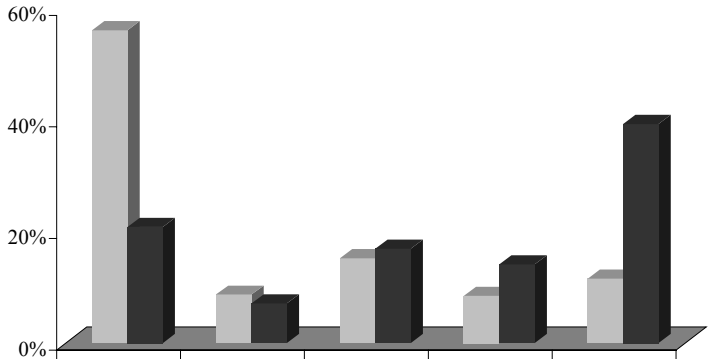


Figure VI-6. Number of Ships in the World Tanker Fleet by Size Range: 1999 (deadweight tons)

Source: PMCL analysis of data from the Fairplay Ships Register

[34] Aframax is an acronym referring to the Average Freight Rate Assessment as listed by Clarkson. "Suezmax" refers to the largest size vessel that can transit the Suez Canal fully loaded.



	10-60,000 DWT	60-80,000 DWT	80-120,000 DWT	120-200,000 DWT	> 200,000 DWT
Number of Ships (% of Tanker Fleet)	56.1%	8.7%	15.2%	8.5%	11.6%
Share of Tanker Fleet Capacity (% of DWT)	20.8%	7.1%	16.9%	14.1%	39.3%

Figure VI-7. Distribution of Tonnage Capacity and Number of Ships in the World Tanker Fleet: 1999

Source: PMCL analysis of data from the Fairplay Ships Register

Figure VI-8 displays the average age of the world tanker fleet according to tonnage capacity. The distribution of sizes across all size ranges of vessels reflects market demand for a wide size range of tankers, and suggests that there is not a trend toward large tankers. On average, the age of the entire tanker fleet is 14.7 years.

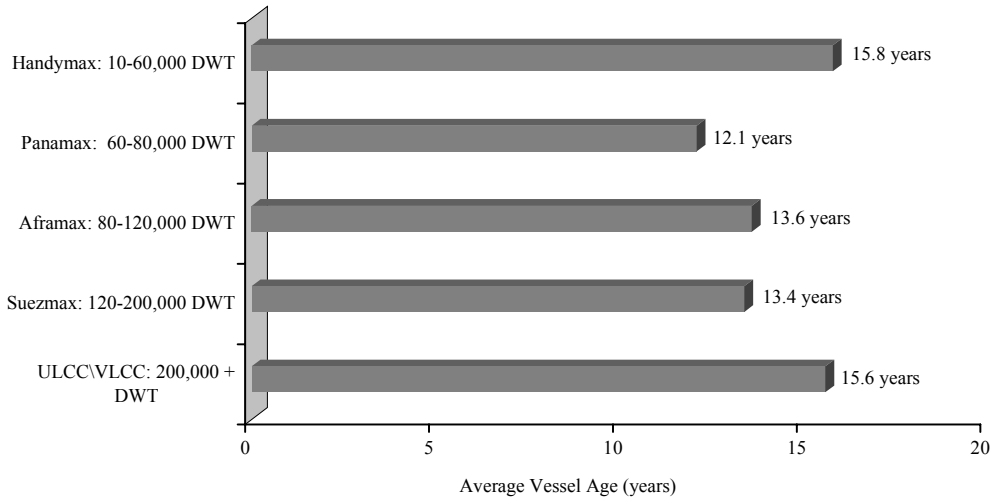


Figure VI-8. Average Age Distribution in Years of World Tanker Fleet by Ship Size Range: 1999 (deadweight tons)

Source: WEFA, Inc. Analysis of Clarkson Research Data

Dry Bulk and Combination Carriers

Dry bulk vessels are primarily designed to carry commodities such as ores, coal and grains. Other goods may include fertilizers, wood products, sugar and cement. In terms of deadweight tonnage, dry bulk vessels make up 37 percent of the world fleet, second only to tankers in capacity share. As shown in Figures VI-9 and Figure VI-10, ships of less than 80,000 DWT are most common in the dry bulk fleet. They comprise almost 70 percent of capacity and over 90 percent of the fleet in terms of vessel population. Panamax class bulk carriers are the largest ships that can navigate the Panama Canal and are commonly used to transport grain and other agricultural commodities across the Atlantic and Pacific Oceans. Most of the world's grain is shipped on vessels of less than 80,000 DWT. Small dry bulk vessels usually carry their own loading equipment and are able to service a wide range of cargo and ports. Larger vessels, greater than 80,000 DWT, are commonly used to transport commodities such as coal, ore and other minerals.

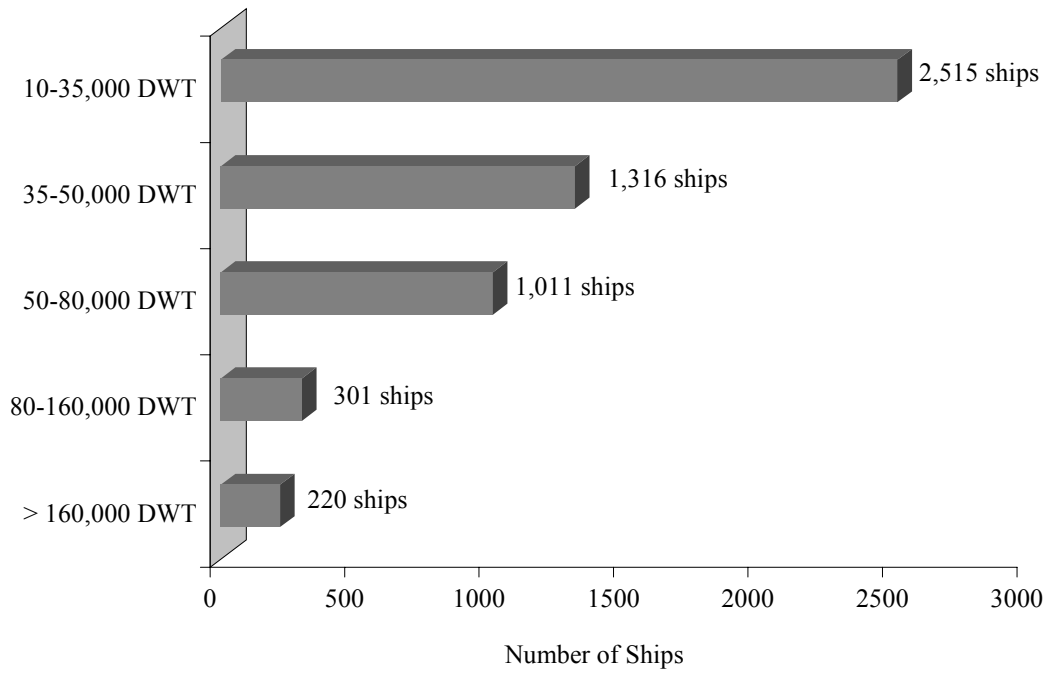
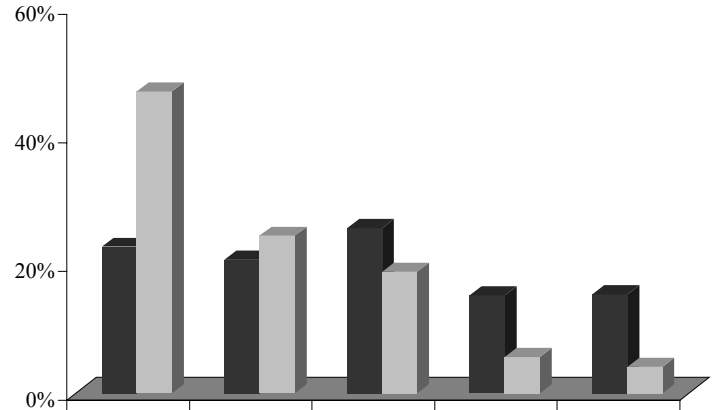


Figure VI-9. Number of Vessels in the World Dry Bulk Cargo Fleet by Ship Size: 1999 (deadweight tons)

Source: PMCL analysis of data from the Fairplay Ships Register



	10 - 35,000 DWT	35 - 50,000 DWT	50 - 80,000 DWT	80 - 160,000 DWT	> 160,000 DWT
Share of Dry Bulk Fleet Capacity (% of DWT)	22.8%	20.8%	25.7%	15.2%	15.4%
Number of Ships (% of Dry Bulk Fleet)	46.9%	24.5%	18.9%	5.6%	4.1%

Figure VI-10. Distribution of Tonnage Capacity and Number of Vessels in the Dry Bulk Fleet: 1999

Source: PMCL analysis of data from the Fairplay Ships Register

Figure VI-11 displays the age distribution of the dry bulk fleet. On average, dry bulk vessels are 14.3 years old. While the total capacity of the dry bulk fleet is more or less evenly distributed across different size ranges, the average age of each size range suggests a general trend toward larger vessels. On average, vessels larger than 160,000 DWT are about eight years old, and about 36 percent have been built since 1995. However, vessels in the smallest size category, less than 35,000 DWT, have an average age of around 17 years.

The dry bulk fleet includes a type of vessel referred to as a "combination carrier." These ships are hybrid vessels that can carry either dry or liquid bulk cargo. Combination carriers are designed to take advantage of temporary differentials in liquid and dry bulk rates and carry the commodity that offers greater returns. Today, combination carriers are in decline. From 1985 to 1999, the capacity of the combination carrier fleet declined an average of 5.8 percent per year. This trend is expected to continue, as there are few markets where dual-use bulk capability is profitable. In addition, because of their design, combination carriers are not cost effective in carrying strictly liquid or dry bulk commodities. Currently, there are 156 combination carriers in the fleet, and since 1989, 22 have been built.

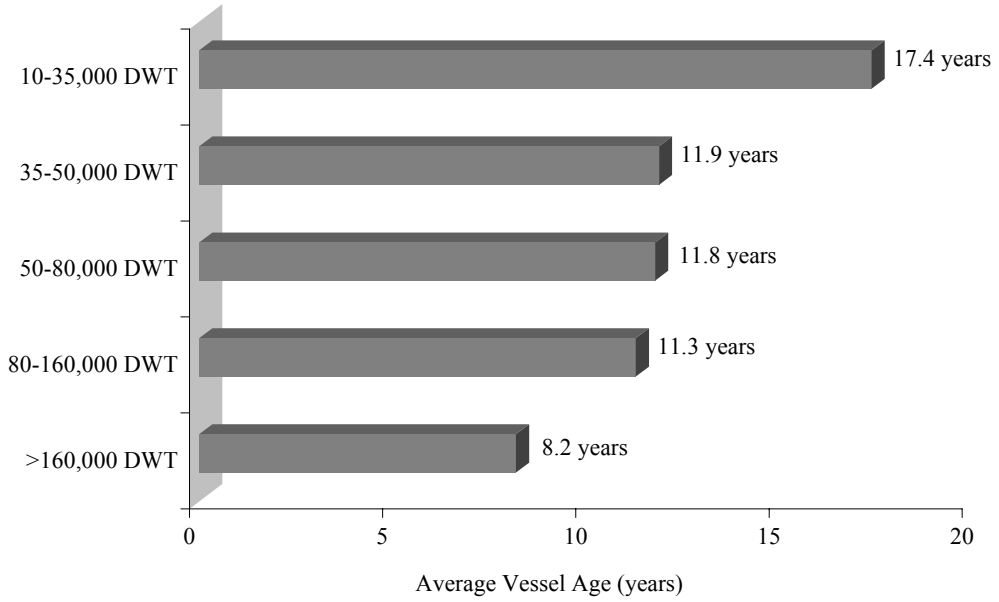


Figure VI-11. Average Age Distribution in Years of the World Dry Bulk Fleet by Ship Size: 1999 (deadweight tons)

Source: WEFA, Inc. Analysis of Clarkson Research Data

Containerships

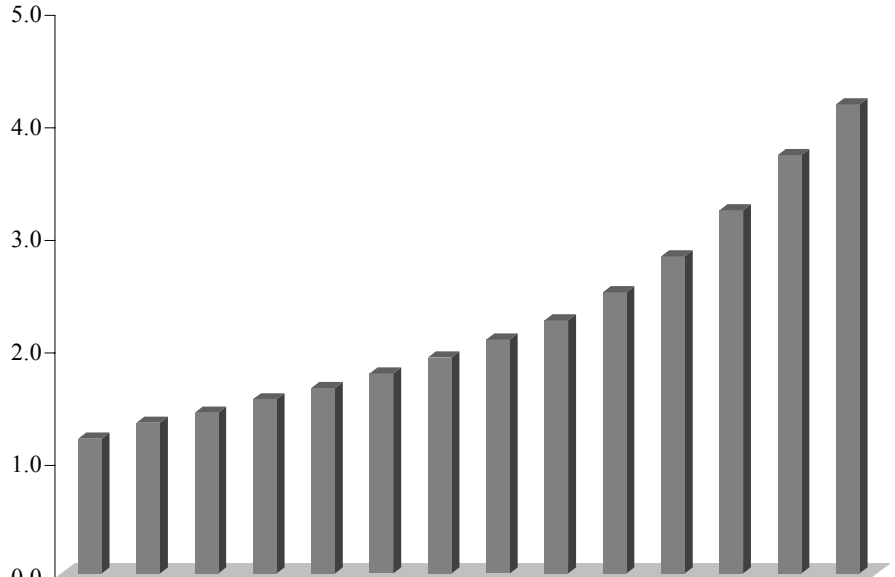
Containerships are dedicated to transporting containerized cargo. Most of their cargo-carrying capacity consists of containers stored on deck or in a cellular framework inside vessel. Once in port, containers are lifted on and off with specialized gantry cranes. Containerships are generally fast and operate on regular sailing schedules.[35]

Containerships are an increasingly important component of the world fleet. Based on commodity weight, about 55 percent of all general cargo is now containerized, and this amount is expected to increase in the future. Shipping goods in containers reduces costs for shippers and carriers. Traditionally, general cargo was shipped as break bulk freight, which is not uniform in size or weight. Containers, however, have standard dimensions and can be loaded or unloaded much faster than break bulk cargo. For ship operators, this is very important. The high cost of modern containerships makes time spent in port a major expense. The less time a ship spends in port, the more voyages it can make and the greater its earnings. Containers also make much

[35] Cargo vessels operated in regularly scheduled sequences of port calls are described as "liner" operations. The types of vessels that are most profitably used in this type of operation are those that carry the goods of multiple shippers or freight that is not shipped in bulk. Typical categories of vessels operated in liner service include container ships, break bulk vessels, Ro/Ro, multipurpose ships, automobile carriers and refrigerated (reefer) vessels. The most important liner vessels in world trade today are containerships.

better use of ship space than break bulk cargo, and they reduce the number of times an item is handled, which increases the likelihood that cargo arrives undamaged.

Figure VI-12 displays growth in the cargo-carrying capacity of the containership fleet over the last decade. The container carrying capability of a vessel is expressed in terms of the number of standard 20 x 8 x 8 foot containers that it can hold, hence the term "twenty-foot equivalents units" (TEUs). From 1986 to 1999, the capacity of the world container fleet increased from 1.20 million TEUs to 4.17 million TEUs.



	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
TEU (millions)	1.20	1.34	1.43	1.55	1.65	1.78	1.92	2.08	2.25	2.50	2.82	3.23	3.72	4.17

Figure VI-12. Growth in the World Containership Fleet Cargo Carrying Capacity: 1986 – 1999 (millions of TEUs)

Source: WEFA, Inc. Analysis of Clarkson Research Data

In addition to overall growth of the container fleet, individual containerships are increasing in size. Today, larger vessels occupy much of the capacity of the container fleet. As shown in Figures VI-13 and VI-14, the capacity of the containership fleet is weighted towards larger vessels. Containerships of 3,000 TEUs or greater make up 40 percent of the fleet in terms of vessel population, and about 43 percent in terms of TEU capacity.

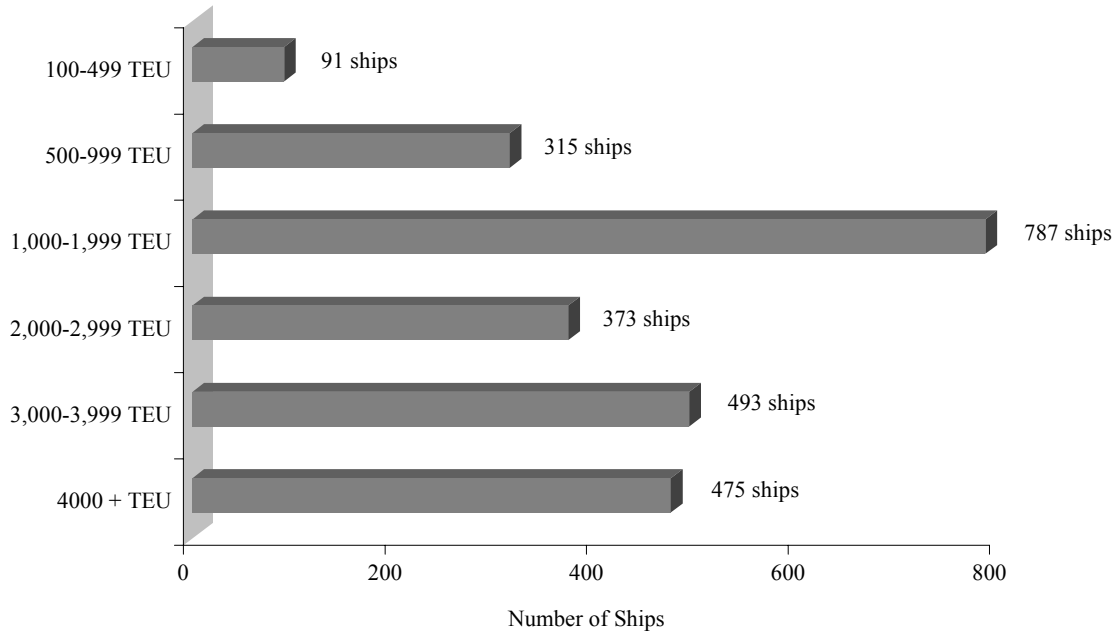


Figure VI-13. Number of Vessels in the World Containership Fleet by Ship Capacity Size Range: 1999 (TEUs)

Source: PMCL analysis of data from the Fairplay Ships Register

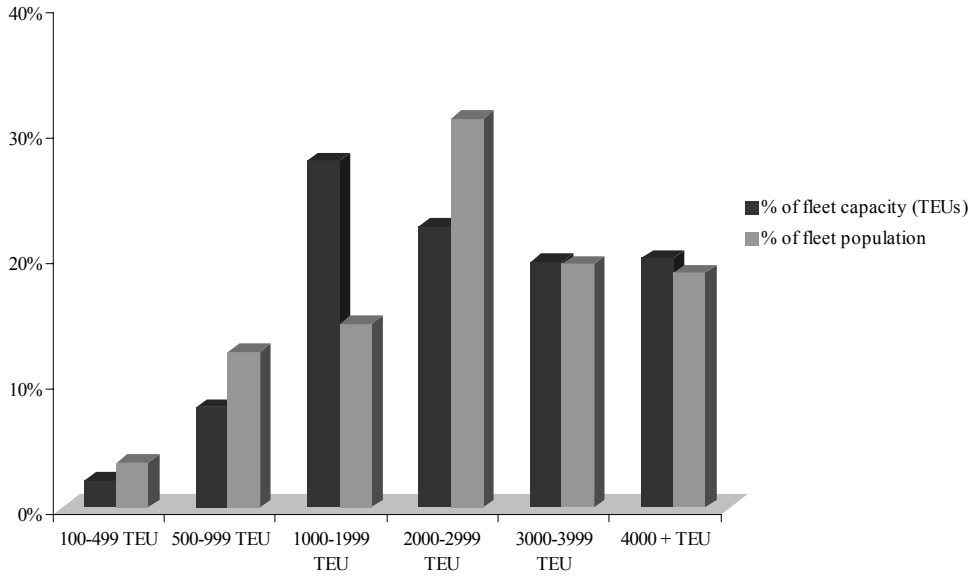


Figure VI-14. Distribution of TEU Capacity and Number of Vessels in the World Containership Fleet: 1999

Source: PMCL analysis of data from the Fairplay Ships Register

Economic efficiency has been the principal force in the trend toward larger containerships. Large vessels can carry more goods, and thus have lower unit transportation costs. The largest containerships also operate at higher speeds (26 knots max), reducing transit times. Some studies indicate that a fully loaded 6,000-TEU ship would offer a 20 percent cost advantage compared to a 4,000-TEU ship.[36] For ocean carriers, the economic benefits of large containerships translate into increased market shares and better customer service. The drawback is that modern containerships require significant capital investments. Container markets are also increasingly competitive, and empty cargo space on a ship at sea is a major cost for ship owners. The formation of carrier alliances has reduced the costs and risks associated with investing in large containerships.

As container services increased in the 1970s and 1980s, shippers demanded voyages that were more frequent. Competition among carriers for the increased demand resulted in numerous companies offering the same services on identical routes. At the same time, many carriers were purchasing larger vessels to increase efficiency. The end result was an oversupply of ship space in an already crowded market. In an attempt to restrain costs and increase efficiency, operators began the "rationalization" of their ships. Carriers wanted to avoid sailing a vessel unless it was full of cargo. Empty container space does not generate revenue for carriers. Rather than sailing ships that were partially full, carriers began renting container space to each other ("slot-sharing"). Eventually, carriers formed partnerships that were based not only on slot sharing, but also on co-investments in ships and terminals. However, unlike mergers, each company remained separate with individual marketing and management departments. Overall, formation of alliances has allowed carriers to:

- Combine their containership fleets,
- Eliminate duplicate voyages,
- Increase the frequency of voyages,
- Expand global coverage,
- Make more efficient use of ship space, and
- Increase their shares of the shipping market.

Each of these factors eased competition, reduced costs and fueled trends toward larger containerships. As individual companies, carriers were reluctant to invest in larger vessels because of the risk and sizeable capital venture involved. There were no guarantees that shipping demand would be sufficient to keep larger vessels full. However, with slot sharing through alliances, an individual carrier has a greater degree of confidence that a ship can be filled to capacity. An example of this trend was an agreement by two of the world's largest container carriers, Maersk and SeaLand. The two companies allied themselves in a load sharing arrangement so that both could lower costs and use ship space more efficiently, which in turn reduced capital costs and risks of purchasing or leasing large containerships. The alliance between Maersk and SeaLand proved so successful that the companies merged under the name Maersk/SeaLand. Today, the company operates some of the world's largest containerships. Maersk/SeaLand has 92 containerships, and of these, 13 have capacities of 6,600 TEUs ("S-Class"), and six have capacities of 6,000 TEUs ("K-Class"). All of these vessels have been built

[36] Drewry Shipping Consultants, "Post Panamax Containerships: 6,000 TEU and Beyond." London, 1996.

since 1996. Once a few industry leaders such as Maersk committed to larger containerships to gain a competitive edge, other operators followed suit. For example, since 1997, P&O Nedlloyd has introduced four 6,690-TEU containerships. According to Fairplay Publications Ltd., discussions are underway for up to 52 additional vessels with capacity in excess of 6,000 TEUs per vessel.

Table VI-1 summarizes landmarks in containership evolution. In 1972, the carrier OOCL introduced the *Liverpool Bay* class, which remained the largest class in terms of design draft until the late 1980s when Hapag Lloyd and APL introduced vessels ranging from 3,500 to 4,300 TEUs.[37] Upward trends in capacity continued throughout the 1980s and 1990s. In 1996, Maersk/SeaLand introduced the *Regina Maersk* with a capacity of 6,000 TEUs. The *Regina Maersk* is deployed on Maersk´s "Suez Express Service," calling on the U.S. East Coast, Canada, Mediterranean, Mid-East and Far East. In 1998, the carrier P&O Nedlloyd introduced the first in a series of four 6,690-TEU "megacontainerships," the *Nedlloyd Southampton*. Maersk/SeaLand launched its new "S" class of containerships with the inauguration of the *Sovereign Maersk* in 1998. These are currently the largest containerships in the world. With a length of about 1,138 feet, a width of nearly 140 feet, a capacity of 6,600 TEUs and a draft of 47.5 feet, the *Sovereign Maersk* is enormous. Table VI-2 summarizes the largest class of containership currently on order for each of the major containership lines. All are expected to be in service by the end of the year 2000. A principal feature of orders placed during 1998 has been increased emphasis on large post-Panamax vessels. Approximately 88 percent of new tonnage is in vessels of at least 4,000 TEUs, and about 73 percent is in vessels of at least 5,000 TEUs.

TABLE VI-1

LANDMARKS IN THE EVOLUTION OF CONTAINERSHIPS: 1972 – 1998

Carrier	Date of Delivery	Length (feet)	Draft (feet)	Beam (feet)	Capacity TEUs
OOCL	1972	941.4	42.7	105.3	3,000
Hapag Lloyd	1981	808.5	41.0	105.6	3,500
United States Lines (USL)	1984	947.9	39.4	105.0	4,300
American President Lines (APL)	1988	902.7	41.0	96.5	4,340
Hapag Lloyd	1991	964.3	41.3	105.6	4,400
Hyundai MM	1992	866.2	44.3	121.7	4,411
NYK	1994	983.7	42.7	121.7	4,743
OOCL	1995	905.3	39.4	131.2	4,850
Maersk/SeaLand "K" Class	1996	1,043.7	45.9	140.4	6,000
P&O Nedlloyd "Southampton" Class	1998	1,115.0	42.7	137.8	6,690
Maersk/SeaLand "S" Class	1998	1,137.8	47.5	140.4	6,600

* Ship dimensions are measured by length and beam (width), while draft measures how low a ship sits in the water.

Source: Adapted from Baird (1999).

[37] Baird, A.J. "Container Vessels of the Next Generation: Are Seaports Ready to Face the Challenge?" Paper presented at the 21st World Ports Conference of the International Association of Ports and Harbors, Port Klang, Malaysia, 15-21 May 1999.

TABLE VI-2

LARGEST SIZE OF CONTAINERSHIP SCHEDULED FOR DELIVERY BY THE YEAR 2000

Carrier	No. of Vessels	Capacity (TEUs)	Carrier	No. of Vessels	Capacity (TEUs)
P&O Nedlloyd	4	6,690	NOL	4	4,918
Maersk/SeaLand	9	6,600	APL	6	4,832
Maersk/SeaLand	3	6,000	MOL	5	4,700
Maersk/SeaLand	9	4,354	Cho Yang	4	4,545
Maersk/SeaLand	6	6,200	DSR Senator	6	4,545
NYK	5	5,700	MISC	2	4,469
Hyundai MM	7	5,551	Hapag Lloyd	6	4,422
Evergreen	13	5,364	CMA/CGM	2	4,000
Hanjin	5	5,300	MSC	2	4,000
Cosco	6	5,200	UASC	10	3,800
Yang Ming	5	5,000	Zim	3	3,500
OOCL	8	4,960	K-Line	8	3,456

* Total Number of Vessels: 138
* Total Capacity: 681,101 TEUs
* 73 % percentage of ordered capacity in vessels of at least 5,000 TEUs

Source: Adapted from Baird, J.B. 1999

Whether or not the size of containerships will continue to grow over the long term is a topic of debate. There are valid arguments on both sides of the issue. Some concede that because of inadequate infrastructure at ports, the size of containerships will plateau within the next few years at no more than 8,000 to 10,000 TEUs. Others question the ability to fill enough container space on large vessels to make it economical. One executive is quoted as saying, "the line haul savings [of a 6,000 TEU ship] are minimal. . . this advantage is quickly eaten up by landside diseconomies and by the need to cut rates to fill the ships."[38] Another shipping executive remarked, "Nobody can fill these monsters . . . you have to get your competitor to prop you up."[39] Then, there is the issue of vessel speed. Ships with capacities of more than 7,000 to 8,000 TEUs will find it harder to reach required speeds of around 24 knots with current ship propulsion technology. However, advances in propulsion or hull designs could overcome this barrier. Existing post-Panamax containerships rely on a single engine with one shaftline and propeller. Larger ships (12,000 + TEUs) will need larger engines to maintain required speeds, and it is questionable whether current single-propeller engines are capable of absorbing such large amounts of power. However, ship and engine designers are currently exploring possible

[38] McLellan, R.G. Bigger Vessels: How Big is too Big?" *Maritime Policy and Management.*" 24(2), 193-211, 1997.

[39] Hanscom, J. "K-Line Breaks Ranks over Deregulation." *SeaTrade Review*. Pp. 33-35, April 1998.

alternatives, including large bore engines coupled with contra-rotating propellers, or the twin engine, twin screw propulsion systems that have already been adopted for large tankers.[40]

Many have suggested that beam and draft requirements of the Suez Canal would cap growth of containerships at around 11,000 TEUs, but dredging of the canal will allow ever-larger ships to navigate the waterway.[41] Currently, the Suez Canal can accommodate vessels with fully loaded drafts of up to 58 feet. Because the canal has no locks, widening and deepening to accommodate larger ships may be economically feasible, assuming sufficient demand exists.

Two additional factors may encourage trends toward larger containerships: (1) steady downward pressures on shipping rates, and (2) the impending requirement for carriers to replace old vessels.[42] Because of increased competition among carriers, freight rates have been declining since the late 1970s. In real terms, rates received for cargo shipped on transpacific trade routes have dropped about 72 percent for eastbound freight and 67 percent for westbound freight. Rates on Atlantic routes have declined almost 60 percent for westbound and 52 percent for eastbound freight (see Table VI-3). In light of these dramatic decreases, carriers have had to seek ways of reducing unit costs. Assuming they can be filled to capacity, larger ships are better able to absorb a drop in rates. For example, if a 3,000 TEU ship barely breaks even at rates of $1,000 per container, then a 6,000 TEU vessel would still be profitable if rates fell to 500 dollars.[43] Thus, in markets where rates fluctuate considerably, bigger ships offer an economic advantage.

TABLE VI-3

CHANGES IN AVERAGE FREIGHT RATES FOR U.S. EAST-WEST TRADE ROUTES: 1978 – 1998

		Current Dollars ($)	Real Terms
Transpacific	eastbound	- 32.1%	-72.1%
	westbound	-20.8%	-67.5%
Transatlantic	westbound	-4.6%	-60.9%
	eastbound	+18.2%	-51.5%

Source: Drewry Shipping Consultants Ltd.

In addition to economic incentives, the general condition of the containership fleet may also have an influence. Older and slower ships will be scrapped in the next few years at a time when the entry of big new ships is expected. For example, Figure VI-15 presents the average age distribution of the containership fleet according to vessel capacity. The smallest vessels in the containership fleet, those with capacities of 100 to 499 TEUs, are the oldest on average (15.4 years), and around 18 percent are at least 25 years old. The average service life of container ships is about 25 years, and older vessels built during the 1970s are reaching the ends of their useful lives. An estimated 12.3 percent of the global container fleet could be retired during the

[40] See, "Fairplay Solutions." Issue No. 37, pp. 9-13, October 1999.

[41] *ibid.*

[42] Baird, 1999. See also, McLennan, 1997.

[43] Drewry Shipping Consultants, "Container Market Outlook: High Risk and High Stakes- Where is the Payback?" London, October 1999.

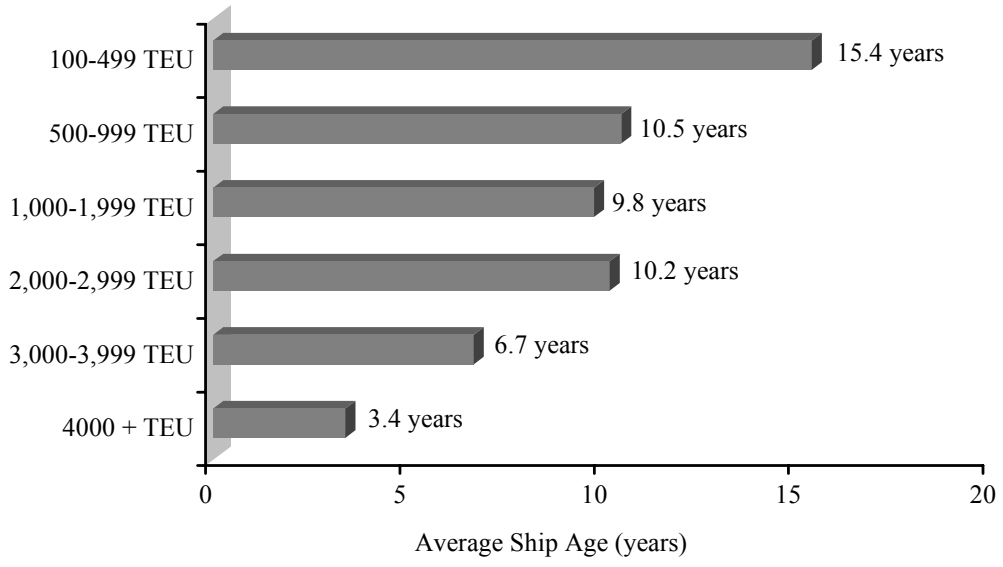


Figure VI-15. Average Age Distribution of the World Containership Fleet by Size: 1999 (TEUs)

Source: WEFA, Inc. Analysis of Clarkson Research Data

years 2000 through 2003, and upwards of 100,000 TEU capacity was expected to be scrapped in 1999. In addition, a substantial amount of slower diesel propulsion ships produced in the mid-1980s may become uneconomical sooner than their expected lifetime, which could lead to higher scrapping rates.[44]

Lastly, as discussed previously, growing congestion along the U.S. land-bridge combined with a shift of Asian manufacturing centers to China and the Indian Subcontinent are spurring carriers to develop all water routes from Asia to the U.S. East Coast. For these routes to be optimal, large containerships (6,000 TEU +) are needed.

Draft Characteristics of the World Fleet

"Draft" refers to how low a ship sits in the water. Draft varies according to a ship's design, its weight, everything on board including cargo, ballast and fuels and the density of water surrounding a vessel.[45] Every ship has a draft at which it can pass through a channel or harbor safely without running aground. Table VI-4 summarizes draft characteristics of vessels in the merchant fleet. Most general cargo vessel drafts (e.g., break bulk and multipurpose ships) fall within 22 to 32 feet. There are very few break bulk or multipurpose vessels with drafts greater

[44] Baird, 1999.

[45] Ballast is a general term given to any tank or compartment on a ship that provides weight when a ship is carrying little or no cargo. Ballast improves stability and handling of a vessel.

TABLE VI-4

DESIGN DRAFT CHARACTERISTICS OF THE WORLD MERCHANT FLEET: 1998

Containership Fleet						
Vessel Capacity (TEU)	**No. of Vessels**	**Percentage of Containership Fleet Capacity (TEU)**	**Average (feet)**	**Max. (feet)**	**Min. (feet)**	**Std. Dev. (feet)**
100-499	91	2.2%	22.6	33.4	20.0	2.4
500-999	315	8.0%	26.5	37.8	20.0	3.4
1,000-1,999	787	19.6%	32.0	43.0	20.5	3.5
2,000-2,999	373	20.0%	37.7	43.3	29.9	2.4
3,000-3,999	493	22.4%	39.7	44.4	29.6	2.3
> 4,000	495	27.7%	42.9	47.5	23.9	4.0
Dry Bulk Fleet						
Vessel Capacity (DWT)	**No. of Vessels**	**Percentage of Dry Bulk Fleet Capacity**	**Average (feet)**	**Max. (feet)**	**Min. (feet)**	**Std. Dev. (feet)**
10,000-34,999	2,498	22.4%	31.7	56.3	20.0	3.1
35,000-49,999	1,316	20.1%	36.7	51.2	24.8	2.0
50,000-79,999	991	24.5%	42.8	54.8	27.9	2.5
80,000-160,000	336	15.0%	53.5	75.6	29.7	5.3
> 160,000	183	18.1%	58.8	76.1	52.9	3.2
Tanker Fleet						
Vessel Capacity (DWT)	**No. of Vessels**	**Percentage of Tanker Fleet Capacity**	**Average (feet)**	**Max. (feet)**	**Min. (feet)**	**Std. Dev. (feet)**
10,000-59,999	2,126	7.0%	34.2	67.2	20.0	4.9
60,000-79,999	330	16.9%	41.7	59.0	28.5	3.6
80,000-119,999	577	16.9%	45.7	64.8	20.0	3.3
120,000-199,999	321	14.1%	54.2	78.1	20.0	3.2
> 200,000	438	39.3%	69.0	93.8	46.0	4.8
General Cargo Fleet (includes break bulk, Ro-Ro, vehicle carriers, multipurpose and heavy lift)						
Vessel Capacity (DWT)	**No. of Vessels**	**Percentage of General Cargo Fleet Capacity**	**Average (feet)**	**Max. (feet)**	**Min. (feet)**	**Std. Dev. (feet)**
10,000-19,999	2049	64.3%	30	41	20.0	2.6
20,000-29,999	442	22.2%	32.7	42.7	20.3	2.9
30,000-39,999	69	5.3%	36.4	42.7	26.9	3.4
> 40,000	82	8.2%	39.1	44.9	28.5	2.7

Includes vessels of 10,000 DWT or greater.

Source: PMCL analysis of data from the Fairplay Ships Register

than 40 feet. The majority of tankers have drafts from 24 to 51 feet; however, about 20 percent of tankers have drafts greater than 50 feet. Suezmax tankers (120,000 to 200,000 DWT) have drafts of about 55 to 60 feet, and the largest oil tankers (VLCCs and ULCCs) can have drafts upwards of 80 and 90 feet. Product tankers (Panamax and Handymax classes) generally have drafts of less than 40 feet, allowing them to navigate the Panama Canal and access refineries and distribution points at ports where depth constraints may exist. Bulk vessels generally fall in the 26 to 44 foot range; however, some dry bulk ships have very deep drafts of greater than 70 feet.

Containerships typically have drafts ranging from 26 to 39 feet, with an average of around 33 feet. Since the introduction of containerized cargo in the 1950s, six generations of containerships have passed, and each subsequent series of ship has had deeper drafts, on average. Before 1986, a channel depth of 45 feet would accommodate most containerships. In 1986, the majority of containerships had capacities of less than 3,000 TEUs with drafts of about 38 feet. At the time, there were only a few post-Panamax (4,000 to 4,500 TEUs) class vessels in operation. Containerships with capacities greater than 4,000 TEU typically have drafts of around 39 to 43 feet, and many cannot enter a 45-foot channel loaded to maximum draft.[46] The largest containerships draw about 47.5 feet, and could require channels of 52 feet.

Interestingly, as new classes of containerships have emerged over the years, TEU capacities appear to have increased at a rate greater than the design draft of the vessels. Table VI-1 illustrates this phenomenon. Note that the TEU capacity and beams (width) of the four landmark vessels introduced since 1991 have increased significantly. However, their design drafts have remained more or less constant. Vessels that are longer and wider allow more containers to be stacked across deck, which distributes cargo weight horizontally rather than vertically.

PROFILE OF THE WORLD FLEET CALLING AT U.S. PORTS

Previous discussions have focused on a general description of the world fleet. However, only a portion of the fleet engages in trade with the United States. Although the composition of vessels that call on U.S. ports has changed through time, an examination of its current status provides an indicator of U.S. port demand. In addition, the physical characteristics of vessels that call on U.S. ports is an important factor for determining potential needs for channel dredging.

Composition of the World Fleet Calling at U.S. Ports

Vessels from each major category of ship in the world fleet can engage in trade with the United States. Figure VI-16 shows the number and distribution of ships recorded as having entered U.S. waters and made at least one port call in 1996. Records indicate that almost 7,000 ships of the merchant fleet call on U.S. ports each year. Dry bulk vessels make up 45 percent of the fleet based on the number of ships, tankers account for 17 percent, general cargo ships comprise 28 percent and containerships account for 10 percent.

[46] When a ship is under sail, various physical and hydrological factors cause it to sit lower in the water than while the vessel is at rest. Thus, allowances of additional channel depth beyond design drafts are taken into account. Vertical ship movement while underway ("squat") may require an additional two feet. An additional foot is usually allowed for trim, which refers to loading practices that make a vessel ride lower in the water to improve handling. Lastly, a general safety margin of two feet for under-keel clearance is allowed. Thus, a vessel with a design draft of 46 feet may require an extra four to five feet, or about of 10 percent of vessel design draft at low water.

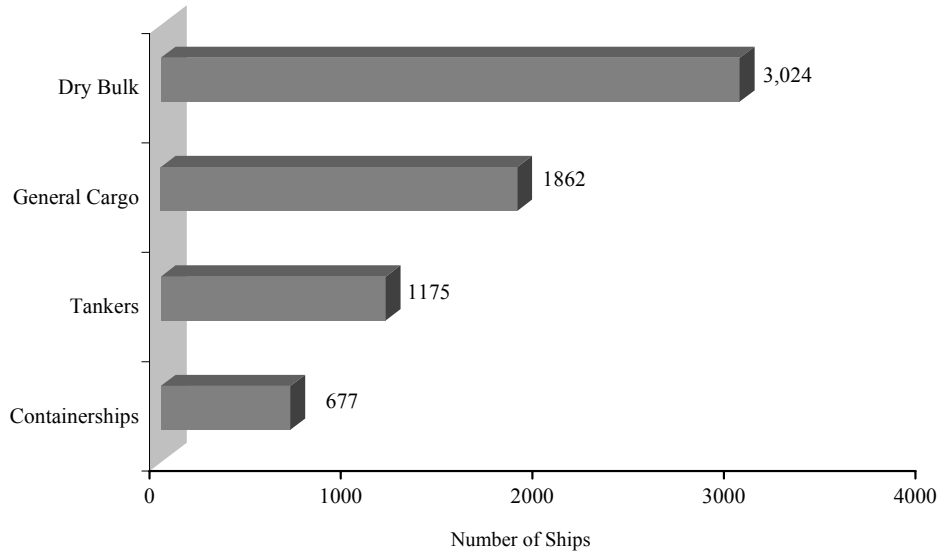


Figure VI-16. Number of Vessels in the World Fleet Calling on U.S. Ports by Ship Type: 1996

Source: PMCL analysis of data from the Fairplay Ships Register and the Waterborne Commerce Statistics Center

Physical Characteristics of the World Fleet Calling at U.S. Ports

Figure VI-17 displays the average size of vessels calling on U.S. ports in terms of deadweight tonnage. General cargo ships are the smallest vessels, with an average size of 10,000 DWT, while tankers are the largest ships to call on U.S. ports. Tankers calling on U.S. ports have an average size of nearly 52,000 DWT. Of these, about 100 are greater than 100,000 DWT. The remainder consists of smaller product tankers and lightering ships used to offload oil from large tankers. Lightering ships and product tankers are relatively small, usually about 20,000 to 30,000 DWT.

With the exception of containerships, general cargo vessels calling on the U.S. are relatively small. Most Ro-Ro, multipurpose, break bulk, vehicle carriers and refrigerated ships have capacities of less than 20,000 DWT. Containerships calling on U.S. ports average about 35,000 DWT, and about 10 percent are over 60,000 DWT. The largest containership to call on U.S. ports is about 85,000 DWT. As noted previously, containerships are commonly classified by TEU rather than tonnage. In 1996, containerships calling U.S. ports had a combined fleet capacity of 1,516 million TEUs with an average vessel capacity of 2,240 TEUs. Ten percent of containerships sailing to the U.S have capacities of at least 4,000 TEU. Most large containerships (at least 50,000 DWT or 4,000 TEUs) that call on U.S. ports are less than five years old. Aged containerships are being phased out, and newly constructed containerships replacing them are generally larger. This is especially true for containerships that operate on U.S. transatlantic and transpacific routes. Table VI-5 displays average design drafts of vessels

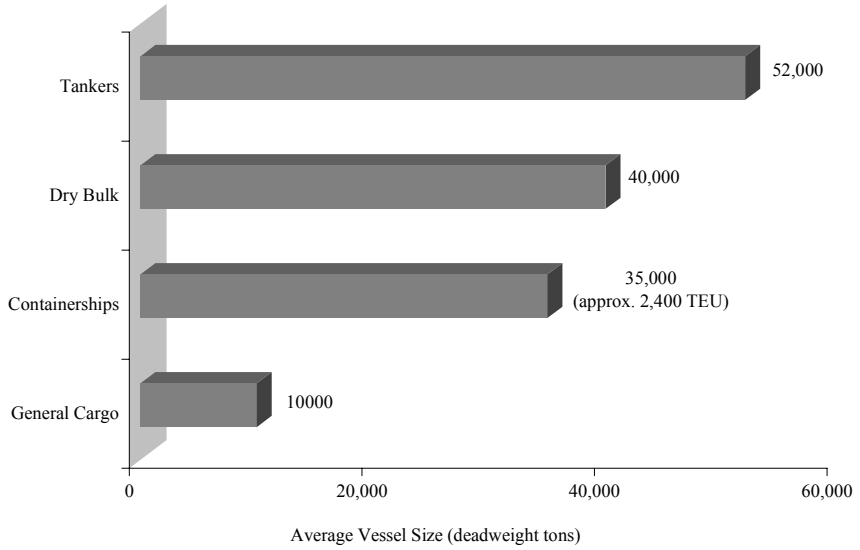


Figure VI-17. Average Size of Vessels Calling on U.S. Ports: 1996 (deadweight tons)

Source: Based on PMCL analysis of data from the Fairplay Ships Register and the Waterborne Commerce Statistics Center

calling on U.S. ports. Tankers traveling to and from the U.S have an average design draft of 38.2 feet, and most range

TABLE VI-5

DESIGN DRAFT CHARACTERISTICS OF VESSELS CALLING ON U.S. PORTS (FEET)

U.S. Calling Fleet	Average	Min.	Max.	Std. Dev.
Tankers	38.2	9.8	74.8	10.0
Dry Bulk Ships	36.4	10.5	76.1	7.9
Containerships	35.7	14.1	47.5	6.1
General Cargo Fleet	26.3	8.8	55.9	7.1

Source: Based on WEFA, Inc. analysis of data from Waterborne Commerce Statistics Center, Lloyds, Fairplay Information Services

from about 20 to 50 feet. Design drafts of dry bulk carriers average 36.4 feet, and the majority range from about 30 to 45 feet. Containerships, the most active ships based on number of calls, have an average design draft of 35.5 feet and most range from 30 to 45 feet.

Figures VI-18 through VI-21 compare the distribution of vessel count and design drafts of both the world fleet and vessels calling U.S. ports. About 25 percent of the world's tankers call on U.S. ports. Only 17 percent have drafts of less than 30 feet, 81 percent have drafts of between 30 and 57 feet, and only 2 percent have drafts greater than 57 feet. The average design draft for tankers calling at U.S. ports is about 38 feet.

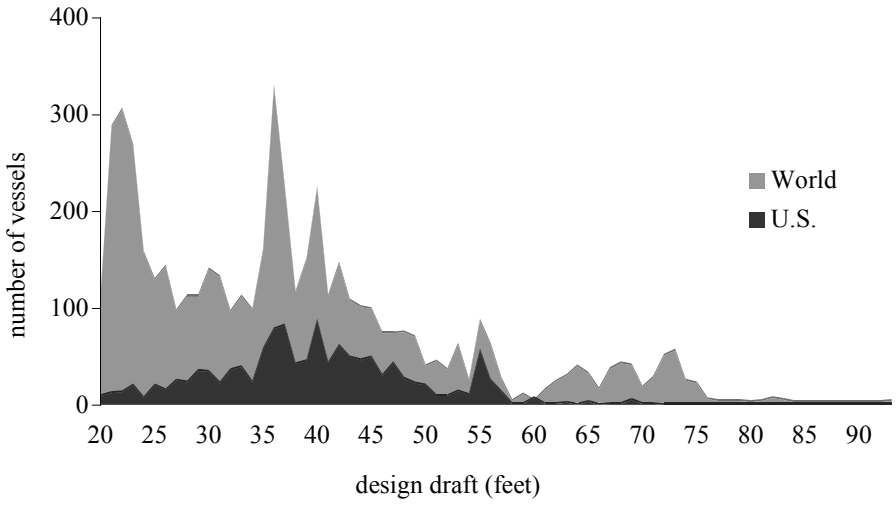


Figure VI-18. Tanker Design Drafts: World Fleet and Vessels Calling on the U.S.: 1996

Sources: PMCL analysis of data from the Fairplay Ships Register and the Waterborne Commerce Statistics Center

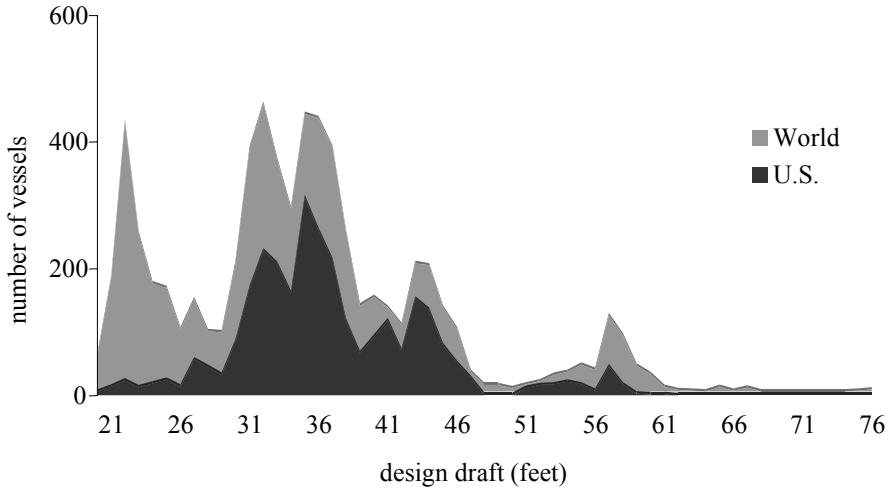


Figure VI-19. Dry Bulk Design Drafts: World Fleet and Vessels Calling on the U.S.: 1996

Source: PMCL analysis of data from the Fairplay Ships Register and the Waterborne Commerce Statistics Center

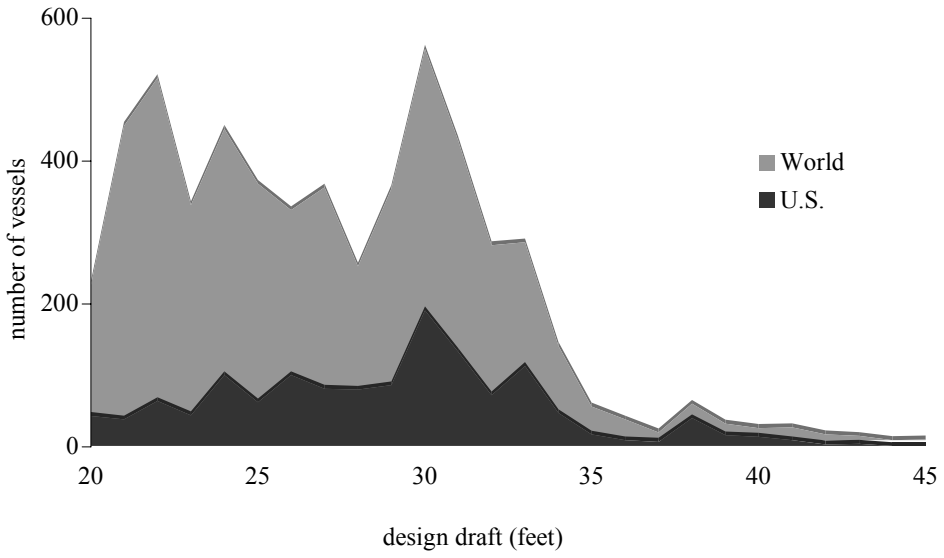


Figure VI-20. General Cargo Design Drafts: World Fleet and Vessels Calling on the U.S.: 1996

Source: PMCL analysis of data from the Fairplay Ships Register and the Waterborne Commerce Statistics Center

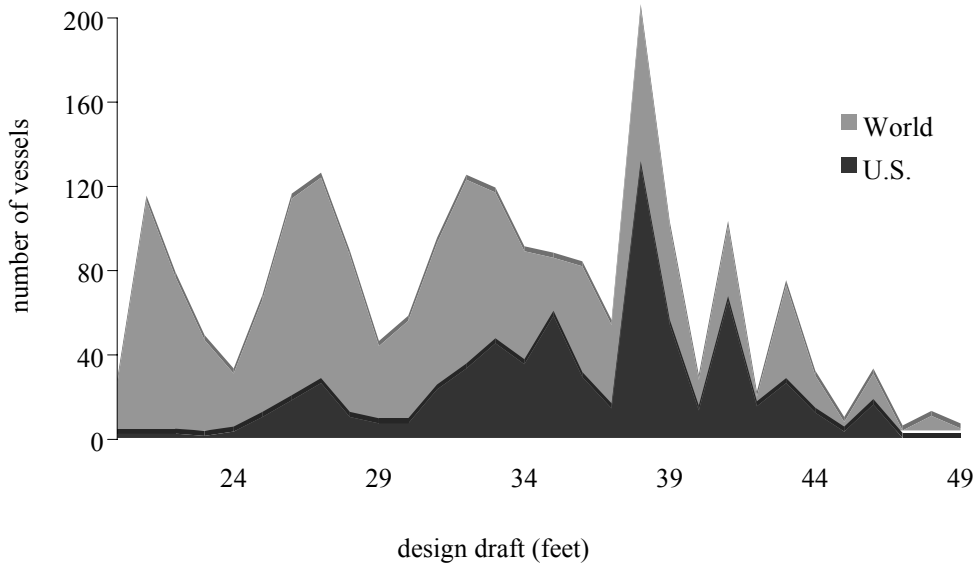


Figure VI-21. Containership Design Drafts: World Fleet and Vessels Calling on the U.S.: 1999

Source: PMCL analysis of data from the Fairplay Ships Register and the Waterborne Commerce Statistics Center

More than 60 percent of the world's Suezmax tankers call on U.S. ports. With design drafts of 55 to 57 feet, these tankers are vital for inbound shipments of crude petroleum from the Mid-East and Africa. Approximately 60 percent of crude imported to Atlantic Coast ports originates in Africa and the Mid-East via the Suez Canal. Figure VI-19 strongly emphasizes the importance of Panamax dry bulk vessels and the importance of U.S. agricultural commodities in world markets. Grain, the United States' number one tonnage and value export, is primarily transported on Panamax ships. In fact, almost 90 percent of the world's grain is shipped in vessels of less 80,000 DWT that have average design drafts of 35 feet.[47] About one-half of all grain exports from the U.S. Gulf Coast are shipped to Asia through the Panama Canal, where the maximum sailing draft is 40 feet. Fully loaded Panamax vessels can also access most major ports in Asia–the destination of almost 85 percent of U.S. grain shipments.

Figures VI-20 and VI-21 compare design drafts of the world container and general cargo fleet with drafts of vessels that call on U.S. ports. Only about 25 percent of the world's general cargo fleet trades with the United States. More than 90 percent of general cargo ships in both the world fleet and those that call on the U.S. have drafts of 35 feet or less. In the future, this is not expected to change. Break bulk ships being built are either very specialized or are multipurpose vessels capable of carrying a variety of cargo including Ro-Ro, reefer and heavy lift. Broad ranges of cargo will likely necessitate ship designs with wide beams and shallow drafts that allow access to most world ports. Smaller designs also allow unrestricted access to the Panama Canal. Most of the world's largest containerships are active in U.S. foreign trade. Sixty percent of the world's containerships with drafts of 40 to 46 feet are calling on U.S. ports. Almost 90 percent of containerships calling on the U.S. have drafts of 30 feet or greater, and 23 percent have drafts of more than 40 feet. Today, only about 3 percent have drafts of 45 feet or more, but this will increase as larger containerships come online. The average age of containerships that call on U.S. ports with design drafts of 45 feet or greater is 6.1 years, while the average for vessels of less than 35 feet is 15.1 years. As mentioned previously, as older and smaller containerships are scrapped, larger vessels are filling the void.

TRAFFIC ANALYSIS OF VESSELS CALLING ON THE U.S.

Data regarding the number of ships that call on U.S. ports are not necessarily indicative of port demand. Actual number of calls made by different types of ships is a more accurate reflection. A "call" is defined as the act of a ship entering or exiting a port and loading outbound cargo or unloading inbound cargo. A single ship may call on several ports while in U.S. waters. For example, containerships coming from Europe may stop at New York, and then move on to Baltimore and Charleston before leaving U.S. waters. Although containerships represent only about 10 percent of the U.S.-calling fleet in terms of individual vessels, they account for slightly more than 40 percent of calls (see Figure VI-22). Some general cargo ships–roll-on/roll-off vessels and vehicle carriers–also operate on a series of port rotations when transporting international cargo. Tankers and dry bulk vessels usually load and discharge all cargo at a single location and make fewer calls relative to containerships. Tankers account for 12 percent of calls

[47] Sewell, T. Grain Carriage by Sea. LLP Reference Publishing, London 1999.

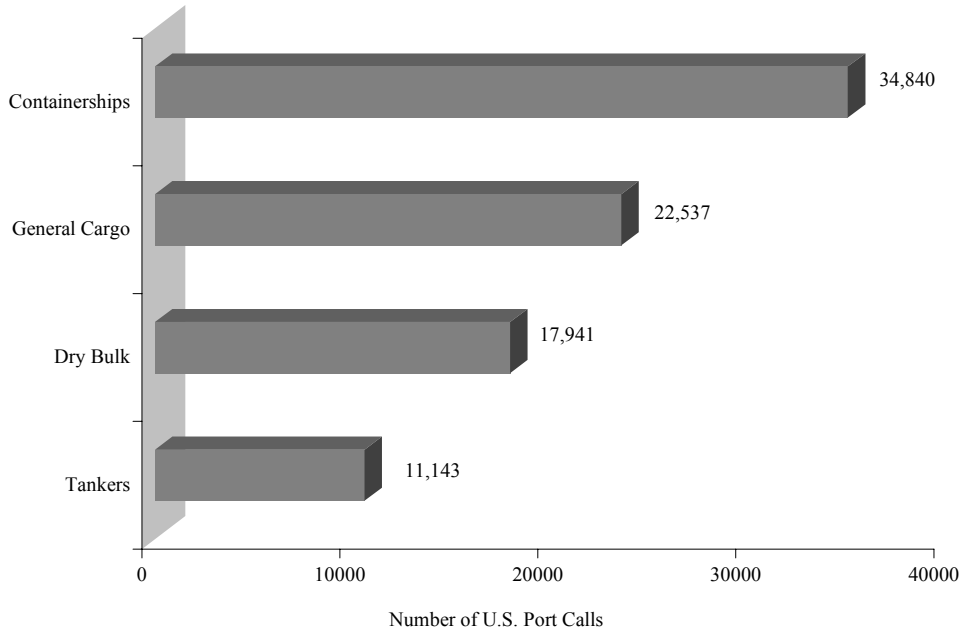


Figure VI-22. Number of Vessels Calls at U.S. Ports: 1996

Source: PMCL analysis of data from the Fairplay Ships Register and the Waterborne Commerce Statistics Center

and dry bulk ships represent 20 percent. General cargo vessels make up most of the remainder–about 27 percent.

Figures VI-23 through VI-26 display the number of inbound and outbound calls by vessel type and design draft. Distribution of tanker traffic by draft is weighted toward larger vessels. The majority of calls by large tankers are inbound, indicating imports of crude petroleum. About 64 percent of tankers calling on the U.S. have design drafts of 45 feet or greater, and fully loaded, these ships cannot access most U.S. ports. Larger tankers (Suezmax and VLCCs) typically transfer cargo at offshore locations. Along the Atlantic Coast, most discharge cargo at offshore terminals in the Caribbean, where it is transferred to smaller ships. Along the Gulf Coast, large tankers transfer cargo within four zones spread in an east/west direction across the Gulf of Mexico.

Distribution of dry bulk calls and design drafts is consistent with general trade patterns in the United States. About 60 percent of dry bulk traffic is outbound, and 40 percent is inbound. Almost 75 percent of dry bulk traffic consists of ships with drafts ranging from 30 to 40 feet, which allows access to major grain ports such as South Louisiana, Plaquemine, New Orleans, Baton Rouge and Mobile. Thirty to forty foot drafts also allow navigation of the Panama Canal. Note the outbound calls for vessels in the 44 to 55 foot ranges. Many of these represent coal exports from ports such Newport News, Norfolk and Baltimore.

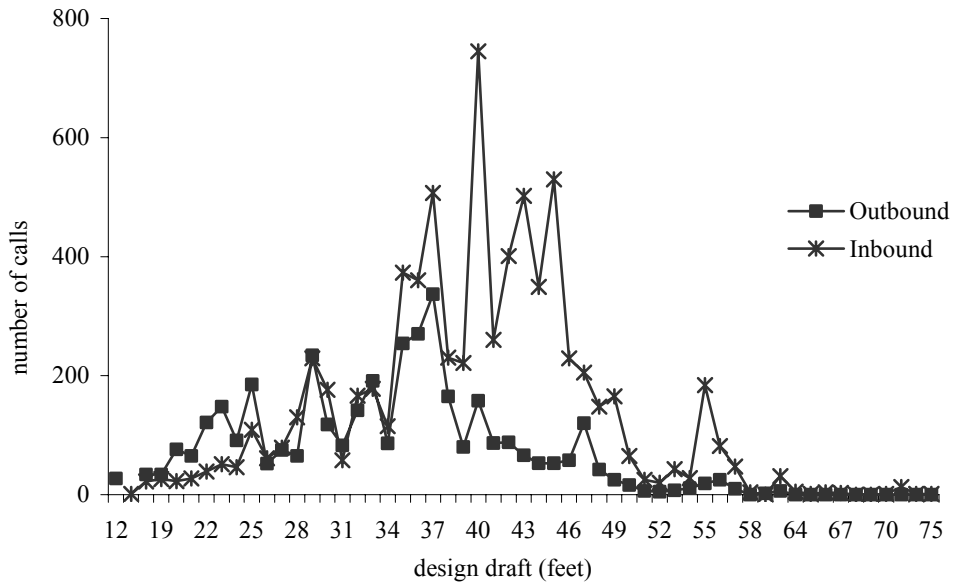


Figure VI-23. Inbound and Outbound U.S. Calls for Tankers: 1996

Source: PMCL analysis of data from the Fairplay Ships Register and the Waterborne Commerce Statistics Center

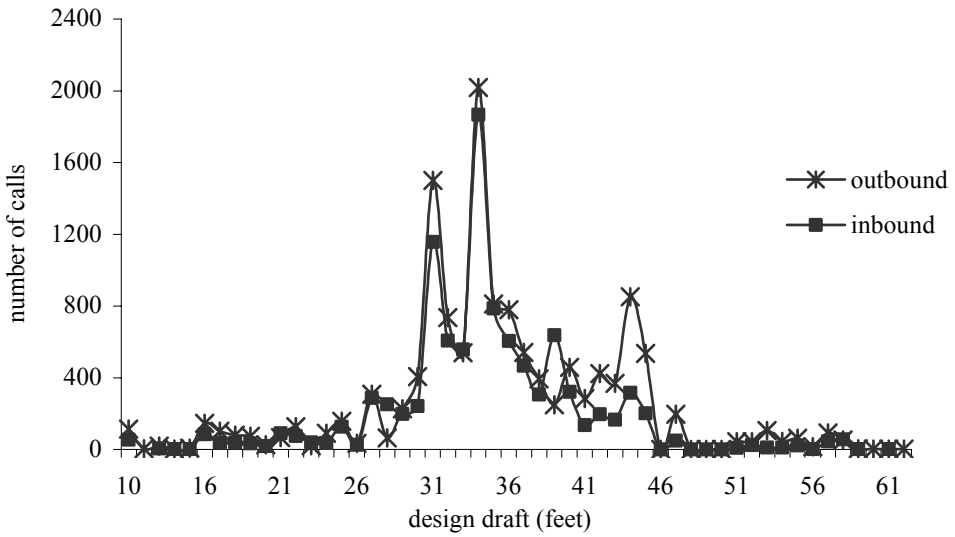


Figure VI-24. Inbound and Outbound U.S. Calls for Dry Bulk Vessels: 1996

Source: PMCL analysis of data from the Fairplay Ships Register and the Waterborne Commerce Statistics Center

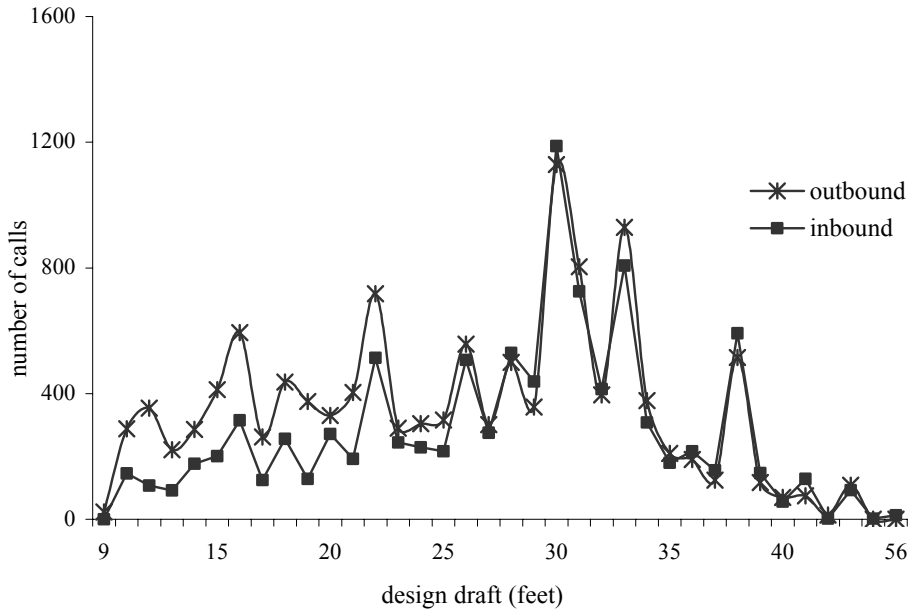


Figure VI-25. Inbound and Outbound U.S. Calls for General Cargo Vessels: 1996

Source: PMCL analysis of data from the Fairplay Ships Register and the Waterborne Commerce Statistics Center

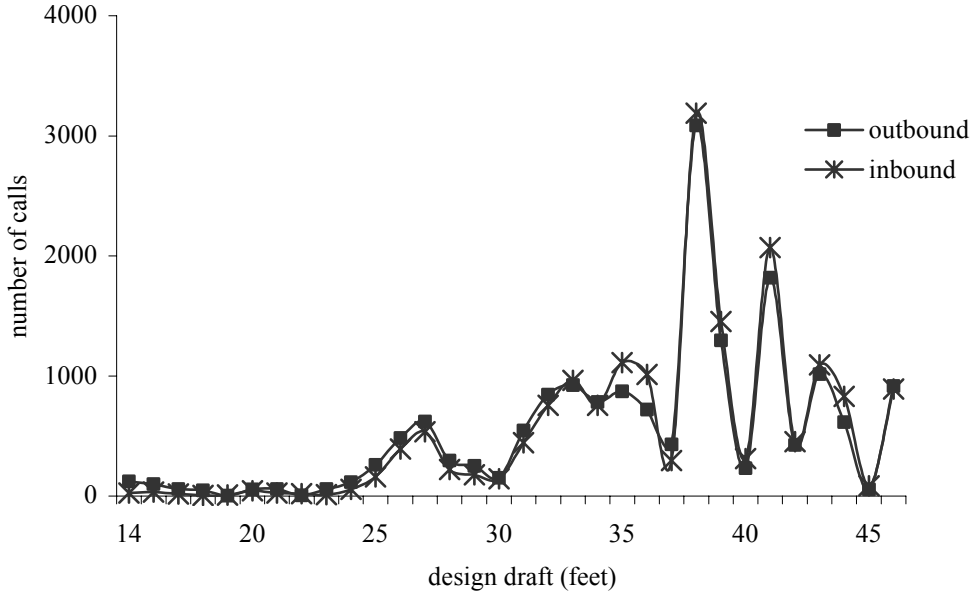


Figure VI-26. Inbound and Outbound U.S. Calls for Containerships: 1996

Source: PMCL analysis of data from the Fairplay Ships Register and the Waterborne Commerce Statistics Center

General cargo traffic vessels according to design draft areas more evenly distributed than other types of ships. For instance, general cargo ships with drafts from 9 to 20 feet comprise 24 percent of calls, vessel with drafts from 21 to 30 feet account for 41 percent, and the remainder make up about 35 percent. The wide distribution reflects the diversity of ports and trade routes serviced by general cargo ships. As noted earlier, the smaller design drafts of general cargo ships allow access to ports in less developed nations where harbors are shallower than ports in developed countries. The distribution of calls for containerships based on draft is weighted towards larger vessels. Vessels with drafts of less than 30 feet account for only 12 percent of calls, while containerships with draft of 40 feet or greater make up 31 percent. Containerships with design drafts of 45 feet or greater currently comprise 6 percent of containership traffic; however, this will likely increase as more post-Panamax vessels are introduced.

TRANSSHIPMENT AND HUBBING OPERATIONS

As demonstrated in previous discussions, cargo is heavily concentrated within several U.S. ports. Bulk cargo is concentrated at ports that offer geographical advantages. For example, ports that handle large volumes of crude petroleum are located near refining centers. Likewise, ports that handle large amounts of agricultural commodities are often located at the entrances of large rivers and provide convenient accesses to inland waterway systems. Ports that handle the largest volumes of bulk commodities have well-developed and specialized infrastructure. In a sense, they specialize in select commodities. Because of geographical advantages and degree of specialization, the predominance of leading bulk and tanker ports is not likely to change.

Traditionally, vessels carrying general cargo called at ports where freight was available for shipment, and demand for vessel space was a function of a port's proximity to production and consumption markets. Advances in intermodal transportation have changed this relationship. Intermodal networks allow general cargo carried in containers to be unloaded from ships and placed directly on railcars for immediate national and international distribution. Thus, in the U.S. the proximity of a port to production centers and end user markets is not nearly as important as it was in the past.

Regional Hub and Spoke Operations

Today, container carriers can discharge containerized cargo at one large regional port and use land transport and/or a network of small "feeder" ships to transfer cargo to its final destination. Rather than alternating between several ports to load and unload containers, carriers are increasingly consolidating cargo at ports referred to as "hubs" or "load centers." By concentrating cargo at select ports with well-developed facilities including rail and truck links, ships spend less total time in ports and more time moving cargo, which translates into lower costs and greater earnings for carriers.

It is not entirely clear which U.S. ports will become major regional hubs. The answer involves a multitude of factors, and is impossible to predict with a great degree of confidence.

However, port infrastructure is critical. With the high capital cost of modern containerships, time spent in port is a major expense, and carriers not only want to call on fewer ports, but they want ones with infrastructure that minimize delays in loading and unloading cargo. To attract the business of major carriers, port managers must increase terminal productivity, reduce terminal costs and improve intermodal (rail and truck) access. Maersk/SeaLand selected the Port of New York/New Jersey as a regional hub, but depth constraints have apparently hampered efficient hub and spoke operations. Maersk's recently introduced post-Panamax vessels lighten their loads at the Canadian port of Halifax before entering New York Harbor.[48] Maersk/SeaLand has also made Los Angeles its West Coast hub. Los Angeles leased its new PIER 400 terminal to Maersk/SeaLand. As part of the PIER 300 complex, the Port completed a 232-acre terminal with 12 "super post-Panamax" cranes and 28 railheads.[49] PIER 300/400 will also include a $20 million rail center–the Terminal Island Container Transfer Facility. The 47-acre facility will have multiuser intermodal capacity that will allow containers to be unloaded from ships and placed directly on railcars for immediate distribution. Channel depths at the facility range from 50 to 63 feet.

Harbor depth remains an obstacle for many ports, particularly along the Gulf and Atlantic Coasts, where major container ports have channel depths of 45 feet or less. Table VI-6 lists the maximum channel depths at major U.S. container ports. Baltimore and Hampton Roads are the only ports that provide channels at or below 50 feet; however, Federal channels that lead directly to container terminals at Baltimore and Hampton Roads are 45 feet deep. Along the Gulf Coast, New Orleans has the deepest channel at 45 feet. Pacific container ports are generally deeper, and many are currently dredging to depths of at least 50 feet. Los Angeles, Long Beach and Tacoma provide channel and berth depths of 50 feet or greater. Seattle and Oakland are deepening to 50 feet.

Table VI-7 and Figure V-27 display the number of trade routes to and from U.S. ports that the five major carrier alliances currently operate. Concentration of routes at select ports gives a good indication of how the five major carrier alliances concentrate cargo traffic at U.S. ports, and provides some indication of which ports besides New York and Los Angeles may become regional hubs. Note that alliances concentrate activity at ports with deep harbors or ones that are currently dredging. Along the Atlantic Coast, alliances currently concentrate liner traffic at New York, Hampton Roads, Charleston, Port Everglades and Savannah. Other possible candidates on the Atlantic Coast include but are not limited to Jacksonville, Miami and San Juan, Puerto Rico. Long Beach, Los Angeles, Tacoma, Seattle, Oakland and Portland are leading candidates on the Pacific, where it is likely that two to four major hubs will emerge. Vancouver, British Columbia is also a contender, given its land and waterside facilities and intermodal links. On the Gulf Coast, Houston and New Orleans are possible candidates for a Gulf Coast hub.

[48] Rerouting of discretionary cargo to deeper ports is referred to as "cargo diversion." Dredging is often cited as a chief factor affecting cargo diversion from East Coast ports to Canada. However, a multitude of other elements can have an impact including but not limited to landside costs, labor practices, taxes and user fees. See Study of the Causes of East Coast Cargo Diversion and International Competitiveness Enhancements. U.S Department of Transportation, Washington, DC, October 1997.

[49] As containerships have become larger and wider, pier-side cranes have evolved. Container cranes must be able to reach across the entire beam (width) of a vessel in order to remove containers stacked across a ship's deck. "Super" post-Panama cranes have outreaches of about 160 feet and can service the largest containerships in operation today.

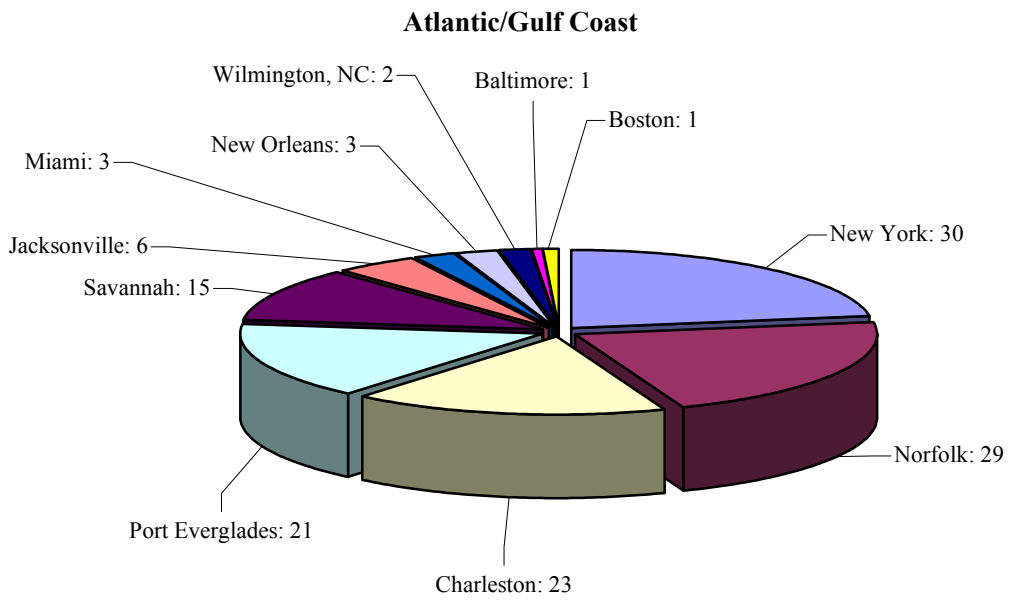
TABLE VI-6

MAXIMUM CHANNEL DEPTHS AT MAJOR U.S. CONTAINER PORTS

Selected U.S Container Ports	Current Maximum Channel Depth	Depth Construction Underway	Authorized Depth
Long Beach, CA	60*	-	81
Los Angeles, CA	63*	-	75
New York	40	45	45
Seattle, WA	40	51	51
Oakland, CA	42	50	50
Charleston, SC	42	45	45
Norfolk, VA	50*	-	50
Houston, TX	40	-	45
Tacoma, WA	50	51	51
Miami, FL	42	-	42
Savannah, GA	42	48	48
Port Everglades, FL	42	-	45
Baltimore, MD	50*	-	50
Portland, OR	40	-	43
New Orleans, LA	45	-	55
Jacksonville, FL	38	-	41
San Juan, PR	36	40	40
Gulfport, MS	36	-	42
Wilmington, NC	38	42	42
Palm Beach, FL	33	-	33

* Channel depths cited are for federally maintained channels at mean low water (MLW). Channels cited for Los Angeles and Long Beach refer to channels that lead directly to major container terminals at these ports. Other locations at both ports may be deeper. Federal channels at Baltimore and Norfolk do not lead directly to container terminals at these ports.

Sources: American Association of Ports Authorities, Corps and individual port statistics.



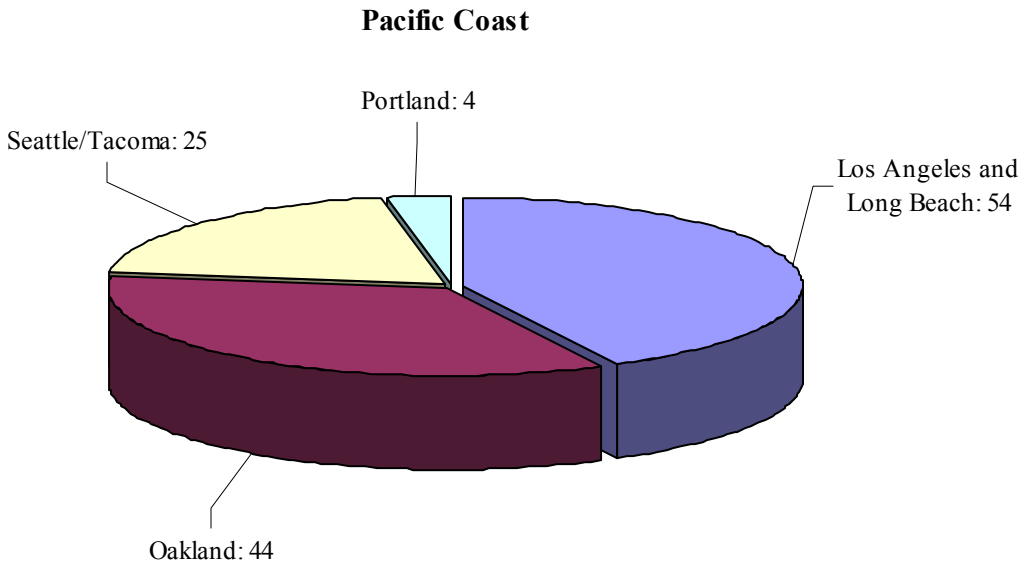


Figure V-27. Number of Trade Routes to and from U.S. Ports by Carrier Alliance as of February 1999

TABLE VI-7

NUMBER OF TRADE ROUTES TO AND FROM U.S. PORTS BY CARRIER ALLIANCE AS OF FEBRUARY 1999

Port of Call	Maersk/SeaLand	Grand Alliance	New World Alliance	Hanjin/DSR/Cho Yang	COCSO/ "K" Line/ Cho Yang	Total by Ports	Percentage by Port
Los Angeles and Long Beach	14	7	11	12	10	54	20.3%
Oakland	9	6	9	12	8	44	16.5%
New York	8	5	3	13	1	30	11.3%
Hampton Roads	10	5	3	10	1	29	10.9%
Seattle/Tacoma	7	4	8	4	2	25	9.4%
Charleston	14	3	3	2	1	23	8.6%
Port Everglades	19	-	-	1	1	21	7.9%
Savannah	-	2	-	13	-	15	5.6%
Jacksonville	6	-	-	-	-	6	2.3%
Houston	4	-	-	-	1	5	1.9%
Portland	-	-	2	-	2	4	1.5%
Miami	3	-	-	-	-	3	1.1%
New Orleans	2	-	-	-	1	3	1.1%
Wilmington, NC	-	-	-	2	-	2	0.8%
Baltimore	-	-	-	-	1	1	0.4%
Boston	1	-	-	-		1	0.4%
Total by Alliance	97	32	39	69	29	266	100%
Percentage by Alliance	36%	12%	15%	26%	11%	100%	

Source: ComPair Schedules: Editorial Supplement to American Shipper, Howard Publishing, Winter (1999).

Ultimately, the port network in the United States may evolve into one with large centralized loading points, thereby concentrating cargo at several important ports along each U.S coastline. It should be stressed, however, that non-hub ports would not necessarily lose under such circumstances. As post-Panamax containerships are introduced, many older vessels they replace are re-deployed on other trade routes or as feeder ships. Since post-Panamax containerships operate most economically by limiting port calls, they are partially dependent upon inland distribution systems and feeder ships to collect and consolidate containers. Although there is a trend toward larger containerships, smaller Panamax class ships are expected to maintain their current share of tonnage capacity in the world fleet.[50] Just by maintaining their current share, amounts of trade carried by these vessels will expand as world trade grows. Ports

[50] See, U.S. Department of Transportation, Office of Intermodalism, "The Impacts of Changes in Ship Design on Transportation Infrastructure and Operations." Washington, DC, February 1998.

that focus on servicing Panamax ships will likely continue to play a significant role in the future, even if they do not compete for the business of larger containerships.

For many ports, the costs of infrastructure improvements may not justify the risk and uncertainty in future demand. Terminal improvements and dredging projects are not only costly, but are difficult to implement because of increasing environmental pressures. Billions of dollars worth of expenditure in port development projects such channel deepening, deep-water berths and post-Panamax cranes does not guarantee that alliances will call on a particular port. Many ports may find it more economical not to compete with other regional ports for load center status.

Megahub Operations

While regional hub and spoke activity is still a major component of total transshipment, over time, especially with the emergence of carrier alliances, a global form of transshipment hubs has emerged. Often referred to as "mega" transshipment hubs, these container terminals are sited at locations sufficiently central to serve main east-west or north-south trade routes and provide fast and efficient feeder services to large sub-regions. They are also being designed and located to accommodate containerships with capacities of at least 6,000 TEUs. Unlike many traditional ports, they do not directly service inland markets.[51]

For carriers operating new generations of container ships, megahubs offer many advantages over traditional liner ports. Depth and channel constraints are a major factor. Megahubs are being located in areas that do not require continual dredging, which is expensive and, in many nations, controversial and difficult to implement because of potential environmental impacts. Dredging is a constant process, particularly at inland ports where siltation occurs.[52] This is not the case with many of the new offshore megahubs, which have the advantage of naturally deep waters. Ports in the Caribbean, Mediterranean and along the Arabian Peninsula have low siltation rates and limited rainfall, thus there is minimal need for dredging. Big ships also have difficulty in navigating rivers, and in ports where congestion exists, this can be a major impediment.

Many ports are struggling to develop infrastructure and improve the efficiency of existing facilities. At some point, expansion may become difficult or impossible. Ports in metropolitan areas must compete with other public interests for alternative land uses near port facilities. In many communities throughout the United States and abroad, local citizens oppose terminal development and dredging due to potential environmental impacts. For example, most major U.S. ports are in or near large urban areas where trucks and trains compete with commuters on crowded highways. Numerous rail at-grade street and highway crossings can hamper access to ocean terminals and cause delays for carriers, shippers and commuters. Collisions associated

[51] See, Baird (1999) and DeMonie, G. "The Global Economy, Very Large Containerships and the Funding of MegaHubs." *Paper presented at the Cargo Systems Port Financing Conference,* London, June 27, 1997.

[52] With the exception of Seattle, WA and Long Beach, CA, most major U.S. ports are located at the mouths of rivers connected to inland waterway systems. Historically this has been advantageous since most goods were transported to and from inland markets via rivers and canals. However, a major disadvantage is that most harbors at the mouths of rivers are not natural deepwater harbors. At ports located at the mouths of rivers, upstream runoff collects soil from the land that is carried downstream and deposited on harbor bottoms.

with at-grade crossings and roads are a problem and may worsen because of increasing port traffic and growing urban congestion.[53] A recent study by the U.S. Maritime Administration found that more than half of all U.S. ports reported that traffic impediments are major infrastructure problems.[54] Land values in large urban areas can also be exorbitant, which makes expansion very costly. In order to serve existing clients, many ports are spending millions of dollars for development projects, but finding additional land to occupy is becoming increasingly more difficult.

More remote locations where there are fewer people and competing industries are much cheaper to develop and maintain. Several sites around the globe are being developed to serve as megahubs. Major hub development is taking place in Asia. At Kabil on Batam Island, investors are planning an enormous U.S. $900 million container transshipment and general cargo port. Kabil has naturally deep water (56 feet), limited population and a location within five miles of major international shipping lanes, the Malacca Straits. Ultimately, Kabil will have the capacity to handle six to ten million TEUs per year. Mina Raysut in Oman is being developed as a new megahub in the Mid-East. Maersk/Sealand has sole management rights to the facility. Currently, Mina Rasut has four berths with depths of 50 feet, six super post-Panamax cranes and six larger cranes with outreaches of 22 containers. These are supposedly the biggest cranes ever built and are capable of servicing yet-to-be built 12,000-TEU ships. Construction has started on a Mediterranean transshipment terminal at the mouth of the Suez Canal.[55] In late 1999, Maersk/ SeaLand agreed to a 30-year concession with the Egyptian government to operate a hub at the Port Said East terminal. The terminal will be able to handle ships of up to 6,000 TEUs, and eventually it will be capable of handling 8,000-TEU ships. The Egyptian government has already started to dredge the harbor at Port Said to 55 feet, and eventually they will deepen it to 60 feet.

In the Mediterranean, several transshipment hubs are operational. Since 1994, these facilities have experienced momentous growth in container throughput. Activity is currently focused at Algeciras (Spain), Gioia Tauro (Italy) and Marsaxlokk (Malta). In only four years of operation, Gioia Tauro has become Italy's busiest seaport. In 1995, only 17,000 TEUs flowed through the port; however, by 1997, throughput increased to an astonishing 2.12 million TEUs (See Figure VI-28). At Marsaxlokk, throughput has increased by 1000 percent since 1990. Both ports have natural deepwater harbors, berths with depths greater than 50 feet and super post-Panamax cranes capable of servicing the largest containerships. Further development is planned at both facilities. Between 1994 and 1997, TEU throughput at Algeciras increased at rate of about 20 percent per year. Today, Algeciras is the 20th largest container port in the world based on the number of containers handled.

In the Caribbean, Freeport is strategically located to serve as a transshipment hub for the East and Gulf Coasts of the United States, the Caribbean and South America. Freeport serves trade lanes to Europe, the Mediterranean, the Far East and Australia. Freeport has several

[53] Fifty-three percent of the U.S. population resides along the nation's coastline. Coastal communities, which are experiencing the fastest growth rates, represent only 17 percent of the United States landmass. See, Culliton, T.J., Population, Distribution, Density, and Growth: State of the Coast Report, U.S. Department of Commerce, National Oceanic and Atmospheric Administration, 1998.

[54] United States Maritime Administration, An Assessment of the U.S. Marine Transportation System: A Report to Congress. September 1999.

[55] Brennan T. , "Egypt has big plans for Suez terminal: Maersk, ECT to run Port Said East." The Journal of Commerce, The Daily Journal of Trade Logistics, 18 November 1999.

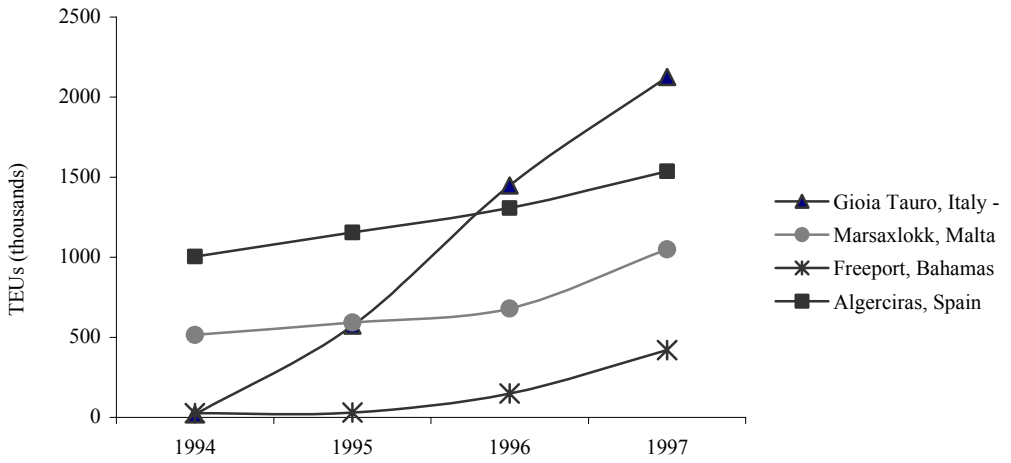


Figure VI-28. TEU Throughput at Selected International Transshipment "Megahubs": 1994 – 1997 (thousands of TEU)

Source: Individual port statistics

advantages. It located just 65 miles from the coast of Florida, and it has deep water, with one of the deepest harbors in the region at 52 feet. Container terminals are now operational and taking regular calls from major carriers. TEU throughput at Freeport has increased from about 26,500 TEUs in 1994 to nearly 420,000 in 1997.

Hub operations at Freeport could affect U.S. ports and the shipping industry in two ways. First, if post-Panamax ships are not able to access U.S. ports because of depth constraints, transshipment at Freeport could become a very viable option for many of the larger carriers. Carriers servicing east/west or north/south trade routes could reroute large containerships to Freeport and bypass U.S East Coast ports. Feeder services could be used to transfer cargo to East Coast ports. Secondly, development at Freeport is funded by Hutchinson Port Holdings, which recently invested over $75 million in a container port (Balboa) located at the entrance to the Panama Canal. Reports indicate that Hutchinson is planning to construct a rail link across the Isthmus that would link Balboa with Port Cristobal on the Atlantic side, which Hutchinson also operates and manages.[56] Once finished, this link could provide a new route for container shipments to the U.S. Atlantic Coast. Conventionally, most Asian cargo bound for the East Coast is shipped to Pacific Coast ports and land-bridged via rail to East Coast markets or on to Europe. However, with a rail link in Panama, cargo could be shipped from the Far East and land-bridged across the Isthmus of Panama, where it could then be transported to Freeport for transshipment to U.S. East Coast ports or directly on to Europe. Thus, Pacific ports could lose cargo traditionally offloaded for rail service to the East Coast, and Atlantic Coast ports could see the loss of cargo shipped directly to Europe from Freeport.

[56] Apparently, Hutchinson is developing the port of Balboa to handle large volumes of container traffic. Projects include dredging to 50 feet and installing several Panamax cranes. Balboa currently has a capacity of about 400,000 TEUs. In the long term, investment is planned to increase this amount to 2 million TEUs. See, United States Department of Transportation, Study of the Causes of East Coast Cargo Diversion and International Competitiveness Enhancements. U.S Department of Transportation, Washington, DC, October 1997.

Discussions surrounding the development of hub and spoke operations are purely speculative in nature. For the reader they are valuable in understanding trends toward increased concentration of containership traffic at U.S. ports. However, because they are speculative they are not directly involved in determining potential dredging needs on a national level.

CONCLUSION

Information regarding the composition, dynamics and operations of the world merchant fleet is critical for port managers who must decide how to prepare their ports for the future. As global trade increases, the fleet will respond. With the exception of break bulk and combination carriers, the cargo carrying capacity of the world merchant fleet will continue to grow as international trade and demands for efficient sea transport increase. Of the different types of vessels, the tonnage capacity of containerships in the world fleet has grown the fastest. Containerships are the only vessels that have significantly increased in terms of individual vessel sizes over the last decade. As the fleet and individual ships grow, it is imperative that U.S. ports have the physical and operational capabilities to handle all types of freight entering and leaving the United States. Consequently, the U.S. must maintain its competitive edge into the future and assure that U.S. ports are at least as efficient as other ports across the world, particularly those ports that serve as the points of origin or destination for U.S. trade. A significant factor that will determine the competitiveness of U.S. ports will be the implementation of port infrastructure projects.

VII. U.S. AND FOREIGN PORT INFRASTRUCTURE

Ports require an array of facilities and equipment to operate efficiently. Infrastructure varies according to the types of cargo and vessels that ports service. For example, ports that handle dry and liquid bulk commodities such as grain and oil need special pier-side facilities to load and unload vessels, and to service containerships, ports must have adequate berths equipped with specialized cranes. Intermodal connections are critical for container operations, and channel depth is important, particularly for ports that service new generations of containerships.

INFRASTRUCTURE AND FACILITIES AT U.S. PORTS

To review the infrastructure and facilities of U.S. and foreign ports, basic information was collected on the availability of cargo handling facilities, including numbers and overall lengths of berths and numbers of cranes on each berth. To the extent possible, facilities were characterized according to the types of vessels they are designed to service.

Table VII-1 summarizes facilities available at ports along each U.S. coastal region.[57] With the exception of the Great Lakes and Gulf Coast, most ports have facilities for all types of cargo. In the Atlantic region, the Caribbean Islands and Portland are the only ports not equipped with container berths, and the Caribbean Islands are the only location lacking dry bulk facilities. Others have berths dedicated to each class of cargo. Along the Gulf Coast, ports are equipped with facilities dedicated to liquid bulk, crude petroleum and general cargo. However, in contrast to the Atlantic Coast, only six major ports along the Gulf have container facilities–Houston, New Orleans, South Louisiana, Texas City, Mobile and Freeport. The remaining ports specialize in general cargo, liquid bulk and dry bulk commodities.

A similar pattern exists on the Pacific Coast, where several ports have facilities for only one or two types of cargo. The Port of Kalama–where about 98 percent of cargo is shipped on dry bulk vessels–is not equipped with container, Ro-Ro or liquid bulk facilities. Similarly, 85 percent of cargo at Oakland is containerized, 9 percent is dry bulk, and the port does not have liquid bulk facilities. Port Hueneme, which specializes in break-bulk agricultural commodities and automobiles, does not have a facility dedicated to containerships.[58]

Port infrastructure along the Great Lakes strongly reiterates the role of these ports as traders of dry bulk goods such as coal, grain, ores and metals. Only two ports along the Great Lakes have container berths, Detroit and Burns Harbor.

[57] These ports are ones most active in foreign trade in terms of both tonnage and value. They were identified in Chapter V of this report.

[58] Port Hueneme does handle refrigerated containers transported on multipurpose ships and has extensive refrigerated storage capacity; however, it does not have a berth dedicated toward servicing cellular containerships.

TABLE VII-1

CARGO HANDLING AND VESSEL SERVICE FACILITIES AT U.S. PORT BY COASTAL REGION

	Petroleum	Other Liquid Bulk	Dry Bulk	General Cargo	Containers	Ro/Ro	Bunkers	Dry Dock	Towage	Rail	Airport
Atlantic Coast											
New York/New Jersey, NY & NJ	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Norfolk Harbor, VA	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Baltimore, MD	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Philadelphia, PA	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Caribbean Islands	✓	✓	×	×	×	×	✓	×	-	×	×
Newport News, VA	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Paulsboro, NJ	✓	✓	-	-	-	-	✓	-	-	✓	✓
Savannah, GA	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Portland, ME	✓	✓	✓	✓	×	×	✓	✓	✓	✓	✓
Charleston, SC	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Miami, FL	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Port Everglades, FL	✓	✓	✓	✓	✓	✓	✓	×	✓	✓	✓
Jacksonville, FL	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Wilmington, NC	✓	✓	✓	✓	✓	✓	✓	×	✓	✓	✓
Gulf Coast											
Houston, TX	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Port of South Louisiana, LA	✓	✓	✓	✓	✓	×	✓	×	✓	✓	✓
Corpus Christi, TX	✓	✓	✓	✓	×	×	✓	✓	✓	✓	✓
New Orleans, LA	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Baton Rogue, LA	✓	✓	✓	✓	×	×	×	×	×	✓	✓
Texas City, TX	✓	✓	✓	✓	×	×	✓	×	✓	✓	✓
Port Arthur, TX	✓	✓	✓	✓	×	×	✓	✓	✓	✓	✓
Lakes Charles, LA	✓	✓	✓	✓	×	×	✓	×	✓	✓	✓
Mobile, AL	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Plaquemine, LA	✓	✓	✓	✓	×	×	-	-	-	✓	✓
Freeport, TX	✓	✓	✓	✓	✓	-	✓	✓	✓	✓	✓
Pacific Coast											
Long Beach, CA	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Los Angeles, CA	✓	✓	✓	✓	✓	✓	✓	×	✓	✓	✓
Seattle, WA	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Portland, OR	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Tacoma, WA	✓	✓	✓	✓	✓	✓	✓	×	✓	✓	✓
Oakland, CA	×	×	✓	✓	✓	✓	×	✓	✓	✓	✓
Kalama, WA	×	×	✓	✓	×	×	×	×	×	✓	✓
Vancouver, WA	✓	✓	✓	✓	✓	✓	✓	-	✓	✓	✓
Richmond, CA	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Barbers Point, HI	✓	✓	✓	✓	✓	✓	✓	✓	✓	-	✓
Hueneme, CA	✓	✓	✓	✓	×	✓	✓	×	✓	✓	✓
Carquinez Strait, CA	✓	✓	✓	-✓	×	--	--	--	--	-	--
Great Lakes											
Duluth - Superior, MN & WI	✓	✓	✓	✓	×	✓	✓	✓	✓	✓	✓
Detroit, MI	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Toledo, OH	✓	✓	✓	✓	×	✓	✓	✓	✓	✓	✓
Chicago, IL	✓	✓	✓	✓	×	×	✓	×	✓	✓	✓
Cleveland, OH	×	✓	✓	✓	×	×	✓	×	✓	✓	✓
Ashtabula, MI	×	×	✓	×	×	×	✓	×	✓	✓	✓
Sandusky, OH	×	×	✓	✓	×	--	✓	--	--	✓	✓
Burns Harbor, IN	✓	✓	✓	✓	✓	✓	✓	--	✓	✓	✓
Conneaut, OH	×	×	✓	×	×	--	--	--	--	✓	--
Calcite, MI	×	--	✓	×	×	--	--	--	--	✓	--
Buffalo, NY	--	✓	✓	✓	-	--	✓	--	✓	✓	✓
Milwaukee, WI	--	×	✓	✓	✓	×	--	--	--	✓	✓

* Dashed line indicates that data are not available. Check marks indicate that the port is equipped with a particular type of infrastructure. An "X" indicates that a port lacks a particular type of infrastructure.

Source: Fairplay World Ports 1997, Saint Lawrence Seaway Development Corporation and individual port statistics.

Table VII-2 displays the number of berths and cranes at U.S. ports. According to available data, there are 154 container berths at Atlantic Coast ports, 138 general cargo berths and 418 tanker berths. Total berth lengths are about 104,000 feet for containerships, 84,000 for general cargo and almost 200,000 for tankers. There are 192 dry bulk berths, with an overall length of nearly 104,000 feet. New York, the most active container port along the Atlantic, has 33 containers berths, with a total length of 23,000 feet. Charleston, Miami, Port Everglades and Jacksonville have between 15 and 26 container berths with overall berth lengths of about 10,000 to 14,000 feet. With the exception of New York/New Jersey, which has 215 tanker berths, tanker capacity appears to be evenly distributed among Atlantic Coast ports.

Along the Gulf Coast, there are significantly fewer container berths. Houston has 16 with a total length of approximately 12,000 feet, and New Orleans has 12 with an overall length of 6,700 feet. The relatively low number of container berths along the Gulf Coast is not surprising given that the region is the origin or destination of only about 8 percent of container shipments in terms of tonnage and 3 percent based on value. In contrast, ports along the Gulf account for about one-half of tanker and dry bulk shipments, and the region has 479 berths dedicated to tankers, with a cumulative length of nearly 232,000 feet. Houston is equipped with 129 tanker berths, with 53,000 feet overall. Remaining Gulf Coast ports have between 20 and 64 tankers berths. With the exception of Freeport and Texas City, most Gulf Coast ports are well equipped to handle large volumes of dry bulk cargo. The Port of South Louisiana, the Nation's number one exporter of grain, has 20 dry bulk berths, with a cumulative length of almost 30,000 feet.

Distribution of facilities along the Pacific Coast is consistent with general trade patterns in the United States. Almost 40 percent of containership cargo measured by weight flows through the Pacific Coast and slightly more than 62 percent in terms of value. Thus, Pacific Coast ports have almost as many container berths as Atlantic Coast ports–128, with a total length of nearly 100,000 feet. Long Beach, Los Angeles, Oakland, Seattle and Tacoma are the main container ports along the Pacific Coast. Others specialize primarily in general cargo, dry bulk and/or liquid bulk traffic.

Facilities at ports on the Great Lakes are designed primarily for non-containerized general cargo and bulk cargo. Chicago, Duluth-Superior and Detroit have the most dry bulk berths along the Great Lakes. Chicago has 90, with a total berth length of 77,000 feet, Duluth-Superior has 35 dry bulk berths, with an overall length of almost 41,000 feet, and Detroit has 34 berths, with about 34,000 feet. In total, there are 268 dry bulk berths along the Great Lakes with a cumulative length of 255,000 feet.

TABLE VII-2

NUMBER OF BERTHS, BERTH LENGTH AND NUMBER OF CRANES BY TRAFFIC TYPE FOR KEY U.S. PORTS

	Container			General Cargo			Dry Bulk			Tanker		
	Berths	Length	Cranes	Berths	Length	Cranes	Berths	Length	Cranes	Berths	Length	Cranes
Atlantic Coast												
New York/New Jersey, NY & NJ	33	23,111	51	24	15,729	5	105	41,075	-	215	89,636	-
Norfolk Harbor VA	17	14,145	7	16	8,746	-	26	16,184	-	35	14,391	-
Philadelphia PA	6	5,265	25	18	12,990	9	6	2,992	-	31	16,847	-
Baltimore MD	16	13,233	11	21	18,182	20	31	24,745	-	34	18,073	-
Newport News VA	5	3,650	4	na	na	3	4	4,000	-	7	3,733	-
Paulsboro, NJ	na	na	na	3	775	-	na	na	na	12	7,604	-
Caribbean Islands	na	na	na	na	na	na	na	na	na	9	8,290	-
Savannah, GA	16	4,836	13	10	3,845	4	8	7,056	-	10	6,373	-
Portland, ME	1	551	na	3	875	-	na	na	na	10	7,120	-
Charleston, SC	15	11,771	16	4	1,634	11	3	1,725	-	11	6,185	-
Port Everglades FL	6	4,548	7	8	3,888	-	2	1,226	-	9	5,404	-
Jacksonville FL	10	6,450	12	14	7,083	8	4	2,541	-	14	7,098	-
Miami, FL	26	13,964	10	11	5,716	3	na	na	na	3	1,780	-
Wilmington, NC	3	2,650	5	6	4,113	4	3	2,088	-	13	6,793	-
Total Top Atlantic Coast Ports	154	104,174	161	138	83,576	67	192	103,632	-	418	202,572	-
Gulf Coast												
Port of South Louisiana, LA	na	na	na	1	200	-	40	28,867	-	64	38,519	-
Houston, TX	16	12,126	-	53	26,055	-	36	19,670	-	129	53,296	-
Baton Rouge LA	na	na	na	6	3,409	-	25	16,255	-	45	22,756	-
Texas City, TX	na	na	na	na	na	na	2	2,150	-	36	16,645	-
Corpus Christi ,TX	1	1,060	-	9	4,246	-	8	6,885	-	39	21,085	-
Port Arthur, TX	2	1,200	-	6	3,500	-	5	3,385	-	17	9,615	-
New Orleans, LA	12	6,716	-	91	37,403	-	35	23,715	-	43	18,176	-
Lake Charles, LA	na	na	na	15	8,098	-	20	12,104	-	38	18,970	-
Mobile, AL	na	na	na	33	19,169	-	39	24,210	-	28	12,958	-
Port of Plaquemine, LA	na	na	na	1	800	-	10	10,550	-	20	10,286	-
Freeport, TX	1	640	-	3	1,362	-	1	195	-	20	9,426	-
Total Top Gulf Ports	32	21,742	-	218	104,242	-	221	147,986	-	479	231,732	-
Pacific Coast												
Los Angeles, CA	30	17,930	28	25	10,960	7	10	6,000	na	28	9,785	na
Long Beach, CA	24	25,313	-	19	13,177	-	5	3,127	-	15	11,536	-
Seattle, WA	9	6,645	-	16	11,729	-	27	18,080	-	20	12,810	-
Portland, OR	31	20,151	-	40	17,089	-	21	8,402	-	10	4,492	-
Tacoma, WA	9	8,450	-	10	6,225	-	16	6,192	-	8	4,505	-
Oakland, CA	24	17,834	-	6	3,715	-	3	1,813	-	na	na	na
Kalama, WA	na	na	na	2	600	-	5	3,202	-	1	680	-
Vancouver, WA	1	1,109	-	3	2,015	-	4	2,630	-	10	12,059	-
Richmond, CA	-	-	-	8	4,390	-	5	4,128	-	3	1,325	-
Barbers Point, HI	na	na	na	na	na	na	3	1,600	-	3	2,195	-
Hueneme, CA	na	na	-	3	2,404	-	3	3,010	-	10	7,210	-
Carquinez Strait, CA	na	na	na	6	3,629	-	na	na	na	na	na	na
Total	128	97432	28	138	75933	7	102	58184	0	108	66597	0

TABLE VII-2

NUMBER OF BERTHS, BERTH LENGTH AND NUMBER OF CRANES BY TRAFFIC TYPE FOR KEY U.S. PORTS

	Container			General Cargo			Dry Bulk			Tanker		
	Berths	**Length**	**Cranes**	**Berths**	**Length**	**Cranes**	**Berths**	**Length**	**Cranes**	**Berths**	**Length**	**Cranes**
Great Lakes												
Duluth-Superior, MN & WI	na	na	na	9	5,354	-	35	40,732	-	3	1,290	-
Toledo, OH	na	na	na	9	4,950	-	18	17,295	-	9	5,006	-
Chicago, IL	na	na	na	28	24,083	-	90	77,249	-	44	19,639	-
Detroit, MI	-	-	-	10	7,347	-	34	33,673	-	11	5,316	-
Sandusky, OH	na	na	na	7	1,153	-	3	4,095	-	na	na	na
Ashtabula, OH	na	na	na	4	2,000	-	11	10,643	-	na	na	na
Cleveland, OH	na	na	na	8	6,539	-	25	26,569	-	5	5,297	-
Burns Waterway Harbor, IN	-	-	-	5	2,702	-	7	6,862	-	1	360	-
Conneaut, OH	na	na	na	na	na	na	7	5,760	-	na	na	na
Calcite, MI	na	na	na	na	na	na	3	2,370	-	na	na	na
Buffalo, NY	na	na	na	na	na	na	18	15,728	-	5	3,718	-
Milwaukee, WI	-	-	-	9	6,407	-	17	13,916	-	3	2,877	-
Total Top Great Lakes Ports				89	60,565	-	268	254,892	-	81	43,506	-
Total for all Key U.S. Ports	306	225,825	161	576	325,421	67	782	565,073	0	1,070	543,828	

"na" means not applicable, and a dashed line indicates data were not available.

Source: Jack Faucett Associates. National Dredging Needs Study of Ports and Harbors: Port Characteristics Data: A Report Submitted to U.S. Army Corps of Engineers Institute for Water Resources, Alexandra, VA, December 1997.

INFRASTRUCTURE DEVELOPMENT AT U.S. PORTS

Infrastructure development at major U.S. ports is primarily geared toward containerized cargo. As containerships become larger and the volume of container trade grows, many ports are building or improving terminals with larger cranes, additional berths, storage yards and computerized information systems. For example, New York/New Jersey has implemented improvements that have resulted in significant increases in container throughput. A major development was the reopening of the Howland Hook Marine Terminal, which provides six new container terminals capable of handling 2.5 million TEUs annually. Channels at New York/New Jersey are being deepened to 45 feet, and New York is finalizing construction plans for the Arlington Rail Yard near its main container terminal, which will link Staten Island with Conrail's main line.

Boston has consolidated all container operations at the Conley Terminal where the Massachusetts Ports Authority purchased four post-Panamax cranes, deepened berths to 45 feet and implemented an automated gate facility.[59] At the same time, the Moran Terminal was transformed into the "Boston AutoPort," which can offload 400 cars an hour. Construction is underway to deepen the Mystic and Reserved Channels at Boston from 35 to 40 feet and the Chelsea River Channel from 35 to 38 feet. Philadelphia has invested over $100 million in new and renovated terminal facilities including a $60 million project to enlarge and expand tunnels and rail clearances to allow double-stack rail service. Construction is also underway to deepen the main shipping channel in the Delaware River from 40 to 45 feet. At Norfolk, the Virginia Port Authority has identified more than $334.8 million in improvements to existing facilities and construction of new infrastructure to accommodate expected increases in general cargo including containerized freight. This includes a 238-acre addition to container terminals at Norfolk, including 1,500 feet of berthing, six post-Panamax cranes and a 100-acre container storage yard.

Along the South Atlantic, the South Carolina State Port Authority is developing a 1,300-acre container terminal at Charleston, and construction is underway to deepen Charleston's main channel from 42 to 45 feet. In Wilmington, construction is underway to deepen the entrance and main channel to the port. Plans call for deepening the entrance channel from 40 to 44 feet and deepening the main channel from 38 to 42 feet. Savannah recently added a new container berth with two post-Panamax cranes, expanded warehousing and general cargo berthing capabilities. In Florida, Jacksonville will soon add two 50-ton container cranes and has completed construction on two new vehicle-processing buildings at its Blount Island Marine Terminal. Jacksonville is also redeveloping major portions of the Tallyrand terminal, including refurbishing existing container facilities and improving rail connections. Port Everglades is expanding its Southport Intermodal Terminal and constructing an on-dock intermodal link. The port is also converting a dry bulk berth to a container facility equipped with two post-Panamax cranes and on-dock rail access. Miami is planning to construct additional container storage areas, Ro-Ro berths and an off-dock intermodal rail link.

[59] As containerships have become larger and wider, pier-side cranes have evolved. Container cranes must be able to reach across the entire beam (width) of a vessel in order to remove containers stacked across a ship's deck. "Super" post-Panama cranes have outreaches of about 160 feet and can service the largest containerships in operation today.

Since 1995, Los Angeles has invested about $820 million in its facilities, and it plans to spend another $1.2 billion over the next 10 years. Los Angeles is completing its PIER 300/400 program, which encompasses 24 separate, but related, projects. As part of the PIER 300 complex, the Port built a 232-acre terminal with 12 super post-Panamax cranes and 28 railheads. This facility, the Global Gateway South Terminal, will be the largest container complex in the United States, at a total cost of about $270 million. Construction is also underway at Los Angeles to deepen the main channel to 75 feet and the entrance channel to 81 feet. Completion of the Alameda Corridor will be a major milestone for both Los Angeles and Long Beach. In general, the Corridor will greatly facilitate cargo flow to hinterland markets, while significantly reducing potential negative impacts of port growth on the environment and neighboring communities. According to the Los Angeles Ports Authority, the project will consolidate operations of three freight railroad carriers into one high-speed, high-capacity corridor. It will eliminate all highway rail crossings, while combining 90 miles of separate rail lines into one 20-mile corridor. This will reduce traffic conflicts at nearly 200 highway crossings of the tracks, saving an estimated 15,000 hours of delay per day for vehicles that must wait at crossings while trains pass. For the ports, it means cargo will move faster between ships and inland markets.

In 1997, Tacoma undertook several projects to increase its share of the container market, including enhanced intermodal access and the removal of a bridge that had restricted large containerships from accessing port facilities. Seattle is expanding several terminals and recently purchased two super post-Panamax cranes. Construction is underway to deepen the East Waterway of the Duwamish River to 51 feet. Development at Seattle and Tacoma is paramount, as Vancouver, British Columbia has emerged as an earnest competitor for containers destined for the Puget Sound. Oakland is building several new terminals with high capacity intermodal access and is deepening harbor channels from 40 to 50 feet. Oakland, Tacoma and Seattle are spending a combined $1.4 billion on expanded facilities in an attempt to wrest trade from the Southern California ports and to boost containerized cargo volumes.

Along the Gulf Coast, Houston is anticipating further growth in container throughput, and it plans to increase capacity by developing a new 720-acre container terminal at Bayport. Compared to its existing depot, Houston's planned terminal would be significantly closer to the ocean, which would save containerships about 30 minutes of sailing time. Bayport will include 7,000 feet of berthing, 10 post-Panamax cranes, on-dock intermodal access and a 124-acre industrial development area. New Orleans recently completed construction of its Nashville "C" Container Terminal, adding 16,000 feet of wharf, two container cranes and additional container storage space. The Board of Commissioners has also approved a comprehensive plan for redevelopment of the Napoleon Avenue "A" and "B" Terminals. The new container terminals will be located on the east bank of the Mississippi River and will feature 1,739 linear feet of wharf and approximately 33 acres for storage. The Port of South Louisiana is refurbishing its main terminal, the Globalplex, by adding a new general cargo berth and, for the first time, a container berth. Lastly, Texas City, which is known primarily as a tanker port, may become a major U.S. container port. Americana Ships and Stevedoring Services of America signed an agreement in April of 2000 to design, develop, operate and finance a 300-acre container terminal at Texas City that would handle ships drawing up to 50 feet of water. The terminal is expected to be operational within three years. Initially, it will have a 3,000-foot berth, 240 acres of container yard and a 60-acre on-dock rail yard.

Although the majority of port development focuses on container trade, some ports with niche markets are also improving infrastructure. New facilities to improve general and bulk cargo are being implemented, including new Ro-Ro terminals, grain elevators and refrigerated storage facilities. For example, Baltimore is constructing a new 100,000-square-foot warehouse for Ro-Ro and break-bulk cargo, an 18-bay maintenance and repair facility and additional container storage space. Port Hueneme has a terminal development program underway that, when complete, will greatly enhance the Port's ability to handle refrigerated containers and Ro-Ro cargo and includes plans for a new on-dock rail yard.

INFRASTRUCTURE AND FACILITIES AT FOREIGN PORTS

Selection of Foreign Ports

As was the case for U.S. ports, several foreign ports were selected based on the value and tonnage of U.S. trade. Since foreign ports often serve more than one U.S. coastal region, the selection of foreign ports by U.S. coast involved mapping the top U.S. ports along each coast with their foreign counterparts. Specifically, researchers analyzed commodity flow between U.S. ports and the top 150 foreign ports. The purpose was to identify foreign ports that handle large volumes of cargo in terms of both weight and tonnage, and ones that serve multiple U.S. coastal regions.

Table VII-3 displays foreign ports ranked by tonnage and value of U.S. regional trade. Rotterdam and Antwerp are the most important European ports for U.S. trade in terms of both tonnage and value. Bremerhaven, Hong Kong, Nagoya and Yokohama are significant based on value for the Atlantic and Gulf Coasts. However, they do not rank high in tonnage, as each handles large volumes of containerized cargo, which is typically lower in weight than bulk freight. Tokyo, Hong Kong, Yokohama and Kaohsiung are important Asian ports serving multiple U.S. coastal regions. Crude petroleum ports such as Puerto la Cruz, Pajaritos and Amuay Bay are important tonnage and value ports; however, they only serve one U.S. coastal region–the Atlantic or Gulf Coast.

Table VII-4 identifies each "multiregional" foreign port. For the purposes of this report, they are considered the most important foreign ports for the United States. However, these ports only represent Europe and Asia, and several ports from other world regions are included even if trade is limited to one U.S. coastal region. These are the following:

- Puerto la Cruz in Venezuela which is the second leading foreign port in terms of tonnage on a national level, and first for the Gulf Coast region,
- Amuay Bay, Venezuela, which is the 13th top foreign port for tonnage nationally and seventh for the Atlantic Coast,

TABLE VII-3

TOP FOREIGN PORTS ENGAGED IN U.S. TRADE BY TONNAGE AND VALUE: 1996

Port	Country	Continent	Tonnage Rank	Value Rank
Atlantic Coast				
Rotterdam	Netherlands	Europe	1	3
Escravos Oil Terminal	Nigeria	Africa	2	34
Cabinda	Angola	Africa	3	44
Cape Lopez	Gabon	Africa	4	45
Antwep	Belgium	Europe	5	2
Vieux Fort	St. Lucia	North America	6	46
Amuay Bay	Venezuela	South America	7	52
Forcados	Nigeria	Africa	8	58
Saint John, NB	Canada	North America	9	51
Sullom Voe	UK	Europe	10	63
Nagoya	Japan	Asia	71	9
Yokohama	Japan	Asia	91	7
Buenos Aires	Argentina	South America	114	10
Felixstowe	UK	Europe	129	6
Bremerhaven	Germany	Europe	144	1
Le Havre	France	Europe	145	4
Hong Kong	Hong Kong	Asia	149	5
Santos	Brazil	South America	153	8
Gulf Coast				
Puerto La Cruz	Venezuela	South America	1	3
Ras Tannura	Saudi Arabia	Mid-East	2	5
Cayo Arcas	Mexico	North America	3	6
Tokyo	Japan	Asia	4	4
Pajaritos	Mexico	North America	5	7
Dos Bocas	Mexico	North America	6	8
La Salina	Venezuela	South America	7	12
Puerto Miranda	Venezuela	South America	8	16
Rotterdam	Netherlands	Europe	9	1
Kaoshiung	Taiwan	Asia	10	11
Veracruz	Mexico	North America	13	9
Antwerp	Belgium	Europe	15	2
Bremerhaven	Germany	Europe	111	10
Pacific Coast				
Tokyo	Japan	Asia	1	2
Hong Kong	Hong Kong	Asia	2	1
Kobe	Japan	Asia	3	7
Kaohsiung	Taiwan	Asia	4	5
Busan	South Korea	Asia	5	3
Inchon	South Korea	Asia	6	20
Keelung	Taiwan	Asia	7	8
Singapore	Singapore	Asia	8	9
Yokohama	Japan	Asia	9	6
Nagoya	Japan	Asia	10	4
Osaka	Japan	Asia	14	10
Great Lakes				
Nanticoke, Ontario	Canada	North America	1	5
Hamilton, Ontario	Canada	North America	2	6
Algoma, Ontario	Canada	North America	3	10
Pointe Noire, Quebec	Canada	North America	4	9
Port Cartier, Quebec	Canada	North America	5	2
Quebec, Quebec	Canada	North America	6	13
Windsor, Ontario	Canada	North America	7	11
Fort Williams, Ontario	Canada	North America	8	3
Courtright, Ontario	Canada	North America	9	21
Goderich, Ontario	Canada	North America	10	39
Antwerp	Belgium	Europe	13	1
Ijmuiden	Netherlands	Europe	17	4
Gand	Belgium	Europe	18	7
Baie Comeau, Quebec	Canada	North America	14	8

Source: Waterborne Commerce Statistics Center, 1996

TABLE VII-4

TOP FOREIGN PORTS SERVING MULTIPLE U.S. COASTAL REGIONS

	U.S. Coastal Region	Regional Rank (Tonnage)	Regional Rank (Value)	National Rank (Tonnage)	National Rank (Value)
Antwerp, Belgium	Atlantic	5	2	10	3
	Gulf	15	2		
	Great Lakes	10	1		
Bremerhaven, Germany	Atlantic	144	1	62	5
	Gulf	111	10		
Hong Kong	Atlantic	149	5	12	1
	Pacific	2	1		
Kaohsiung, Taiwan	Gulf	10	11	7	8
	Pacific	4	5		
Nagoya, Japan	Atlantic	71	9	50	7
	Pacific	10	4		
Rotterdam, Holland	Atlantic	1	3	6	9
	Gulf	9	1		
Tokyo, Japan	Gulf	4	4	1	2
	Pacific	1	2		
Yokohama, Japan	Atlantic	91	7	26	6
	Pacific	9	6		

Source: Waterborne Commerce Statistics Center, 1996

- Cayo Arcas in Mexico, which ranks third on a national basis and sixth for the Gulf Coast
- Ras Tannura in Saudi Arabia, which is fourth in tonnage overall, and second for the Gulf Coast,
- The Escravos Oil terminal in Nigeria, which is second in tonnage for Atlantic Coast ports and eighteenth nationally,
- Kobe, Japan, which is thirteenth in tonnage for the nation, and seventh in tonnage for the Pacific, and lastly,
- Hamilton (Ontario), Port Cartier (Quebec) and Nanticoke (Quebec), given that they are the top tonnage and value ports for the Great Lakes Region.

Seventeen foreign ports were selected to compare infrastructure with major U.S. ports. Of these, three are in Europe, six are in Asia, three are in Latin America, three are in Canada and one is in Africa. Collectively, they account for about 20 percent of U.S. trade in terms of tonnage and almost 35 percent of trade value.

Infrastructure at Foreign Ports

Table VII-5 summarizes facilities at the selected foreign ports. With the exception of Puerto La Cruz, which has general cargo berthing, facilities at Amuay Bay, the Escravos Oil

TABLE VII-5

CARGO HANDLING FACILITIES AT FOREIGN PORTS

Port	Petroleum	Other Liquid Bulk	Dry Bulk	General Cargo	Containers	Ro/Ro	Bunkers	Dry Dock	Towage	Rail	Airport
Amuay Bay	✓	X	X	X	X	X	✓	X	✓	X	✓
Antwerp, Belgium	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Bremerhaven, Germany	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Cayo Arcas Terminal, Mexico	✓	X	X	X	X	X	X	X	X	X	X
Escravos Oil Terminal, Nigeria	✓	X	X	X	X	X	X	X	X	X	X
Hamilton, Ontario	✓	✓	✓	✓	X	X	✓	✓	✓	✓	✓
Hong Kong, Tokyo	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Kaohsiung, Taiwan	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Nagoya, Japan	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Nanticoke, Ontario	-	-	✓	-	-	-	-	-	-	-	-
Port Cartier, Quebec	-	-	✓	-	-	-	✓	-	-	X	X
Puerto la Cruz, Venezuela	✓	X	X	✓	X	X	✓	X	✓	✓	✓
Ras Tannura, Saudi Arabia	✓	X	X	X	X	X	✓	X	X	✓	X
Rotterdam, Holland	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Tokyo, Japan	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Yokohama, Japan	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Sources: Fairplay and individual port statistics. Dash indicates data not available. Check marks indicate that the port is equipped with a particular type of infrastructure. An "X" indicates that a port lacks a particular type of infrastructure.

terminal, Cayo Arcas and Ras Tanura are dedicated to crude petroleum and petroleum products Cayo Arcas and the Escravos oil terminal operate Single Point Mooring (SPM) facilities.[60] Ras Tanura is also equipped with SPM buoys, but has landside terminals as well. Other ports in Asia and Europe are equipped to handle any type of cargo, and like some in the United States, they are among the world's largest based on tonnage and physical size.

Table VII-6 displays the number of berths and cranes at selected foreign ports. Rotterdam is the world's largest port in terms of tonnage and the world's fourth most active container port. Annual throughput at Rotterdam is almost 300 million metric tons.[61] In comparison, total U.S. foreign trade runs about one billion metric tons a year. Rotterdam has approximately 47 miles of available berthing (246,400 feet). Annual TEU throughput is about six million, and nearly 32,000 feet of berths are dedicated to containership operations. Rotterdam also has extensive general cargo capacity of at least 39,000 feet, including berths for Ro-Ro and refrigerated cargo. The port has a large industrial center and is located at the entrance to Europe's network of inland waterways. Rotterdam has 96 tanker berths, with an overall length of around 96,000 feet, and almost 80,000 feet of dry bulk facilities.

[60] Many offshore oil terminals use Single Point Mooring (SPM) technology. SPM buoys employ undersea pipelines that feed to the sea surface through large buoys. Tankers connect to hoses on the buoys and discharge oil to onshore storage facilities. This concept allows for a tanker vessel to take the line of least resistance to loads imposed by wind, wave and current, by being able to weathervane about the mooring point. Thus, there is no need for jetties or breakwaters, and water depth is generally adequate. Most SPM buoys are located in 70 to 90 feet of water.

[61] Statistics for tonnage and container traffic are those of the Antwerp Port Federation-SEA survey. Other information regarding *total* foreign port tonnage is based on individual port statistics.

TABLE VII-6

AVAILABLE DATA REGARDING NUMBER OF BERTHS, BERTH LENGTH AND NUMBER OF CRANES BY TRAFFIC TYPE FOR KEY U.S. PORTS

	Container			General Cargo			Dry Bulk			Tanker		
	Berths	Length	Cranes	Berths	Length	Cranes	Berths	Length	Cranes	Berths	Length	Cranes
Atlantic Coast												
Amuay Bay	na	na	na	na	na	na	na	na	na	8	6,140	-
Antwerp, Belgium	78	28,330	30	123	104,400	30	17	25,550	na	45	59,060	-
Bremerhaven, Germany	-	23,100	-	-	92,360	109	-	-	-	-	-	-
Cayo Arcas Terminal, Mexico*	na	na	na	na	na	na	na	na	na	na	na	na
Escravos Oil Terminal, Nigeria*	na	na	na	na	na	na	na	na	na	na	na	na
Hamilton, Ontario	-	-	-	-	-	-	40	20,615	-	-	-	-
Hong Kong, China	19	19,880	38	-	25,500	55	4	--	--	12	10,800	--
Kaohsiung, Taiwan	21	20,405	54	84	53,095	21	5	4,300	-	-	-	-
Nagoya, Japan	-	-	-	104	72,800	17	-	-	-	33	29,700	-
Nanticoke, Ontario	-	-	-	-	-	-	-	-	-	-	-	-
Port Cartier, Quebec	-	-	-	-	-	-	-	-	-	-	-	-
Puerto la Cruz, Venezuela	na	na	Na	na	na	na	na	na	na	6	6,350	-
Ras Tanura, Saudi Arabia	na	na	Na	na	na	na	na	na	na	12	10,000	-
Rotterdam, Holland	-	31,875	72	-	39,000	221	-	79,525	-	96	96,000	-
Tokyo, Japan	18	18,300	21	65	42,135	-	13	3,156	-	2	2,460	-
Yokohama, Japan	21	17,521	38	53	31,524	-	-	-	-	-	-	-
Total	161	143,531	259	559	474,340	344	74	50,568	0	198	186,270	0

* Cayo Arcas and the Escravos Oil terminal utilize single point mooring (SPM) loading facilities for tankers. Cayo Arcas also operates a fixed offshore loading tower.
* Berths identified as container and general cargo berths were listed as general cargo.
* "na" means not applicable, and a dashed line indicates data were not available.

Source: Fairplay World Ports 1997 and individual port statistics.

With total tonnage throughput at about 115 million metric tons, Antwerp is a major European port in terms of tonnage and container traffic. The position of Antwerp on the delta of the Scheldt, Meuse and Rhine Rivers provides links to Belgium's 960 miles of waterways. Since Napoleon Bonaparte ordered the construction of what was a 1,500-foot-long river terminal in 1803, the port has never stopped growing. Today, Antwerp has an overall berth length of roughly 217,000 feet (41 miles). The port is the ninth most active container port in the world, and has at least 78 container berths, with an overall length 28,000 feet. It is interesting to note that the average length of container berths at Antwerp is 360 feet, while at most other ports container berths typically range from 700 to about 1,000 feet in length. The reason is that many container facilities at Antwerp are dedicated to barge operations. Barges, which are generally not longer than 300 feet, transport about 25 percent (1.1 million TEUs) of Antwerp's containers to and from the European hinterland.

Like their American counterparts, selected Asian ports are located near massive consumer markets. Tokyo is within a 60-mile radius of a market with 30 million people and a vast network of manufacturing industry that produces a variety of goods for export to world markets including the United States. It is not surprising that top Asian ports have container facilities comparable to their U.S. counterparts. Tokyo, Kaohsuing and Yokohama have between 17,000 and 20,000 feet of container berths, which is roughly equivalent to Los Angeles, Long Beach and Oakland. Asian ports also have extensive general cargo capacity. Unfortunately, most data sources for Asian ports do not distinguish between general cargo and dry bulk berths. However, given the limited natural resources in Japan, particularly with respect to agriculture, dry bulk capacity has to be significant in order to handle large volumes of dry bulk imports such as rice, wheat and corn. Japan is the destination of nearly 17 million tons of U.S. grain–about 18 percent of all U.S. grain exports.

With the exception of offshore oil terminals, selected foreign ports have access to rail. However, in many cases rail access is not as important as it is in the United States, particularly with respect to container shipping. For example, at Antwerp 60 percent of containers are dispatched by truck and 25 percent are shipped by barge. Only 7 percent are shipped by rail. In fact, Antwerp's significant advantage is its access to hinterland markets through inland navigation links. At Rotterdam, container transport by barge is becoming increasingly popular. Barge shipment on the Rhine River provides a cheap alternative for containers destined for inland markets in Germany and elsewhere. Up until a few years ago, containers were almost exclusively transported to and from the hinterland by truck, but today approximately 30 percent of containers handled at Rotterdam travel by inland waterways. Rates are cheaper than rail and truck and some barge companies are able to offer just-in-time services. Nevertheless, barge traffic is limited to the main waterway routes, and rail will likely become more important as congestion on Europe's highways worsens.

INFRASTRUCTURE DEVELOPMENT AT FOREIGN PORTS

Like their counterparts in the United States, many foreign ports discussed in this subsection are improving container facilities and, in some cases, constructing new ones to meet

increases in demand. Hong Kong currently has eight container terminals and is constructing a ninth one that should be complete by the end of 2001. Terminal "9" will add about 6,270 feet of berthing with 24 gantry cranes. Another milestone for Hong Kong was the completion of the River Trade Terminal (RTT) at Teun Mun. The RTT supports the operation of the port's main container terminals by providing a consolidation point for containers shipped by river to main ocean terminals. The RTT, which will also handle break-bulk and bulk cargoes, has an overall berth length of almost 10,000 feet. Port officials expect the RTT will encourage greater use of the waterways to transport containers via barge between Hong Kong and the Pearl River Delta areas. Transporting containers on barges is cheaper, and it should help reduce congestion on Hong Kong's road networks. Hong Kong is also deepening portions of its main channel that lead to container terminals from 46 to 55 feet.

Japan is investing heavily in container facilities. In 1996, the Japanese government allocated funds for the construction and upgrade of 50 container berths at its primary deep draft ports including Yokohama, Nagoya and Tokyo. Fifteen new berths are planned for areas handling North American and European cargo. At Tokyo, a new container terminal is planned for the Aomi Terminal, and cargo handling/storage facilities will be improved. To accommodate larger containerships, berths at the Ohi Terminal are being lengthened from 985 feet to 1,115 feet and deepened to 49 feet. At Yokohama, construction is underway on four container terminals with the capacity to handle 3.4 million TEUs annually. The terminal will host four 1,180-foot berths with three gantry cranes each. Nagoya is planning a container distribution center with three new berths equipped with super post-Panamax cranes. Kaohsiung is expected to complete its fifth container terminal with four additional berths with a total length of nearly 2,610 feet, and a sixth container terminal with four berths is on the drawing board.

In Europe, Antwerp increased annual container capacity from 600,000 to 750,000 TEUs by adding several new gantry cranes. In 1997, the port opened a second river terminal dedicated to container operations with an overall berth length of about 4,500 feet. The terminal has an annual capacity of 650,000 TEUs. Antwerp has also gained approval for another river container facility that will add an additional 15,500 feet of berthing length and three million TEUs of capacity. In 1998, Bremerhaven finished deepening its outer channel from 40 to 46 feet, and is planning additional expansion to its new container terminal. Rotterdam is constructing a series of new container facilities at the Maasvlakte container terminal as part of the port's overall development scheme–the Delta 2000-8 plan. The construction of the so-called *Betuwe* rail line at Rotterdam is very important for the transportation of containers. At a cost of $5 billion, the *Betuwe* will establish a freight-only rail corridor to Germany. Its purpose is to alleviate growing congestion along Europe's highway network and is analogous to the Alameda Corridor in Los Angeles.

Although most development is taking place at major container ports, Ras Tanaru in Saudi Arabia has expanded its petroleum handling facilities. In 1998, the port installed a seventh SPM buoy at the Ju'aymah Offshore Terminal. The new buoy is capable of filling the largest tankers in operation today.

CHANNEL DEPTH COMPARISONS: U.S. AND FOREIGN PORTS

Table VII-7 displays maximum channel depths at U.S. ports and information regarding the physical characteristics of ships that call on these ports.[62] Within the Atlantic Coastal region, Baltimore, Norfolk and Newport News have the deepest channels at 50 feet. These ports handle large amounts of bulk goods such as coal, and both Norfolk and Baltimore are major container and general cargo ports. Maximum channel depths at remaining ports along the Atlantic Coast range from 38 feet at Jacksonville to 45 feet at New York and Portland.

The largest vessel calling on Atlantic Coast ports is a bulk carrier of 200,269 deadweight tons (DWT) with a design draft of 57 feet. In general, channel depths along the Gulf and Atlantic Coasts restrict access to tankers and dry bulk ships larger than 80,000 to 100,000 DWT. Today, most supertankers offload cargo at offshore terminals in the Caribbean, where it is transferred to smaller ships. Suezmax tankers arrive at Big Stone Anchorage in Delaware Bay with 55-foot drafts. They then transfer about 35 percent of crude petroleum onto barges or smaller tankers, reducing sailing draft to navigate the 40-foot channel depth in the Delaware River. The port estimates that 60 percent of crude arriving from Africa and Europe undergo lightering operations, and 25 percent of crude coming the Persian Gulf is transferred to smaller ships at terminals in the Caribbean. Only Aframax and Panamax vessels sail directly to refineries along the Delaware River.[63] The largest containership to call on Atlantic ports is a 6,000 TEU containership (the *Regina Maersk*) with a design draft of 46 feet.

Several major Pacific Coast ports are deeper than their counterparts on the Atlantic and Gulf Coasts. At 63 feet, Los Angeles has the greatest maximum channel depth. Long Beach has a 60-foot main channel that can accommodate the largest containerships and most of the dry bulk vessels in operation today. Tacoma's and Oakland's channels are currently 50 feet, which allows access to about 98 percent all containerships (fully loaded to tonnage capacity) in the world fleet. Channels at remaining Pacific Coast ports are shallower. Seattle has a maximum depth of 40 feet, Kalama and Richmond are at 40 feet, Barbers Point is at 36 feet and Hueneme is 35 feet deep. A tanker with a capacity of 265,000 DWT and a design draft of 66 feet is one of the largest vessels that calls on Pacific Coast ports.

On average, Gulf Coast ports are shallower than their Atlantic or Pacific Coast counterparts. South Louisiana, Corpus Christi, Texas City, Mobile and Freeport have maximum channel depths of 45 feet, and remaining ports have 40-foot channels. As noted in Chapter V of this report, approximately 44 percent of grain exported from the Gulf Coast is shipped through Panama Canal to markets in Asia. Accordingly, Panamax class bulk carriers are commonly used for Gulf Coast grain shipments. In fact, almost 90 percent of the world's grain is shipped in vessels of less 80,000 DWT that have, on average, drafts of 35 feet.[64] The largest vessels that call

[62] Channel depths can vary within a given port depending upon the location and purpose of the channel. For example, a port can have an entrance channel, a main channel (inbound and outbound) and channels that lead from main channels to berthing areas. Depths listed in Table VII-7 refer to federally-maintained main channels. Data regarding vessel design were not available for every port.

[63] See Philadelphia Regional Ports International Goods Movements Task Force, "Global Trends in Container, Break-bulk and Tanker Shipping, Vessel Size and Their Impact on Channel Deepening. A Report by the Port of Philadelphia and Camden, April 4th 1996.

[64] Sewell, T. Grain Carriage by Sea. LLP Reference Publishing, London 1999.

TABLE VII-7

VESSEL DIMENSIONS AND CHANNEL DEPTHS FOR U.S. PORTS

	Largest Vessel Calling the Port				Maximum Channel Depth (feet)
	Deadweight Tons	Length (feet)	Beam (feet)	Design Draft (feet)	
Atlantic Coast					
New York/New Jersey	--	--	--	--	45
Norfolk, VA	--	--	--	--	50
Philadelphia/Camden	--	--	--	--	40
Baltimore, MD	200,269	924	--	57	50
Newport News, VA	--	--	--	--	50
Caribbean Islands	--	--	--	--	55
Savannah, GA	58,869	867	36	41	42
Boston, MA	--	--	--	--	40
Portland, ME	--	--	--	--	45
Charleston, SC	102,816	--	--	--	42
Miami, FL	76,049	--	36	42	42
Jacksonville, FL	--	873	--	32	38
Port Everglades, FL	73,502	1,026	39	38	42
Wilmington, NC	--	860	31	34	38
Gulf Coast					
Houston, TX	--	780	105	39	40
Port of South Louisiana, LA	--	--	--	--	45
Corpus Christi, TX	232,700	--	--	65	40
New Orleans, LA	--	--	--	--	45
Baton Rouge, LA	--	--	--	--	45
Texas City, TX	150,000	915	36	55	40
Port Arthur, TX	39,026	--	--	33	40
Lake Charles, LA	160,000	--	--	55	40
Mobile, AL	154,900	876	--	55	45
Port of Plaquemine, LA	--	--	--	--	40
Freeport, TX	--	--	--	--	45
Pacific Coast					
Long Beach, CA	265,000	--	--	66	81
Los Angeles, CA	--	--	--	--	63
Seattle, WA	176,380	828	73	51	40
Portland, OR	44,484	--	--	38	40
Tacoma, WA	--	--	--	--	50
Oakland, CA	--	--	--	--	50
Kalama, WA	--	--	--	--	40
Vancouver, WA	60,000	--	--	43	40
Richmond, CA	--	--	--	--	45
Barbers Point, HI	--	--	--	--	36
Port Hueneme, CA	--	756	33	32	35
Carquinez Strait, CA	--	--	--	--	35
Great Lakes					
Duluth-Superior, MN	--	912	96	26	28
Detroit, MI	25,000	--	--	26	27
Toledo, OH	--	912	--	--	27
Chicago, IL	--	669	24	-	27
Cleveland, OH	--	975	--	--	27
Ashtabula, MI	--	--	--	--	28
Sandusky, MI	--	--	--	--	28
Burns Harbor, MI	--	900	--	--	27
Conneaut, OH	--	--	--	--	28
Calcite, MI	--	--	--	--	27
Buffalo, NY	--	--	--	--	27
Milwaukee Harbor, WI	--	--	--	--	27

Sources: Fairplay World Ports, 1997 and individual port statistics.

on Gulf Coast ports are tankers that import crude petroleum. Suezmax, VLCCs and ULCCs transfer cargo offshore within four lightering zones spread in an east/west direction across the Gulf of Mexico. For example, the LOOP Terminal (Louisiana Offshore Oil Port) is situated about 32 nautical miles offshore from the main entrances to the Mississippi River. Water depths at the LOOP exceed 90 feet and can accommodate any tanker in the world fleet. Oil is transferred to smaller ships or is pumped ashore via SPM buoys to storage facilities, where it then transferred to refineries. Each year, approximately 280 vessels visit the LOOP. As noted earlier, Houston and New Orleans are the top container ports along the Gulf Coast. In terms of TEU throughput, Houston has about 63 percent of the regional market, and New Orleans currently has 24 percent. Houston's main shipping channel (40 feet) can accommodate containerships with design drafts of around 36 feet fully loaded by DWT, and New Orleans (45 feet) allows access to containerships with drafts of approximately 41 feet fully loaded by DWT.

Maximum navigable depth for the U.S. Great Lakes port system is 27 feet. The depth of the St. Lawrence Seaway is 27 feet, and locks along the Seaway limit vessels to lengths of 730 feet, beams of 76 feet and drafts of 26 feet. As shown in Table VII-7, maximum channel depths range from 27 to 28 feet.

Table VII-8 characterizes foreign ports based on channel depths and the largest vessels calling each port. Not surprisingly, offshore oil terminals are most accessible. These facilities are constructed offshore where there is not a need for maintenance dredging. SPM buoys at Escravos are situated in 98 feet of water, while maximum depth at Cayo Arcas is approximately 72 feet. Ras Tanura, which has both SPMs and landside berthing, has a maximum depth of 70 feet. Puerto la Cruz is relatively shallow with a depth of 55 feet. Rotterdam has a channel depth

TABLE VII-8

VESSEL DIMENSIONS AND MAXIMUM CHANNEL DEPTHS AT TOP FOREIGN PORTS

	Largest Vessel Calling the Port				Maximum Channel Depth (feet)
	Deadweight Tons	Length (feet)	Beam (feet)	Design Draft (feet)	
Amuay Bay	135,000	920	--	51	43
Antwerp, Belgium	275,000	--	--	72	49
Bremerhaven, Germany	70,202	--	--	--	46
Cayo Arcas Terminal, Mexico	290,767	--	--	73	72
Escravos Oil Terminal, Nigeria	350,000	--	--	73	98
Hamilton, Ontario	35,930	--		32	29
Hong Kong, China	--	--	--	--	54
Kaohsiung, Taiwan	--	--	--	--	46
Nagoya, Japan	322,941	--	--	73	50
Nanticoke, Ontario	--			--	--
Port Cartier, Quebec	180,000	900	--	--	55
Puerto la Cruz, Venezuela	--	--	--	--	55
Ras Tanura, Saudi Arabia	--			--	70
Rotterdam, Holland	551,662	--	--	81	79
Tokyo, Japan	--	--	--	--	40
Yokohama, Japan	--	--	--	--	46

* Depth at offshore petroleum ports (Escravos and Cayo Arcas) refer to maximum depths at SPM buoys.

Sources: Fairplay World Ports 1997 and individual port statistics

of 79, feet allowing access to the Maasvlakte port complex. The Maasvlakte hosts Rotterdam's largest petroleum, dry bulk and container facilities. Antwerp has a maximum a channel of 49 feet. Tokyo, Yokohama and Nagoya have channels ranging from 40 to 50 feet. Hong Kong has a depth of 54 feet, which allows access to any fully loaded containership in operation today. Seven of the 16 foreign ports have channels that exceed 50 feet.

Table VII-9 compares channel depths at major U.S. ports along each coastline with the most active ports engaged in trade with each coastal region. With the exception of the Pacific Coast, foreign ports are generally more accessible than their U.S. counterparts. For instance, four of the most active foreign ports that trade with the Atlantic Coast have channels greater than 65 feet, six are between 45 and 49 feet and only four are less than 45 feet. On the Gulf Coast, five ports have channels of 40 feet and five have channels of 45 feet. However, only three of the most active foreign ports for the Gulf Coast have channels of 40 less of less. Two have channels of 45 and 46 feet, respectively, and the remaining eight are at least 50 feet deep. Channel depths at several major U.S. ports along the Pacific Coast are comparable to those of their foreign counterparts. Four have channels of at least 50 feet, five have channels ranging from 30 to 45 feet and three have channels less that 40 feet deep. Two of the most active foreign ports for the Pacific region have depths that exceed 50 feet, three have channels ranging from 46 to 48 feet, one is at 45 feet and three are at 40 feet.

Data in Table VII-9 reveal that many major U.S. container ports are significantly shallower than their foreign counterparts, particularly along the Gulf and Atlantic Coasts. Major container ports along the Atlantic and Gulf Coasts have channels of 45 feet or less.[20] However, Rotterdam has a maximum channel depth of 79 feet, Antwerp is 49 feet deep and Hong King is at 54 feet. Bremerhaven is 46 feet deep, and Felixstowe is 45 feet deep and is in the process of deepening to 48 feet. Principal container ports along the Pacific Coast appear to be in a better position when compared to their foreign counterparts. Los Angeles and Long Beach have channels of at least 60 feet, which allows access to the world's largest containerships. Oakland and Tacoma are currently at 50 feet and 51 feet, and construction is underway at Seattle to deepen to 51 feet.

CONCLUSION

Based on available data, U.S. ports are comparable to their foreign counterparts with regard to landside infrastructure such as berths and cranes. Like their foreign counterparts, many major container ports are developing new terminals and intermodal connections. Perhaps the greatest challenge facing U.S. ports with respect to landside infrastructure is growing problems with urban congestion. In many instances, port expansion has become very difficult. Ports in urban areas must compete with other public interests for alternative land uses near port facilities. In addition, many communities throughout the United States and abroad oppose terminal development due to potential environmental and socioeconomic impacts. Some ports are facing

[20] Maximum channel depths at Baltimore and Norfolk are 50 feet. However, Federal channels that led directly to container terminals at these ports are 45 feet deep.

this challenge and developing innovative solutions such as transportation corridors (e.g. the Alameda Corridor). Although U.S. ports appear to be well positioned in terms of dockside infrastructure, channel depth remains an obstacle–particularly for ports that expect to service new generations of containership operations. Atlantic and Gulf Coast container ports appear to be at the greatest disadvantage.

TABLE VII-9

TRAFFIC AND CHANNEL DEPTH COMPARISON BETWEEN TOP U.S. PORTS AND TOP FOREIGN PORTS BY U.S. COASTAL REGION (1996)

U.S. Ports	Regional Market Share (millions of metric tons)	Regional Market Share ($U.S. billions)	Maximum Channel Depth (feet)	Foreign Ports	Market Share Atlantic Coast Trade (millions of metric tons)	Market Share Atlantic Coast Trade ($U.S. billions)	Maximum Channel Depth (feet)
Atlantic Coast	311.64	$238.9		**Atlantic Coast**			
New York/ New Jersey, NY & NJ	50.7	$66.71	45	Rotterdam, Holland	7.9	$10.0	79
Norfolk Harbor, VA	35.3	$26.02	50	Escravos Oil Terminal, Nigeria	6.8	$1.0	98
Baltimore, MD	26.8	$24.58	50	Cabinda, Angola	5.2	$0.8	--
Philadelphia Harbor, PA	26.2	$19.31	40	Cap Lopez, Gabon	5.0	$0.7	67
Caribbean Islands	17.6	$15.15	55	Antwerp, Belgium	4.7	$12.1	49
Newport News, VA	16.9	$13.34	50	Vieux Fort, France	4.5	$0.7	28
Paulsboro, NJ	13.5	$10.52	40	Amuay Bay, Venezuela	3.9	$0.6	43
Savannah Harbor, GA	13.1	$9.54	42	Forcados, Nigeria	3.3	$0.5	69
Portland, ME	12.1	$9.48	44	Saint John, Canada	3.1	$0.6	40
Charleston, SC	9.6	$4.91	42	Sullom Voe, U.K.	3.0	$0.4	75
Miami, FL	4.2	$15.1	42	Santos, Brazil	2.5	$4.5	45
Port Everglades, FL	6.8	$10.5	42	Hong Kong, China	2.3	$6.4	48
Jacksonville, FL	6.8	$9.5	38	Le Havre, France	2.2	$6.5	68
Wilmington, NC	3.7	$4.9	38	Bremerhaven, Germany	2.2	$14.9	46
				Felixstowe, U.K.	1.4	$6.1	45
				Buenos Aires, Argentina	1.1	$2.7	47
				Yokohama, Japan	0.7	$4.8	40
				Nagoya, Japan	0.5	$2.7	42
Total	243.3	$209.1		Total	60.1	$75.9	
Gulf Coast	497.6	$111.8		*Gulf Coast*	497.6	$111.8	
Houston, TX	79.0	$34.1	40	Puerto La Cruz, Venezuela	22.6	$3.0	55
Port of South Louisiana, TX	76.0	$13.9	45	Ras Tanura, Saudi Arabia	18.9	$2.6	68
Corpus Christi, TX	51.4	$7.1	45	Cayo Arcas, Mexico	18.8	$2.2	72
Port of New Orleans, LA	42.5	$15.9	45	Tokyo, Japan	14.6	$2.8	40
Port of Baton Rouge, LA	32.5	$5.6	45	Pajaritos, Mexico	13.1	$2.1	--
Texas City, TX	32.1	$4.5	40	Dos Bocas, Mexico	12.0	$1.6	90
Port Arthur, TX	27.8	$4.1	40	La Salina, Mexico	9.2	$1.1	45
Lake Charles, LA	26.6	$3.5	40	Puerto Miranda, Venezuela	8.2	$0.9	40
Mobile, AL	23.1	$3.5	45	Rotterdam, Holland	7.6	$4.2	79
Port of Plaquemine, LA	18.8	$2.1	45	Kaohsiung, Taiwan	5.6	$1.3	53
Freeport, TX	17.4	$3.2	45	Veracruz, Mexico	4.9	$1.4	31
				Antwerp, Belgium	4.3	$3.7	51
				Bremerhaven, Germany	0.5	$1.4	46
Total	427.2	$97.7		Total	140.3	$28.3	

TABLE VII-9

TRAFFIC AND CHANNEL DEPTH COMPARISON BETWEEN TOP U.S. PORTS AND TOP FOREIGN PORTS BY U.S. COASTAL REGION (1996)

U.S. Ports	Regional Market Share (millions of metric tons)	Regional Market Share ($U.S. billions)	Maximum Channel Depth (feet)	Foreign Ports	Market Share Atlantic Coast Trade (millions of metric tons)	Market Share Atlantic Coast Trade ($U.S. billions)	Maximum Channel Depth (feet)
Pacific Coast	174.0	$270.0		**Pacific Coast**	174.0	$270.0	
Long Beach Harbor, CA	32.7	$87.0	60	Tokyo, Japan	12.7	$36.3	40
Los Angeles Harbor, CA	25.2	$72.8	81	Hong Kong, China	9.6	$41.1	54
Seattle, WA	15.4	$34.1	40	Kobe, Japan	7.2	$11.0	46
Port of Portland, OR	15.0	$9.5	40	Kaohsiung, Taiwan	7.1	$14.1	53
Tacoma, WA	12.9	$20.6	50	Busan, Korea	5.9	$17.2	45
Oakland, CA	7.8	$26.8	50	Inchon, South Korea	4.8	$1.5	43
Kalama, WA	6.6	$1.2	40	Keelung, Taiwan	3.3	$10.5	40
Vancouver, WA	5.2	$1.6	40	Singapore	3.2	$10.1	69
Richmond, CA	4.9	$1.2	38	Yokohama, Japan	2.6	$12.2	40
Barbers Point, HI	4.8	$0.7	42	Nagoya, Japan	2.5	$14.3	46
Port Hueneme, CA	0.7	$2.7	35	Osaka, Japan	1.7	$6.0	40
Carquinez Strait, CA	4.2	$2.3	45				
Total by Top Ports	135.4	$260.4		Total	60.7	$174.2	
Great Lakes	50.9	$6.5		**Great Lakes**	50.9	$6.5	
Duluth-Superior	10.1	$1.3	27	Nanticoke, Ontario	4.6	$0.2	--
Port of Detroit	5.7	$1.7	27	Hamilton, Ontario	4.5	$0.2	29
Toledo, OH	5.4	$0.7	28	Seven Islands, Quebec	4.3	$0.1	59
Port of Chicago, IL	4.0	$0.9	27	Sault Ste. Marie, Ontario	3.7	$0.1	21
Cleveland, OH	3.6	$0.5	28	Port Cartier, Quebec	2.4	$0.4	50
Ashtabula, OH	3.5	$0.2	28	Quebec, Quebec	2.1	$0.1	51
Sandusky, OH	2.4	$0.1	26	Courtright, Ontario	2.0	$0.1	--
Burns Waterway, IN	2.1	$0.2	30	Windsor, Ontario	1.8	$0.2	29
Conneaut, OH	2.1	$0.1	27	Port Arthur, Ontario	1.6	$0.1	--
Calcite, MI	1.6	$0.0	25	Antwerp, Belgium	1.4	$0.0	51
Port of Buffalo, NY	1.0	$0.2	27	Comeau Bay, Quebec	0.9	$0.8	40
Milwaukee, WI	1.3	$0.1	27	Ijmuiden, Netherlands	0.5	$0.2	--
Total	42.8	$6.0		Total	29.9	$2.6	

Source: Fairplay World Ports and Waterborne Commerce Statistics Center, 1996

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VIII. RESULTS OF THE FLEET AND SHIPPING FORECAST

OVERVIEW OF FORECASTING METHODOLOGY

Commodity trade forecasts developed for this study provided the foundation for a procedure to estimate future vessel traffic at U.S. ports. Referred to as the Fleet and Shipping Forecast, this methodology is the basis for identifying potential future dredging needs at U.S. ports. Analysis begins with forecasts of future cargo volumes by vessel type (i.e., the base cargo profile).[66] Base cargo reflects data derived from the 1996 Waterborne Commerce Statistics Center data files aggregated by commodity according to port location and ship type. Next, cargo is shifted among and within vessel types and size categories, which reflects trends of shifting cargo into larger ships as global trade increases. A good example is the increasing rate at which general cargo shifts from smaller and older break-bulk vessels to newer and larger containerships. Shifts in vessel types and sizes are enacted on a yearly time step, starting with the base year 1996 and extending over a 2000 through 2020 forecast horizon. Future vessel calls are then estimated based on the shifted cargo using average vessel characteristics and average cargo loadings per call in each vessel size-type category.

National Level

Vessel demands on the U.S. port system are expected to intensify during the next two decades as the world economy expands and nations such as the United States become increasingly dependent upon global commerce. Table VIII-1 and Figure VIII-1 summarize projected number of calls on a national scale. By the year 2020, the total number of calls to U.S. ports is forecast to more than double. Containership traffic is expected to increase the most. From 2000 through 2020, containership calls are projected to grow from about 42,000 to almost 121,000 annually. General cargo traffic is expected to grow as well; however, containership traffic will increase at a much faster rate as more and more general cargo is shipped in containers rather than as break-bulk freight.[67] Tanker calls are anticipated to double by 2020, reflecting strong growth in imported crude petroleum. Dry bulk traffic is expected to increase, but at a slower rate relative to other ship types. Exports of grain and coal, the primary U.S. commodities transported on dry bulk ships, are not forecast to grow as much as other commodities.

[66] See Appendix D of this report for a detailed discussion of the Fleet Forecast methodology.

[67] Recall that the vessel category of general cargo ships includes refrigerated ships, automobile carriers, Ro-Ro vessels and multipurpose ships.

TABLE VIII-1

PROJECTED NUMBER OF CALLS TO AND FROM U.S. PORTS BY SHIP TYPE: YEARS 2000, 2010 AND 2020 (THOUSANDS OF CALLS)

	Year 2000	Year 2010	Year 2020	Total Change	% Annual Growth
Total	114.49	178.87	260.82	146.33	4.2%
Tankers	17.12	24.83	34.04	16.92	3.5%
Dry Bulk	20.03	27.96	36.69	16.66	3.1%
Containership	41.88	74.49	121.05	79.17	5.5%
General Cargo	31.98	45.93	60.29	28.31	3.2%
Other	3.49	5.66	8.76	5.27	4.7%

Source: Based on data from Waterborne Commerce Statistics Center

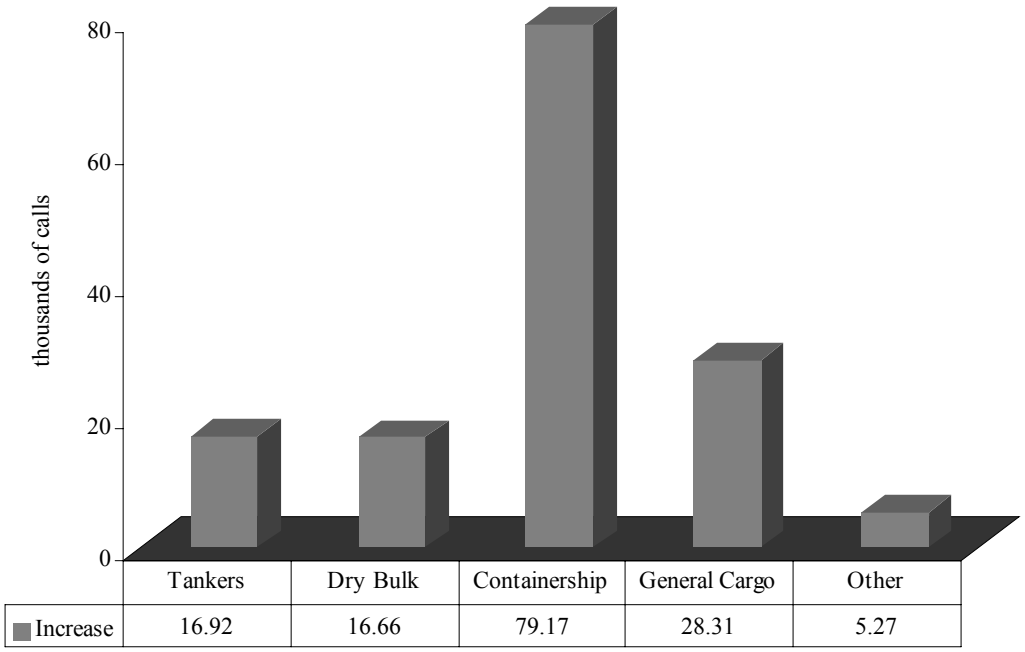

Figure VIII-1. Projected Increase in Annual Number of Calls to and from the U.S. by Vessel Type: 2000 – 2020 (thousands of calls)

Regional Level

Figures VIII-2 through VIII-5 and Tables VIII-2 through VIII-5 summarize forecasted growth in the number of calls along each U.S. coastal region. The greatest increase is expected to occur along the Atlantic Coast. By the year 2020, total calls to and from Atlantic Coast ports are forecast to increase from about 55,100 in the year 2000 to approximately 126,300 in 2020. Based on vessel type, containerships are expected to grow the fastest–about 5.4 percent annually. Growth in containership calls reflects expected increases in container trade with Africa, the Mid-East and Southeast Asia including the Indian Subcontinent. As noted previously, some carriers have already begun to reroute Asian cargo through the Suez Canal rather than using the traditional West Coast land-bridge route. Increased general cargo traffic reflects growing trade with developing nations in South America, Africa and the Mid-East. As developing nations increase manufacturing capacity infrastructure, there will be greater demand for commodities such as iron and steel, exports of which are expected to double by 2020. Exports of products carried on general cargo ships, including automobiles and refrigerated foods, are expected to grow substantially over the forecast period. Dry bulk traffic should grow the least. Again, in large part this reflects slow growth in coal exports during the next few decades. About 70 percent of U.S. coal exports are shipped from Atlantic Coast ports.

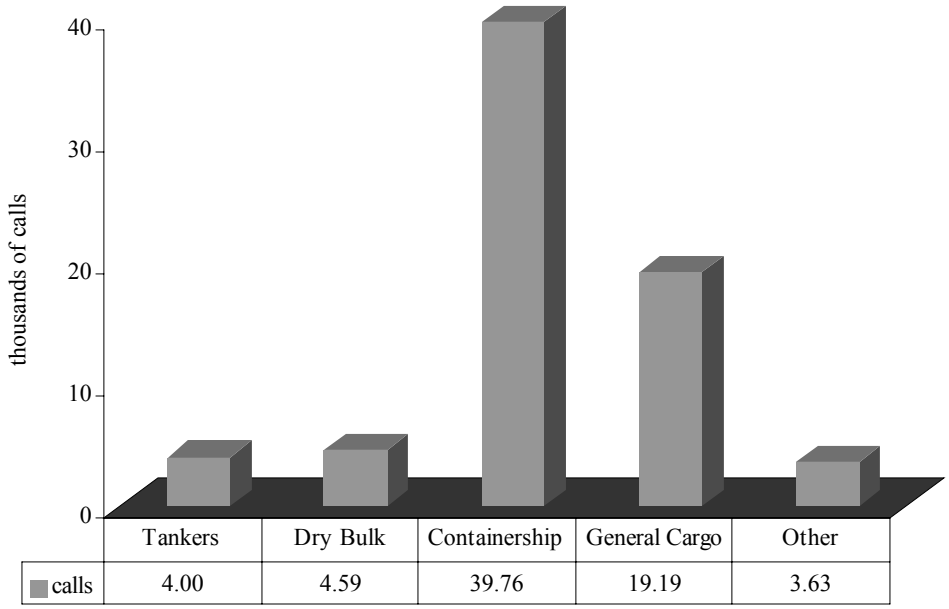

Figure VIII-2. Projected Increase in Annual Number of Calls to and from the Atlantic Coast by Vessel Type: 2000 – 2020 (thousands of calls)

TABLE VIII-2

PROJECTED NUMBER OF CALLS TO AND FROM THE ATLANTIC COAST BY SHIP TYPE: YEARS 2000, 2010 AND 2020 (THOUSANDS OF CALLS)

	Year 2000	Year 2010	Year 2020	Total Change	% Annual Growth
Total	55.12	86.38	126.30	71.18	4.2%
Tankers	5.06	6.72	9.06	4.00	3.0%
Dry Bulk	5.74	7.91	10.33	4.59	3.0%
Containership	21.45	37.95	61.21	39.76	5.4%
General Cargo	20.78	30.23	39.97	19.19	3.3%
Other	2.10	3.57	5.73	3.63	5.1%

Source: Based on data from Waterborne Commerce Statistics Center

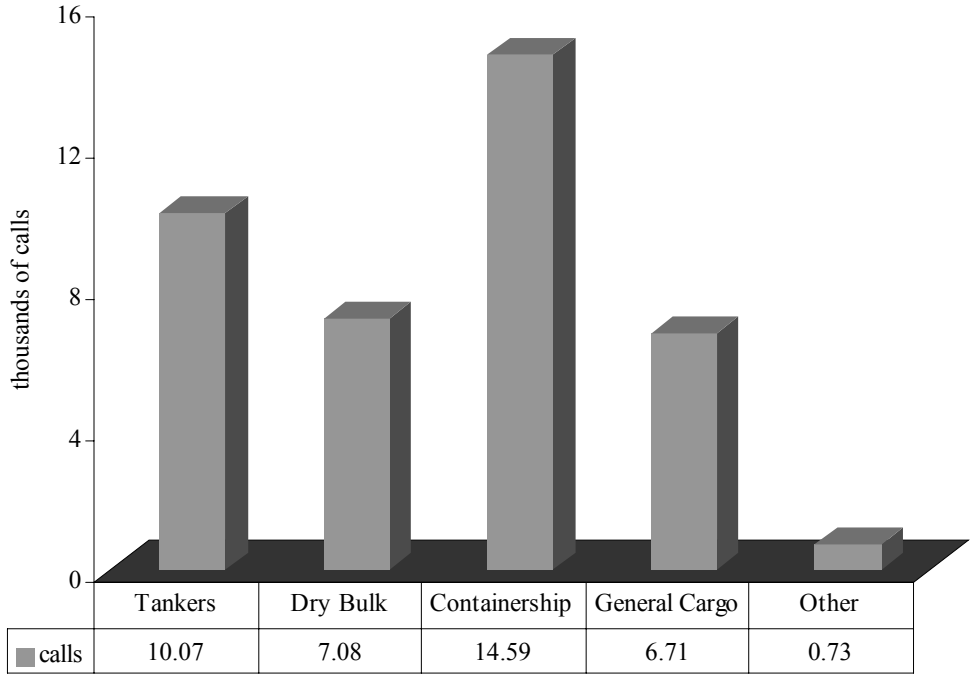

Figure VIII-3. Projected Increase in Annual Number of Calls to and from the Gulf Coast by Vessel Type: 2000 – 2020 (thousands of calls)

TABLE VIII-3

PROJECTED NUMBER OF CALLS TO AND FROM THE GULF COAST BY SHIP TYPE: YEARS 2000, 2010 AND 2020 (THOUSANDS OF CALLS)

	Year 2000	Year 2010	Year 2020	Total Change	% Annual Growth
Total	28.91	46.15	68.09	39.19	4.4%
Tankers	9.74	14.53	19.81	10.07	3.6%
Dry Bulk	7.45	10.73	14.53	7.08	3.4%
Containership	3.91	9.43	18.50	14.59	8.1%
General Cargo	7.22	10.53	13.93	6.71	3.3%
Other	0.59	0.93	1.32	0.73	4.1%

Source: Based on data from Waterborne Commerce Statistics Center

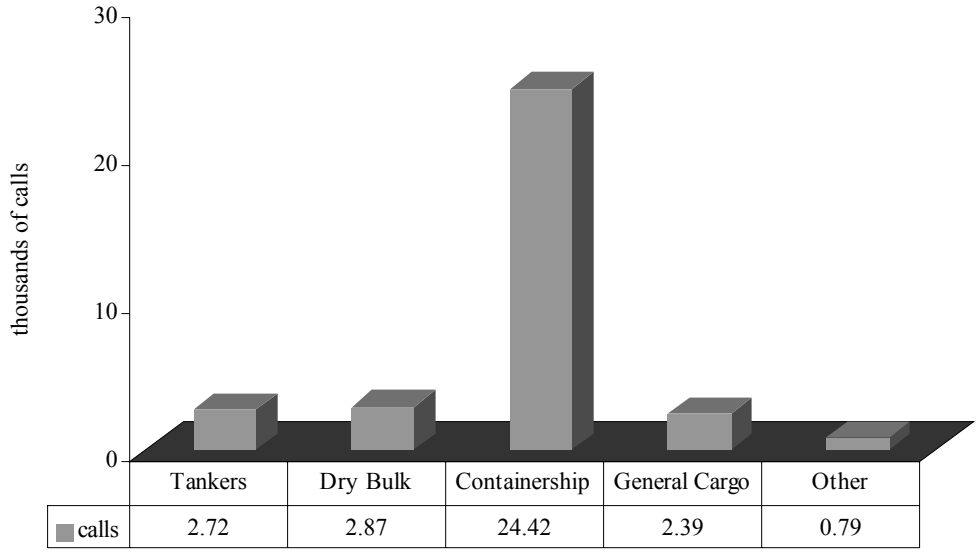

Figure VIII-4. Projected Increase in Annual Number of Calls to and from the Pacific Coast by Vessel Type: 2000 – 2020 (thousands of calls)

TABLE VIII-4

PROJECTED NUMBER OF CALLS TO AND FROM THE PACIFIC COAST BY SHIP TYPE: YEARS 2000, 2010 AND 2020 (THOUSANDS OF CALLS)

	Year 2000	Year 2010	Year 2020	Total Change	% Annual Growth
Total	27.03	41.57	60.22	33.19	4.1%
Tankers	2.07	3.30	4.79	2.72	4.3%
Dry Bulk	4.30	5.74	7.17	2.87	2.6%
Containership	16.33	26.73	40.75	24.42	4.7%
General Cargo	3.64	4.80	6.03	2.39	2.6%
Other	0.69	1.00	1.48	0.79	3.9%

Source: Based on data from Waterborne Commerce Statistics Center

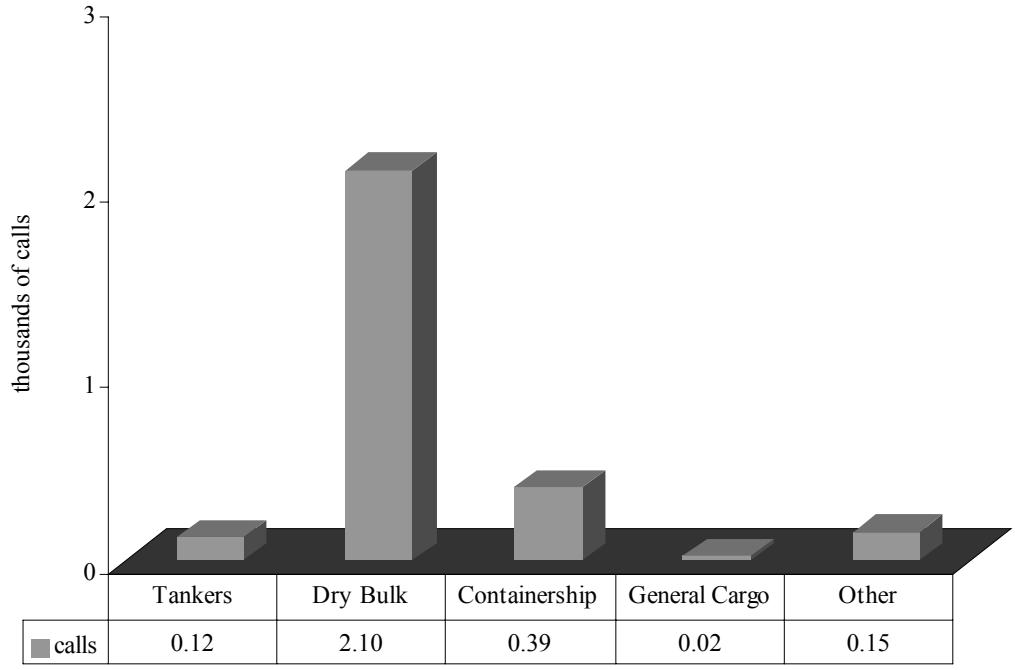

Figure VIII-5. Projected Increase in Annual Number of Calls to and from the Great Lakes by Vessel Type: 2000 – 2020 (thousands of calls)

TABLE VIII-5

PROJECTED NUMBER OF CALLS TO AND FROM THE GREAT LAKES BY SHIP TYPE: YEARS 2000, 2010 AND 2020 (THOUSANDS OF CALLS)

	Year 2000	Year 2010	Year 2020	Total Change	% Annual Growth
Total	3.44	4.76	6.22	2.78	3.0%
Tankers	0.25	0.28	0.37	0.12	2.0%
Dry Bulk	2.55	3.58	4.65	2.10	3.0%
Containership	0.20	0.38	0.59	0.39	5.6%
General Cargo	0.34	0.37	0.36	0.02	0.3%
Other	0.10	0.15	0.25	0.15	4.7%

Source: Based on data from Waterborne Commerce Statistics Center

Annual calls to Gulf Coast ports are forecast to increase from 28,900 in the year 2000 to about 68,100 in 2020. Tanker calls along the Gulf Coast are expected to more than double by 2020 signaling strong growth in trade of crude or refined petroleum, petrochemicals and other industrial chemicals. Dry bulk traffic is anticipated to increase as world demand for bulk agricultural commodities (e.g., grain and oil seeds) and U.S. imports of ores from South America and Africa increase. From 2000 to 2020, forecasts suggest that containership calls to and from Gulf Coast ports will increase from about 3,900 in the year 2000 to 18,500 in 2020. Again, in large part, projected growth will result from increased container trade with nations in Africa and, in particular, Latin America.

Annual vessel traffic along the Pacific Coast is also forecast to increase considerably. By 2020, calls are forecast to increase to about 60,000 per year–an average annual growth rate of 4.1 percent. As shown in Figure VIII-4, annual containership traffic is estimated to increase by about 25,000 calls per year. Most of this growth is attributed to anticipated increases in trade with Asia and the east coast of South America.

Annual calls to and from the Great Lakes region are projected to increase by almost 2,800 by the year 2020. As is the case with the Pacific Coast, growth in annual traffic along the Great Lakes should be restricted to a specific type of ship. Almost all of the increased traffic on the Great Lakes is expected to consist of dry bulk calls.

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IX. DREDGING NEEDS ANALYSIS

CONCEPTUAL UNDERPINNINGS OF DREDGING NEEDS

The physical characteristics of vessels are important dredging determinants. Ships calling at a port demand specified depth clearances as they sail through the channels or maneuver within the harbor. This draft requirement normally is associated with the ship's design draft. However, ships often operate at drafts, termed sailing drafts, that vary considerably from the design draft of the vessel. [68] Reasons for not sailing fully loaded are complex and are dependent upon a range of factors including channel depth constraints, demand for shipping, types of cargo carried, and the operational characteristics of a ship (e.g., liner vs. tramp services).

Ships operating as liner services, such as containerships and break bulk general cargo ships, operate on rotations of regularly scheduled ports of call. Liner ships continually load and unload cargo along their routes. Thus, the sailing draft at each port of call will vary depending upon the amount and type of cargo loaded or unloaded at a port along a rotation. For example, containerships coming from Asia often carry low-weight, high-volume goods such as televisions or clothing. In this case vessels may be light-loaded because the cargo maximizes a ship's volume before maximizing its dimensions based on weight. In contrast, when leaving U.S. ports, containerships often carry more dense and heavier goods such as animal feed or paper products. In this case vessels may be maximizing ship dimensions in terms of weight and may be sailing closer to design draft.

Other vessels operate at reduced drafts because they carry one-way cargo. Ships chartered for one-way movements, i.e., tramps, such as dry bulk vessels, may come into a port empty to pick up a load of crude petroleum or coal. Ships may also call a port with a sailing draft that is less than the design draft as a means to operate safely in the harbor. Light loading in this case ensures maneuverability and reduces the risk of running aground. An example is a coal carrier that calls at a shallow port and loads to the maximum draft of that harbor. To meet charter requirements the ship then calls at another port with deeper water to "top off" or fill the ship completely.[69]

Vessels may also sail light-loaded because of market forces or depth constraints. From an economic perspective a ship operator would rather sail at full volume or tonnage capacity. The reason is that sailing light-loaded increases unit transportation costs for carriers, which indirectly raises costs for shippers and ultimately for consumers. For example, assume a fully loaded 6,000 TEU containership is sailing on a route from Rotterdam to New York. When fully loaded to tonnage capacity, it sails at a draft of 46 feet and requires water depths of 51 feet to safely navigate. To sail into New York using its 45-foot channel, the vessel offloads cargo at the

[68] The sailing draft is the actual vertical depth of the vessel (below the water line) as it passes through the channel. This may vary from the specified design draft of the same vessel, which is the maximum draw of the ship. Sailing draft varies based on the total tons carried onboard. Thus, if a ship is not carrying a full load, she is said to be "light-loaded ." A "light-loaded " vessel has an incrementally reduced depth demand, as this depth demand changes in relation to the tonnage carried.

[69] A charter or charter party is the legal document that sets forth the terms and conditions under which the vessel owner makes a ship available to the shipper on an exclusive basis.

Canadian port of Halifax. Sailing with that lighter load results in a 32 percent cost increase per TEU.[70] Sailing light-loaded can impose significant costs on other types of vessels as well, particularly ships that haul price-sensitive commodities such as a grain and coal. A good example is the current situation on the Great Lakes, where water levels are down more than a foot in the last year and two feet in the last two years. Ships that transport coal and ore are limited to carrying loads of at least 10,000 tons below their full tonnage capacities. On long voyages across the Great Lakes this can cost operators as much as six to seven dollars per ton.[71] Thus, intentionally sailing with less than full loads is not optimal for carriers.

In light of the economic disadvantages of not sailing fully loaded, an essential assumption incorporated in the dredging needs analysis is that vessels calling on U.S. ports sail fully loaded to tonnage capacity (i.e., at design draft). Again, the authors recognize that this is not always the case. For a variety of economic or physical factors, ships sail light-loaded. In the future further study is needed to develop an adequate method of modeling the complex economic forces that influence current and future sailing drafts of the fleet. Results of this analysis do not provide a singular basis for determining dredging needs. Current channel depths, trade volume (tonnage and value) and the predominant types of vessels serviced by a given port should be taken into consideration.

METHODOLOGY

The dredging needs analysis begins with an evaluation of *accessibility*, which is defined as the supply of channel depth available for safe vessel transit. A ship's need for accessibility is based on its dimensions. For the purposes of this study, demand for accessibility is defined as a ship's design draft plus a safety clearance of 10 percent of design draft. Figure IX-1 illustrates this concept. To determine current and anticipated usage rates of channels or harbors, vessel design drafts corresponding to projected vessel calls are compared with channel depths to determine which calls and associated cargo tonnage exceed channel depths.[72] Cases in which vessel design drafts plus the safety clearance are greater than channel depths are considered *constrained* vessel movements or calls. Thus, dredging needs are defined in terms of constrained vessel calls or movements rather than in terms of dredged material quantities. In addition, the tonnages associated with constrained calls are analyzed. Use of design draft as a key variable in measuring constraints maximizes the number of constrained calls. The use of design draft in measuring constraints produces an upper bound on the estimates of constraints because vessels are sometimes filled by volume rather than weight. They may also not be sailing with a full load of cargo due to market forces.

Constraints to vessel calls are estimated for each Corps project location for existing and planned (authorized and anticipated) future depths.[73] Project locations refer to harbors or

[70] See Appendix E for the methodology used to calculate the unit cost of light loading under this hypothetical scenario.

[71] Tower, C. "Carriers Optimistic at Start of Season." The Journal of Commerce, April 27 2000.

[72] Appendix F provides a comprehensive overview of the dredging needs methodology.

[73] See Appendix F for a list of project location, ports and associated depths included in this analysis.

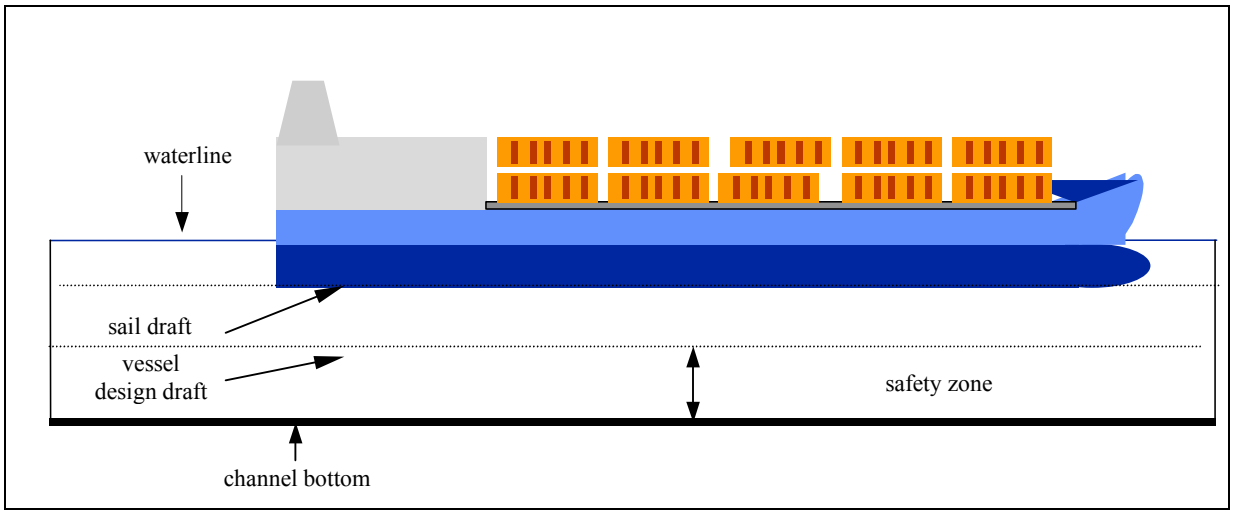

Figure IX-1. Illustration of Channel and Ship Characteristics

channels where the Corps maintains channel depths or ones where the Corps is currently constructing (i.e., deepening) channels or portions of a harbor. Some ports have multiple project locations. Results are presented under two scenarios: (1) constraints assuming planned projects are not implemented and (2) constraints with planned deepening projects. Planned projects are those that have received Congressional authorization or are expected to be authorized, but have not yet been constructed. Results listed as "with planned projects" assume that authorized and anticipated construction will occur during the forecast period.[74] The results are discussed in terms of the nation, four coastal regions, four vessel types and ports within the regions.

Channels Constraints: 2000 – 2020

The Nation

Total vessel calls nationwide in 2000 were estimated to be approximately 114,500, of which about 27,600 or 24 percent would have been constrained (Table IX-1). Without planned projects constrained calls would increase by 137 percent in 2020 to about 65,000 (an average annual growth rate of about 4.4 percent). That would be 25 percent of total vessel calls nationwide of approximately 261,000**.** Constrained calls with planned projects in 2020 would be approximately 33,400 (an average annual growth rate of about 1 percent), 21 percent greater than in 2000 and 13 percent of total nationwide calls.

Total tonnages nationwide in 2000 were estimated to be about 1.1 billion metric tons, of which about 59 percent would have been constrained. About three-fifths (58 percent) of tonnage would be constrained in 2020 without planned projects (Table IX-2). However, in 2020 with planned projects less than two-fifths (38 percent) of tonnage would be constrained.

The beneficial impact of implementing planned harbor deepening projects is dramatic (Figure IX-2). Completion of planned projects nationwide by 2020 would reduce constrained calls by 49 percent compared to 2020 without planned projects. Planned projects

[74] Appendix F lists projects included in the dredging analysis.

TABLE IX-1

PROJECTED CONSTRAINED CALLS FOR THE UNITED STATES: YEARS 2000 – 2020 (THOUSANDS OF CALLS)

With Planned Projects				
	Year 2000	**Year 2010**	**Year 2020**	**% Annual Change**
Total Projected Calls	114.49	178.87	260.82	4.2%
Constrained Calls	27.55	23.88	33.35	1.0%
Percent Constrained	24.1%	13.4%	12.8%	na
Distribution of Constrained Calls by Coastal Region				
Atlantic Coast	10.50	9.03	13.89	1.4%
Gulf Coast	7.13	6.52	7.88	0.5%
Pacific Coast	7.23	4.41	6.29	-0.7%
Great Lakes	2.69	3.92	5.29	3.4%
Without Planned Projects				
	Year 2000	**Year 2010**	**Year 2020**	**% Annual Change**
Total Projected Calls	114.49	178.87	260.82	4.2%
Constrained Calls	27.55	43.67	65.18	4.4%
Percent Constrained	24.1%	24.4%	25.0%	na
Distribution of Constrained Calls by Coastal Region				
Atlantic Coast	10.50	17.11	26.89	4.8%
Gulf Coast	7.13	11.02	15.84	4.1%
Pacific Coast	7.23	11.62	17.16	4.4%
Great Lakes	2.69	3.92	5.29	3.4%

Source: Based on data from the Waterborne Commerce Statistics Center

TABLE IX-2

PROJECTED CONSTRAINED TONNAGE FOR THE UNITED STATES: YEARS 2000 – 2020 (MILLIONS OF METRIC TONS)

With Planned Projects				
	Year 2000	**Year 2010**	**Year 2020**	**% Annual Change**
Total Projected Tonnage	1132.62	1695.76	2394.31	3.8%
Amount Constrained	667.91	703.29	903.71	1.5%
Percent Constrained	59.0%	41.5%	37.7%	na
Distribution of Constrained Tonnage by Coastal Region				
Atlantic Coast	196.12	222.90	309.30	2.3%
Gulf Coast	367.82	353.57	418.36	0.6%
Pacific Coast	54.75	56.37	82.20	2.1%
Great Lakes	49.22	70.45	93.85	3.3%
Without Planned Projects				
	Year 2000	**Year 2010**	**Year 2020**	**% Annual Change**
Total Projected Tonnage	1132.62	1695.76	2394.31	3.8%
Amount Constrained	667.91	989.57	1381.68	3.7%
Percent Constrained	59.0%	58.4%	57.7%	na
Distribution of Constrained Tonnage by Coastal Region				
Atlantic Coast	196.12	274.63	387.16	3.5%
Gulf Coast	367.82	557.23	773.42	3.8%
Pacific Coast	54.75	87.25	127.26	4.3%
Great Lakes	49.22	70.45	93.85	3.3%

Source: Based on data from the Waterborne Commerce Statistics Center

would achieve the largest reduction in constrained calls on the Pacific Coast (down 63 percent), while the reductions on the Gulf and Atlantic Coasts (down 50 and 48 percent respectively) would be close to the national average.

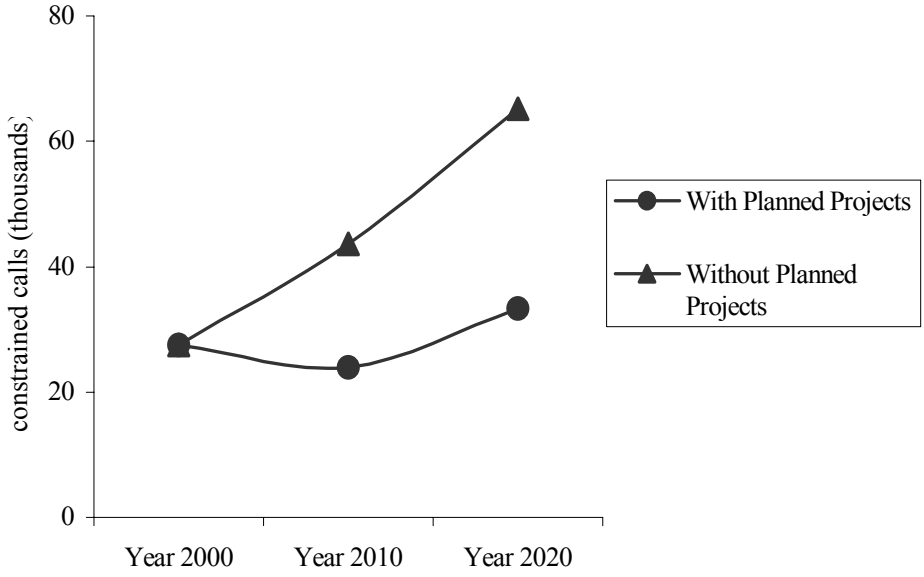

Figure IX-2. Constrained Calls with and without Planned Corps Construction Projects: Years 2000 – 2020

Source: Based on data from the Waterborne Commerce Statistics Center

Additional projects would be needed to eliminate the remaining 33,400 constrained vessel calls. Even with planned projects completed 13 percent of total calls nationwide would be constrained in 2020. Without additional projects the level of constraints would rise as foreign waterborne trade continues to expand. A continuing program of reconnaissance and feasibility studies is needed to explore in detail the need for the additional projects.

Regions

The Atlantic Coast in 2000 would have comprised almost two-fifths of the nation's constrained vessel calls, while slightly over one-fourth each would have occurred on the Pacific and Gulf Coasts, and only ten percent on the Great Lakes (Figure IX-3 and Table IX-1). The Gulf Coast in 2000 would have assumed the lead in national constrained tonnage with 55 percent of that traffic, while nearly 30 percent would have occurred on the Atlantic Coast and only eight percent each on the Pacific Coast and Great Lakes (Table IX-2). The Gulf Coast would predominate in constrained tonnage since it leads in both constrained liquid and dry bulk cargo.

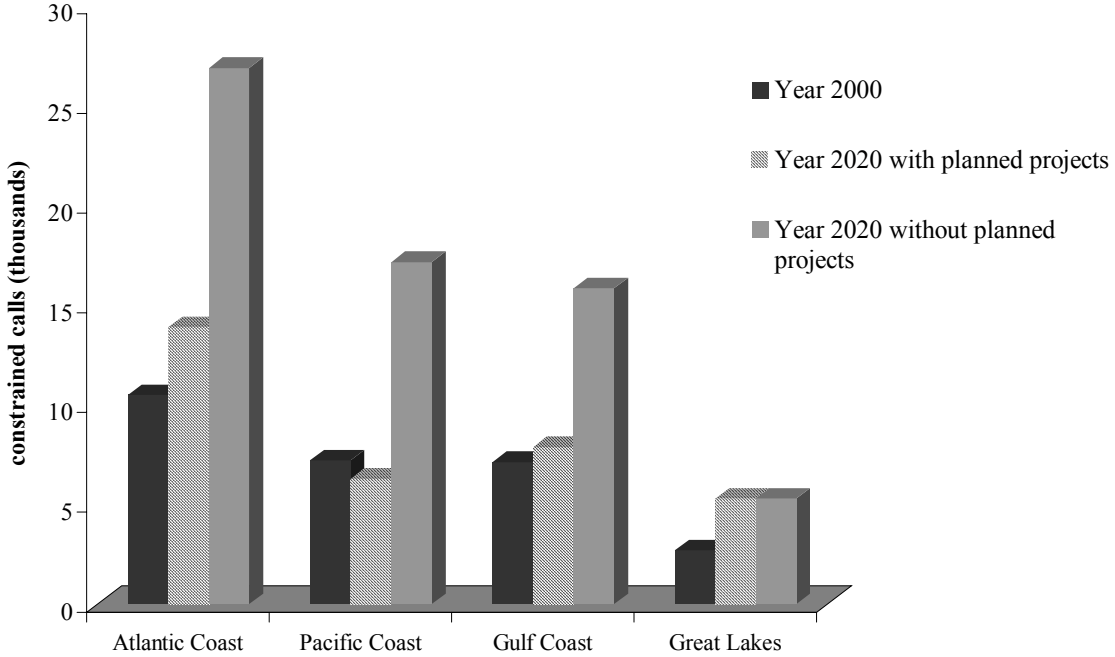

Figure IX-3. Constrained Calls by Coastal Region with and without Planned Corps Projects: Years 2000 and 2020

Source: Based on data from the Waterborne Commerce Statistics Center

On the Atlantic Coast the constrained calls would grow over 156 percent from 2000 to 2020 without planned projects, but only 32 percent with planned projects. The Atlantic Coast share of constrained calls nationwide would rise from 38 percent in 2000 to 41 percent in 2020 without planned projects and to 42 percent in 2020 with planned projects (Figure IX-3 and Table IX-1). This would be due in part to having the highest growth (156 percent) in constrained calls among the four regions without the planned projects and because the planned projects would not reduce the constrained calls as much as on the Pacific and Gulf Coasts. Constrained calls would account for about one-fifth of total calls on the Atlantic Coast in 2000 (19 percent) and in 2020 without planned projects (21 percent), but drop to 11 percent in 2020 with planned projects. If planned projects are constructed, growth rate in constrained calls would be approximately 1.4 percent per year. In the absence of planned projects, the growth in constrained calls along the Atlantic Coast would be a high 4.8 percent per year.

On the Atlantic Coast the constrained tonnage in 2020 without planned projects would climb 97 percent above the 2000 level and grow 58 percent with planned projects (Table IX-2). The Atlantic Coast share of constrained tonnage nationwide would decrease from 29 percent in 2000 to 28 percent in 2020 without planned projects, but increase to 34 percent with planned projects. That increase indicates that improvements from planned projects along the Atlantic Coast would not keep pace with the growth in constrained traffic relative to other regions.

On the Pacific Coast the constrained calls in 2020 without planned projects would grow by 137 percent above the 2000 level, but drop by 26 percent with planned projects (Figure IX-3

and Table IX-1). As a result, its 26 percent share of nationwide constrained calls in 2000 and in 2020 without planned projects would drop to 19 percent with planned projects. Constrained calls would account for over one-fourth of total calls on the Pacific Coast in 2000 (27 percent) and in 2020 without planned projects (28 percent), but fall to 10 percent in 2020 with planned projects. Under a planned project scenario, constraints along the Pacific are forecast to drop by almost 1 percent per year. However, without planned projects, constraints are expected to grow by 4.4 percent per annum.

Constrained tonnage on the Pacific Coast would grow 132 percent by 2020 without planned projects and only 50 percent by 2020 with planned projects (Table IX-2). However, its share of constrained tonnage nationwide would be 9 percent in 2020 under both scenarios.

On the Gulf Coast the constrained calls in 2020 without planned projects would increase by 122 percent above the 2000 level, but only rise by 11 percent with planned projects (Figure IX-3 and Table IX-1). Its 26 percent share of nationwide constrained calls in 2000 would fall to 24 percent in 2020 under both scenarios. Constrained calls would account for about one-fourth of total calls on the Gulf Coast in 2000 (25 percent) and in 2020 without planned projects (23 percent), but decrease to 12 percent in 2020 with planned projects. Along the Gulf Coast, constraints are projected to increase at a modest rate under a planned project scenario (0.06 percent per year). However, without planned projects, constrained calls are estimated to grow at an average annual rate of 4.1 percent.

Constrained tonnage on the Gulf Coast would climb 110 percent from 2000 by 2020 without planned projects, but only 14 percent by 2020 with planned projects (Table IX-2). Its share of constrained tonnage nationwide would rise to 56 percent in 2020 without planned projects, but drop by ten percent to 46 percent in 2020 with planned projects. That decrease indicates that, in contrast to the Atlantic Coast, improvements from the planned projects along the Gulf coast would outpace the growth in constrained traffic relative to other regions.

On the Great Lakes the constrained calls would rise 97 percent from 2000 to 2020 under both scenarios since there are no planned projects in that region (Figure IX-3 and Table IX-1). Its share of nationwide constrained calls would decrease from 10 percent in 2000 to 8 percent in 2020 without planned projects, but jump to 16 percent in 2020 when planned projects in other regions would be completed. Despite the much smaller number of calls and constrained calls compared to other regions, constrained calls would comprise an extremely high percentage of total calls on the Great Lakes. It would be 78 percent in 2000 and 85 percent under both scenarios in 2020.

Constrained tonnage on the Great Lakes between 2000 and 2020 would grow by 91 percent under both scenarios (Table IX-1). Among the four regions that would be the smallest growth rate without planned projects and the largest growth rate with planned projects because no projects are planned for the Great Lakes.

Vessel Types

Tables IX-3 through IX-6 show the distribution of constrained tonnage and calls by ship type along each coast assuming planned projects are built. In terms of tonnage, the Gulf Coast appears to be the most constrained. In the year 2000, forecasts suggest that almost 55 percent of

tanker tonnage will be constrained. However, this should decline by almost 9 percent by the year 2020 as planned projects are constructed. In the year 2000, 77 percent of constrained tonnage is in the form of tanker and dry bulk shipments. On the Atlantic Coast, tankers account for about 68 percent. The reason that tankers account for most constrained tonnage is that these ships transport crude petroleum and petroleum products, which account for approximately 40 to 50 percent of tonnage trade in the United States.

Most crude petroleum from Africa, Latin America and the Mid-East is transported to the U.S. in large Suezmax tankers, VLCCs or ULCCs. These ships generally sail fully loaded and have drafts that far exceed most channels at Corps projects. Large oil tankers either transfer cargo to smaller ships at locations in the Caribbean, or lighter at offshore mooring points in the Gulf of Mexico or in the Atlantic Ocean (e.g., Big Stone Anchorage). Either they unload all cargo or lighter enough to reduce sail drafts so that they can berth at ports such as Houston or Philadelphia. In a sense, the tanker sector has responded to channel constraints at U.S. ports. As large tankers began to rapidly come on-line in the 1970s, the industry realized that developing lightering infrastructure was a viable option to address the issue of channel constraints. Today, this infrastructure is extensive and well developed. In terms of calls, tankers are less constrained than with respect to tonnage. Projections indicate that in the year 2000, about 22 percent of tanker calls are constrained. This apparent disparity is indicative of the fact that the majority of imported crude petroleum is hauled in Suezmax or larger tankers. Thus, the 22 percent of constrained tanker calls carry most constrained tonnage.

TABLE IX-3

PROJECTED CONSTRAINED CALLS AND TONNAGE FOR THE ATLANTIC COAST BY SHIP TYPE WITH PLANNED PROJECTS: YEARS 2000 – 2020 (THOUSANDS OF CALLS AND MILLIONS OF METRIC TONS)

	Year 2000	Year 2010	Year 2020	% Annual Change
Total Constrained Calls	10.5	9.03	13.89	1.4%
Tanker	2.29	2.48	3.30	1.8%
Dry Bulk	1.80	2.36	3.38	3.2%
Containership	5.23	2.78	5.28	0.05%
General Cargo	1.12	1.34	1.83	2.5%
Other	0.03	0.04	0.06	3.5%
Total Constrained Tons	196.12	222.90	309.30	2.3%
Tanker	132.39	163.52	228.01	2.8%
Dry Bulk	41.45	45.09	55.18	1.4%
Containership	17.72	8.77	17.61	0.0%
General Cargo	2.13	1.67	2.53	0.9%
Other	2.43	3.85	5.96	4.6%

Source: Based on data from the Waterborne Commerce Statistics Center

TABLE IX-4

PROJECTED CONSTRAINED CALLS AND TONNAGE FOR THE GULF COAST BY SHIP TYPE: YEARS 2000 – 2020 (THOUSANDS OF CALLS AND MILLIONS OF METRIC TONS)

	Year 2000	Year 2010	Year 2020	% Annual Change
Total Constrained Calls	7.13	6.52	7.88	0.5%
Tanker	4.29	4.57	4.97	0.7%
Dry Bulk	1.93	1.04	1.35	-1.8%
Containership	0.63	0.54	1.09	2.8%
General Cargo	0.27	0.35	0.45	2.6%
Other	0.01	0.01	0.02	3.5%
Total Constrained Tons	367.82	353.57	418.36	0.6%
Tanker	281.91	311.00	362.30	1.3%
Dry Bulk	82.82	39.94	51.13	-2.4%
Containership	2.31	1.88	3.89	2.6%
General Cargo	0.68	0.63	0.91	1.5%
Other	0.10	0.12	0.13	1.3%

Source: Based on data from the Waterborne Commerce Statistics Center

TABLE IX-5

PROJECTED CONSTRAINED CALLS AND TONNAGE FOR THE PACIFIC COAST BY SHIP TYPE: YEARS 2000 – 2020 (THOUSANDS OF CALLS AND MILLIONS OF METRIC TONS)

	Year 2000	Year 2010	Year 2020	% Annual Change
Total Constrained Calls	7.20	4.41	6.29	-0.7%
Tanker	0.38	0.43	0.65	2.7%
Dry Bulk	1.35	1.68	2.18	2.4%
Containership	5.29	2.08	3.13	-2.6%
General Cargo	0.16	0.21	0.31	3.4%
Other	0.01	0.01	0.01	0.0%
Total Constrained Tons	54.75	56.37	82.20	2.1%
Tanker	12.21	14.16	22.91	3.2%
Dry Bulk	23.67	29.23	38.67	2.5%
Containership	18.20	12.01	19.16	0.3%
General Cargo	0.63	0.93	1.41	4.1%
Other	0.04	0.04	0.06	2.0%

Source: Based on data from the Waterborne Commerce Statistics Center

TABLE IX-6

PROJECTED CONSTRAINED CALLS AND TONNAGE FOR THE GREAT LAKES BY SHIP TYPE: YEARS 2000 – 2020 (THOUSANDS OF CALLS AND MILLIONS OF METRIC TONS)

	Year 2000	Year 2010	Year 2020	% Annual Change
Total Constrained Calls	2.69	3.92	5.29	3.4%
Tanker	0.12	0.19	0.28	4.3%
Dry Bulk	2.33	3.29	4.34	3.2%
Containership	0.19	0.37	0.59	5.8%
General Cargo	0.04	0.06	0.09	4.1%
Total Constrained Tons	49.22	70.45	93.85	3.3%
Tanker	0.33	0.39	0.57	2.8%
Dry Bulk	48.66	69.59	92.52	3.3%
Containership	0.12	0.32	0.56	8.0%
General Cargo	0.11	0.15	0.20	3.0%

Source: Based on data from the Waterborne Commerce Statistics Center

Dry bulk ships account for a substantial percentage of constrained tonnage. On the Gulf Coast, they comprise 23 percent in the year 2000. This should decrease by about 10 percent by the year 2020. On the Pacific Coast, dry bulk ships account for 43 percent of constrained tonnage. Dry bulk constraints on the Pacific and Gulf Coasts largely consist of ships carrying agricultural commodities such as grain. Along the Atlantic Coast, many dry bulk constraints represent outbound coal carriers with design drafts that exceed channel depths at ports such as Baltimore or Newport News. On the Great Lakes, dry bulk ships make up almost all of the traffic and thus most of the constrained tonnage. This is a direct result of draft limitations throughout the entire Great Lakes port system. Maximum navigable depth for the Great Lakes port system is 27 feet. Vessels entering or exiting the Great Lakes are limited to a length of 730 feet, a beam of 76 feet and a draft of 26 feet because of infrastructure constraints along the St. Lawrence Seaway.

Relative to dry bulk ships and tankers, containerships account for small amounts of constrained tonnage. In 2000, about 9 percent of constrained tonnage along the Atlantic Coast is expected to be carried by containerships. This represents about 17 million metric tons of cargo, which is significant given that containerized freight is usually higher in volume and lower in weight than bulk commodities. It is also substantial in terms of monetary value. For example, based on 1996 data, the average value per ton of cargo carried on containerships is $4,830. Thus, in terms of 1996 dollars, constrained containership tonnage on the Atlantic Coast is worth about $82 billion. On the Pacific Coast, projections indicate that about 33 percent of constrained tonnage will be transported by containerships by the year 2020. In absolute terms, this represents 18 million metric tons.

General cargo ships account for a relatively small amount of constraints with respect to both tonnage and calls. Based on tonnage, general cargo ships make up approximately 1 percent of constraints on each coast. Constrained calls are somewhat higher, particularly along the Atlantic Coast. In 2000, estimates suggest that about 1,600 general cargo calls will be constrained. This represents approximately 5 percent of total general cargo calls to and from the United States. As discussed in Chapter VI, operators of general cargo ships prefer smaller

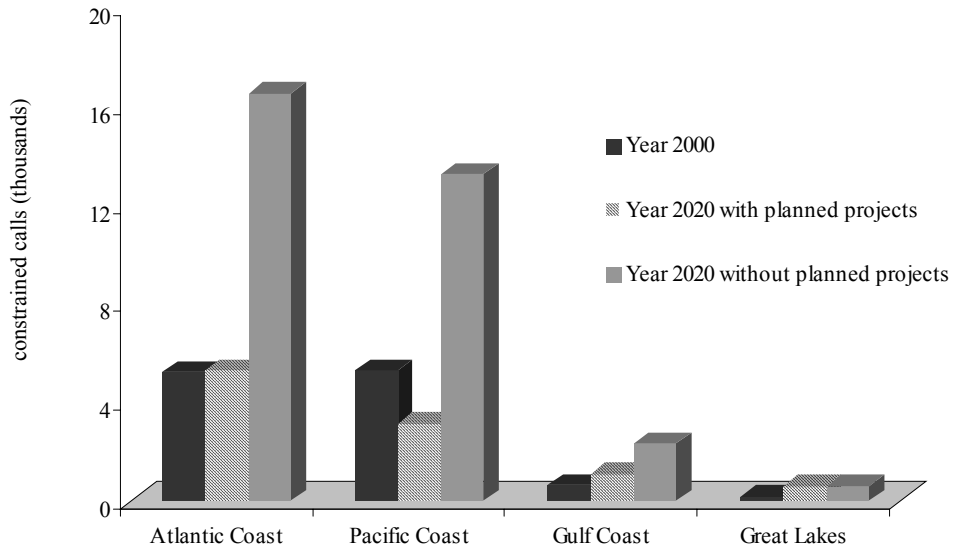

Figure IX-4. Constrained Containership Calls by Coastal Region with and without Planned Corps Projects: Years 2000 and 2020

Source: Based on data from the Waterborne Commerce Statistics Center

designs that allow flexibility to service a wide range of trades and ports. Many containership operators, on the other hand, are introducing large ships that operate on a series of port rotation routes based on regional hub and spoke operations. Cargo is then shipped to hinterland markets via truck, rail or through smaller feeder ships. Over the forecast horizon, general cargo constraints are not expected to grow.

TABLE IX-7

CONSTRAINED CONTAINERSHIP CALLS BY COASTAL REGION WITH AND WITHOUT PLANNED CORPS PROJECTS: YEARS 2000 AND 2020 (THOUSANDS OF CALLS)

	Year 2000	% of total	Year 2020 (with planned projects)	% of total	Year 2020 (without planned projects)	% of total
Atlantic Coast	5.23	46.1%	5.28	52.3%	16.52	50.6%
Pacific Coast	5.29	46.6%	3.13	31.0%	13.24	40.5%
Gulf Coast	0.63	5.6%	1.09	10.8%	2.33	7.1%
Great Lakes	0.19	1.7%	0.59	5.8%	0.59	1.8%
Total	11.34	100.0%	10.09	100.0%	32.68	100.0%

Source: Based on data from the Waterborne Commerce Statistics Center

Although containerships account for a relatively small amount of constrained tonnage, they make up a much greater portion of constraints in terms of calls. Unlike bulk carriers that generally discharge or load all cargo during one call, containerships operate as liner services. Figure IX-4 and Table IX-7 present estimates of constrained calls for containerships only.

In the year 2000, estimates show that most constrained containership calls will occur along the Atlantic and Pacific Coasts. Of the approximate 11,300 constrained containership

calls, about 5,200 are predicted to take place along the Atlantic Coast. Nearly 5,300 are expected to occur along the Pacific Coast. Under a planned project scenario, predictions suggest that in the year 2020 about 10,000 containership calls will be constrained. Of these, close to 5,300 (more than one-half) will take place at Atlantic Coast ports. Even without planned projects, Atlantic Coast ports are expected to see more than one-half of all constrained containership calls. Constrained containership traffic along the remaining coastal regions without planned projects should increase or decline slightly relative to the total volume of constrained calls if planned projects are constructed. Along the Pacific Coast, constrained containership calls are expected to decrease from the nearly 5,300 in 2000 to around 3,100 in 2020. Constrained calls for ports along the Gulf Coast are predicted to increase from about 600 per year to nearly 1,100 under a planned project scenario. If planned projects are not built, constrained containership calls along both the Gulf and Pacific Coast are expected to more than double.

X. FINDINGS AND STUDY CONCLUSIONS

The National Dredging Needs Study of Ports and Harbors (NDNS) has represented a multiyear multiproduct effort to develop and analyze strategic maritime information. A comprehensive database of nearly two million records containing data relating to international maritime trade in the United States was collected and compiled. The comprehensive database consists of information:

- The different types of ships that call on U.S. ports including vessel type, size, operational characteristics, origin and destination;
- U.S. and foreign port infrastructure and port development;
- Types, quantities and value of maritime commodities imported and exported;
- Forecasts of commodity flows by direction at the coast and port level;
- Vessel calls by type of ship, coast and port;
- Forecasts of vessel calls by ship type, coast and port;
- Number of vessel calls expected to be constrained by channel depths under current and future conditions.

Using this database and specific assumptions regarding demand for channel depth, extensive analyses were undertaken to meet the legislative requirements of the study as dictated by the Water Resources Development Act of 1992 (WRDA'92). In particular, WRDA'92 directed the Corps to conduct a study to assess the status of international maritime trade and, its impact on U.S. deep draft ports and harbors with an emphasis on Federal navigation channels. Principal findings of the study are summarized below.

KEY FINDINGS

1. Overview and Analysis of International Trade on a Global, National and Regional Level

Analysis of international trade on a global level emphasizes the growing importance of maritime trade to the Nation's economy. Foreign commerce makes up about 27 percent of Gross Domestic Product (GDP) and is worth roughly $1.5 trillion. Study forecasts indicate that foreign cargo traffic will more than double by the year 2020. By 2040, imports and exports are expected to increase eightfold. Although commodities such as crude petroleum, grain and coal will remain important to the U.S. economy, the leading growth area for increases in global trade is container shipping. Because the U.S. is the world's number one market for containerized commodities such electronics, machinery and other manufactured goods, continued growth is

expected. Increases in container shipping has largely been spurred by economic expansion in many Asian countries, most notably China, Japan, Korea and Malaysia.

On a national and regional level, the NDNS began with a port-wise and coastal study of international trade in terms of cargo value and tonnage**.** Out of approximately 9,300 commercial waterway facilities in the United States, 150 deep draft ports account for more than 99 percent of foreign waterborne trade. About 75 percent of international tonnage and almost 90 percent of international cargo value flows through 25 ports.

International commodity flows to and from the Pacific Coast are substantial in terms of monetary value. Pacific Coast ports account for slightly less than 43 percent of all foreign maritime trade based on dollar value. Ports along the Pacific Coast handle a wide range of goods such as grain and crude petroleum; however, high value containerized freight is the most important cargo for major Pacific Coast ports. When measured in dollars, about 60 percent of containership cargo flows through the Pacific Coast, most of which is imported from Asia. Pacific Coast ports will continue to benefit from trade with Asia, and cargo volumes will increase as economies in nations such as China continue to develop.

Trade along the Gulf Coast is characterized by large amounts of bulk commodities such as grain, crude petroleum and chemicals. Ports along the Gulf Coast account for about 50 percent of total foreign waterborne trade by weight, but only around 18 percent based on value. Because of its proximity to major inland waterways, the Gulf Coast will continue to serve as a vital point of entry and exit for bulk commodities.

Ports along the Atlantic Coast account for 30 percent of foreign waterborne trade based on tonnage and about 38 percent in terms of value. Atlantic Coast ports handle about 70 percent of the Nation's coal exports, 60 percent of exported refined petroleum, 30 percent of imported crude petroleum and about one-half of containerized tonnage. Europe has traditionally been the main source of container trade along the Atlantic Coast. However, throughout the 1990s, containership traffic from Asia to the Atlantic Coast has increased and continued growth is expected. Two primary factors have contributed to growing containership traffic on the Atlantic Coast. The first has been the gradual eastward shift of Asian manufacturing centers to Southeast Asia, East China and the Indian Subcontinent. Growing congestion on the U.S. transcontinental east-west rail network (i.e. the U.S. "land-bridge) is acting as a catalyst as well. As trade with Asia continues to swell, rail connections and transfers are becoming increasingly strained, resulting in delays and higher costs for shippers. Some container carriers have responded by rerouting Asian cargo on an all water route through the Suez Canal rather than land-bridging it across the continental United States. This is important because containerships sailing this route are some of the largest vessels in operation today.

Although they account for a relatively small share of tonnage and value on a national level, ports along the Great Lakes play a valuable role in trade with Canada. In terms of tonnage, ores, coal and non-metallic crude minerals are important commodities. Based on value, iron and steel imports from Europe and exports of grains and oil seeds are important commodities. Shipment of containerized commodities on the Great Lakes is minimal, comprising only about 0.1 percent of total U.S. containership trade in terms of both value and weight.

2. Description and Analysis of the Types and Sizes of Ships in the World Merchant Fleet, Including an Examination of Current Vessel Traffic with Channel Depths at U.S. Deep Draft Ports.

There are four basic types of merchant vessels: dry bulk ships, tankers, general cargo ships and containerships. Tankers and dry bulk ships transport about two-thirds of U.S. imports and exports when measured by weight. Coal, ores, chemicals, agricultural goods and crude or refined petroleum are the primary commodities shipped in tankers and dry bulk ships. Over the past twenty years or so, the size of the largest tankers and dry bulk ships has remained more or less constant, and there does not appear to be a trend toward larger vessels.

General cargo vessels are ships designed to carry non-bulk, non-containerized freight. They transport about 15 percent of foreign trade based on value and 5 percent in terms of tonnage. General cargo ships are relatively small and are not growing in size. Their numbers have declined in recent years, as containerships have become the primary method of transporting non-bulk dry cargo, e.g., manufactured and semi-manufactured goods.

Unlike other vessels, containerships are growing in terms of both fleet capacity and vessel size. On average, their share of the world fleet's cargo-carrying capacity increased 8.8 percent per annum from 1985 to 1999. Not only are containerships the fastest growing type of vessel in the fleet, but they are also becoming increasingly larger. Containership size is generally measured by the number of containers that a vessel can carry expressed in twenty-foot equivalent units (TEU). In the 1980s, containerships of 2,000 to 3,000 TEUs were considered the norm. Since then, deregulation of the transportation industry, consolidation among containership companies and growing volumes of container trade have spawned a race among major carriers to build larger vessels in pursuit of lower costs and increased competitiveness. Today, companies are introducing "megaships" that range from 6,000 to 7,500 TEUs, and plans are underway for vessels of 10,000 to 12,000 TEUs. Fully loaded by weight, megaships require channels of 50 feet or more. In the U.S., only a handful of ports currently meet this requirement.

Containerships account for about 40 percent of the total vessel calls at U.S. deep draft ports, followed by general cargo vessel with 26 percent of the total. Containership traffic is heavily weighted towards larger vessels. Containerships with a draft of 40 ft or greater make up 31 percent of their vessel calls while only 12 percent of their traffic occurs in ships with drafts of less than 30 ft. Only 6 percent comprises vessels with drafts greater than 45 ft. By contrast, less than 3 percent of general cargo vessel calls are in ships with drafts exceeding 40 ft, but 65 percent occur in ships with drafts from 9 to 30 ft.

Bulk ships comprise about one-third of total vessel calls at U.S. deep draft ports, with 21 percent by dry bulk ships and 13 percent by tankers. Dry bulk traffic consists largely of medium- sized vessels. Almost 75 percent is in ships with drafts of 30-40 ft and only 17 percent of their traffic occurs in ships with drafts greater than 40 ft. Only 7 percent comprises vessels with drafts of more than 40 ft. About 20 percent of tanker traffic consists of very large ships with design drafts with 45 ft or greater. These ships cannot access many U.S. ports when fully loaded, so they transfer cargo at offshore mooring points or to smaller ships or barges.

3. Assessment of the National Waterside Infrastructure Needs and a Comparison of Drafts at U.S. and Major World Ports.

To assess national waterside infrastructure needs, a mapping of ports along each U.S. coastal region was used to compile a listing of "key" U.S. ports. Criteria for port selection was based on the amount of cargo handled at each port, measured by value and tonnage. The same process was used to identify major foreign ports that trade with each U.S. coastal region. Key U.S. and foreign ports were analyzed based on the status of their cargo handling facilities and current channel depths.

Analysis showed that major port development is taking place around the world in response to growth in container shipping and larger containerships. Ports are investing heavily in dockside infrastructure such as expanded berths, newer and larger cranes, improved intermodal capabilities and deeper channels. It appears that U.S. ports are keeping pace with their foreign counterparts with regard to dockside infrastructure. Many major container ports in the U.S. are developing new terminals and implementing massive projects to reduce port congestion, and accommodate megaships that are wider, longer and deeper, and that require quick turnaround times to remain profitable.

Although U.S. ports are currently comparable to foreign ports in terms of dockside infrastructure, channel depth remains an obstacle. This is particularly true for ports along the Atlantic Coast that expect to service new generations of containerships. Container traffic to and from the U.S. travels on three primary trade routes. About 90 percent flows through ports along the Atlantic and West Coasts and originates or is destined to Asia and Europe. Gulf Coast container shipments account for most of the remainder. Today, megaships are being deployed on east-west routes that service Europe, the U.S. and Asia. Foreign ports on these routes have deepened, or are planning to deepen, harbor channels to 50 to 53 feet (16 meters). In the U.S., channels designed for containerships along the Atlantic Coast are currently 45 feet or less, while channels at major Pacific Coast container ports are at least 50 feet deep.

4. Projection of Future Vessel Traffic at U.S. Deep Draft Ports

As commodity flows increase, vessel demands on the Nation's ports system will grow. On a national level NDNS analysis indicates that the total number of annual calls to and from the U.S. will more than double by the year 2020 (from about 114,500 in the year 2000 to approximately 261,000 in the year 2020). Containership traffic is expected to increase the most. From 2000 through 2020, containership calls are projected to grow from about 42,000 to almost 121,000 annually. Containerships are expected to account for the majority of increased calls (54 percent), and they will likely increase at the fastest rate (5.5 percent per annum). Projections indicate that the greatest increase in containership traffic will occur along the Atlantic Coast. General cargo traffic is expected to grow as well; however, containership traffic will increase at a much faster rate as more and more general cargo is shipped in containers rather than as break-bulk freight.[67] Tanker calls are anticipated to double by 2020, reflecting strong growth in imported crude petroleum. Dry bulk traffic is expected to increase, but at a slower rate relative

[67] Recall that the vessel category of general cargo ships includes refrigerated ships, automobile carriers, Ro-Ro vessels and multipurpose ships.

to other ship types. Exports of grain and coal, the primary U.S. commodities transported on dry bulk ships, are not forecast to grow as much as other commodities.

The greatest increase is expected to occur along the Atlantic Coast. By the year 2020, total calls to and from Atlantic Coast ports are forecast to increase from about 55,100 in the year 2000 to approximately 126,300 in 2020. Based on vessel type, containerships are expected to grow the fastest–about 5.4 percent annually.

Annual calls to Gulf Coast ports are forecast to increase from 28,900 in the year 2000 to about 68,100 in 2020. Tanker calls along the Gulf Coast are expected to more than double by 2020 signaling strong growth in trade of crude or refined petroleum, petrochemicals and other industrial chemicals. Dry bulk traffic is anticipated to increase as world demand for bulk agricultural commodities (e.g., grain and oil seeds) and U.S. imports of ores from South America and Africa increase. From 2000 to 2020, forecasts suggest that containership calls to and from Gulf Coast ports will increase from about 3,900 in the year 2000 to 18,500 in 2020. Again, in large part, projected growth will result from increased container trade with nations in Africa and, in particular, Latin America.

Annual vessel traffic along the Pacific Coast is also forecast to increase considerably. By 2020, calls are forecast to increase to about 60,000 per year–an average annual growth rate of 4.1 percent. Annual containership traffic is estimated to increase by about 25,000 calls per year. Most of this growth is attributed to anticipated increases in trade with Asia and the east coast of South America.

Annual calls to and from the Great Lakes region are projected to increase by almost 2,800 by the year 2020. As is the case with the Pacific Coast, growth in annual traffic along the Great Lakes should be restricted to a specific type of ship. Almost all of the increased traffic on the Great Lakes is expected to consist of dry bulk calls.

5. Dredging Needs Analysis

A methodology was developed to assess the growing demand for channel depth at the Nation's deep draft ports. Demand was measured as the number of "constrained vessel calls" to and from Federally maintained channels**.** A ship's need for channel depth is based on its dimensions, the most important of which is its design draft. A ship's design draft refers to the depth at which it rests in the water when it is fully loaded to tonnage capacity. To estimate current and anticipated usage rates of channels, vessel design drafts corresponding to projected vessel calls were compared with channel depths to determine which calls, and associated cargo tonnage, exceed channel depths. Cases in which vessel design drafts, plus a safety clearance, were greater than channel depths are "constrained vessel movements". Constrained movements indicate a potential need for deeper channels.

Two scenarios were analyzed. The first assumes that "planned" deepening projects occur, while the second assumes that planned projects are not implemented. Planned projects are those that have undergone feasibility study requirements, and are scheduled to begin at some point during the dredging needs study horizon (i.e., 2000 – 2020). Planned projects have received

Congressional authorization; however, funding has not been appropriated and construction has not yet begun.

For the year 2000, total calls were estimated at approximately 114,500 per year. The NDNS model indicates that about 27,600 (24 percent) of these calls were constrained. Projections show that total calls will grow to about 261,000 in the year 2020, of which approximately 33,400 (13 percent of total calls) could be constrained with planned projects. This reflects an average annual growth rate of constrained calls of about 1 percent. In the absence of planned deepening projects, constrained vessels calls are expected to be significantly greater. The total number of constrained calls in 2020 would be about 65,000 (25 percent of total calls), which represents an average annual growth rate of 4.4 percent.

Completion of planned projects nationwide by 2020 would reduce constrained calls by 49 percent compared to 2020 without planned projects. Additional projects would be needed to eliminate the remaining 33,400 constrained vessel calls. Planned projects would achieve the largest reduction in constrained calls on the Pacific Coast (down 63 percent), while the reductions on the Gulf and Atlantic Coasts (down 50 and 48 percent respectively) would be close to the national average.

While constraints were measured for all types of vessels, containerships are the most important with respect to dredging needs. The dredging needs model estimates for the year 2000 about 11,300 containership calls would have been constrained. This equates to 25 percent of total containerships calls (114,500) in 2000. If planned projects are constructed, this is expected to increase to about 33 percent in 2020. However, if planned projects are not implemented, about 65 percent of containership calls will be constrained. Ports along the Atlantic Coast are expected to experience the greatest increase in constrained containership traffic. With planned projects in 2020, the distribution of constrained calls by coastal region is: Atlantic Coast (52 percent), Pacific Coast (31 percent), Gulf Coast (11 percent) and Great Lakes (6 percent). Even without planned projects, Atlantic Coast ports are expected to see more than one-half of all constrained containership calls in 2020. Thus, it appears that harbor channels along the Atlantic Coast that handle large volumes of container trade have the greatest potential need for channel deepening.

Conclusion

Economic forces that impact maritime navigation are numerous and complex. When changes occur, they do not happen quickly but gradually, over time. Port planning, including channel construction, requires a long-term perspective to understand and accommodate changes in the navigation industry. Capital must be raised, environmental and economic impacts must be assessed, and the lengthy construction process must take place. Thus, the ability of planners and port masters to recognize and anticipate changes in navigation is crucial.

In response to Section 402 of WRDA 1992, the National Dredging Needs Study of Ports and Harbors (NDNS) has represented a multiyear multiproduct effort to develop and analyze strategic maritime information regarding the status of U.S. deep draft ports. The NDNS sheds light on several critical issues. By far, the most important are the growing reliance of the U.S.

economy on foreign maritime trade and the need for adequate infrastructure to maintain a seamless flow of cargo between the U.S. and its trading partners. As foreign trade grows, the maritime transportation system, which links nations in the world economy, will become increasingly vital to maintaining economic growth and national prosperity. Over 90 percent of foreign trade flows through coastal harbors and navigation channels constructed, operated and maintained by the USACE.

Total nationwide vessel calls in 2000 were estimated to be approximately 114,500, of which about 27,600 or 24 percent would have been constrained. In the absence of planned deepening projects, however, constrained vessel calls in 2020 are projected to be significantly greater, about 65,000 or 25 percent of the 261,000 total calls. That represents an average annual growth rate of 4.4 percent. The constrained foreign trade flows would adversely impact upon the growth of the Nation's economy.

On the other hand, the construction of planned projects will greatly enhance the ability of the Nation's ports to manage growing volumes of foreign trade. This is particularly true with respect to the increasing draft requirements of containerships, which are critical from the perspective of dredging needs. Projections show that with planned projects approximately 33,400 vessel calls or 13 percent of the 261,000 total calls would be "constrained" in 2020. This reflects an average annual growth rate of constrained vessel calls of about 1 percent.

Completion of planned projects nationwide by 2020 would reduce constrained calls by 49 percent compared to 2020 without projects. Planned projects would achieve the largest reduction in constrained calls on the Pacific Coast (down 63 percent), while the reductions on the Gulf and Atlantic Coasts (down 50 and 48 percent respectively) would be close to the national average.

Additional channel deepening projects would be needed to eliminate these 33,400 constrained vessel calls in 2020 that would comprise 13 percent of total calls. Furthermore, new projects should be planned to meet the growth in commodity and vessel traffic that is projected to continue between 2020 and 2040.

The NDNS database represents a comprehensive source of data for planning purposes because of the extent of port, vessel, and trade characteristics that were gathered as part of this study. It is a valuable tool that can be used to identify reconnaissance-level port studies in high constraint areas where studies or projects are currently not planned, particularly for ports that handle high volumes of containership cargo. In addition, the database serves as a comprehensive, centralized source of information to support feasibility studies and other analyses conducted by the Corps field offices.

RECOMMENDATIONS FOR FURTHER STUDY

Because of the extent of port, vessel and trade characteristics that were gathered as part of this study, the NDNS database represents a comprehensive source of data for planning purposes. The NDNS database is a valuable tool that can be used to identify reconnaissance-level port studies in high constraint areas, where studies or projects are currently not planned, particularly for ports that handle high volumes of containership cargo. In addition, the database serves as a

comprehensive, centralized source of information to support analyses conducted by Corps field offices. Efforts should be made to further develop and enhance the NDNS database to be used as an on-going analytical instrument for regional and strategic planning. Potential activities could include updating the database on an annual basis to account for changing patterns of trade and trends in the merchant fleet. Understanding the true economic impacts of channel constraints requires information on how transportation costs are affected if constraints are reduced or eliminated. Thus, the NDNS database could be linked to ocean-going voyage costs to develop generalized reconnaissance-level benefit estimates of potential deepening projects, or could be used to identify the expected aggregate increase in transportation costs that will occur if planned projects are not constructed.

Another important effort could include refinements and extensions of the dredging needs analytical model. Database records are limited to baseline Waterborne Commerce data that reflect tonnage loaded or unloaded at a port of call. Refined characterization of depth constraints would come from data regarding activity occurring during a voyage or rotation of multiple port calls. This would require tracking a vessel's movements in the U.S., identifying the foreign port from which the vessel sailed, and lastly identifying the foreign port the vessels call on after leaving U.S. waters. Identifying these voyages and associated costs would allow a mapping of hypothetical routes and associated costs, constraints and numerous other analytical scenarios, thereby improving the strategic and analytical capabilities of the model. Another modification of the model would involve developing and applying a system of mathematical equations for estimating constraints that account for the fact that ships sometimes sail light loaded for reasons other than depth constraints. Lastly, efforts could be made to link commodity forecasts and deep draft vessel calls forecasts to the inland transportation system. Such a linkage would allow identification of the Nation's intermodal network, port hinterlands, and the origin or destination of inland commodity flows, which could allow analyses of inland capacity limitations and ripple effects of relieving waterside constraints.

APPENDIX A

OVERVIEW OF WEFA GLOBAL TRADE MODELS

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WEFA global trade models were developed to support estimation of current and future international trade. The following profile of the WEFA global trade models includes discussions of the following:

- The relationship between trade and economic development,
- The structure and function of the trade models,
- Data used in the models, and
- A comparison of trade models relative to other trade models.

Discussions begin with the recognition of the dynamic relationship between every nation's economic development and the character and scale of its international trade.

As trading partners of the United States develop, they experience changes in domestic production, consumption and international trade. Developing countries usually have limited import capacity due to infrastructure constraints and inadequate access to capital. Emerging nations tend to import in order to fill gaps in domestic production, which is often export-oriented. As emerging countries continue to develop, domestic enterprises begin to produce substitutes for imported foreign products. Eventually, developing nations reach a mature stage at which their economy shifts from a manufacturing to a service-oriented system, and production bases shift from low-value to high-value products. At this point, imports of manufactured goods increase as foreign producers replace domestic producers. Markets for consumer goods in mature economies often become saturated. At this stage, new consumption replaces old products, but there is relatively little real growth except for population increases. Although populations in mature economies grow relatively slowly, their absolute volume of consumption is relatively high.

Given the relationship between economic development and trade, in which levels of imports are affected by stages of national development, WEFA trade models are designed with a nonlinear structure to allow long-term trade forecasting. The models have a bottom-up structure and assume that every commodity flow reflects the individual decisions of producers and consumers.

In the model, total world trade is the aggregate interaction of 3,600 trade routes for 77 different types of commodities. Each trade route represents a single commodity flow between two trading partners among the 48 countries and 12 regions presented in Table A-1. This creates a bilateral matrix of world trade. Most of the importer-exporter relationships for each type of commodity are forecast independently. The 77 types of commodities are grouped according to the International Standard Industrial Classification (ISIC) code. The two general categories are "primary and manufactured." Primary commodities consist of two subgroups: (1) "Agriculture, Hunting, Fishing and Forestry" commodities, and (2) "Mining and Quarrying" commodities including goods such as crude petroleum and scrap metal. Manufactured commodities are more diverse and include 46 subgroups. The commodity classification system is presented in Tables A-2 and A-3.

WEFA global trade models are structured as import demand models. Each model treats commodity flows as one-way, such that Country A's imports from Country B are identical to

Country B's exports to Country A. Estimated demand for imports in Country A is based on aggregate demand in Country A and relative prices of the imported goods. Aggregate demand is a function of personal consumption expenditures, business investment and consumption structure. Exports from Country B are derived from estimated import demand in Country A. Exports are rationalized across major regional groupings. The success of County B's exporters is based on the relative prices of their products, their productivity and prevailing exchange rates.

To analyze nonlinear relationships between trade and economic development, models estimate long-term trends in a country's demand for imports. The WEFA global trade modeling system uses a pooled data set containing cross-section and time-series data from 60 countries/regions and 15 years of international trade data. The approximately 900 observations in the data set for each commodity category exceed the total number of observations of most simple time-series models. In most cases, trade coefficients are statistically valid, since the statistical reliability increases as the number of observations increase.

Models reflect imperfect competition and limited information available to potential trading partners. Traditionally, international trade has moved along predefined routes, with limited ability to rapidly shift country suppliers. With better technology and fewer barriers to trade, this is changing. Competition between exporters is modeled by forcing the trade forecast for each exporting country to equal the estimated import demand from a group of exporters. Using this approach, differential price and production factors are taken into account, since market shares are determined by the relative competitiveness of each exporting country.

Global trade models incorporate commodity-specific commerce data covering the U.S. and over 160 other countries. Data were developed from United Nations trade information by Statistics Canada. Given inconsistencies and missing information in the raw information reported to the United Nations, Statistics Canada verifies and revises raw reported data, making estimates of bilateral trade flows where necessary. Current versions of the WEFA model use 1996 data from Statistics Canada for nations other than the United States. Data from the U.S. Department of Commerce is used for U.S. trade routes.

TABLE A-1

WORLD REGIONS AND NATIONS REPRESENTED IN WEFA TRADE FORECASTING MODELS

Developed Countries		Developing Countries	
Region	**Nation**	**Region**	**Nation**
North America	United States	Asia	South Korea
	Canada		Taiwan
Asia	Japan		Indonesia
Europe	Germany		Malaysia
	France		Hong Kong
	U.K.		Philippines
	Italy		Singapore
	Austria		Thailand
	Belgium		Vietnam
	Denmark	Indian Subcontinent	India
	Finland		Pakistan
	Greece		Other Indian Subcontinent
	Ireland	Latin America	Argentina
	Netherlands		Brazil
	Norway		Venezuela
	Portugal		Other E. Coast, S. America
	Spain		Chile
	Sweden		Colombia
	Switzerland		Peru
	Turkey		Other W. Coast, S. America
	Other W. Europe		Mexico
Oceania	Australia		Caribbean Basin
	New Zealand		Costa Rica
			Panama
			Other Central America
		CIS*/Eastern Europe	Former Soviet Union
			Eastern Europe
		Mid-East	Israel
			Mediterranean
			Persian Gulf
			Northern Africa
			Eastern Africa
			Western Africa
			Other Southern Africa
		Other	Other Region

* Commonwealth of Independent States

TABLE A-2

COMMODITY CLASSIFICATION SYSTEM FOR PRIMARY (NON-MANUFACTURED) COMMODITIES IN WEFA TRADE FORECASTING MODELS

ISIC Code	Primary Commodities (non-manufactured)
C1	**Agriculture, Hunting, Forestry, Fishing**
C1A	Grain
C1B	Oil Seeds
C1C	Vegetables and Fruits–Refrigerated
C1D	Vegetables and Fruits–non-Refrigerated
C1E	Cork and Wood
C1F	Natural Rubber
C1G	Cotton
C1H	Other Raw Textile Materials
C1I	Other Agriculture
C2	**Mining and Quarrying**
C2A	Non-Metallic Crude Minerals
C2B	Natural Fertilizers
C2C	Ores
C2D	Coal
C2E	Crude Petroleum
C2F	Natural Gas
C2G	Scrap Metal

TABLE A-3

COMMODITY CLASSIFICATION SYSTEM FOR MANUFACTURED AND SEMI-MANUFACTURE COMMODITIES IN WEFA TRADE FORECASTING MODELS

ISIC Code	Manufactured Commodities	ISIC Code	Manufactured Commodities
C311	Food	C3822	Agricultural Machinery
C311A	Meat/Dairy/Fish	C3823	Metal & Wood Work. Machinery
C311B	Other Meat/Dairy/Fish/Fruit/Vegetables Preserved, Prepared or Concentrated	C3824	Special Industrial Machinery
C311C	Sugar	C3825	Office and Computing Machinery
C311D	Animal Feed	C3829	Machinery and Equipment, nec.
C311E	Animal and Vegetable Oils	C3831	Electrical Industrial Machinery
C311F	Other Food, Cereals, Composite Food Products	C3832	Radio, TV, & Comm. Equipment
C313	Beverages	C3832A	Radio and Television
C314	Tobacco	C3832B	Semi-conductors, Elect. Tubes, etc
C321	Textiles	C3832C	Other Communications Equip.
C322	Apparel	C3833	Electric Appliances & Housewares
C323	Leather and Products	C3839	Electrical Apparatus, nec.
C324	Footwear	C3841	Shipbuilding and Repairing
C331	Wood Products	C3842	Railroad Equipment
C332	Furniture and Fixtures	C3843	Motor Vehicles and Parts
C341	Paper and Products	C3843A	Motor Vehicles
C341A	Waste Paper	C3843B	Parts of Motor Vehicles
C341B	Pulp	C3844	Motorcycles and Bicycles
C341C	Paper and Paperboard and Products	C3845	Aircraft
C342	Printing and Publishing	C3849	Transport Equipment, nec.
C3511	Basic Industrial Chemicals	C3851	Professional Equipment
C3511A	Organic Chemicals	C3852	Photographic and Optical Goods
C3511B	Inorganic Chemicals	C3853	Watches and Clocks
C3512	Manufactured Fertilizers and Fertilizers/Pesticides	C390	Other Manufacturing, nec.
C3513	Synthetic Resins		
C3521	Paints, Varnishes and Lacquers		
C3522	Drugs and Medicines		
C3523	Soap and Cleaning Preparations		
C3529	Chemical Products, nec.		
C353	Petroleum Refineries		
C354	Petroleum and Coal Products		
C354A	Briquettes, Lignite, Peat and Coke		
C354B	Residual Petroleum Products		
C355	Rubber Products		
C356	Plastic Products, nec.		
C361	Kitchenware and Plumbing		
C362	Glass and Products		
C369	Non-Metallic Products, nec.		
C371	Iron and Steel		
C372	Non-Ferrous Metals and Products		
C381	Metal Products		
C3821	Engines and Turbines		

* nec. = not elsewhere classified
* semi-manufactured commodities include goods such as iron and steel, aluminum, paper and wood.

Lack of consistent, trade-specific prices for commodities has led to the models' hybrid methodology, which uses U.S. price statistics, exchange rates and general export price indices for exporting countries and regions. Econometric models often focus on real trade volumes and assume that the prices of goods are exogenous (i.e. not determined by the model). However, nominal dollar amounts tend to reflect changes in exchange rates, which in turn affect real demand for goods and services. Therefore, there can be significant fluctuations in the nominal value of trade, but limited volatility in real volume of trade. In order to account for the effects of nominal values, the models include price and exchange rate information in the trade forecast calculations.

Prices and exchange rates are descriptive of current value and can be structurally significant and can describe the behavior of consumers. In the development of the models, a standardized approach was used to adjust trade value to volume in order to account for commodity prices and exchange rates. Differences in price inflation, relative to U.S. prices, for each country are taken into account using export price indices. In addition, real changes in commodity prices are captured in the price indices, and exchange rate changes are applied to avoid unilateral effects of changes in international prices. These measures are applied to mature economies and selected emerging markets. However, they are not used to adjust the value of exports of developing countries. Less developed nations are assumed to have no control over the prices of their exports, and the volume of their trade reflects U.S. dollar price adjustments only and not exchange rates.

For developing country exports, the model assumes that each importer's own nominal dollar value may be properly deflated with the general price inflation in U.S. dollars. This adjustment is reasonable since developing country exporters have no control over the prices of their exports and regulate domestic exchange rates to insure that their exports remain competitive in terms of the general inflation rate in the U.S. market. When an emerging or mature country's economy is experiencing inflation, the model assumes that export prices adjust as the nation's own exchange rate devalues with the domestic inflation rate. To the extent that this does not occur, exporters would find themselves priced out of the market unless they were prepared to subsidize exports. In either case, exporters cannot sell their products at prices above the rate of U.S. price inflation.

When a currency appreciates relative to the U.S. dollar, the export price index increases. If the importer's currency is also appreciating, the nominal dollar imports of that country are greater, and the impact of the appreciation on the exporter and the resulting rise in the price index is reduced. Consequently, the higher dollar value of the reported imports and the greater value in the price index can have a minimal net effect. Import-demand equations in the model also include import-demand price indices and exporter performance measures–relative wages and relative rates of productivity growth. Import demand price indices are based on United States Bureau of Labor Statistics (BLS) trade price indices. BLS indices were developed using survey data from U.S. importers and exporters. Although the import-demand indices are commodity-specific, they are not specific to any one partner country or region. BLS forecasts are based on private forecasts derived from U.S. inter-industry models, reflecting the macroeconomic developments and factors specific to related industries. Exporter performance measures are based on data maintained by the World Trade Organization on wages and productivity.

The WEFA global trade model specifications represent a compromise between sector and regional detail. The hybrid structure of the model (using pooled cross-section and time-series data) incorporates long-term relationships between trade and economic growth using a cross-country structure. This is preferable to a simple time-series model, since it allows national economies to develop over time. In addition, the volatility of international trade makes a time-series model less efficient in discerning the underlying causal factors. The models' pooled data set, which combines country-specific information over time with multicountry information, offers an effective means to assess economic development-related determinants of trade.

Each trade commodity model within the WEFA Global Trade Service stands alone, defining the relationships between exporters and importers trading in a single commodity category. For each commodity, the global competitive balance between exporters and importers is estimated. Unlike other world trade models, WEFA models do not begin with a top-down estimate of total trade demand. WEFA models employ a "bottom up" approach in which total demand is derived in logical steps from country-based demand and supply to trade partner regions.

For the most part, econometric models define import demand and export supply potential. If separate econometric models are inappropriate due to the sparseness of available data, or due to a failure to find a statistically significant model, simplified parametric models are used in conjunction with the econometric models. Because of the large number of trade flows in the model and their interdependence, it is critical that each global trade model incorporate internal tests and limits to insure those valid forecasts are developed. Since logarithmic forms used in the econometric models are sometimes explosive, limits are imposed in the global trade model system to assure the quality of the trade forecasts. Testing is done in the global trade models using a self-contained expert system. A set of decision rules continuously checks the results against past trends in trade. Whenever a preliminary flow is found to be moving erratically, an alternative, more stable, estimation technique is substituted. The standard error of the base equation is used as an initial test for statistical accuracy for each importer-exporter equation. Forecasting accuracy is tested against historical data in order to determine which countries and regions require additional cross-country modeling and which countries and regions require alternative, simplified parametric specifications.

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APPENDIX B

TOP 150 U.S. PORTS BY CARGO TONNAGE AND CARGO VALUE

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Tables B-1 and B-2 present the top 150 U.S. ports based on international trade measured in metric tons and in U.S. dollars. Data were obtained from the U.S. Corps of Engineers Waterborne Commerce Statistics Center.

TABLE B-1

INTERNATIONAL CARGO TONNAGE DISTRIBUTION AMONG THE TOP 150 U.S. PORTS

Rank	Port	Coastal Region	Metric Tons (millions)	Market Share (%)	Cumulative Market Share (%)
1	Houston, TX	Gulf	78.98	7.68	7.6
2	Port Of South Louisiana, LA	Gulf	76.00	7.39	15.0
3	Corpus Christi, TX	Gulf	51.36	5.00	20.0
4	New York/New Jersey, NY & NJ	Atlantic	50.68	4.93	24.9
5	Port Of New Orleans, LA	Gulf	42.55	4.14	29.0
6	Norfolk Harbor, VA	Atlantic	35.28	3.43	32.4
7	Long Beach Harbor, CA	Pacific	32.68	3.18	35.5
8	Port of Baton Rouge, LA	Gulf	32.47	3.16	38.7
9	Texas City, TX	Gulf	32.05	3.12	41.8
10	Port Arthur, TX	Gulf	27.81	2.71	44.5
11	Baltimore, MD	Atlantic	26.81	2.61	47.1
12	Lake Charles, LA	Gulf	26.63	2.59	49.6
13	Philadelphia Harbor, PA	Atlantic	26.19	2.55	52.2
14	Los Angeles Harbor, CA	Pacific	25.18	2.45	54.6
15	Mobile Harbor, AL	Gulf	23.13	2.25	56.8
16	Port of Plaquemine, LA	Gulf	18.77	1.83	58.7
17	Pascagoula Harbor, MS	Gulf	18.41	1.79	60.4
18	Caribbean Islands	Atlantic	17.57	1.71	62.1
19	Freeport, TX	Gulf	17.42	1.69	63.8
20	Beaumont, TX	Gulf	17.07	1.66	65.5
21	Port of Newport News, VA	Atlantic	16.91	1.64	67.1
22	Seattle Harbor, WA	Pacific	15.44	1.50	68.6
23	Tampa Harbor, FL	Gulf	15.27	1.49	70.1
24	Port of Portland, OR	Pacific	15.01	1.46	71.5
25	Paulsboro, NJ	Atlantic	13.53	1.32	72.8
26	Savannah Harbor, GA	Atlantic	13.06	1.27	74.1
27	Tacoma Harbor, WA	Pacific	12.91	1.26	75.3
28	Portland, ME	Atlantic	12.09	1.18	76.5
29	Duluth-Superior Harbor, MN & WI	Great Lakes	10.12	0.98	77.5
30	Charleston Harbor, SC	Atlantic	9.60	0.93	78.4
31	Port of Boston, MA	Atlantic	9.44	0.92	79.3
32	Oakland Harbor, CA	Pacific	7.85	0.76	80.1
33	Galveston, TX	Gulf	6.95	0.68	80.8
34	Port Everglades Harbor, FL	Atlantic	6.84	0.67	81.4
35	Jacksonville Harbor, FL	Atlantic	6.78	0.66	82.1
36	Port of Kalama, WA	Pacific	6.56	0.64	82.7
37	Matagorda Ship Channel, TX	Gulf	5.94	0.58	83.3
38	Port of Detroit, MI	Great Lakes	5.71	0.56	83.8
39	Toledo Harbor, OH	Great Lakes	5.44	0.53	84.4
40	Port of Vancouver, WA	Pacific	5.19	0.50	84.9
41	Richmond Harbor, CA	Pacific	4.87	0.47	85.3
42	Barbers Point, HI	Pacific	4.81	0.47	85.8
43	Marcus Hook, PA	Atlantic	4.69	0.46	86.3
44	San Juan Harbor, PR	Atlantic	4.34	0.42	86.7
45	Miami Harbor, FL	Atlantic	4.22	0.41	87.1
46	Carquinez Strait, CA	Pacific	4.22	0.41	87.5
47	Guayanilla Harbor, PR	Atlantic	4.12	0.40	87.9
48	Port of Chicago, IL	Great Lakes	3.96	0.39	88.3
49	Port of Longview, WA	Pacific	3.90	0.38	88.7
50	New Castle Area, DE	Atlantic	3.89	0.38	89.0
51	Port of Wilmington Harbor, NC	Atlantic	3.69	0.36	89.4
52	Cleveland Harbor, OH	Great Lakes	3.61	0.35	89.7

TABLE B-1

INTERNATIONAL CARGO TONNAGE DISTRIBUTION AMONG THE TOP 150 U.S. PORTS

Rank	Port	Coastal Region	Metric Tons (millions)	Market Share (%)	Cumulative Market Share (%)
53	Ashtabula Harbor, OH	Great Lakes	3.45	0.34	90.1
54	Providence River and Harbor, RI	Atlantic	3.25	0.32	90.4
55	El Segundo, CA	Pacific	3.13	0.30	90.7
56	Other Puget Sound Area Ports, WA	Pacific	3.03	0.29	91.0
57	Yabucoa Harbor, PR	Atlantic	2.88	0.28	91.3
58	Wilmington Harbor, DE	Atlantic	2.87	0.28	91.5
59	Morehead City Harbor, NC	Atlantic	2.82	0.27	91.8
60	Coos Bay, OR	Pacific	2.66	0.26	92.1
61	York River, VA	Atlantic	2.57	0.25	92.3
62	Piscataqua River, ME & NH	Atlantic	2.52	0.25	92.6
63	Sandusky Harbor, OH	Great Lakes	2.37	0.23	92.8
64	Burns Waterway Harbor, IN	Great Lakes	2.14	0.21	93.0
65	Conneaut Harbor, OH	Great Lakes	2.05	0.20	93.2
66	Valdez Harbor, AK	Pacific	1.95	0.19	93.4
67	Anacortes Harbor, WA	Pacific	1.83	0.18	93.6
68	Chester Area, PA	Atlantic	1.82	0.18	93.7
69	Gulfport Harbor, MS	Gulf	1.81	0.18	93.9
70	New Haven Harbor, CT	Atlantic	1.80	0.17	94.1
71	Canaveral Harbor, FL	Atlantic	1.77	0.17	94.3
72	Brunswick Harbor, GA	Atlantic	1.70	0.17	94.4
73	Calcite, MI	Great Lakes	1.61	0.16	94.6
74	Camden, NJ	Atlantic	1.60	0.16	94.7
75	Honolulu Harbor, Oahu, HI	Pacific	1.51	0.15	94.9
76	Grays Harbor and Chehalis River, WA	Pacific	1.48	0.14	95.0
77	Nikishka, AK	Pacific	1.41	0.14	95.2
78	Delaware River at Camden, NJ	Atlantic	1.40	0.14	95.3
79	Milwaukee Harbor, WI	Great Lakes	1.30	0.13	95.4
80	San Francisco Harbor, CA	Pacific	1.29	0.13	95.5
81	Jobos Harbor, PR	Atlantic	1.23	0.12	95.7
82	Lake Huron, MI	Great Lakes	1.16	0.11	95.8
83	Port of Albany, NY	Atlantic	1.15	0.11	95.9
84	Presque Isle Harbor, MI	Great Lakes	1.14	0.11	96.0
85	Pittsburgh, CA	Pacific	1.12	0.11	96.1
86	Brownsville, TX	Gulf	1.11	0.11	96.2
87	Georgetown Harbor, SC	Atlantic	1.11	0.11	96.3
88	Everett Harbor, WA	Pacific	1.09	0.11	96.4
89	Kenai River, AK	Pacific	1.05	0.10	96.5
90	Port of Buffalo, NY	Great Lakes	1.03	0.10	96.6
91	Anchorage, AK	Pacific	1.03	0.10	96.7
92	Fall River Harbor, MA	Atlantic	0.95	0.09	96.8
93	Sacramento, CA	Pacific	0.94	0.09	96.9
94	Bellingham Bay and Harbor, WA	Pacific	0.93	0.09	97.0
95	Northville, L.I., NY	Atlantic	0.92	0.09	97.1
96	San Diego Harbor, CA	Pacific	0.91	0.09	97.2
97	Searsport Harbor, ME	Atlantic	0.90	0.09	97.3
98	Stockton, CA	Pacific	0.86	0.08	97.3
99	Salem Harbor, MA	Atlantic	0.84	0.08	97.4
100	Michoud Canal, LA	Gulf	0.84	0.08	97.5
101	Port Angeles Harbor, WA	Pacific	0.80	0.08	97.6
102	Stoneport, MI	Great Lakes	0.76	0.07	97.7
103	Palm Beach Harbor, FL	Atlantic	0.74	0.07	97.7
104	Indiana Harbor, IN	Great Lakes	0.73	0.07	97.8
105	Ponce Harbor, PR	Atlantic	0.72	0.07	97.9
106	Port Hueneme, CA	Pacific	0.71	0.07	97.9
107	Seward Harbor, AK	Pacific	0.70	0.07	98.0
108	Port Manatee, FL	Gulf	0.69	0.07	98.1
109	Delaware River Between Philadelphia & Trenton	Atlantic	0.65	0.06	98.1
110	Bucksport Harbor, ME	Atlantic	0.63	0.06	98.2
111	Other San Francisco Bay Area Ports, CA	Pacific	0.62	0.06	98.3

TABLE B-1

INTERNATIONAL CARGO TONNAGE DISTRIBUTION AMONG THE TOP 150 U.S. PORTS

Rank	Port	Coastal Region	Metric Tons (millions)	Market Share (%)	Cumulative Market Share (%)
112	Bridgeport Harbor, CT	Atlantic	0.59	0.06	98.3
113	Skagway Harbor, AK	Pacific	0.57	0.05	98.4
114	Panama City Harbor, FL	Gulf	0.54	0.05	98.4
115	Humboldt Harbor and Bay, CA	Pacific	0.53	0.05	98.5
116	Lake Michigan, MI and WI	Great Lakes	0.52	0.05	98.5
117	Kodiak Harbor, AK	Pacific	0.52	0.05	98.6
118	Port of Richmond, VA	Atlantic	0.51	0.05	98.6
119	Port of Hopewell, VA	Atlantic	0.47	0.05	98.7
120	Redwood City Harbor, CA	Pacific	0.47	0.05	98.7
121	Oswego Harbor, NY	Great Lakes	0.46	0.04	98.8
122	Fernandina Harbor, FL	Atlantic	0.46	0.04	98.8
123	Muskegon Harbor, MI	Great Lakes	0.46	0.04	98.8
124	Unalaska Bay and Island, AK	Pacific	0.44	0.04	98.9
125	Port Inland, MI	Great Lakes	0.42	0.04	98.9
126	Stony Point, NY	Atlantic	0.41	0.04	99.0
127	Bayou Dupre, LA	Gulf	0.35	0.03	99.0
128	Homer, AK	Pacific	0.32	0.03	99.0
129	Mare Island Strait, CA	Pacific	0.32	0.03	99.1
130	Fairport Harbor, OH	Great Lakes	0.28	0.03	99.1
131	Prince Wales Is. West Side, AK	Pacific	0.28	0.03	99.1
132	Antioch, CA	Pacific	0.28	0.03	99.1
133	Drummond Island, MI	Great Lakes	0.27	0.03	99.2
134	Marysville, MI	Great Lakes	0.26	0.02	99.2
135	Erie Harbor, PA	Great Lakes	0.24	0.02	99.2
136	Mayaguez Harbor, PR	Atlantic	0.24	0.02	99.2
137	Suisun Bay Channel, CA	Pacific	0.21	0.02	99.3
138	Cape Cod Canal, MA	Atlantic	0.19	0.02	99.3
139	Marblehead, OH	Great Lakes	0.18	0.02	99.3
140	Alpena Harbor, MI	Great Lakes	0.16	0.02	99.3
141	Port Dolomite, MI	Great Lakes	0.15	0.01	99.3
142	Coeymans, NY	Atlantic	0.13	0.01	99.3
143	Ludington Harbor, MI	Great Lakes	0.13	0.01	99.3
144	Port Jefferson Harbor, NY	Atlantic	0.12	0.01	99.4
145	Lorain Harbor, OH	Great Lakes	0.11	0.01	99.4
146	Hilo Harbor, HI	Pacific	0.08	0.01	99.4
147	Kahului Harbor, Maui, HI	Pacific	0.07	0.01	99.4
148	Escanaba, MI	Great Lakes	0.06	0.01	99.4
149	New London Harbor, CT	Atlantic	0.06	0.01	99.4
150	Charlevoix Harbor, MI	Great Lakes	0.06	0.006	99.4
	Total Top 150 Ports		1,027.96	99.4	

Source: Waterborne Commerce Statistics Center (1996)

TABLE B-2

INTERNATIONAL CARGO VALUE DISTRIBUTION AMONG THE TOP 150 U.S. PORTS

Rank	Port	Coastal Region	$U.S (billions)	Market Share (%)	Cumulative Market Share (%)
1	Long Beach, CA	Pacific	86.953	13.9	13.9
2	Los Angeles, CA	Pacific	72.823	11.6	25.5
3	New York/New Jersey, NY & NJ	Atlantic	66.709	10.6	36.1
4	Houston, TX	Gulf	34.140	5.4	41.6
5	Seattle, WA	Pacific	34.079	5.4	47.0
6	Oakland, CA	Pacific	26.830	4.3	51.3
7	Charleston, SC	Atlantic	26.023	4.1	55.4
8	Norfolk, VA	Atlantic	24.581	3.9	59.3
9	Tacoma, WA	Pacific	20.557	3.3	62.6
10	Baltimore, MD	Atlantic	19.306	3.1	65.7
11	New Orleans, LA	Gulf	15.947	2.5	68.2
12	Miami, FL	Atlantic	15.148	2.4	70.6
13	Port of South Louisiana, LA	Gulf	13.905	2.2	72.9
14	Savannah, GA	Atlantic	13.342	2.1	75.0
15	Port Everglades, FL	Atlantic	10.516	1.7	76.7
16	Jacksonville, FL	Atlantic	9.544	1.5	78.2
17	Philadelphia, PA	Atlantic	9.478	1.5	79.7
18	Portland, OR	Pacific	9.469	1.5	81.2
19	Corpus Christi, TX	Gulf	7.126	1.1	82.3
20	Baton Rouge, LA	Gulf	5.638	0.9	83.2
21	Wilmington, NC	Atlantic	4.912	0.8	84.0
22	Texas City, TX	Gulf	4.484	0.7	84.7
23	San Juan, PR	Atlantic	4.212	0.7	85.4
24	Port Arthur, TX	Gulf	4.149	0.7	86.1
25	Boston, MA	Atlantic	4.114	0.7	86.7
26	Mobile, AL	Gulf	3.535	0.6	87.3
27	Lake Charles, LA	Gulf	3.520	0.6	87.9
28	Freeport, TX	Gulf	3.177	0.5	88.4
29	Newport News, VA	Atlantic	3.016	0.5	88.8
30	Tampa, FL	Gulf	2.763	0.4	89.3
31	Caribbean Islands	Atlantic	2.689	0.4	89.7
32	Port Hueneme, CA	Pacific	2.651	0.4	90.1
33	Beaumont, TX	Gulf	2.554	0.4	90.5
34	Wilmington, DE	Atlantic	2.430	0.4	90.9
35	Pascagoula, MS	Gulf	2.416	0.4	91.3
36	Carquinez Strait, CA	Pacific	2.266	0.4	91.7
37	Port of Plaquemine, LA	Gulf	2.078	0.3	92.0
38	Richmond, VA	Atlantic	2.030	0.3	92.3
39	Paulsboro, NJ	Atlantic	1.977	0.3	92.6
40	Chester, PA	Atlantic	1.911	0.3	93.0
41	Portland, ME	Atlantic	1.850	0.3	93.2
42	Brownsville, TX	Gulf	1.796	0.3	93.5
43	Galveston, TX	Gulf	1.756	0.3	93.8
44	Detroit, MI	Great Lakes	1.670	0.3	94.1
45	Brunswick, GA	Atlantic	1.655	0.3	94.3
46	Vancouver, WA	Pacific	1.646	0.3	94.6
47	Palm Beach, FL	Atlantic	1.539	0.2	94.9
48	Duluth-Superior, MI & WI	Great Lakes	1.261	0.2	95.1
49	Kalama, WA	Pacific	1.240	0.2	95.3
50	Richmond, CA	Pacific	1.215	0.2	95.4
51	Ponce Harbor, PR	Atlantic	1.159	0.2	95.6
52	Gulfport Harbor, MS	Gulf	1.133	0.2	95.8
53	Port of Longview, WA	Pacific	0.997	0.2	96.0
54	Port of Chicago, IL	Great Lakes	0.922	0.1	96.1
55	San Diego Harbor, CA	Pacific	0.884	0.1	96.3
56	Morehead City Harbor, NC	Atlantic	0.841	0.1	96.4
57	Delaware River At Camden, NJ	Atlantic	0.832	0.1	96.5

TABLE B-2

INTERNATIONAL CARGO VALUE DISTRIBUTION AMONG THE TOP 150 U.S. PORTS

Rank	Port	Coastal Region	$U.S (billions)	Market Share (%)	Cumulative Market Share (%)
58	Toledo Harbor, OH	Great Lakes	0.727	0.1	96.6
59	Mayaguez Harbor, PR	Atlantic	0.708	0.1	96.8
60	Providence River and Harbor, RI	Atlantic	0.701	0.1	96.9
61	Honolulu Harbor, Oahu, HI	Pacific	0.686	0.1	97.0
62	Barbers Point, HI	Pacific	0.670	0.1	97.1
63	Marcus Hook, PA	Atlantic	0.642	0.1	97.2
64	Unalaska Bay and Island, AK	Pacific	0.603	0.1	97.3
65	Camden, NJ	Atlantic	0.592	0.1	97.4
66	Guayanilla Harbor, PR	Atlantic	0.562	0.1	97.5
67	New Castle Area, DE	Atlantic	0.560	0.1	97.6
68	Canaveral Harbor, FL	Atlantic	0.540	0.1	97.6
69	San Francisco Harbor, CA	Pacific	0.509	0.1	97.7
70	New Haven Harbor, CT	Atlantic	0.497	0.1	97.8
71	Grays Harbor and Chehalis River, WA	Pacific	0.478	0.1	97.9
72	El Segundo, CA	Pacific	0.468	0.1	98.0
73	Cleveland Harbor, OH	Great Lakes	0.457	0.1	98.0
74	Yabucoa Harbor, PR	Atlantic	0.447	0.1	98.1
75	Matagorda Ship Channel, TX	Gulf	0.432	0.1	98.2
76	Coos Bay, OR	Pacific	0.389	0.1	98.2
77	Other Puget Sound Area Ports, WA	Pacific	0.373	0.1	98.3
78	Fernandina Harbor, FL	Atlantic	0.372	0.1	98.3
79	York River, VA	Atlantic	0.335	0.1	98.4
80	Jobos Harbor, PR	Atlantic	0.332	0.1	98.5
81	Valdez Harbor, AK	Pacific	0.328	0.1	98.5
82	Panama City Harbor, FL	Gulf	0.313	0.0	98.6
83	Anchorage, AK	Pacific	0.300	0.0	98.6
84	Piscataqua River, ME & NH	Atlantic	0.296	0.0	98.6
85	Anacortes Harbor, WA	Pacific	0.278	0.0	98.7
86	Delaware River Between Philadelphia & Trenton	Atlantic	0.246	0.0	98.7
87	Kenai River, AK	Pacific	0.245	0.0	98.8
88	Bellingham Bay and Harbor, WA	Pacific	0.243	0.0	98.8
89	Pittsburgh, CA	Pacific	0.239	0.0	98.8
90	Port of Albany, NY	Atlantic	0.235	0.0	98.9
91	Sacramento, CA	Pacific	0.229	0.0	98.9
92	Port Manatee, FL	Gulf	0.223	0.0	99.0
93	Port of Buffalo, NY	Great Lakes	0.212	0.0	99.0
94	Nikishka, AK	Pacific	0.211	0.0	99.0
95	Burns Waterway Harbor, IN	Great Lakes	0.209	0.0	99.1
96	Everett Harbor, WA	Pacific	0.200	0.0	99.1
97	Ashtabula Harbor, OH	Great Lakes	0.200	0.0	99.1
98	Kodiak Harbor, AK	Pacific	0.183	0.0	99.2
99	Northville, L.I., NY	Atlantic	0.176	0.0	99.2
100	Bridgeport Harbor, CT	Atlantic	0.163	0.0	99.2
101	Georgetown Harbor, SC	Atlantic	0.151	0.0	99.2
102	Searsport Harbor, ME	Atlantic	0.148	0.0	99.3
103	Milwaukee Harbor, WI	Great Lakes	0.147	0.0	99.3
104	Stockton, CA	Pacific	0.143	0.0	99.3
105	Homer, AK	Pacific	0.135	0.0	99.3
106	Port Angeles Harbor, WA	Pacific	0.128	0.0	99.3
107	Seward Harbor, AK	Pacific	0.121	0.0	99.4
108	Humboldt Harbor and Bay, CA	Pacific	0.110	0.0	99.4
109	Bucksport Harbor, ME	Atlantic	0.110	0.0	99.4
110	Skagway Harbor, AK	Pacific	0.093	0.0	99.4
111	Sandusky Harbor, OH	Great Lakes	0.089	0.0	99.4
112	Michoud Canal, LA	Gulf	0.089	0.0	99.4
113	Other San Francisco Bay Area Ports, CA	Pacific	0.083	0.0	99.5
114	Conneaut Harbor, OH	Great Lakes	0.078	0.0	99.5
115	Mare Island Strait, CA	Pacific	0.067	0.0	99.5

TABLE B-2

INTERNATIONAL CARGO VALUE DISTRIBUTION AMONG THE TOP 150 U.S. PORTS

Rank	Port	Coastal Region	$U.S (billions)	Market Share (%)	Cumulative Market Share (%)
116	Bayou Dupre, LA	Gulf	0.065	0.0	99.5
117	Prince Wales Is. West Side, AK	Pacific	0.064	0.0	99.5
118	Port of Hopewell, VA	Atlantic	0.061	0.0	99.5
119	Fall River Harbor, MA	Atlantic	0.056	0.0	99.5
120	Redwood City Harbor, CA	Pacific	0.051	0.0	99.5
121	Salem Harbor, MA	Atlantic	0.041	0.0	99.5
122	Indiana Harbor, IN	Great Lakes	0.036	0.0	99.5
123	Suisun Bay Channel, CA	Pacific	0.035	0.0	99.5
124	Presque Isle Harbor, MI	Great Lakes	0.035	0.0	99.5
125	Oswego Harbor, NY	Great Lakes	0.031	0.0	99.5
126	Cape Cod Canal, MA	Atlantic	0.029	0.0	99.6
127	Lake Michigan, MI and WI	Great Lakes	0.025	0.0	99.6
128	Lake Huron, MI	Great Lakes	0.024	0.0	99.6
129	Gary Harbor, IN	Great Lakes	0.016	0.0	99.6
130	Port Jefferson Harbor, NY	Atlantic	0.015	0.0	99.6
131	Calcite, MI	Great Lakes	0.015	0.0	99.6
132	New Bedford and Fairhaven Harbor, MA	Atlantic	0.013	0.0	99.6
133	Ludington Harbor, MI	Great Lakes	0.009	0.0	99.6
134	Erie Harbor, PA	Great Lakes	0.009	0.0	99.6
135	Muskegon Harbor, MI	Great Lakes	0.007	0.0	99.6
136	Antioch, CA	Pacific	0.007	0.0	99.6
137	Alpena Harbor, MI	Great Lakes	0.006	0.0	99.6
138	Drummond Island, MI	Great Lakes	0.006	0.0	99.6
139	Fairport Harbor, OH	Great Lakes	0.006	0.0	99.6
140	Coeymans, NY	Atlantic	0.006	0.0	99.6
141	Lorain Harbor, OH	Great Lakes	0.006	0.0	99.6
142	Kahului Harbor, Maui, HI	Pacific	0.005	0.0	99.6
143	Stony Point, NY	Atlantic	0.005	0.0	99.6
144	Stoneport, MI	Great Lakes	0.004	0.0	99.6
145	Charlevoix Harbor, MI	Great Lakes	0.004	0.0	99.6
146	Marysville, MI	Great Lakes	0.004	0.0	99.6
147	Monroe Harbor, MI	Great Lakes	0.003	0.0	99.6
148	Hilo Harbor, HI	Pacific	0.003	0.0	99.6
149	Port Inland, MI	Great Lakes	0.003	0.0	99.6
150	Escanaba, MI	Great Lakes	0.002	0.0	99.6
	Total Top 150 Ports		$624.60	99.6	

Source: Waterborne Commerce Statistics Center (1996)

APPENDIX C

FOREIGN PORTS

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Tables C-1 and C-2 list foreign ports included in this study. Table C-1 includes origins/destinations of cargo that are not distinct ports, but are aggregations of many terminals and ports and that on an individual basis are relatively insignificant in terms of U.S. trade. For example, the category "High Seas Gulf of Mexico" includes a multitude of offshore oil platforms in the Gulf of Mexico and accounts for almost four percent of foreign cargo based on tonnage. However, each individual oil platform accounts for a significantly smaller portion. Table C-2 lists ports contained in C-1 that were considered individual port entities for the purposes of this study.

TABLE C-1

TOP 200 FOREIGN PORTS INCLUDING AGGREGATE LOCATIONS (METRIC TONS, 1996)

Rank	Port	Metric Tons (millions)	Percent of U.S. Foreign Cargo	Cumulative Percent
1	High Seas, Gulf of Mexico	34.67	3.4	3.4
2	Tokyo	29.81	2.9	6.2
3	Puerto La Cruz	25.86	2.5	8.7
4	Cayo Arcas	21.76	2.1	10.8
5	Ras At Tannurah	21.37	2.1	12.9
6	Pajaritos	18.26	1.8	14.7
7	Rotterdam	17.68	1.7	16.4
8	Kaohsiung	14.91	1.4	17.8
9	Dos Bocas	14.74	1.4	19.2
10	Puerto Miranda	13.54	1.3	20.6
11	All Other Colombian Caribbean Region Ports	12.97	1.3	21.8
12	Antwerp	12.91	1.2	23.1
13	Adicora	12.54	1.2	24.3
14	Kobe	12.40	1.2	25.5
15	Hong Kong	12.31	1.2	26.7
16	Amuay Bay	11.84	1.1	27.8
17	La Salina	11.63	1.1	28.9
18	Inchon	11.57	1.1	30.0
19	Busan	10.50	1.0	31.1
20	Sullom Voe	8.07	0.8	31.8
21	Escravos Oil Terminal	7.57	0.7	32.6
22	Cabinda	7.51	0.7	33.3
23	Kwa Ibo Terminal	7.19	0.7	34.0
24	Cap Lopez	6.44	0.6	34.6
25	Veracruz	6.30	0.6	35.2
26	Singapore	6.28	0.6	35.8
27	Mongstad	6.22	0.6	36.4
28	Pointe Noire, Que	6.05	0.6	37.0
29	Yokohama	5.96	0.6	37.6
30	Saint John, NB	5.53	0.5	38.1
31	Cozumel Island	5.48	0.5	38.7
32	Abashiri	5.42	0.5	39.2
33	Shang Hai	5.31	0.5	39.7
34	Forcados	5.30	0.5	40.2
35	Arzew	5.28	0.5	40.7
36	All Other Netherlands Antilles Ports	5.21	0.5	41.2

TABLE C-1

TOP 200 FOREIGN PORTS INCLUDING AGGREGATE LOCATIONS (METRIC TONS, 1996)

Rank	Port	Metric Tons (millions)	Percent of U.S. Foreign Cargo	Cumulative Percent
37	Dairen	5.21	0.5	41.7
38	Esmeraldas	5.17	0.5	42.2
39	Praia Mole	5.06	0.5	42.7
40	Aalvik	5.04	0.5	43.2
41	Chang Sha	4.93	0.5	43.7
42	Alexandria	4.92	0.5	44.2
43	Goto Oil Terminal	4.85	0.5	44.6
44	Nanticoke, Ont	4.84	0.5	45.1
45	Bajo Grande	4.81	0.5	45.6
46	Amsterdam	4.78	0.5	46.0
47	Quebec, Que	4.76	0.5	46.5
48	Hamilton, Ont	4.69	0.5	46.9
49	Castries	4.61	0.4	47.4
50	Tai Chung	4.61	0.4	47.8
51	Vancouver, BC	4.58	0.4	48.3
52	All Other Canada Great Lakes Region Ports	4.49	0.4	48.7
53	Chi Lung	4.48	0.4	49.1
54	Genoa	4.40	0.4	49.6
55	Bonny	4.33	0.4	50.0
56	Santos	4.28	0.4	50.4
57	Algoma, Ont	4.26	0.4	50.8
58	Nagoya	4.19	0.4	51.2
59	Port Rhoades	4.06	0.4	51.6
60	Skikda	4.03	0.4	52.0
61	Immingham	3.96	0.4	52.4
62	Al Fuhayhil	3.89	0.4	52.8
63	All Other South Korea Ports	3.81	0.4	53.1
64	All Other Angola Ports	3.67	0.4	53.5
65	All Other Scotland East Coast Ports	3.47	0.3	53.8
66	Bangkok	3.42	0.3	54.1
67	Hamburg	3.34	0.3	54.5
68	Pohang	3.27	0.3	54.8
69	Gand	3.27	0.3	55.1
70	Le Havre	3.27	0.3	55.4
71	Kamsar	3.24	0.3	55.7
72	Gamba	3.24	0.3	56.0
73	Bremerhaven	3.19	0.3	56.4
74	Acevedo	3.07	0.3	56.7
75	Point Lisas	3.04	0.3	56.9
76	Alger	3.00	0.3	57.2
77	Port Cartier, Que	2.98	0.3	57.5
78	Casablanca	2.96	0.3	57.8
79	Puerto Cabello	2.96	0.3	58.1
80	Haifa	2.95	0.3	58.4
81	Brass	2.89	0.3	58.7
82	Galeota Point	2.89	0.3	58.9
83	Halifax, Ns	2.88	0.3	59.2

TABLE C-1

TOP 200 FOREIGN PORTS INCLUDING AGGREGATE LOCATIONS (METRIC TONS, 1996)

Rank	Port	Metric Tons (millions)	Percent of U.S. Foreign Cargo	Cumulative Percent
84	Osaka	2.88	0.3	59.5
85	Point Tupper, Cbi	2.87	0.3	59.8
86	Al Jubail	2.86	0.3	60.1
87	Coatzacoalcos	2.82	0.3	60.3
88	Carmen	2.81	0.3	60.6
89	Punta Cardon	2.78	0.3	60.9
90	Ulsan	2.78	0.3	61.1
91	All Other Canada Atlantic Region Ports	2.76	0.3	61.4
92	Orangestad	2.71	0.3	61.7
93	Ijmuiden	2.66	0.3	61.9
94	Djakarta	2.65	0.3	62.2
95	Taranto	2.60	0.3	62.4
96	All Other Indonesia Ports	2.57	0.2	62.7
97	Puerto Matias De Galves	2.54	0.2	62.9
98	La Spezia	2.53	0.2	63.2
99	El Palito	2.48	0.2	63.4
100	Buenos Aires	2.46	0.2	63.6
101	Caleta Patillos	2.42	0.2	63.9
102	Puerto Ordaz	2.40	0.2	64.1
103	Karachi	2.40	0.2	64.3
104	Cartagena	2.38	0.2	64.6
105	Manila	2.37	0.2	64.8
106	Duran	2.36	0.2	65.0
107	Durban	2.34	0.2	65.3
108	Limon	2.32	0.2	65.5
109	All Other England West Coast Ports	2.31	0.2	65.7
110	Freeport, Grand Bahama I	2.29	0.2	65.9
111	All Other Spain Atlantic Region Ports	2.26	0.2	66.1
112	Abaetetuba	2.25	0.2	66.4
113	Victoria	2.21	0.2	66.6
114	Maracaibo	2.20	0.2	66.8
115	All Other Saudi Arabia Ports	2.15	0.2	67.0
116	Felixstowe	2.14	0.2	67.2
117	Kelang	2.11	0.2	67.4
118	Malongo Oil Terminal	2.10	0.2	67.6
119	Barcelona	2.10	0.2	67.8
120	Altamira	2.08	0.2	68.0
121	Buenaventura	2.05	0.2	68.2
122	Fos	2.03	0.2	68.4
123	Fort Williams, Ont	2.02	0.2	68.6
124	Dunkerque	1.98	0.2	68.8
125	Windsor, Ont	1.98	0.2	69.0
126	Abbot Point	1.96	0.2	69.2
127	Gijon	1.92	0.2	69.4
128	Puerto Cortes	1.91	0.2	69.5
129	Liverpool	1.91	0.2	69.7
130	Haina	1.91	0.2	69.9

TABLE C-1

TOP 200 FOREIGN PORTS INCLUDING AGGREGATE LOCATIONS (METRIC TONS, 1996)

Rank	Port	Metric Tons (millions)	Percent of U.S. Foreign Cargo	Cumulative Percent
131	Point A Pierre	1.90	0.2	70.1
132	Dagu/Tanggu	1.89	0.2	70.3
133	Sepetiba Bay	1.89	0.2	70.5
134	Constanta	1.88	0.2	70.6
135	Lazaro Cardenas	1.88	0.2	70.8
136	Albufeira	1.88	0.2	71.0
137	San Nicolas Bay	1.87	0.2	71.2
138	Niteroi	1.86	0.2	71.4
139	Cerros Island	1.82	0.2	71.5
140	Melbourne	1.80	0.2	71.7
141	Terneuzen	1.77	0.2	71.9
142	Come-By-Chance, Nfld	1.77	0.2	72.1
143	Chiba	1.75	0.2	72.2
144	Jeddeh	1.72	0.2	72.4
145	All Ports In Bulgaria	1.71	0.2	72.6
146	Leningrad	1.70	0.2	72.7
147	Dhuba	1.68	0.2	72.9
148	Courtright, Ont	1.63	0.2	73.0
149	Hantsport, NS	1.62	0.2	73.2
150	Callao	1.61	0.2	73.4
151	Bullen Baai	1.60	0.2	73.5
152	San Antonio	1.58	0.2	73.7
153	All Other Peru Ports	1.58	0.2	73.8
154	Ashdod	1.58	0.2	74.0
155	Hound Point	1.58	0.2	74.1
156	All Other Canada Pacific Region Ports	1.58	0.2	74.3
157	Al Kuwayt	1.53	0.1	74.4
158	Alexandretta	1.53	0.1	74.6
159	All Other Egypt Mediterranean Region Ports	1.52	0.1	74.7
160	Blubber Bay, BC	1.52	0.1	74.9
161	Tomakomai	1.50	0.1	75.0
162	Valparaiso	1.48	0.1	75.2
163	Goderich, Ont	1.48	0.1	75.3
164	Kingston	1.48	0.1	75.4
165	Baie Comeau, Que	1.46	0.1	75.6
166	Trombetas	1.46	0.1	75.7
167	Valencia	1.45	0.1	75.9
168	Matrah	1.45	0.1	76.0
169	Tuxpan	1.45	0.1	76.1
170	Bejaia	1.44	0.1	76.3
171	Tobata	1.44	0.1	76.4
172	Aigion	1.43	0.1	76.6
173	Abonnema	1.41	0.1	76.7
174	Progreso	1.39	0.1	76.8
175	El Jorf Lasfar	1.38	0.1	77.0
176	Isdemir	1.37	0.1	77.1
177	Abu Zanimah	1.37	0.1	77.2

TABLE C-1

TOP 200 FOREIGN PORTS INCLUDING AGGREGATE LOCATIONS (METRIC TONS, 1996)

Rank	Port	Metric Tons (millions)	Percent of U.S. Foreign Cargo	Cumulative Percent
178	Puerto Barrios	1.37	0.1	77.4
179	All Other Brazil Ports South of Recife	1.37	0.1	77.5
180	Luanda	1.34	0.1	77.6
181	Ponta Da Madeira	1.34	0.1	77.8
182	Dumai	1.31	0.1	77.9
183	Kashima	1.31	0.1	78.0
184	Bunbury	1.24	0.1	78.1
185	Lisboa	1.20	0.1	78.2
186	Mamonal	1.19	0.1	78.4
187	Demerara	1.19	0.1	78.5
188	Al Juaymah	1.18	0.1	78.6
189	Canneto	1.16	0.1	78.7
190	All Other Thailand Ports	1.16	0.1	78.8
191	Ventspils	1.13	0.1	78.9
192	Enstead	1.12	0.1	79.0
193	Ad Dammam	1.12	0.1	79.1
194	Acajutla	1.11	0.1	79.2
195	Hiro	1.10	0.1	79.4
196	Shimizu	1.10	0.1	79.5
197	Barranquilla	1.08	0.1	79.6
198	Milford Haven	1.08	0.1	79.7
199	Muroran	1.08	0.1	79.8
200	Sidi Kerir	1.03	0.1	79.9
	Totals	827.05	80.0%	

Source: Waterborne Commerce Statistics Center, 1996

TABLE C-2

TOP 175 FOREIGN PORTS EXCLUDING AGGREGATE LOCATIONS (METRIC TONS, 1996)

Rank	Port	Metric Tons (millions)	Percent of U.S. Foreign Cargo	Cumulative Percent
1	Tokyo	29.81	2.9%	2.9
2	Puerto La Cruz	25.86	2.5%	5.4
3	Cayo Arcas	21.76	2.1%	7.5
4	Ras At Tannurah	21.37	2.1%	9.6
5	Pajaritos	18.26	1.8%	11.3
6	Rotterdam	17.68	1.7%	13.0
7	Kaohsiung	14.91	1.4%	14.5
8	Dos Bocas	14.74	1.4%	15.9
9	Puerto Miranda	13.54	1.3%	17.2
10	Antwerp	12.91	1.2%	18.5
11	Kobe	12.40	1.2%	19.7
12	Hong Kong	12.31	1.2%	20.8
13	Amuay Bay	11.84	1.1%	22.0
14	La Salina	11.63	1.1%	23.1
15	Inchon	11.57	1.1%	24.2
16	Busan	10.50	1.0%	25.2
17	Sullom Voe	8.07	0.8%	26.0
18	Escravos Oil Terminal	7.57	0.7%	26.8
19	Cabinda	7.51	0.7%	27.5
20	Kwa Ibo Terminal	7.19	0.7%	28.2
21	Cape Lopez	6.44	0.6%	28.8
22	Veracruz	6.30	0.6%	29.4
23	Singapore	6.28	0.6%	30.0
24	Mongstad	6.22	0.6%	30.6
25	Seven Islands, Que	6.05	0.6%	31.2
26	Yokohama	5.96	0.6%	31.8
27	Saint John, NB	5.53	0.5%	32.3
28	Cozumel Island	5.48	0.5%	32.8
29	Shanghai	5.31	0.5%	33.4
30	Forcados	5.30	0.5%	33.9
31	Arzew	5.28	0.5%	34.4
32	Dairen	5.21	0.5%	34.9
33	Esmeraldas	5.17	0.5%	35.4
34	Tuburao	5.06	0.5%	35.9
35	Alexandria	4.92	0.5%	36.4
36	Goto Oil Terminal	4.85	0.5%	36.8
37	Nanticoke, Ont	4.84	0.5%	37.3
38	Bajo Grande	4.81	0.5%	37.8
39	Amsterdam	4.78	0.5%	38.2
40	Quebec, Que	4.76	0.5%	38.7
41	Hamilton, Ont	4.69	0.5%	39.1
42	Vieux Fort	4.61	0.4%	39.6
43	Taichung	4.61	0.4%	40.0
44	Vancouver, BC	4.58	0.4%	40.5
45	Keelung	4.48	0.4%	40.9
46	Genoa	4.40	0.4%	41.3

TABLE C-2

TOP 175 FOREIGN PORTS EXCLUDING AGGREGATE LOCATIONS (METRIC TONS, 1996)

Rank	Port	Metric Tons (millions)	Percent of U.S. Foreign Cargo	Cumulative Percent
47	Bonny	4.33	0.4%	41.7
48	Santos	4.28	0.4%	42.2
49	Sault Ste. Marie, Ont	4.26	0.4%	42.6
50	Nagoya	4.19	0.4%	43.0
51	Port Rhoades	4.06	0.4%	43.4
52	Skikda	4.03	0.4%	43.8
53	Immingham	3.96	0.4%	44.1
54	Mina Al Ahamadai	3.89	0.4%	44.5
55	Bangkok	3.42	0.3%	44.8
56	Hamburg	3.34	0.3%	45.2
57	Pohang	3.27	0.3%	45.5
58	Gand	3.27	0.3%	45.8
59	Le Havre	3.27	0.3%	46.1
60	Kamsar	3.24	0.3%	46.4
61	Gamba	3.24	0.3%	46.7
62	Bremerhaven	3.19	0.3%	47.1
63	Point Lisas	3.04	0.3%	47.3
64	Alger	3.00	0.3%	47.6
65	Port Cartier, Que	2.98	0.3%	47.9
66	Casablanca	2.96	0.3%	48.2
67	Puerto Cabello	2.96	0.3%	48.5
68	Haifa	2.95	0.3%	48.8
69	Brass	2.89	0.3%	49.1
70	Galeota Point	2.89	0.3%	49.3
71	Halifax, NS	2.88	0.3%	49.6
72	Osaka	2.88	0.3%	49.9
73	Point Tupper, Cbi	2.87	0.3%	50.2
74	Al Jubail	2.86	0.3%	50.4
75	Coatzacoalcos	2.82	0.3%	50.7
76	Carmen	2.81	0.3%	51.0
77	Punta Cardon	2.78	0.3%	51.3
78	Ulsan	2.78	0.3%	51.5
79	Orangestad	2.71	0.3%	51.8
80	Ijmuiden	2.66	0.3%	52.1
81	Djakarta	2.65	0.3%	52.3
82	Taranto	2.60	0.3%	52.6
83	Santo Tomas	2.54	0.2%	52.8
84	La Spezia	2.53	0.2%	53.0
85	El Palito	2.48	0.2%	53.3
86	Buenos Aires	2.46	0.2%	53.5
87	Caleta Patillos	2.42	0.2%	53.8
88	Puerto Ordaz	2.40	0.2%	54.0
89	Karachi	2.40	0.2%	54.2
90	Cartagena	2.38	0.2%	54.5
91	Manila	2.37	0.2%	54.7
92	Guayaquil	2.36	0.2%	54.9
93	Durban	2.34	0.2%	55.1

TABLE C-2

TOP 175 FOREIGN PORTS EXCLUDING AGGREGATE LOCATIONS (METRIC TONS, 1996)

Rank	Port	Metric Tons (millions)	Percent of U.S. Foreign Cargo	Cumulative Percent
94	Puerto Limon	2.32	0.2%	55.4
95	Freeport, Grand Bahama Is	2.29	0.2%	55.6
96	Victoria	2.21	0.2%	55.8
97	Maracaibo	2.20	0.2%	56.0
98	Felixstowe	2.14	0.2%	56.2
99	Kelang	2.11	0.2%	56.4
100	Malongo Oil Terminal	2.10	0.2%	56.6
101	Barcelona	2.10	0.2%	56.8
102	Altamira	2.08	0.2%	57.0
103	Buenaventura	2.05	0.2%	57.2
104	Fos	2.03	0.2%	57.4
105	Port Arthur, Ont	2.02	0.2%	57.6
106	Dunkerque	1.98	0.2%	57.8
107	Windsor, Ont	1.98	0.2%	58.0
108	Gijon	1.92	0.2%	58.2
109	Puerto Cortes	1.91	0.2%	58.4
110	Liverpool	1.91	0.2%	58.6
111	Haina	1.91	0.2%	58.7
112	Point A Pierre	1.90	0.2%	58.9
113	Hsinkang	1.89	0.2%	59.1
114	Sepetiba Bay	1.89	0.2%	59.3
115	Constanta	1.88	0.2%	59.5
116	Puerto Mexico	1.88	0.2%	59.7
117	San Nicolas Bay	1.87	0.2%	59.8
118	Roi De Janerio	1.86	0.2%	60.0
119	Cerros Island	1.82	0.2%	60.2
120	Melbourne	1.80	0.2%	60.4
121	Terneuzen	1.77	0.2%	60.5
122	Come-By-Chance, Nfld	1.77	0.2%	60.7
123	Chiba	1.75	0.2%	60.9
124	Judda	1.72	0.2%	61.0
125	St. Petersburg	1.70	0.2%	61.2
126	Dhuba	1.68	0.2%	61.4
127	Courtright, Ont	1.63	0.2%	61.5
128	Hantsport, NS	1.62	0.2%	61.7
129	Callao	1.61	0.2%	61.8
130	Bullen Baai	1.60	0.2%	62.0
131	San Antonio	1.58	0.2%	62.1
132	Ashdod	1.58	0.2%	62.3
133	Hound Point	1.58	0.2%	62.5
134	Al Kuwayt	1.53	0.1%	62.6
135	Iskinderun	1.53	0.1%	62.7
136	Blubber Bay, BC	1.52	0.1%	62.9
137	Tomakomai	1.50	0.1%	63.0
138	Valparaiso	1.48	0.1%	63.2
139	Goderich, Ont	1.48	0.1%	63.3
140	Kingston	1.48	0.1%	63.5

TABLE C-2

TOP 175 FOREIGN PORTS EXCLUDING AGGREGATE LOCATIONS (METRIC TONS, 1996)

Rank	Port	Metric Tons (millions)	Percent of U.S. Foreign Cargo	Cumulative Percent
141	Comeau Bay, Que	1.46	0.1%	63.6
142	Trombetas	1.46	0.1%	63.8
143	Valencia	1.45	0.1%	63.9
144	Matrah	1.45	0.1%	64.0
145	Tuxpan	1.45	0.1%	64.2
146	Bejaia	1.44	0.1%	64.3
147	Tobata	1.44	0.1%	64.5
148	Aigion	1.43	0.1%	64.6
149	Abonnema	1.41	0.1%	64.7
150	Merida	1.39	0.1%	64.9
151	El Jorf Lasfar	1.38	0.1%	65.0
152	Isdemir	1.37	0.1%	65.1
153	Abu Zanimah	1.37	0.1%	65.3
154	Puerto Barrios	1.37	0.1%	65.4
155	Luanda	1.34	0.1%	65.5
156	Ponta Da Madeira	1.34	0.1%	65.7
157	Dumai	1.31	0.1%	65.8
158	Kashima	1.31	0.1%	65.9
159	Bunbury	1.24	0.1%	66.0
160	Lisboa	1.20	0.1%	66.1
161	Mamonal	1.19	0.1%	66.3
162	Georgetown	1.19	0.1%	66.4
163	Al Juaymah	1.18	0.1%	66.5
164	Canneto	1.16	0.1%	66.6
165	Ventspils	1.13	0.1%	66.7
166	Enstead	1.12	0.1%	66.8
167	Ad Dammam	1.12	0.1%	66.9
168	Acajutla	1.11	0.1%	67.0
169	Kure	1.10	0.1%	67.1
170	Shimizu	1.10	0.1%	67.2
171	Barranquilla	1.08	0.1%	67.3
172	Milford Haven	1.08	0.1%	67.5
173	Muroran	1.08	0.1%	67.6
174	Sidi Kerir	1.03	0.1%	67.7
175	Newcastle	1.02	0.1%	67.8
	Totals	700.71	67.8	

Source: Waterborne Commerce Statistics Center, 1996

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APPENDIX D

METHODOLOGY FOR FORECASTS OF FUTURE PORT CALLS AND CHANNEL DEPTH CONSTRAINTS

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This section discusses procedures used to calculate current and projected dredging needs at deep draft ports in the United States. Forecasts of the composition of future vessel calls at deep draft U.S. ports are developed, and information on channel depths form the basis for the analysis of potential depth constraints. Data from the USACE Waterborne Commerce Statistics Center (WCSC) form the basis for estimating of future depth constraints at U.S. ports.

The methodology employed involves a set of theoretical assumptions and calculations regarding the size and type of vessels that call on U.S. ports. It is based on generalized projections of cargo shifts between vessel types and sizes over time. Results of this analysis provide strong indications of potential dredging needs. The analytical procedure used to generate results can be refined and extended in the future to more precisely identify future dredging requirements.

The vessel type and size shift analysis included in this report is based on shifts between 11 major ship types and 146 vessel size groups of 10,000 deadweight tons (DWT). The large number of vessel types and sizes provides for a more detailed projection of vessel types and sizes than used for previous analyses, but significantly increases the magnitude of the computations. Unlike other fleet forecast procedures that may employ more complex assumptions with more aggregated data, this analysis uses simplified assumptions. It is anticipated that this approach will support more complex assumptions in the future while maintaining the detail of the fundamental data.

OVERVIEW OF DREDGING NEEDS METHODOLOGY

The methodology for identifying dredging needs is represented by a sequential process consisting of four major steps. The flow of this process is illustrated in Figure D-1. The analysis starts with forecasts of future cargo volumes by vessel type (base cargo profile). Base cargo reflects data derived from the detailed 1996 Waterborne Commerce Statistics Center data files aggregated across commodities by port location and vessel type. Next, cargo is shifted among and within vessel type and size categories, incorporating the trend toward larger ships. Shifts in vessel types and sizes are enacted on a yearly time step, starting with the base year 1996, over the 2000 – 2040 forecast horizon. Future vessel calls are then estimated based on the shifted cargo using average vessel characteristics and average cargo loadings per call in each vessel size-type category. Finally, vessel design drafts corresponding to these projected calls are compared with channel depths to determine which calls (and cargo tonnage) are in excess of channel depths. Cases in which vessel design drafts exceed channel depth are called *constrained* movements. Constraints are used as an indicator for potential channel dredging needs. Constraints are estimated for each Corps location engaged in foreign trade in 1996 based on with- and without-projects channel depths.

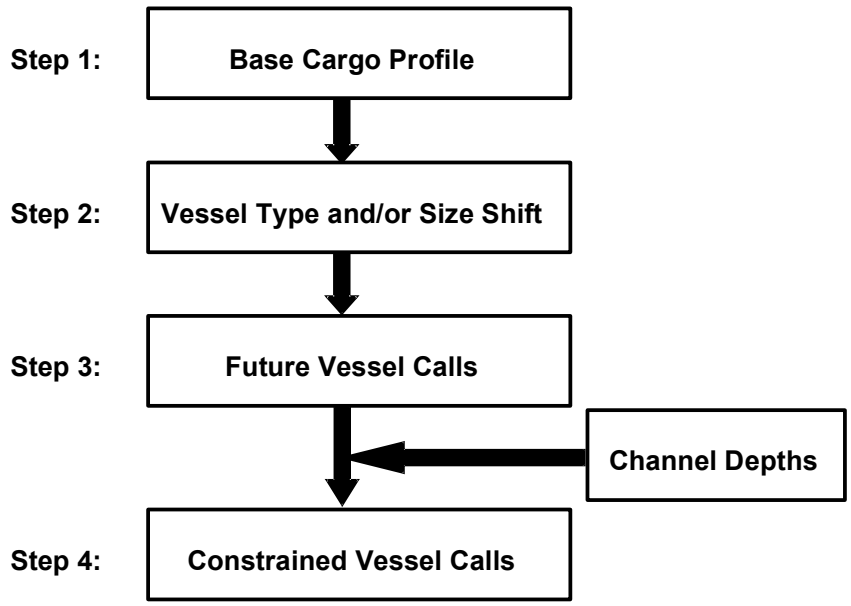

Figure D-1. Major Elements of Dredging Needs Methodology

DEVELOPMENT OF THE BASE CARGO PROFILE

The overall intent of this analysis is to identify the projected vessel calls that could encounter constraints while accessing U.S. port locations as a result of design drafts exceeding available channel depths. The first step in the analysis involves identifying the base set of vessels and cargo to which the forecast of commodities and vessel shift procedures are applied. Figure D-2 illustrates how 1996 cargo and vessel data are used in conjunction with the commodity forecast to derive a baseline forecast of calls. The source of the base cargo for this analysis is the 1996 Waterborne Commerce Statistics Center import and export data at a commodity level. Commodity-level data consists of records for each of potentially 77 different commodities that may be carried on a vessel at a port on a given date.

Commodity tonnage for each of the 77 commodity groups carried on each vessel in the 1996 database were forecast for the years 2000, 2010, 2020, 2030 and 2040. As shown in Figure D-2, commodity growth rates implied by WEFA long-term trade forecasts were applied to 1996 vessel cargoes at the commodity group level. After growth rates were applied, tonnage of individual commodities was aggregated into a total tonnage carried on a vessel at a port for 1996 and for each of the forecast years.

Next, total tonnage across all vessels calling or moving at a particular location was calculated for each forecast year and aggregated to port, coastal and national geographic levels. Tonnage transported reflects anticipated increases of total trade over the forecast period. At this

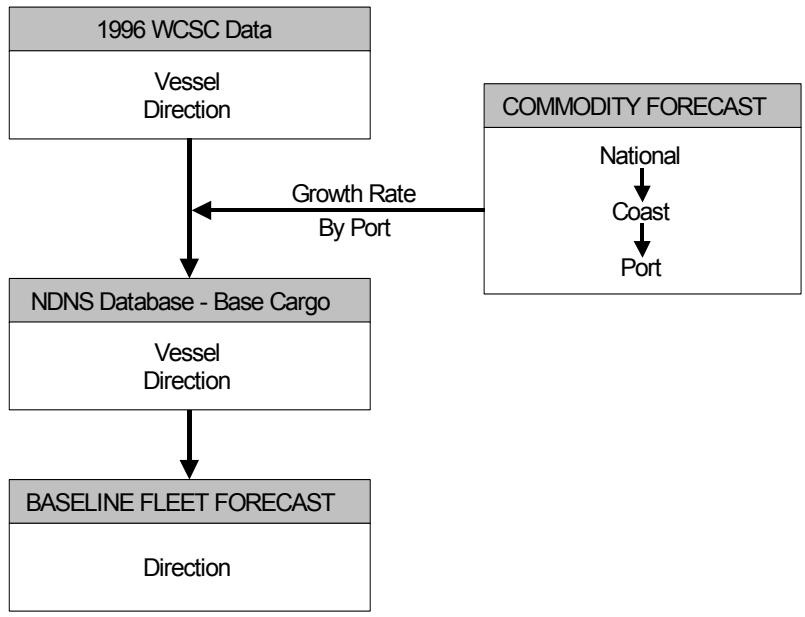

Figure D-2. Base Cargo Profile

stage of the analysis, tonnage has not shifted into different sizes of ship. Hence, the result of this step is baseline forecasts of calls–more trade results in more calls from a set of ships that reflect the distribution of 1996 ship design characteristics.

ALGORITHM FOR VESSEL SIZE AND TYPE SHIFT

Shifting of cargo represents general trends towards larger vessels and changes in shipping technologies, such as shifts of general cargo from bulk-break to containerships. In order to permit the forecast of trade to incorporate these trends, vessel type and size categories were established. Vessel calls and associated tonnage in the base cargo profile were allocated/aggregated into 11 major ship types and 146 vessel size groups of 10,000 deadweight tons (DWT).

Table D-1 lists the different vessel types and size categories assumed for the analysis. Vessel were grouped as one of the following: bulk carrier, combination carrier, containerships, dry cargo, offshore, passenger, reefer, Ro-Ro, tanker and vehicle carrier. The before-shift number of size categories reflects the number of classes identified in the 1996 Waterborne Commerce Statistics Center data. After the shifting of cargo, the number of DWT classes reflects the total number of classes among which cargo can shift over the forecast horizon. The vessel types are combined into one of five vessel-category groupings of bulk, container, general, other or tanker, corresponding with vessel groupings discussed throughout this report.

TABLE D-1 VESSEL TYPE AND/OR SIZE SHIFTS			
Before Shift Vessel Type	**Before Shift Size Range**	**After Shift Vessel Type**	**After Shift Size Range**
Bulk Carrier	0-19	Bulk Carrier	0-24
Combination	0-16	Bulk Carrier	0-21
Container	0-8	Container	0-13
Dry Cargo	0-5	Container	0-10
Miscellaneous	0-3	Miscellaneous	0-3
Offshore	0-27	Offshore	0-27
Passenger	0-1	Passenger	0-1
Reefer	0-1	Reefer	0-1
Ro-Ro	0-5	Container	0-5
Tanker	0-45	Tanker	0-50
Vehicle Carrier	0-5	Vehicle Carrier	0-5

The cargo-shifting procedure projects the number, amount of tonnage carried, average deadweight tonnage (DWT) and the average design drafts of vessels at any port location over the 1996 to 2040 forecast period. The current application assumes that 20 percent of the cargo in each 10,000 DWT vessel size group is shifted to the next largest size group over each 10-year time period in the forecast,[21] and is based on recent communications with industry experts and past fleet forecasting experience. The shift algorithm is applied to base year 1996 import and export vessel movements at each location, for each vessel type and size category and for each direction (import and export). The baseline cargo profile consists of 11 vessel types and 146 vessel sizes; however, after the shift algorithm is applied, the data are comprised of 161 vessel sizes.

As indicated in Table D-1, reefer, vehicle carrier, offshore and passenger vessel types do not increase in size from the "before" size to the "after" size as reflected by the baseline 1996 data. Table D-1 also indicates the vessel types for which tonnage shifts to different vessel types. The assumptions for shifting among ship types are as follows. Within all groups of ships, 20 percent of cargo is shifted to the next larger size over a 10-year period, except for dry cargo and Ro-Ro ships, where 20 percent of tonnage is shifted into containerships, and combination carriers, where 20 percent of tonnage is shifted to bulk carriers.

Tonnages were not shifted to different vessel sizes for vessels calling port locations within the Great Lakes. Vessels currently operating within the Great Lakes are not likely to increase in size because of existing channel depths, operating behavior and market forces. For vessels entering and exiting the Great Lakes through the St. Lawrence Seaway, existing

[21] To account for the shorter time between the base year 1996 data and the first forecast year of 2000, a prorated annual cargo shift is applied for this four-year period. In each year between 1996 and 2000, 92 percent of the forecast tonnage remains in the beginning vessel size, and 8 percent of the forecast tonnage shifts to the next larger size vessel or vessel type.

structures and channel depths along the seaway limit the size of vessels that can be safely accommodated.

In order to identify potential dredging needs, it is necessary to determine the physical design characteristics pertaining to vessels in each vessel type and class. The physical vessel characteristics of DWT and design draft of ships were obtained from Fairplay for those vessels found in the base 1996 data. Average DWT and design draft were calculated for each vessel type and class existing in the 1996 data. For vessel sizes that did not exist in the 1996 data and Fairplay source, the average DWT and average design draft were interpolated using the next larger and smaller vessels size categories. For containerships, the largest existing vessel provided by Fairplay was a DWT size 10. As shown in Table D-1, the shift algorithm includes containerships out to DWT sizes 11, 12 and 13. Bulk vessels of DWT sizes 11, 12 and 13 are used to approximate the average DWT and average design draft of containership DWT sizes 11, 12 and 13, respectively.

CALCULATION OF FUTURE LOAD

Vessels do not necessarily sail at full design capacity. Many factors such as type of commodity, origin/destination, or supply and demand can influence the level of capacity at which a vessel sails. For this analysis, the percentage of the ship used by each call is defined as "vessel utilization" and is an estimate of the actual tonnage that would be loaded and off-loaded. Utilization depends on the available cargo-carrying capacity of each vessel type and size. Vessel utilization is calculated by dividing the average tonnage per call by the average deadweight tonnage:

Utilization Rate = Average Tonnage Per Call / Average Deadweight Tonnage

A utilization rate was calculated from the base 1996 data and averaged for each vessel type and size class. The calculated utilization rate is constant by port and vessel size. Within the port, the calculated utilization rate varies by direction, location and vessel size. Estimates of utilization are needed in this analysis to calculate the future load. Load refers to the amount of tonnage carried per vessel per call and is derived from the base 1996 data. Load is calculated by multiplying the utilization rate and average deadweight tonnage in any particular vessel type and size class.[22] For each forecast year, future load for each vessel type and size class is calculated as:

Load = Utilization * Average Deadweight Tonnage

[22] Future load is adjusted to correct for unusually high and low utilizations found in the base 1996 data. All utilization rates greater than 1.0 were set to 1.0. Utilization rates less than 0.05 were set to 0.05. The utilizations greater than 1.0 likely result from shuttle vessels making more frequent voyages. The very low utilizations reflect a small amount of cargo per call.

CALCULATION OF FUTURE VESSEL CALLS

The final step of the forecast is to convert estimates of tonnage in each vessel type and size category into estimates of vessel calls. The number of calls is calculated by dividing the sum of the projected and shifted tonnages by vessel type and location, by a computed average future load or tons per call. The result is the number of calls a vessel must make to carry the forecasted tonnage:

Number of Vessel Calls = Tonnage / Load

ASSIGNED PROJECT DEPTHS OVERVIEW

The controlling physical constraint in accessibility of vessels is available channel depth. In this study, channel depths are identified by specific location codes. Port location codes are specific, detailed locations identified by the Waterborne Commerce Statistics Center. A port can have more than one location code assigned. Therefore some ports (not all) can have more than one analyzed channel depth.

Two definitions of channel depth are used in this analysis. *With project* channel depths reflect channel depths if projects that are currently authorized, programmed or planned to be constructed by 2020 are constructed. *Without project* channel depths represent existing channel depths and consider that channel depths are not dredged deeper than the existing depth such that authorized, programmed or planned channel depths are not implemented. Appendix F lists the port/location names corresponding channel depths for three time periods–years 2000, 2010, and 2020–to represent the *with project* condition in analyzing channel constraints.

METHOD FOR IDENTIFYING CHANNEL CONSTRAINTS

The determination of whether a channel constraint exists occurs at the detailed location code level for all channel depths within a port. Therefore, a single overall controlling depth representing a port is not assumed.[23] Each location code is analyzed separately for the specific channel depth and projected calls occurring at that location.

To account for underkeel clearance, a margin of 10 percent was added to the design draft of each vessel. Constrained vessel calls are defined as those vessel movements where the design draft exceeds the channel depth, accounting for the assumed margins for under-keel clearance.

[23] Since a port can have more than one location code, and location codes can have different channel depths, a port can have more than one associated channel depth. In this context, if a vessel enters other location codes while moving to its final destination location, only the call at the final destination's location code is analyzed

For this discussion, a call is defined as a vessel coming in (import destination) or going out (export origin) of a port location. Since the forecast of calls has associated cargo tonnage, this analysis identifies the number of constrained calls and the tonnage associated with those constrained calls.

The extent of information available from the forecast of calls for each location and forecast year includes:

- Number of calls
- Metric tons of cargo
- Number of constrained calls
- Constrained metric tonnage

The information can be organized and analyzed obtained at the following levels for the alternative channel depth assumptions:

- Group of locations (port, coastal region, and national levels)
- Direction (import and export)
- Vessel type and size classes

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APPENDIX E

CALCULATIONS OF A HYPOTHETICAL LIGHT-LOADING SCENARIO

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A 6,000 TEU containership is sailing from Rotterdam to New York. Loaded to deadweight capacity, she needs to draw 51 feet of water. To enter New York harbor, operators must reduce sail draft to 40 feet. This assumes she needs to sail at 10 percent less than design draft (46 *.10 = 4.6 feet). To reduce draft, the vessel lightens at the Canadian port of Halifax.

Ship Characteristics:

TEU:	6,000
DWT:	82,000
Design Draft:	46 ft.
Total Daily Operating Cost:	$60,197
TPI:	279

Total Daily Operating Costs:

- Assume constant revenues per TEU
- Assume constant unit weight for TEU (13.8 tons)
- 3,348 tons per foot = 243 TEUs per foot
- Light loading from 46 feet to 40 feet necessitates a reduction in sailing draft of 6 feet and TEU at 40 feet = [(6000 – (243*6.)] = 4, 542 TEU
- Unit daily fixed cost fully loaded = $10.03 per TEU
- Unit daily fixed cost light loaded = $13.25 per TEU
- Percentage increase in unit cost per TEU: 32%

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APPENDIX F

PORT/LOCATION CHANNEL DEPTHS

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TABLE F-1

PORT/LOCATION CHANNEL DEPTHS

Port Name	Location Code	Location Name	CWIS Number	Channel Depth (feet)		
				Year 2000	Year 2010	Year 2020
Afognak Bay, AK	95300	Afognak Island, AK		48	48	48
Akutan Islands, AK	96090	Akutan Island, AK		40	40	40
Alexandria Bay, NY	70230	Alexandria Bay, NY		27	27	27
Alpena Harbor, MI	76133	Alpena, MI	74196	18.5	18.5	18.5
Anacortes Harbor, WA	91282	Anacortes Harbor, WA		44	44	44
	91284	Anacortes Harbor, WA	67300	18	18	18
Anchorage, AK	95290	Anchorage, AK	360	43	43	43
Antioch, CA	81405	Antioch, CA	16180	35	35	35
Ashtabula Harbor, OH	72101	Ashtabula Harbor, OH	650	28	28	28
Baltimore Harbor and Channels, MD	5550	Baltimore Hbr and Channels, MD	870	50	50	50
Barataria Bay, LA	20657	Barataria Bay, LA		12	12	12
Barber Points, HI	84746	Barbers Point Channel Oahu	910	42	46	46
Bayou Dupre, LA	20539	Bayou Dupre, LA		6	6	6
Bayou La Batre, LA	15518	Bayou La Batre, AL		15	15	15
Beaumont, TX	60056	Beaumont, TX	15780	40	40	40
Bellingham Bay and Harbor, WA	91287	Bellingham Bay & Harbor, WA Main Channel	1310	30	30	30
Bridgeport Harbor, CT	1687	Bridgeport, CT Main Harbor	73360	35	35	35
Brownsville, TX	66683	Brownsville Ship Channel, TX	1990	36	36	36
Brunswick Harbor, GA	13170	Brunswick Hbr, GA	2080	30	36	36
Bucksport, ME	331	Bucksport Harbor, ME	331	16	16	16
Burlington-Florence-Roebling, NJ	4370	Burlington, NJ	4550	40	40	40
Burns Waterway Harbor, IN	77625	Burns Waterway Harbor, IN	2250	27	27	27
Calcite, MI	76159	Calcite, MI		25	25	25
Canaveral Harbor, FL	14150	Canaveral Harbor, FL	2520	40	40	40
Charleston Harbor, SC	12212	Charleston Cooper River, SC	2980	40	45	45
	12213	Charleston Shipyard River, SC	16730	38	38	38
	12214	Charleston Ashley River, SC	74464	30	30	30
	12216	Wando River, SC	2980	40	45	45
Charlevoix Harbor, MI	77433	Charlevoix Michigan Ironton, MI	2990	18	18	18
Chester Area, PA	4450	Chester, PA	4570	40	45	45
	4453	Eddystone, PA	4570	40	45	45
Caribbean Islands	17840	Caribbean Islands	74399	25	25	25
Cleveland Harbor, OH	72073	Cleveland Harbor, OH	3430	28	28	28
Conneaut Harbor, OH	72108	Conneaut Harbor, OH	3770	27	27	27
Corpus Christi, TX	60770	Corpus Christi, TX	14340	45	50	50
Delaware River at Camden, NJ	4340	Gloucester, NJ	4570	40	45	45
	4343	Camden, NJ	43005	40	45	45
	4350	Delair, NJ	4550	40	40	40
Delaware River between Philadelphia and Trenton	4495	Morrisville, PA	4550	12	12	12
Drummond Island, MI	78006	Drummond Island, MI		27	27	27
Duluth-Superior Harbor, MN and WI	79283	Superior, WI	5050	27	27	27
	79286	Duluth, MN	5050	27	27	27
East Pearl, MS	15641	East Pearl River, MS		9	9	9
Eastport Harbor, ME	51	Eastport Hbr, ME		40	40	40
El Segundo, CA	80265	El Segundo, CA		59	59	59
Erie Harbor, PA	72122	Erie Harbor, PA	5600	29	29	29
Escanaba, MI	77875	Escanaba, MI		40	40	40
Everett Harbor, WA	91249	Everett Harbor, WA Outer Harbor	5700	30	30	30
Fairport Harbor, OH	72088	Fairport Harbor, OH Grand River	5760	24	24	24
Fajardo Harbor, PR	17210	Fajardo Hbr, PR		24	24	24
Fall River Harbor, MA	1346	Fall River Hbr, MA	9410	35	35	35
Fernando Harbor, FL	13224	Fernandina, FL	5840	36	36	36
Fort Pierce Harbor, FL	14213	Fort Pierce Hbr, FL	6260	28	28	28

TABLE F-1

PORT/LOCATION CHANNEL DEPTHS

Port Name	Location Code	Location Name	CWIS Number	Channel Depth (feet)		
				Year 2000	Year 2010	Year 2020
Caribbean Islands	17800	Caribbean Islands		27	27	27
Freeport, TX	60518	Freeport Harbor, TX	6170	45	45	45
Galveston, TX	66355	Galveston Channel, TX	6340	40	45	45
Gary Harbor, IN	77629	Gary, IN		27	27	27
Georgetown Harbor, SC	12110	Winyah Bay & Georgetown Hbr, SC	6480	27		
Gloucester Harbor, MA	660	Gloucester Hbr, MA	416	20	20	20
Grays Harbor and Chehalis River, WA	91016	Grays Hbr & Chehalis River, WA Westhaven	6770	30	30	30
	91018	Grays Hbr & Chehalis River, WA South Aberdeen	6770	30	30	30
Guanica Harbor, PR	17628	Guanica Hbr, PR		24	24	24
Guayanilla Harbor, PR	17610	Guayanilla Hbr, PR		39	39	39
Gulfport Harbor, MS	15610	Gulfport Hbr & Ship Is Pass, MS	7150	36	36	36
Haines, AK	94963	Haines, AK	80506	15	15	15
Hilo Harbor, HI	84012	Hilo Hbr, HI	7550	35	35	35
Holland Harbor, MI	77578	Holland Harbor, MI	7610	21	21	21
Homer, AK	95220	Homer, AK	80508	20	20	20
Honolulu Harbor, Oahu, HI	84752	Honolulu Hbr, Oahu, HI	7660	45	45	45
Hoonah Harbor, AK	94952	Hoonah, AK	76001	18.5	18.5	18.5
Houston, TX	60370	Houston Ship Channel, TX	7780	40	45	45
Humboldt Harbor and Bay, CA	82690	Humboldt Hbr & Bay, CA	7860	38	38	38
Huron Harbor, OH	72051	Huron Harbor, OH	7920	28	28	28
Hydaburg, AK	93823	Hydaburg, AK		50	50	50
Icy Bay, AK	95050	Icy Bay, AK		43	43	43
Indiana Harbor, IN	77632	Indiana Harbor Indiana East Chicago, IN	18120	22	22	22
Jacksonville Harbor, FL	14018	Jacksonville Harbor, FL	8410	38	40	40
Jobos Harbor, PR	17540	Jobos Hbr, PR		26	26	26
Juneau Harbor, AK	94811	Juneau Gastineau Channel, AK		50	50	50
Kahului Harbor, Maui, HI	84315	Kahului Hbr, Maui, HI	8660	35	35	35
Kake Harbor, AK	93855	Kake, AK		66	66	66
Ketchikan Harbor, AK	93810	Ketchikan, AK (Tongass Narrows)	72798	15	15	15
Key West Harbor, FL	14467	Key West Hbr, FL	8970	30	30	30
Klawock, AK	93826	Klawock, AK		42	42	42
Kodiak Harbor, AK	95351	Kodiak Harbor, AK)	72753	22	22	22
Lake Charles, LA	20955	Calcasieu River and Pass Lake Charles, LA	2440	40	40	40
Lake Huron, MI	76069	Essexville, MI	57420	25	25	25
	76071	Bay City, MI	57420	25	25	25
	76074	Zilwaukee, MI	57420	22	22	22
	76075	Carrolton, MI	57420	22	22	22
	76077	Saginaw, MI	57420	22	22	22
Lake Michigan, MI and WI	77566	Ferrysburg, MI	6670	21	21	21
	77567	Grand Haven Harbor, MI	6670	21	21	21
	77825	Green Bay, WI	6910	24	24	24
Long Beach Harbor, CA	80200	Long Beach Harbor, CA	74719	50	76	76
	80201	Long Beach Outer Harbor, CA	74719	60	76	76
Lorain Harbor, OH	72060	Lorain Harbor, OH	10060	28	28	28
Los Angeles Harbor, CA	80210	Los Angeles Harbor, CA	74719	81	81	81
Lower Delaware Bay, DE	4402	Lower Delaware Bay, DE	4570	40	45	45
Ludington Harbor, MI	77535	Ludington Harbor, MI	10270	27	27	27
Manistee Harbor, MI	77523	Manistee Harbor, MI	10480	21	21	21
Marblehead, OH	72044	Marblehead, OH		28	28	28
Marcus Hook, PA	4430	Claymont, DE	4570	40	45	45
	4440	Marcus Hook, PA	4570	40	45	45
Mare Island Strait, CA	82310	San Pablo Bay & Mare I Strait, CA	16230	45	45	45
Marysville, MI	75017	Marysville, MI	17300	27	27	27

TABLE F-1

PORT/LOCATION CHANNEL DEPTHS

Port Name	Location Code	Location Name	CWIS Number	Channel Depth (feet)		
				Year 2000	Year 2010	Year 2020
Matagorda Ship Channel, TX	60658	Matagorda Ship Channel, TX	10810	38	38	38
Mayaguez Harbor, PR	17710	Mayaguez Hbr, PR	22280	30	30	30
Menominee Harbor and River, MI and WI	77849	Marinette, MI & WI		21	21	21
	77850	Menominee, MI & WI	45044	21	21	21
Metlakatla Harbor, AK	93807	Metlakatla, AK	76002	15	15	15
Miami Harbor, FL	14325	Miami Harbor, FL	10140	42	50	50
	14326	Miami River, FL	74379	15	15	15
Michoud Canal, LA	15800	Michoud Canal, LA	64	36	36	36
Milwaukee Harbor, WI	77690	Milwaukee, WI	11270	27	27	27
Mobile Harbor, AL	15497	Mobile Harbor, AL Chickasaw Creek	11670	45	50	55
Morehead City Harbor, NC	11590	Morehead City Hbr, NC	11810	45	45	45
Muskegon Harbor, MI	77562	Muskegon Harbor, MI	12060	27	27	27
Narragansett Bay, RI	1402	Newport Harbor, RI	72599	21	21	21
	1408	Davisville, RI		25	25	25
Nawiliwi Harbor, Kauai, HI	84840	Nawiliwili Hbr, Kauai, HI	73336	35	35	35
New Bedford and Fairhaven Harbor, MA	1294	New Bedford & Fairhaven Hbr, MA	432	30	30	30
New Castle Area, DE	4415	Delaware City, DE	4570	40	45	45
New Haven Harbor, CT	1646	New Haven, CT Main Harbor	12380	35	35	35
New London Harbor, CT	1525	New London Harbor, CT	249	40	40	40
New York/New Jersey, NY and NJ	2120	Long Island Sound At Rye Beach, NY		15	15	15
	2210	East River NY Upper NY Bay To USN Shipyard	41062	40	40	40
	2410	Buttermilk Channel, NY	41015	40	40	40
	2470	Bay Ridge Channel, NY	1040	40	40	40
	2475	Red Hook Channel, NY	1040	40	40	40
	2510	Gravesend Bay, NY	12490	45	45	45
	2610	Sandy Hook Bay, NJ Non Proj Area		35	35	35
	2850	Elizabeth River, NJ	12520	35	35	35
	2910	Hudson River, NY & NJ Yonkers NY	7810	32	32	32
Nikishka, AK	95270	Nikishki, AK		42	42	42
Nome, AK	97695	Nome, AK		30	30	30
Norfolk Harbor, VA	10383	Norfolk Hbr, VA Southern Br Eliz R	12801	50/45*	50	55
	10387	Norfolk Harbor, VA Portsmouth VA	12801	50/45*	50	55
	10385	Norfolk Hbr, VA Eastern Br Eliz R	12801	50/45*	50	55
Northville, L.I., NY	3844	Northville L.I., NY		54	54	54
Ogdensburg Harbor, NY	70245	Ogdensburg Harbor, NY	13130	27	27	27
Olympia Harbor, WA	91178	Olympia Harbor, WA	13320	30	30	30
Ontonagon Harbor, MI	79205	Ontonagon Harbor, MI	13330	15	15	15
Oswego Harbor, NY	71184	Oswego Harbor, NY	13440	24	24	24
Other Puget Sound Area Ports, WA	91560	Ferndale, WA		53	53	53
	91565	Cherry Point, WA		65	65	65
Other San Francisco Bay Area Ports, CA	82360	Richardson Bay, CA		27	27	27
	82400	San Francisco Bay Area Other Ports, CA		27	27	27
Palm Beach Harbor, FL	14266	Palm Beach Harbor, FL	13590	33	33	33
Panama City Harbor, FL	15230	Panama City Harbor, FL	13640	32	32	32
Pascagoula Harbor, MS	15555	Pascagoula Hbr, MS	13680	38	42	42
	15556	Bayou Casotte, MS		36	36	36
Paulsboro, NJ	4330	Paulsboro, NJ	4570	40	45	45
	4335	Eagle Point Westville, NJ	4570	40	45	45
Pearl Harbor, Oahu, HI	84750	Pearl Harbor, Oahu, HI		60	60	60
Pensacola Harbor, FL	15405	Pensacola Hbr, FL	13830	33	33	33
Philadelphia Harbor, PA	4680	Schuykill River Phila, PA Project	16550	33	33	33
Piscataqua River, ME and NH	600	Portsmouth Hbr, NH	512	35	35	35
	610	Piscataqua River, NH	512	35	35	35
Ponce Harbor, PR	17590	Ponce Harbor, PR	75007	36	36	36

TABLE F-1

PORT/LOCATION CHANNEL DEPTHS

Port Name	Location Code	Location Name	CWIS Number	Channel Depth (feet)		
				Year 2000	Year 2010	Year 2020
Port Angeles Harbor, WA	91097	Port Angeles Harbor, WA		45	45	45
Port Arthur, TX	66288	Port Arthur, TX	15780	40	40	40
Port Dolomite, TX	76202	Port Dolomite, MI		25	25	25
Port Everglades Harbor, FL	14311	Port Everglades Hbr, FL	76031	42	42	42
	14312	Dania Cut Off Canal, FL		18	18	18
Caribbean Islands	17850	Caribbean Islands		55	55	55
Port Hueneme, CA	80355	Port Hueneme, CA	74656	35	35	35
Port Huron, MI	75020	Port Huron, MI	17300	27	27	27
Port Inland, MI	77934	Port Inland, MI		29	29	29
Port Jefferson Harbor, NY	3840	Port Jefferson Harbor L.I., NY	73749	12	12	12
Port Manatee, FL	14795	Port Manatee, FL	10166	40	40	40
Port of Albany, NY	3130	Albany, NY	7810	32	32	32
Port of Astoria, OR	90015	Astoria, OR	3630	40	43	43
Port of Baton Rouge, LA	20169	Lower Miss River Mile 169	68	45	50	55
	20173	Lower Miss River Mile 173	68	45	50	55
	20175	Lower Miss River Mile 175	68	45	50	55
	20181	Lower Miss River Mile 181	68	45	50	55
	20185	Lower Miss River Mile 185	68	45	50	55
	20187	Lower Miss River Mile 187	68	45	50	55
	20203	Lower Miss River Mile 203	68	45	50	55
	20205	Lower Miss River Mile 205	68	45	50	55
	20208	Lower Miss River Mile 208	68	45	50	55
	20228	Baton Rouge, LA Miles 226 Thru 235	68	45	50	55
Port of Boston, MA	701	Boston, MA Main Water Front	1960	40	45	45
	702	Boston, MA Chelsea River	76132	38	38	38
	703	Boston, MA Mystic River	431	40	40	40
	711	Boston, MA Weymouth Fore River	19790	35	35	35
Port of Buffalo, NY	72350	Buffalo Harbor, NY	2140	27	27	27
Port of Chicago, IL	77642	Lake Calumet, IL	2410	27	27	27
Port of Detroit, MI	73008	Thru 73013 Port Of Detroit Mi/Tre	4710	27	27	27
	73010	Wyandotte, MI	4710	27	27	27
	73011	Ecorse, MI	4710	27	27	27
	73013	Detroit, MI	4710	27	27	27
Port of Hopewell, VA	10352	James River & Port of Hopewell, VA	8430	25	25	25
Port of Kalama, WA	90075	Kalama, WA	3630	40	43	43
Port of Longview, WA	90066	Longview, WA	3630	40	43	43
Port of New Orleans, LA	15973	Gulf Outlet Miles 70-73	11410	36	36	36
	20107	Lower Miss River Mile 107	68	45	50	55
	20108	Lower Miss River Mile 108	68	45	50	55
	20114	Lower Miss River Mile 114	68	45	50	55
	20500	Inner Harbor Navigation Canal, LA	11410	36	36	36
Port of Newport News, VA	10343	Newport News , VA	73783	50/45*	50	55
Port of Plaquemine, LA	20002	Lower Miss River Mile 2	68	45	50	55
	20025	Lower Miss River Mile 25	68	45	50	55
	20027	Lower Miss River Mile 27	68	45	50	55
	20046	Lower Miss River Mile 46	68	45	50	55
	20049	Lower Miss River Mile 49	68	45	50	55
	20053	Lower Miss River Mile 53	68	45	50	55
	20055	Lower Miss River Mile 55	68	45	50	55
	20059	Lower Miss River Mile 59	68	45	50	55
	20063	Lower Miss River Mile 63	68	45	50	55
	20072	Lower Miss River Mile 72	68	45	50	55
	20075	Lower Miss River Mile 75	68	45	50	55

TABLE F-1

PORT/LOCATION CHANNEL DEPTHS

Port Name	Location Code	Location Name	CWIS Number	Channel Depth (feet)		
				Year 2000	Year 2010	Year 2020
Port of Portland, OR	90102	Oregon Slough Oregon And Bay, OR	66005	40	40	40
	90508	Portland, OR	3630	40	40	40
Port of Richmond, VA	10350	James River, VA	8430	25	25	25
Port of South Louisiana, LA	20116	Lower Miss River Mile 116	68	45	50	55
	20118	Lower Miss River Mile 118	68	45	50	55
	20120	Lower Miss River Mile 120	68	45	50	55
	20125	Lower Miss River Mile 125	68	45	50	55
	20126	Lower Miss River Mile 126	68	45	50	55
	20127	Lower Miss River Mile 127	68	45	50	55
	20128	Lower Miss River Mile 128	68	45	50	55
	20135	Lower Miss River Mile 135	68	45	50	55
	20138	Lower Miss River Mile 138	68	45	50	55
	20140	Lower Miss River Mile 140	68	45	50	55
	20145	Lower Miss River Mile 145	68	45	50	55
	20146	Lower Miss River Mile 146	68	45	50	55
	20151	Lower Miss River Mile 151	68	45	50	55
	20156	Lower Miss River Mile 156	68	45	50	55
	20158	Lower Miss River Mile 158	68	45	50	55
	20160	Lower Miss River Mile 160	68	45	50	55
Port of Vancouver, WA	90106	Vancouver, WA	3630	40	40	40
	90107	Vancouver, WA	3620	27	27	27
Port of Wilmington, NC	11832	Wilmington Harbor, NC	20030	38	42	42
Port Royal Harbor, SC	12310	Port Royal, SC	14380	27	27	27
Port Townsend Harbor, WA	91113	Port Townsend Harbor, Wa		30	30	30
Portland Harbor, ME	545	Portland Harbor, ME	367	30	30	30
Potomac River at Alexandria, VA	6104	Potomac River at Alexandria, VA	597	24	24	24
Presque Isle Harbor, MI	79077	Presque Isle Harbor, MI	48012	27	27	27
Prince Wales Island west side, AK	93827	Prince Wales Island, AK		43	43	43
Providence River and Harbor, RI	1379	Providence River and Harbor, RI	566	40	40	40
Poughkeepsie, NY	3052	Poughkeepsie, NY	7810	32	32	32
Redwood City Harbor, CA	82238	Redwood City Hbr, CA	15100	30	30	30
Rio Vista, CA	81112	Rio Vista, CA	15870	35	35	35
Rochester (Charlotte) Harbor, NY	71039	Rochester Hbr, NY	15390	21	21	21
Sacramento, CA	81726	Yolo Port District, CA	15870	35	35	35
Salem Harbor, MA	675	Salem Harbor, MA	439	32	32	32
San Diego Harbor, CA	80020	San Diego Harbor, CA	16110	40	40	40
San Francisco Harbor, CA	82202	San Francisco Hbr, CA	16130	40	40	40
San Juan Harbor, PR	17130	San Juan Hbr, PR	16190	40	40	40
Sandusky Harbor, OH	72046	Sandusky Harbor, OH	16260	26	26	26
Sault Ste. Marie, MI	78024	Sault Ste Marie, MI		25	25	25
Savannah Harbor, GA	13040	Savannah Harbor, GA	75085	42	48	48
Searsport Harbor, ME	332	Searsport Hbr, Me	377	35	35	35
Seattle Harbor, WA	91209	Seattle Harbor, WA Duwamish River	67318	30	30	30
	91210	Seattle Harbor, WA West Waterway	67318	34	34	34
	91211	Seattle Harbor, WA Harbor Island	67318	34	34	34
	91212	Seattle Harbor, WA East Waterway	67318	34	51	51
	91213	Seattle Harbor, WA Elliott Bay	67318	34	34	34
	91217	Lake Washington Ship Canal, WA/Ballard	9400	30	30	30
	91219	Lake Washington Ship Canal, WA/Portage Bay Cut	9400	30	30	30
Seward Harbor, AK	95180	Seward, AK	72765	15	15	15
Sitka Harbor, AK	94845	Sitka Harbor, AK	72845	22	22	22
Skagway Harbor, AK	94965	Skagway Harbor, AK	72846	30	30	30
Caribbean Islands	17310	St. Caribbean Islands		35	35	35

TABLE F-1

PORT/LOCATION CHANNEL DEPTHS

Port Name	Location Code	Location Name	CWIS Number	Channel Depth (feet)		
				Year 2000	Year 2010	Year 2020
Caribbean Islands	17370	Caribbean Islands		30	30	30
Stockton, CA	81442	Stockton, CA	16180	35	35	35
Stoneport, MI	76148	Stoneport, MI		25	25	25
Stony Point, NY	3014	Stony Point, NY	7810	32	32	32
Tacoma Harbor, WA	91181	Tacoma Harbor, WA		65	65	65
	91186	Tacoma Harbor, WA		40	40	40
	91187	Tacoma Harbor, WA		40	40	40
	91188	Tacoma Harbor, WA	72902	35	51	51
	91189	Tacoma Harbor, WA	72902	30	30	30
Tampa Harbor, FL	14790	Tampa Harbor, FL	17960	43	43	43
Texas City, TX	60414	Texas City, TX	18130	40	40	50
Thompson Point, NJ and vicinity	4325	Thompson Point, NJ	4570	40	45	45
Toledo Harbor, OH	72014	Toledo, OH	18280	28	28	28
Valdez Harbor, AK	95130	Valdez, AK		108	108	108
Whittier Harbor, AK	95175	Whittier, AK		45	45	45
Wilmington Harbor, DE	4660	Christina River Wilmington DE	20040	38	38	38
Wrangell Harbor, AK	93819	Wrangell Hbr., AK		40	40	40
Yabucoa Harbor, PR	17490	Yabucoa Harbor, PR		50	50	50
	93814	Clarence Strait, AK		43	43	43
	3114	Coeymans, NY	7810	32	32	32
	20792	Atchafalaya R Morgan Cty to Gulf	680	20	20	20
	20675	Bayou Lafourche, LA		12	26	26
	765	Cape Cod Canal, MA	2620	32	32	32
	82323	Carquinez Strait, CA	16230	45	45	45
	20715	Houma Navigation Canal, LA	7760	18	18	18
	95260	Kenai River, AK		45	45	45
	96365	Naknek River, AK		3	3	3
	330	Penobscot River, ME	13820	22	22	22
	81401	Pittsburg, CA	16180	35	35	35
	95100	Prince William Sound		unlimited	unlimited	unlimited
	93802	Revillagigedo Channel		43	43	43
	4550	Salem River, NJ	24950	18	18	18
	3860	Shelter Is & Shelter Is Sd L.I., NY		46	46	46
	94805	Stephens Passage, AK		43	43	43
	81050	Suisun Bay Channel, CA	17720	40	40	40
	90947	Yaquina Bay & Harbor, OR	20290	30	30	30
	10270	York River, VA	73803	22	22	22

Note: * 50 = outbound channel depth
45 = inbound channel depth

APPENDIX G

ANALYSIS OF PORT LEVEL CONSTRAINTS

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TABLE G-1

ANALYSIS OF PORT LEVEL CONSTRAINTS, YEAR 2000

Port Name/Location Name	Calls						Tons					
	Relative Rank	Number of Call	Constrained Calls with Projects	Constrained Calls without Projects	Percent of Total Constrained Calls with Projects	Percent of Total Constrained Calls without Projects	Relative Rank	Number of Tons	Constrained Tons with Projects	Constrained Tons without Projects	Percent of Total Constrained Calls with Projects	Percent of Total Constrained Calls without Projects
Afognak Bay, AK	147	16	0	0	0.0%	0.0%	139	199,273	0	0	0.0%	0.0%
Akutan Island, AK	204	2	0	0	0.0%	0.0%	211	320	0	0	0.0%	0.0%
Albany, NY	209	2	2	2	0.0%	0.0%	215	35	35	35	0.0%	0.0%
Alexandria Bay, NY	160	13	12	12	0.0%	0.0%	212	257	234	234	0.0%	0.0%
Alpena Harbor, MI	138	26	26	26	0.1%	0.1%	142	173,825	173,825	173,825	0.0%	0.0%
Anacortes Harbor, WA	106	68	45	45	0.2%	0.2%	71	1,739,383	1,467,634	1,467,634	0.2%	0.2%
Anchorage, AK	82	113	4	42	0.0%	0.2%	91	913,344	7,476	560,029	0.0%	0.1%
Antioch, CA	170	10	4	4	0.0%	0.0%	132	260,120	112,599	112,599	0.0%	0.0%
Ashtabula Harbor, OH	73	150	123	123	0.4%	0.4%	52	4,035,505	3,925,298	3,925,298	0.6%	0.6%
Atchafalaya River Morgan City To Gulf	105	74	30	30	0.1%	0.1%	108	594,939	498,983	498,983	0.1%	0.1%
Baltimore Harbor and Channels, MD	11	3,743	96	96	0.3%	0.3%	14	28,568,056	6,919,631	6,919,631	1.0%	1.0%
Barataria Bay LA	210	2	2	2	0.0%	0.0%	189	20,863	20,863	20,863	0.0%	0.0%
Barbers Point, HI	78	120	71	71	0.3%	0.3%	37	6,201,626	5,220,431	5,220,431	0.8%	0.8%
Bayou Dupre, LA	142	22	22	22	0.1%	0.1%	118	458,043	458,043	458,043	0.1%	0.1%
Bayou La Batre, AL	180	8	8	8	0.0%	0.0%	199	5,407	5,407	5,407	0.0%	0.0%
Bayou Lafourche, LA	162	13	13	13	0.0%	0.0%	184	32,680	32,680	32,680	0.0%	0.0%
Beaumont, TX	34	586	264	264	1.0%	1.0%	18	21,809,133	19,046,977	19,046,977	2.8%	2.8%
Bellingham Bay and Harbor, WA	94	92	61	61	0.2%	0.2%	93	896,308	812,549	812,549	0.1%	0.1%
Bridgeport Harbor, CT	99	81	20	20	0.1%	0.1%	104	687,524	349,655	349,655	0.1%	0.1%
Brownsville, TX	64	221	36	36	0.1%	0.1%	80	1,289,536	517,075	517,075	0.1%	0.1%
Brunswick Harbor, GA	42	393	171	171	0.6%	0.6%	68	1,904,625	1,617,006	1,617,006	0.2%	0.2%
Bucksport Harbor, ME	136	27	27	27	0.1%	0.1%	114	533,323	533,323	533,323	0.1%	0.1%
Burlington-Florence-Roebling, NJ	181	8	0	0	0.0%	0.0%	136	214,447	0	0	0.0%	0.0%
Burns Waterway Harbor, IN	81	114	102	102	0.4%	0.4%	64	2,499,044	2,455,477	2,455,477	0.4%	0.4%
Calcite, MI	108	67	67	67	0.2%	0.2%	74	1,602,483	1,602,483	1,602,483	0.2%	0.2%
Canaveral Harbor, FL	51	294	14	14	0.1%	0.1%	70	1,789,150	176,396	176,396	0.0%	0.0%
Cape Cod Canal, MA	182	8	8	8	0.0%	0.0%	150	137,357	137,357	137,357	0.0%	0.0%
Carquinez Strait, CA	48	323	20	20	0.1%	0.1%	41	5,211,070	804,693	804,693	0.1%	0.1%
Charleston Harbor, SC	6	5,180	1,539	1,539	5.6%	5.6%	28	11,329,280	5,631,091	5,631,091	0.8%	0.8%
Charlevoix Harbor, MI	193	4	4	4	0.0%	0.0%	192	15,881	15,881	15,881	0.0%	0.0%
Chester Area, PA	47	324	29	29	0.1%	0.1%	66	2,348,970	1,668,277	1,668,277	0.2%	0.2%
Caribbean Islands	76	122	15	15	0.1%	0.1%	166	75,499	10,408	10,408	0.0%	0.0%
Clarence Strait, AK	211	2	0	0	0.0%	0.0%	216	0	0	0	0.0%	0.0%

TABLE G-1

ANALYSIS OF PORT LEVEL CONSTRAINTS, YEAR 2000

Port Name/Location Name	Calls						Tons					
	Relative Rank	Number of Call	Constrained Calls with Projects	Constrained Calls without Projects	Percent of Total Constrained Calls with Projects	Percent of Total Constrained Calls without Projects	Relative Rank	Number of Tons	Constrained Tons with Projects	Constrained Tons without Projects	Percent of Total Constrained Calls with Projects	Percent of Total Constrained Calls without Projects
Cleveland Harbor, OH	65	219	191	191	0.7%	0.7%	53	4,005,059	3,901,086	3,901,086	0.6%	0.6%
Coeymans, NY	173	10	2	2	0.0%	0.0%	146	154,254	36,354	36,354	0.0%	0.0%
Conneaut Harbor, OH	95	89	67	67	0.2%	0.2%	65	2,395,354	2,303,313	2,303,313	0.3%	0.3%
Coos Bay, OR	54	258	181	181	0.7%	0.7%	63	2,677,478	2,234,826	2,234,826	0.3%	0.3%
Cordova Harbor, AK	202	3	3	3	0.0%	0.0%	197	10,475	10,475	10,475	0.0%	0.0%
Corpus Christi, TX	21	1,399	423	423	1.5%	1.5%	3	63,728,999	37,233,008	37,233,008	5.6%	5.6%
Del Rvr Betwn Phila Tren	89	100	100	100	0.4%	0.4%	102	751,076	751,076	751,076	0.1%	0.1%
Delaware River At Camden, NJ	31	698	40	40	0.1%	0.1%	55	3,444,488	847,571	847,571	0.1%	0.1%
Drummond Island, MI	167	12	12	12	0.0%	0.0%	133	253,105	253,105	253,105	0.0%	0.0%
Duluth-Superior Harbor, MN and WI	44	379	368	368	1.3%	1.3%	32	7,986,353	7,944,293	7,944,293	1.2%	1.2%
East Pearl River MS	68	184	184	184	0.7%	0.7%	158	106,627	106,627	106,627	0.0%	0.0%
Eastport Harbor, ME	130	34	2	2	0.0%	0.0%	137	211,167	12,212	12,212	0.0%	0.0%
El Segundo, CA	110	63	0	0	0.0%	0.0%	48	4,384,981	0	0	0.0%	0.0%
Erie Harbor, PA	141	23	22	22	0.1%	0.1%	126	337,343	332,893	332,893	0.0%	0.0%
Escanaba, MI	203	2	0	0	0.0%	0.0%	174	56,988	0	0	0.0%	0.0%
Everett Harbor, WA	113	59	45	45	0.2%	0.2%	96	852,826	822,143	822,143	0.1%	0.1%
Fairport Harbor, OH	154	14	14	14	0.1%	0.1%	127	321,296	321,296	321,296	0.0%	0.0%
Fajardo Harbor, PR	215	2	0	0	0.0%	0.0%	209	627	0	00	0.0%	0.0%
Fall River Harbor, MA	109	66	38	38	0.1%	0.1%	83	1,248,317	936,269	936,269	0.1%	0.1%
Fernandina Harbor, FL	46	343	26	26	0.1%	0.1%	107	608,687	143,074	143,074	0.0%	0.0%
Fort Pierce Harbor, FL	149	16	8	8	0.0%	0.0%	170	66,071	52,385	52,385	0.0%	0.0%
Caribbean Islands	197	4	2	2	0.0%	0.0%	214	123	76	76	0.0%	0.0%
Freeport Harbor, TX	32	686	206	206	0.7%	0.7%	17	22,370,873	15,363,626	15,363,626	2.3%	2.3%
Galveston Channel, TX	40	440	78	78	0.3%	0.3%	34	6,847,699	4,149,669	4,149,669	0.6%	0.6%
Gary Harbor, IN	194	4	3	3	0.0%	0.0%	188	24,044	23,546	23,546	0.0%	0.0%
Georgetown Harbor, SC	87	100	85	85	0.3%	0.3%	82	1,258,162	1,224,729	1,224,729	0.2%	0.2%
GIWW Mile 87	185	7	0	0	0.0%	0.0%	210	324	0	0	0.0%	0.0%
Gloucester Harbor, MA	111	62	26	26	0.1%	0.1%	185	31,306	11,882	11,882	0.0%	0.0%
Grays Harbor and Chehalis River, WA	77	121	121	121	0.4%	0.4%	75	1,486,087	1,486,087	1,486,087	0.2%	0.2%
Guanica Harbor, PR	163	12	2	2	0.0%	0.0%	180	41,573	3,326	3,326	0.0%	0.0%
Guayanilla Harbor, PR	91	95	74	74	0.3%	0.3%	47	4,393,031	4,040,599	4,040,599	0.6%	0.6%
Gulfport Harbor, MS	39	489	43	43	0.2%	0.2%	67	2,230,190	438,509	438,509	0.1%	0.1%
Haines, AK	206	2	1	1	0.0%	0.0%	186	26,199	26,077	26,077	0.0%	0.0%

TABLE G-1

ANALYSIS OF PORT LEVEL CONSTRAINTS, YEAR 2000

Port Name/Location Name	Calls						Tons					
	Relative Rank	Number of Call	Constrained Calls with Projects	Constrained Calls without Projects	Percent of Total Constrained Calls with Projects	Percent of Total Constrained Calls without Projects	Relative Rank	Number of Tons	Constrained Tons with Projects	Constrained Tons without Projects	Percent of Total Constrained Calls with Projects	Percent of Total Constrained Calls without Projects
Hilo Harbor, HI	172	10	5	5	0.0%	0.0%	165	75,679	72,741	72,741	0.0%	0.0%
Holland Harbor, MI	200	4	4	4	0.0%	0.0%	183	35,936	35,936	35,936	0.0%	0.0%
Homer, AK	119	46	42	42	0.2%	0.2%	129	294,952	283,070	283,070	0.0%	0.0%
Honolulu Harbor, Oahu, HI	57	245	13	13	0.0%	0.0%	79	1,337,947	512,578	512,578	0.1%	0.1%
Hoonah Harbor, AK	152	16	16	16	0.1%	0.1%	141	178,491	178,491	178,491	0.0%	0.0%
Houma Navigation Canal LA	174	9	9	9	0.0%	0.0%	205	2,195	2,195	2,195	0.0%	0.0%
Houston, TX	1	9,821	1,633	1,633	5.9%	5.9%	1	90,631,628	59,997,078	59,997,078	9.0%	9.0%
Humboldt Harbor and Bay, CA	92	95	74	74	0.3%	0.3%	112	564,139	479,674	479,674	0.1%	0.1%
Huron Harbor, OH	188	6	6	6	0.0%	0.0%	193	14,741	14,741	14,741	0.0%	0.0%
Hydaburg, AK	146	17	0	0	0.0%	0.0%	144	163,346	0	0	0.0%	0.0%
Icy Bay, AK	150	16	0	0	0.0%	0.0%	163	80,324	0	0	0.0%	0.0%
Indiana Harbor, IN	122	40	40	40	0.1%	0.1%	94	891,913	891,913	891,913	0.1%	0.1%
Jacksonville Harbor, FL	16	2,033	187	187	0.7%	0.7%	35	6,819,398	3,317,195	3,317,195	0.5%	0.5%
Jobos Harbor, PR	71	161	71	71	0.3%	0.3%	78	1,413,759	1,282,059	1,282,059	0.2%	0.2%
Juneau Harbor, AK	158	14	0	0	0.0%	0.0%	149	142,353	0	0	0.0%	0.0%
Kahului Harbor, Maui, HI	169	10	5	5	0.0%	0.0%	172	61,309	36,712	36,712	0.0%	0.0%
Kake Harbor, AK	184	7	0	0	0.0%	0.0%	182	39,371	0	0	0.0%	0.0%
Kenai River, AK	115	54	0	0	0.0%	0.0%	88	984,132	0	0	0.0%	0.0%
Ketchikan Harbor, AK	104	74	68	68	0.2%	0.2%	148	143,525	135,795	135,795	0.0%	0.0%
Key West Harbor, FL	161	13	2	2	0.0%	0.0%	208	846	10	10	0.0%	0.0%
Klawock, AK	137	26	0	0	0.0%	0.0%	134	226,739	0	0	0.0%	0.0%
Kodiak Harbor, AK	159	14	10	10	0.0%	0.0%	196	10,534	5,920	5,920	0.0%	0.0%
Lake Charles, LA	30	759	381	381	1.4%	1.4%	11	32,773,540	29,132,549	29,132,549	4.4%	4.4%
Lake Huron	114	58	58	58	0.2%	0.2%	84	1,178,870	1,178,870	1,178,870	0.2%	0.2%
Lake Michigan	116	49	46	46	0.2%	0.2%	111	566,763	553,132	553,132	0.1%	0.1%
Long Beach Harbor, CA	4	6,389	26	26	0.1%	0.1%	9	35,978,945	598,349	598,349	0.1%	0.1%
Lorain Harbor, OH	183	8	8	8	0.0%	0.0%	152	131,346	131,346	131,346	0.0%	0.0%
Los Angeles Harbor, CA	5	5,363	0	0	0.0%	0.0%	13	29,167,363	0	0	0.0%	0.0%
Lower Delaware Bay, DE	176	9	9	9	0.0%	0.0%	130	270,557	270,557	270,557	0.0%	0.0%
Ludington Harbor, MI	156	14	14	14	0.1%	0.1%	157	118,512	118,512	118,512	0.0%	0.0%
Manistee Harbor, MI	201	4	4	4	0.0%	0.0%	175	48,191	48,191	48,191	0.0%	0.0%
Marblehead, OH	195	4	4	4	0.0%	0.0%	173	58,412	58,412	58,412	0.0%	0.0%
Marcus Hook, PA	85	106	69	69	0.2%	0.2%	36	6,227,606	5,716,230	5,716,230	0.9%	0.9%
Mare Island Strait, CA	132	33	5	5	0.0%	0.0%	123	402,076	78,163	78,163	0.0%	0.0%

TABLE G-1

ANALYSIS OF PORT LEVEL CONSTRAINTS, YEAR 2000

Port Name/Location Name	Calls						Tons					
	Relative Rank	Number of Call	Constrained Calls with Projects	Constrained Calls without Projects	Percent of Total Constrained Calls with Projects	Percent of Total Constrained Calls without Projects	Relative Rank	Number of Tons	Constrained Tons with Projects	Constrained Tons without Projects	Percent of Total Constrained Calls with Projects	Percent of Total Constrained Calls without Projects
Marysville, MI	145	17	17	17	0.1%	0.1%	128	314,315	314,315	314,315	0.0%	0.0%
Matagorda Ship Channel, TX	62	224	152	152	0.6%	0.6%	38	6,061,863	5,706,344	5,706,344	0.9%	0.9%
Mayaguez Harbor, PR	53	263	4	4	0.0%	0.0%	135	224,320	11,708	11,708	0.0%	0.0%
Menominee Harbor and River, MI and WI	140	25	12	12	0.0%	0.0%	154	121,672	77,683	77,683	0.0%	0.0%
Metlakatla Harbor, AK	177	9	9	9	0.0%	0.0%	176	47,725	47,725	47,725	0.0%	0.0%
Miami Harbor, FL	3	7,853	1,782	1,782	6.5%	6.5%	42	4,894,163	1,492,495	1,492,495	0.2%	0.2%
Milwaukee Harbor, WI	83	112	86	86	0.3%	0.3%	76	1,457,256	1,396,678	1,396,678	0.2%	0.2%
Mobile Harbor, AL	19	1,547	305	305	1.1%	1.1%	15	27,230,381	12,592,861	12,592,861	1.9%	1.9%
Morehead City Harbor, NC	61	232	18	18	0.1%	0.1%	58	3,129,788	828,660	828,660	0.1%	0.1%
Muskegon Harbor, MI	135	29	29	29	0.1%	0.1%	110	593,625	593,625	593,625	0.1%	0.1%
Naknek River, AK	198	4	4	4	0.0%	0.0%	194	13,074	13,074	13,074	0.0%	0.0%
Narragansett Bay, RI	124	38	12	12	0.0%	0.0%	145	157,928	138,434	138,434	0.0%	0.0%
Nawiliwili Harbor, Kauai, HI	208	2	1	1	0.0%	0.0%	202	3,526	282	282	0.0%	0.0%
New Bedford and Fairhaven Harbor, MA	164	12	5	5	0.0%	0.0%	179	43,189	35,985	35,985	0.0%	0.0%
New Castle Area, DE	86	104	90	90	0.3%	0.3%	44	4,631,332	4,471,847	4,471,847	0.7%	0.7%
New Haven Harbor, CT	67	187	89	89	0.3%	0.3%	69	1,889,255	1,442,137	1,442,137	0.2%	0.2%
New London Harbor, CT	171	10	2	2	0.0%	0.0%	168	69,314	52	52	0.0%	0.0%
Nikishka, AK	117	48	5	5	0.0%	0.0%	72	1,638,693	158,233	158,233	0.0%	0.0%
Nome, AK	216	1	0	0	0.0%	0.0%	207	992	0	00	0.0%	0.0%
Norfolk Harbor, VA	12	3,483	244	244	0.9%	0.9%	10	34,188,694	15,047,102	15,047,102	2.3%	2.2%
Northville, L.I., NY	133	311	0	0	0.0%	0.0%	99	790,293	0	0	0.0%	0.0%
Oakland Harbor, CA	9	4,112	2,360	2,360	8.6%	8.6%	31	8,750,045	6,286,744	6,286,744	0.9%	0.9%
Ogdensburg Harbor, NY	155	14	13	13	0.0%	0.0%	160	90,359	90,116	90,116	0.0%	0.0%
Olympia Harbor, WA	148	16	16	16	0.1%	0.1%	151	136,406	136,406	136,406	0.0%	0.0%
Ontonagon Harbor, MI	189	6	6	6	0.0%	0.0%	162	84,466	84,466	84,466	0.0%	0.0%
Oswego Harbor, NY	102	74	11	11	0.0%	0.0%	124	377,149	140,728	140,728	0.0%	0.0%
Other Puget Sound Area Ports, WA	93	94	0	0	0.0%	0.0%	73	1,623,964	0	0	0.0%	0.0%
Other San Francisco Bay Area Ports, CA	121	42	42	42	0.2%	0.2%	105	639,694	639,694	639,694	0.1%	0.1%
Palm Beach Harbor, FL	24	1,091	16	16	0.1%	0.1%	103	730,030	177,989	177,989	0.0%	0.0%
Panama City Harbor, FL	58	244	54	54	0.2%	0.2%	106	615,315	328,505	328,505	0.0%	0.0%
Pascagoula Harbor, MS	38	528	300	300	1.1%	1.1%	20	17,923,903	16,940,196	16,940,196	2.5%	2.5%
Paulsboro, NJ	52	268	195	195	0.7%	0.7%	21	16,396,680	15,863,568	15,863,568	2.4%	2.4%

TABLE G-1

ANALYSIS OF PORT LEVEL CONSTRAINTS, YEAR 2000

Port Name/Location Name	Calls						Tons					
	Relative Rank	Number of Call	Constrained Calls with Projects	Constrained Calls without Projects	Percent of Total Constrained Calls with Projects	Percent of Total Constrained Calls without Projects	Relative Rank	Number of Tons	Constrained Tons with Projects	Constrained Tons without Projects	Percent of Total Constrained Calls with Projects	Percent of Total Constrained Calls without Projects
Pearl Harbor, Oahu, HI	178	9	0	0	0.0%	0.0%	153	126,876	0	0	0.0%	0.0%
Penobscot River ME	175	9	9	9	0.0%	0.0%	190	17,237	17,237	17,237	0.0%	0.0%
Pensacola Harbor, FL	118	47	8	8	0.0%	0.0%	164	78,607	25,877	25,877	0.0%	0.0%
Philadelphia Harbor, PA	20	1,535	281	281	1.0%	1.0%	12	31,678,323	26,347,463	26,347,463	3.9%	3.9%
Piscataqua River, ME and NH	75	138	100	100	0.4%	0.4%	61	2,858,202	2,483,149	2,483,149	0.4%	0.4%
Pittsburg, CA	123	39	38	38	0.1%	0.1%	85	1,128,463	1,113,062	1,113,062	0.2%	0.2%
Ponce Harbor, PR	41	418	18	18	0.1%	0.1%	97	804,900	251,685	251,685	0.0%	0.0%
Port Angeles Harbor, WA	107	67	2	2	0.0%	0.0%	109	594,896	3,453	3,453	0.0%	0.0%
Port Arthur, TX	28	825	483	483	1.8%	1.8%	8	36,074,628	32,968,327	32,968,327	4.9%	4.9%
Port Dolomite, MI	192	5	5	5	0.0%	0.0%	147	145,569	145,569	145,569	0.0%	0.0%
Port Everglades Harbor, FL	7	4,831	81	81	0.3%	0.3%	33	7,511,145	805,301	805,301	0.1%	0.1%
Port in Caribbean	56	250	90	90	0.3%	0.3%	16	22,821,796	14,358,518	14,358,518	2.1%	2.1%
Port Hueneme, CA	55	255	15	15	0.1%	0.1%	98	799,538	85,735	85,735	0.0%	0.0%
Port Huron, MI	74	146	36	36	0.1%	0.1%	178	43,705	12,068	12,068	0.0%	0.0%
Port Inland, MI	143	20	20	20	0.1%	0.1%	119	437,389	437,389	437,389	0.1%	0.1%
Port Jefferson Harbor, NY	190	6	6	6	0.0%	0.0%	140	180,438	180,438	180,438	0.0%	0.0%
Port Manatee, FL	90	98	4	4	0.0%	0.0%	120	435,448	17,658	17,658	0.0%	0.0%
Port Of Albany, NY	98	85	62	62	0.2%	0.2%	81	1,262,365	1,181,778	1,181,778	0.2%	0.2%
Port Of Astoria, OR	168	11	3	3	0.0%	0.0%	159	97,048	36,432	36,432	0.0%	0.0%
Port Of Baton Rouge, LA	18	1,556	271	271	1.0%	1.0%	7	37,017,037	15,143,344	15,143,344	2.3%	2.3%
Port Of Boston, MA	26	1,006	314	314	1.1%	1.1%	30	9,412,044	4,403,634	4,403,634	0.7%	0.7%
Port Of Buffalo, NY	79	118	54	54	0.2%	0.2%	100	769,740	553,229	553,229	0.1%	0.1%
Port Of Chicago, IL	37	538	409	409	1.5%	1.5%	45	4,604,966	4,397,790	4,397,790	0.7%	0.7%
Port Of Detroit, MI	35	575	429	429	1.6%	1.6%	40	5,831,958	5,653,766	5,653,766	0.8%	0.8%
Port Of Hopewell, VA	96	88	37	37	0.1%	0.1%	117	480,557	344,482	344,482	0.1%	0.1%
Port Of Kalama, WA	80	118	37	37	0.1%	0.1%	51	4,192,457	2,173,826	2,173,826	0.3%	0.3%
Port Of Longview, WA	60	233	15	15	0.1%	0.1%	54	3,949,658	260,299	260,299	0.0%	0.0%
Port Of New Orleans, LA	8	4,166	501	501	1.8%	1.8%	5	46,949,126	19,961,745	19,961,745	3.0%	3.0%
Port Of New York/New Jersey	2	8,441	2,158	2,158	7.8%	7.8%	4	58,319,236	31,819,009	31,819,009	4.8%	4.8%
Port Of Newport News, VA	27	837	113	113	0.4%	0.4%	23	14,808,803	8,700,853	8,700,853	1.3%	1.3%
Port Of Plaquemine, LA	36	549	290	290	1.1%	1.1%	19	19,149,668	15,724,668	15,724,668	2.4%	2.4%
Port Of Portland, OR	22	1,393	295	295	1.1%	1.1%	25	13,127,054	4,585,714	4,585,714	0.7%	0.7%
Port Of Richmond, VA	49	319	260	260	0.9%	0.9%	113	549,343	463,289	463,289	0.1%	0.1%
Port Of South Louisiana, LA	15	2,237	701	701	2.5%	2.5%	2	77,304,652	43,226,155	43,226,155	6.5%	6.5%

TABLE G-1

ANALYSIS OF PORT LEVEL CONSTRAINTS, YEAR 2000

Port Name/Location Name	Calls						Tons					
	Relative Rank	Number of Call	Constrained Calls with Projects	Constrained Calls without Projects	Percent of Total Constrained Calls with Projects	Percent of Total Constrained Calls without Projects	Relative Rank	Number of Tons	Constrained Tons with Projects	Constrained Tons without Projects	Percent of Total Constrained Calls with Projects	Percent of Total Constrained Calls without Projects
Port Of Vancouver, WA	45	372	41	41	0.1%	0.1%	50	4,324,042	757,049	757,049	0.1%	0.1%
Port Of Wilmington, NC	29	764	220	220	0.8%	0.8%	49	4,342,138	2,151,550	2,151,550	0.3%	0.3%
Port Royal Harbor, SC	151	16	3	3	0.0%	0.0%	167	69,648	24,298	24,298	0.0%	0.0%
Port Townsend Harbor, WA	199	4	2	2	0.0%	0.0%	206	1,667	1,200	1,200	0.0%	0.0%
Portland Harbor, ME	50	316	231	231	0.8%	0.8%	24	14,618,955	14,473,260	14,473,260	2.2%	2.2%
Potomac River At Alexandria, VA	139	25	5	5	0.0%	0.0%	181	40,162	9,062	9,062	0.0%	0.0%
Potomac River At Lower Cedar Point, MD	212	2	2	2	0.0%	0.0%	195	12,768	12,768	12,768	0.0%	0.0%
Presque Isle Harbor, MI	125	37	37	37	0.1%	0.1%	87	1,015,825	1,015,825	1,015,825	0.2%	0.2%
Prince Wales Is. West Side, AK	128	36	0	0	0.0%	0.0%	131	263,125	0	0	0.0%	0.0%
Prince William Sound, AK	153	16	0	0	0.0%	0.0%	156	119,129	0	0	0.0%	0.0%
Providence River and Harbor, RI	70	164	31	31	0.1%	0.1%	57	3,321,319	1,105,326	1,105,326	0.2%	0.2%
Redwood City Harbor, CA	157	14	14	14	0.1%	0.1%	125	356,271	356,271	356,271	0.1%	0.1%
Revillagigedo Channel	166	12	0	0	0.0%	0.0%	171	62,293	0	0	0.0%	0.0%
Richmond Harbor, CA	43	391	52	52	0.2%	0.2%	39	5,902,920	2,391,078	2,391,078	0.4%	0.4%
Rochester (Charlotte) Harbor, NY	127	37	15	15	0.1%	0.1%	161	84,784	6,804	6,804	0.0%	0.0%
Sacramento, CA	103	74	41	41	0.1%	0.1%	92	906,196	554,851	554,851	0.1%	0.1%
Salem Harbor, MA	134	30	27	27	0.1%	0.1%	86	1,052,144	1,052,019	1,052,019	0.2%	0.2%
Salem River, NJ	84	109	20	20	0.1%	0.1%	169	68,641	21,324	21,324	0.0%	0.0%
San Diego Harbor, CA	69	179	17	17	0.1%	0.1%	90	928,133	57,977	57,977	0.0%	0.0%
San Francisco Harbor, CA	63	221	58	58	0.2%	0.2%	77	1,427,173	1,060,611	1,060,611	0.2%	0.2%
San Juan Harbor, PR	14	3,035	50	50	0.2%	0.2%	46	4,571,109	1,387,377	1,387,377	0.2%	0.2%
Sandusky Harbor, OH	97	86	79	79	0.3%	0.3%	62	2,681,643	2,652,803	2,652,803	0.4%	0.4%
Sault Ste. Marie, MI	144	18	16	16	0.1%	0.1%	200	4,075	3,664	3,664	0.0%	0.0%
Savannah Harbor, GA	10	3,907	1,088	1,088	4.0%	3.9%	22	15,075,434	4,904,378	4,904,378	0.7%	0.7%
Searsport Harbor, ME	100	80	39	39	0.1%	0.1%	95	866,933	572,734	572,734	0.1%	0.1%
Seattle Harbor, WA	13	3,449	2,394	2,394	8.7%	8.7%	26	12,370,745	11,419,493	11,419,493	1.7%	1.7%
Seward Harbor, AK	120	45	15	15	0.1%	0.1%	121	430,306	398,721	398,721	0.1%	0.1%
Shelter Is & Shelter Is Sd LI, NY	205	2	0	0	0.0%	0.0%	198	8,442	0	0	0.0%	0.0%
Sitka Harbor, AK	179	9	5	5	0.0%	0.0%	201	3,744	1,962	1,962	0.0%	0.0%
Skagway Harbor, AK	131	33	31	31	0.1%	0.1%	116	524,255	520,452	520,452	0.1%	0.1%
Caribbean Islands	196	4	0	0	0.0%	0.0%	203	2,616	0	0	0.0%	0.0%
Caribbean Islands	66	218	16	16	0.1%	0.1%	155	119,556	17,146	17,146	0.0%	0.0%
Stephens Passage, AK	191	6	0	0	0.0%	0.0%	177	44,127	0	0	0.0%	0.0%
Stockton, CA	101	76	32	32	0.1%	0.1%	89	941,828	520,892	520,892	0.1%	0.1%

TABLE G-1

ANALYSIS OF PORT LEVEL CONSTRAINTS, YEAR 2000

Port Name/Location Name	Calls						Tons					
	Relative Rank	Number of Call	Constrained Calls with Projects	Constrained Calls without Projects	Percent of Total Constrained Calls with Projects	Percent of Total Constrained Calls without Projects	Relative Rank	Number of Tons	Constrained Tons with Projects	Constrained Tons without Projects	Percent of Total Constrained Calls with Projects	Percent of Total Constrained Calls without Projects
Stoneport, MI	126	37	37	37	0.1%	0.1%	101	765,585	765,585	765,585	0.1%	0.1%
Stony Point, NY	129	35	3	3	0.0%	0.0%	115	530,010	42,401	42,401	0.0%	0.0%
Suisun Bay Channel, CA	165	12	10	10	0.0%	0.0%	138	207,028	195,627	195,627	0.0%	0.0%
Tacoma Harbor, WA	17	1,774	752	752	2.7%	2.7%	29	11,122,913	5,315,792	5,315,792	0.8%	0.8%
Tampa Harbor, FL	23	1,116	50	50	0.2%	0.2%	27	12,255,960	1,467,546	1,467,546	0.2%	0.2%
Texas City, TX	25	1,048	683	683	2.5%	2.5%	6	38,879,446	36,711,956	36,711,956	5.5%	5.5%
Thompson Point NJ and Vicinity	207	2	0	0	0.0%	0.0%	191	16,701	0	0	0.0%	0.0%
Toledo Harbor, OH	59	241	181	181	0.7%	0.7%	43	4,791,662	4,597,606	4,597,606	0.7%	0.7%
Unalaska Bay and Island, AK	72	154	67	67	0.2%	0.2%	122	408,415	243,221	243,221	0.0%	0.0%
Valdez Harbor, AK	187	6	0	0	0.0%	0.0%	143	168,093	0	0	0.0%	0.0%
Whittier Harbor, AK	213	2	0	0	0.0%	0.0%	204	2,606	0	0	0.0%	0.0%
Wilmington Harbor, DE	33	674	58	58	0.2%	0.2%	60	3,037,771	1,076,125	1,076,125	0.2%	0.2%
Wrangell Harbor, AK	214	2	0	0	0.0%	0.0%	213	148	0	0	0.0%	0.0%
Yabucoa Harbor, PR	88	100	5	5	0.0%	0.0%	56	3,407,170	257,593	257,593	0.0%	0.0%
Yaquina Bay & Harbor, OR	186	7	7	7	0.0%	0.0%	187	24,781	24,781	24,781	0.0%	0.0%
York River, VA	112	59	50	50	0.2%	0.2%	59	3,116,323	3,080,650	3,080,650	0.5%	0.5%
TOTAL		114,493	27,516	27,554				1,132,622,971	668,532,712	669,085,265		

TABLE G-2

ANALYSIS OF PORT LEVE CONSTRAINTS, YEAR 2010

Port Name/Location Name	Calls						Tons					
	Relative Rank	Number of Call	Constrained Calls with Projects	Constrained Calls without Projects	Percent of Total Constrained Calls with Projects	Percent of Total Constrained Calls without Projects	Relative Rank	Number of Tons	Constrained Tons with Projects	Constrained Tons without Projects	Percent of Total Constrained Calls with Projects	Percent of Total Constrained Calls without Projects
Afognak Bay, AK	149	24	0	0	0.0%	0.0%	135	316,650	0	0	0.0%	0.0%
Akutan Island, AK	202	5	0	0	0.0%	0.0%	210	716	0	0	0.0%	0.0%
Albany, NY	207	3	3	3	0.0%	0.0%	215	21	21	21	0.0%	0.0%
Alexandria Bay, NY	157	18	17	17	0.0%	0.1%	212	401	373	373	0.0%	0.0%
Alpena Harbor, MI	148	24	24	24	0.1%	0.1%	149	203,427	203,427	203,427	0.0%	0.0%
Anacortes Harbor, WA	106	99	72	72	0.2%	0.3%	71	2,597,231	2,347,760	2,347,760	0.3%	0.2%
Anchorage, AK	86	152	7	61	0.1%	0.0%	87	1,398,626	30,449	884,605	0.0%	0.1%
Antioch, CA	189	8	4	4	0.0%	0.0%	152	195,925	98,549	98,549	0.0%	0.0%
Ashtabula Harbor, OH	71	229	197	197	0.5%	0.8%	48	6,584,564	6,451,517	6,451,517	0.9%	0.7%
Atchafalaya River Morgan City To Gulf	89	138	80	80	0.2%	0.3%	107	858,355	746,939	746,939	0.1%	0.1%
Baltimore Harbor and Channels, MD	11	5,893	97	97	0.2%	0.4%	15	40,086,666	6,781,802	6,781,802	1.0%	0.7%
Barataria Bay, LA	208	3	3	3	0.0%	0.0%	189	25,553	25,553	25,553	0.0%	0.0%
Barbers Point, HI	77	172	68	113	0.3%	0.3%	37	9,493,450	5,316,933	8,217,452	0.8%	0.8%
Bayou Dupre, LA	133	36	36	36	0.1%	0.2%	110	822,402	822,402	822,402	0.1%	0.1%
Bayou La Batre, AL	173	13	13	13	0.0%	0.1%	198	9,543	9,543	9,543	0.0%	0.0%
Bayou Lafourche, LA	154	19	9	19	0.0%	0.0%	182	45,739	43,896	45,739	0.0%	0.0%
Beaumont, TX	34	924	428	428	1.0%	1.8%	17	35,019,934	30,604,544	30,604,544	4.3%	3.1%
Bellingham Bay and Harbor, WA	88	139	102	102	0.2%	0.4%	86	1,539,934	1,443,226	1,443,226	0.2%	0.1%
Bridgeport Harbor, CT	97	118	34	34	0.1%	0.1%	102	958,813	505,158	505,158	0.1%	0.1%
Brownsville, TX	55	380	69	69	0.2%	0.3%	75	2,297,484	932,537	932,537	0.1%	0.1%
Brunswick Harbor, GA	44	607	215	347	0.8%	0.9%	69	2,952,972	1,995,797	2,613,478	0.3%	0.3%
Bucksport Harbor, ME	143	27	27	27	0.1%	0.1%	122	465,307	465,307	465,307	0.1%	0.0%
Burlington-Florence-Roebling, NJ	190	8	1	1	0.0%	0.0%	142	236,758	3,191	3,191	0.0%	0.0%
Burns Waterway Harbor, IN	81	164	151	151	0.3%	0.6%	64	3,888,744	3,845,635	3,845,635	0.5%	0.4%
Calcite, MI	122	56	56	56	0.1%	0.2%	95	1,177,461	1,177,461	1,177,461	0.2%	0.1%
Canaveral Harbor, FL	57	352	21	21	0.0%	0.1%	79	2,073,275	212,334	212,334	0.0%	0.0%
Cape Cod Canal, MA	179	12	12	12	0.0%	0.0%	153	181,050	181,050	181,050	0.0%	0.0%
Carquinez Strait, CA	47	525	44	44	0.1%	0.2%	39	9,091,426	1,709,874	1,709,874	0.2%	0.2%
Charleston Harbor, SC	5	8,538	582	2,706	6.2%	2.4%	25	19,405,299	2,822,338	10,052,574	0.4%	1.0%
Charlevoix Harbor, MI	201	5	5	5	0.0%	0.0%	196	14,779	14,779	14,779	0.0%	0.0%
Chester Area, PA	48	486	58	69	0.2%	0.2%	63	3,922,728	2,881,057	2,950,204	0.4%	0.3%

TABLE G-2

ANALYSIS OF PORT LEVE CONSTRAINTS, YEAR 2010

Port Name/Location Name	Calls						Tons					
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Caribbean Islands	95	122	25	25	0.1%	0.1%	164	109,548	32,768	32,768	0.0%	0.0%
Clarence Strait, AK	209	3	0	0	0.0%	0.0%	216	0	0	0	0.0%	0.0%
Cleveland Harbor, OH	63	322	286	286	0.7%	1.2%	49	6,307,459	6,168,055	6,168,055	0.9%	0.6%
Coeymans, NY	181	11	4	4	0.0%	0.0%	155	165,085	61,680	61,680	0.0%	0.0%
Conneaut Harbor, OH	94	126	103	103	0.2%	0.4%	65	3,795,850	3,699,553	3,699,553	0.5%	0.4%
Coos Bay, OR	54	394	292	292	0.7%	1.2%	58	4,272,625	3,698,064	3,698,064	0.5%	0.4%
Cordova Harbor, AK	203	4	4	4	0.0%	0.0%	193	20,169	20,169	20,169	0.0%	0.0%
Corpus Christi, TX	21	2,052	158	631	1.4%	0.7%	3	100,737,494	16,049,764	57,498,668	2.3%	5.8%
Del Rvr Betwn Phila Tren	84	156	156	156	0.4%	0.7%	99	1,040,104	1,040,104	1,040,104	0.1%	0.1%
Delaware River At Camden, NJ	30	1,175	42	61	0.1%	0.2%	56	5,003,900	855,883	1,117,619	0.1%	0.1%
Drummond Island, MI	183	10	10	10	0.0%	0.0%	156	162,683	162,683	162,683	0.0%	0.0%
Duluth-Superior Harbor, MN and WI	53	400	391	391	0.9%	1.6%	43	7,972,113	7,940,000	7,940,000	1.1%	0.8%
East Pearl River MS	65	304	304	304	0.7%	1.3%	148	205,734	205,734	205,734	0.0%	0.0%
Eastport Harbor, ME	116	69	11	11	0.0%	0.0%	120	481,757	93,866	93,866	0.0%	0.0%
El Segundo, CA	99	117	2	2	0.0%	0.0%	45	7,567,324	91,654	91,654	0.0%	0.0%
Erie Harbor, PA	135	36	34	34	0.1%	0.1%	118	556,212	549,931	549,931	0.1%	0.1%
Escanaba, MI	210	3	1	1	0.0%	0.0%	187	32,844	525	525	0.0%	0.0%
Everett Harbor, WA	110	87	68	68	0.2%	0.3%	90	1,330,457	1,289,878	1,289,878	0.2%	0.1%
Fairport Harbor, OH	159	17	17	17	0.0%	0.1%	129	387,098	387,098	387,098	0.1%	0.0%
Fajardo Harbor, PR	205	4	0	0	0.0%	0.0%	207	1,537	0	0	0.0%	0.0%
Fall River Harbor, MA	105	102	62	62	0.1%	0.3%	80	2,035,007	1,630,760	1,630,760	0.2%	0.2%
Fernandina Harbor, FL	42	629	60	60	0.1%	0.3%	91	1,275,516	375,308	375,308	0.1%	0.0%
Fort Pierce Harbor, FL	158	18	12	12	0.0%	0.1%	178	58,529	48,895	48,895	0.0%	0.0%
Caribbean Islands	194	6	3	3	0.0%	0.0%	214	195	138	138	0.0%	0.0%
Freeport Harbor, TX	32	1,094	300	300	0.7%	1.3%	18	34,447,555	22,452,234	22,452,234	3.2%	2.3%
Galveston Channel, TX	40	666	80	116	0.3%	0.3%	33	10,419,971	5,298,238	6,419,225	0.8%	0.6%
Gary Harbor, IN	192	7	6	6	0.0%	0.0%	186	38,654	38,061	38,061	0.0%	0.0%
Georgetown Harbor, SC	82	160	0	129	0.3%	0.0%	81	1,819,068	0	1,752,576	0.0%	0.2%
GIWW Mile 87	185	10	0	0	0.0%	0.0%	211	650	0	0	0.0%	0.0%
Gloucester Harbor, MA	111	86	40	40	0.1%	0.2%	181	49,291	23,975	23,975	0.0%	0.0%
Grays Harbor and Chehalis River, WA	74	184	184	184	0.4%	0.8%	73	2,364,475	2,364,475	2,364,475	0.3%	0.2%
Guanica Harbor, PR	163	16	4	4	0.0%	0.0%	176	61,826	16,322	16,322	0.0%	0.0%
Guayanilla Harbor, PR	96	122	90	90	0.2%	0.4%	52	5,597,441	5,053,899	5,053,899	0.7%	0.5%

TABLE G-2

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Port Name/Location Name	Calls						Tons					
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Gulfport Harbor, MS	38	789	71	71	0.2%	0.3%	66	3,614,176	788,720	788,720	0.1%	0.1%
Haines, AK	215	3	1	1	0.0%	0.0%	194	17,184	17,023	17,023	0.0%	0.0%
Hilo Harbor, HI	165	16	9	9	0.0%	0.0%	166	107,474	102,174	102,174	0.0%	0.0%
Holland Harbor, MI	197	6	6	6	0.0%	0.0%	177	59,191	59,191	59,191	0.0%	0.0%
Homer, AK	119	62	58	58	0.1%	0.2%	124	439,007	425,099	425,099	0.1%	0.0%
Honolulu Harbor, Oahu, HI	56	361	21	21	0.0%	0.1%	77	2,123,703	824,326	824,326	0.1%	0.1%
Hoonah Harbor, AK	146	25	25	25	0.1%	0.1%	137	307,754	307,754	307,754	0.0%	0.0%
Houma Navigation Canal LA	167	14	14	14	0.0%	0.1%	202	4,662	4,662	4,662	0.0%	0.0%
Houston, TX	1	15,924	920	2,737	6.3%	3.9%	1	143,459,078	52,551,501	94,816,526	7.5%	9.6%
Humboldt Harbor and Bay, CA	76	178	145	145	0.3%	0.6%	97	1,114,148	983,057	983,057	0.1%	0.1%
Huron Harbor, OH	187	10	10	10	0.0%	0.0%	191	21,356	21,356	21,356	0.0%	0.0%
Hydaburg, AK	142	27	0	0	0.0%	0.0%	139	269,000	0	0	0.0%	0.0%
Icy Bay, AK	145	25	0	0	0.0%	0.0%	159	132,852	0	0	0.0%	0.0%
Indiana Harbor, IN	117	69	69	69	0.2%	0.3%	84	1,632,256	1,632,256	1,632,256	0.2%	0.2%
Jacksonville Harbor, FL	15	3,350	225	394	0.9%	0.9%	38	9,180,152	2,868,490	4,199,464	0.4%	0.4%
Jobos Harbor, PR	66	303	113	113	0.3%	0.5%	78	2,118,702	1,845,808	1,845,808	0.3%	0.2%
Juneau Harbor, AK	151	20	-	-	0.0%	0.0%	144	234,113	0	0	0.0%	0.0%
Kahului Harbor, Maui, HI	168	14	8	8	0.0%	0.0%	169	85,443	57,684	57,684	0.0%	0.0%
Kake Harbor, AK	180	11	0	0	0.0%	0.0%	174	67,000	0	0	0.0%	0.0%
Kenai River, AK	118	65	3	3	0.0%	0.0%	93	1,258,019	4,792	4,792	0.0%	0.0%
Ketchikan Harbor, AK	100	113	104	104	0.2%	0.4%	140	264,420	252,012	252,012	0.0%	0.0%
Key West Harbor, FL	152	20	3	3	0.0%	0.0%	208	1,533	23	23	0.0%	0.0%
Klawock, AK	129	40	1	1	0.0%	0.0%	132	374,590	238	238	0.0%	0.0%
Kodiak Harbor, AK	156	18	14	14	0.0%	0.1%	197	13,608	8,412	8,412	0.0%	0.0%
Lake Charles, LA	29	1,189	585	585	1.3%	2.4%	10	51,289,381	46,166,720	46,166,720	6.6%	4.7%
Lake Huron	113	78	78	78	0.2%	0.3%	85	1,575,271	1,575,271	1,575,271	0.2%	0.2%
Lake Michigan	114	75	71	71	0.2%	0.3%	105	875,596	857,635	857,635	0.1%	0.1%
Long Beach Harbor, CA	4	10,551	0	43	0.1%	0.1%	8	57,543,022	0	890,987	0.0%	0.1%
Lorain Harbor, OH	175	12	12	12	0.0%	0.1%	143	234,795	234,795	234,795	0.0%	0.0%
Los Angeles Harbor, CA	6	8,511	0	0	0.0%	0.0%	11	47,280,910	0	0	0.0%	0.0%
Lower Delaware Bay DE	169	14	10	14	0.0%	0.0%	133	357,156	309,714	357,156	0.0%	0.0%
Ludington Harbor, MI	162	17	17	17	0.0%	0.1%	154	173,817	173,817	173,817	0.0%	0.0%
Manistee Harbor, MI	198	6	6	6	0.0%	0.0%	170	79,376	79,376	79,376	0.0%	0.0%
Marblehead, OH	200	5	5	5	0.0%	0.0%	183	44,159	44,159	44,159	0.0%	0.0%

TABLE G-2

ANALYSIS OF PORT LEVE CONSTRAINTS, YEAR 2010

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Marcus Hook, PA	83	158	101	111	0.3%	0.4%	34	10,156,299	9,341,093	9,542,511	1.3%	1.0%
Mare Island Strait, CA	125	53	9	9	0.0%	0.0%	112	783,567	65,037	65,037	0.0%	0.0%
Marysville, MI	150	24	24	24	0.1%	0.1%	127	421,763	421,763	421,763	0.1%	0.0%
Matagorda Ship Channel, TX	61	331	229	229	0.5%	1.0%	40	8,850,960	8,359,388	8,359,388	1.2%	0.8%
Mayaguez Harbor, PR	50	465	15	15	0.0%	0.1%	130	382,573	62,723	62,723	0.0%	0.0%
Menominee Harbor and River, MI and WI	131	38	21	21	0.0%	0.1%	147	205,745	143,652	143,652	0.0%	0.0%
Metlakatla Harbor, AK	171	13	13	13	0.0%	0.1%	171	76,114	76,114	76,114	0.0%	0.0%
Miami Harbor, FL	2	13,185	2,561	3,057	7.0%	10.7%	41	8,383,333	852,386	2,527,864	0.1%	0.3%
Milwaukee Harbor, WI	80	165	132	132	0.3%	0.6%	74	2,311,762	2,236,868	2,236,868	0.3%	0.2%
Mobile Harbor, AL	17	3,017	76	472	1.1%	0.3%	13	46,040,597	4,210,253	19,292,512	0.6%	1.9%
Morehead City Harbor, NC	60	339	32	32	0.1%	0.1%	55	5,049,341	1,489,402	1,489,402	0.2%	0.2%
Muskegon Harbor, MI	130	39	39	39	0.1%	0.2%	106	860,946	860,946	860,946	0.1%	0.1%
Naknek River, AK	193	6	6	6	0.0%	0.0%	192	20,262	20,262	20,262	0.0%	0.0%
Narragansett Bay, RI	128	42	18	18	0.0%	0.1%	145	218,909	200,070	200,070	0.0%	0.0%
Nawiliwili Harbor, Kauai, HI	211	3	2	2	0.0%	0.0%	203	3,559	940	940	0.0%	0.0%
New Bedford and Fairhaven Harbor, MA	161	17	8	8	0.0%	0.0%	184	41,982	33,166	33,166	0.0%	0.0%
New Castle Area, DE	92	127	70	104	0.2%	0.3%	51	5,653,805	4,239,573	5,376,338	0.6%	0.5%
New Haven Harbor, CT	69	250	112	112	0.3%	0.5%	72	2,384,750	1,739,953	1,739,953	0.2%	0.2%
New London Harbor, CT	178	12	4	4	0.0%	0.0%	179	56,807	94	94	0.0%	0.0%
Nikishka, AK	108	94	21	21	0.0%	0.1%	67	3,439,112	943,240	943,240	0.1%	0.1%
Nome, AK	216	1	0	0	0.0%	0.0%	209	1,088	0	0	0.0%	0.0%
Norfolk Harbor, VA	14	4,791	162	317	0.7%	0.7%	14	41,723,805	14,436,351	14,976,777	2.1%	1.5%
Northville, L.I., NY	136	35	1	1	0.0%	0.0%	109	834,904	1,722	1,722	0.0%	0.0%
Oakland Harbor, CA	9	6,395	6	3,984	9.1%	0.0%	30	14,207,948	7,283	10,978,593	0.0%	1.1%
Ogdensburg Harbor, NY	153	19	17	17	0.0%	0.1%	158	143,779	143,374	143,374	0.0%	0.0%
Olympia Harbor, WA	144	25	25	25	0.1%	0.1%	146	218,263	218,263	218,263	0.0%	0.0%
Ontonagon Harbor, MI	191	8	8	8	0.0%	0.0%	167	95,964	95,964	95,964	0.0%	0.0%
Oswego Harbor, NY	124	54	19	19	0.0%	0.1%	134	345,524	216,370	216,370	0.0%	0.0%
Other Puget Sound Area Ports, WA	90	135	1	1	0.0%	0.0%	70	2,677,133	2,408	2,408	0.0%	0.0%
Other San Francisco Bay Area Ports, CA	123	55	55	55	0.1%	0.2%	111	820,906	820,906	820,906	0.1%	0.1%
Palm Beach Harbor, FL	23	1,684	29	29	0.1%	0.1%	98	1,058,628	228,914	228,914	0.0%	0.0%
Panama City Harbor, FL	45	534	115	115	0.3%	0.5%	96	1,148,041	588,059	588,059	0.1%	0.1%

TABLE G-2

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Pascagoula Harbor, MS	37	824	438	453	1.0%	1.8%	19	27,010,861	25,481,373	25,574,157	3.6%	2.6%
Paulsboro, NJ	59	339	199	247	0.6%	0.8%	23	20,916,455	17,371,949	20,202,860	2.5%	2.0%
Pearl Harbor, Oahu, HI	170	13	0	0	0.0%	0.0%	151	201,460	0	0	0.0%	0.0%
Penobscot River, ME	174	13	13	13	0.0%	0.1%	188	32,117	32,117	32,117	0.0%	0.0%
Pensacola Harbor, FL	115	73	15	15	0.0%	0.1%	163	119,075	39,697	39,697	0.0%	0.0%
Philadelphia Harbor, PA	19	2,356	395	425	1.0%	1.7%	12	46,258,812	37,748,332	38,648,872	5.4%	3.9%
Piscataqua River, ME and NH	79	168	117	117	0.3%	0.5%	68	3,382,876	2,914,305	2,914,305	0.4%	0.3%
Pittsburg, CA	137	33	32	32	0.1%	0.1%	108	853,616	839,450	839,450	0.1%	0.1%
Ponce Harbor, PR	43	621	28	28	0.1%	0.1%	100	1,002,276	257,731	257,731	0.0%	0.0%
Port Angeles Harbor, WA	109	92	4	4	0.0%	0.0%	104	931,555	23,551	23,551	0.0%	0.0%
Port Arthur, TX	27	1,325	781	781	1.8%	3.3%	7	58,308,277	53,421,900	53,421,900	7.6%	5.4%
Port Dolomite, MI	199	5	5	5	0.0%	0.0%	161	119,226	119,226	119,226	0.0%	0.0%
Port Everglades Harbor, FL	7	8,004	134	134	0.3%	0.6%	31	10,801,578	1,464,561	1,464,561	0.2%	0.1%
Port in Caribbean	51	440	143	143	0.3%	0.6%	16	37,985,904	23,106,482	23,106,482	3.3%	2.3%
Port Hueneme, CA	62	324	52	52	0.1%	0.2%	94	1,190,102	336,382	336,382	0.0%	0.0%
Port Huron, MI	73	194	58	58	0.1%	0.2%	175	64,749	25,047	25,047	0.0%	0.0%
Port Inland, MI	155	18	18	18	0.0%	0.1%	131	382,006	382,006	382,006	0.1%	0.0%
Port Jefferson Harbor, NY	182	11	11	11	0.0%	0.0%	123	461,936	461,936	461,936	0.1%	0.0%
Port Manatee, FL	91	133	8	8	0.0%	0.0%	116	607,057	18,710	18,710	0.0%	0.0%
Port Of Albany, NY	101	113	80	80	0.2%	0.3%	82	1,715,076	1,608,166	1,608,166	0.2%	0.2%
Port Of Astoria, OR	160	17	3	6	0.0%	0.0%	162	119,187	28,388	30,554	0.0%	0.0%
Port Of Baton Rouge, LA	20	2,249	63	401	0.9%	0.3%	9	56,612,944	3,586,872	23,080,775	0.5%	2.3%
Port Of Boston, MA	28	1,269	145	447	1.0%	0.6%	35	9,956,697	2,450,132	5,577,424	0.3%	0.6%
Port Of Buffalo, NY	85	155	90	90	0.2%	0.4%	101	1,001,056	780,103	780,103	0.1%	0.1%
Port Of Chicago, IL	35	883	707	707	1.6%	3.0%	44	7,885,817	7,603,413	7,603,413	1.1%	0.8%
Port Of Detroit, MI	36	849	696	696	1.6%	2.9%	36	9,860,439	9,682,204	9,682,204	1.4%	1.0%
Port Of Hopewell, VA	103	110	60	60	0.1%	0.3%	119	536,450	404,763	404,763	0.1%	0.0%
Port Of Kalama, WA	98	118	34	39	0.1%	0.1%	60	4,218,192	1,924,223	2,093,165	0.3%	0.2%
Port Of Longview, WA	64	321	12	30	0.1%	0.1%	53	5,548,071	184,883	544,184	0.0%	0.1%
Port Of New Orleans, LA	8	7,159	326	726	1.7%	1.4%	5	74,237,031	5,137,155	27,878,657	0.7%	2.8%
Port Of New York/New Jersey	3	12,756	1,220	3,403	7.8%	5.1%	4	83,163,212	28,517,917	46,889,424	4.1%	4.7%
Port Of Newport News, VA	31	1,139	88	107	0.2%	0.4%	28	14,887,647	6,774,370	7,614,246	1.0%	0.8%
Port Of Plaquemine, LA	39	757	134	376	0.9%	0.6%	20	26,102,400	7,801,960	20,680,259	1.1%	2.1%
Port Of Portland, OR	22	2,007	500	500	1.1%	2.1%	24	19,471,773	8,005,225	8,005,225	1.1%	0.8%

TABLE G-2

ANALYSIS OF PORT LEVE CONSTRAINTS, YEAR 2010

Port Name/Location Name	Calls						Tons					
	Relative Rank	Number of Call	Constrained Calls with Projects	Constrained Calls without Projects	Percent of Total Constrained Calls with Projects	Percent of Total Constrained Calls without Projects	Relative Rank	Number of Tons	Constrained Tons with Projects	Constrained Tons without Projects	Percent of Total Constrained Calls with Projects	Percent of Total Constrained Calls without Projects
Port Of Richmond, VA	52	430	346	346	0.8%	1.5%	113	731,530	614,792	614,792	0.1%	0.1%
Port Of South Louisiana, LA	16	3,134	159	933	2.1%	0.7%	2	111,688,892	9,615,352	58,156,721	1.4%	5.9%
Port Of Vancouver, WA	46	525	99	99	0.2%	0.4%	50	5,853,793	1,690,347	1,690,347	0.2%	0.2%
Port Of Wilmington, NC	26	1,385	241	436	1.0%	1.0%	42	8,288,644	1,673,517	3,999,804	0.2%	0.4%
Port Royal Harbor, SC	177	12	6	6	0.0%	0.0%	172	72,713	52,141	52,141	0.0%	0.0%
Port Townsend Harbor, WA	195	6	4	4	0.0%	0.0%	205	2,451	1,776	1,776	0.0%	0.0%
Portland Harbor, ME	49	479	330	330	0.8%	1.4%	21	23,509,891	23,328,999	23,328,999	3.3%	2.4%
Potomac River At Alexandria, VA	140	30	9	9	0.0%	0.0%	180	52,141	19,703	19,703	0.0%	0.0%
Potomac River At Lower Cedar Point, MD	212	3	3	3	0.0%	0.0%	199	9,541	9,541	9,541	0.0%	0.0%
Presque Isle Harbor, MI	139	30	30	30	0.1%	0.1%	114	656,190	656,190	656,190	0.1%	0.1%
Prince Wales Is. West Side, AK	121	56	0	0	0.0%	0.0%	125	436,882	0	0	0.0%	0.0%
Prince William Sound, AK	147	25	0	0	0.0%	0.0%	150	201,522	0	0	0.0%	0.0%
Providence River And Harbor, RI	75	183	54	54	0.1%	0.2%	59	4,263,628	2,000,900	2,000,900	0.3%	0.2%
Redwood City Harbor, CA	172	13	13	13	0.0%	0.1%	136	314,425	314,425	314,425	0.0%	0.0%
Revillagigedo Channel	164	16	0	0	0.0%	0.0%	165	109,199	0	0	0.0%	0.0%
Richmond Harbor, CA	41	658	9	92	0.2%	0.0%	32	10,655,833	238,444	4,309,889	0.0%	0.4%
Rochester (Charlotte) Harbor, NY	120	57	39	39	0.1%	0.2%	168	86,891	22,966	22,966	0.0%	0.0%
Sacramento, CA	107	98	62	62	0.1%	0.3%	89	1,358,357	970,909	970,909	0.1%	0.1%
Salem Harbor, MA	127	43	40	40	0.1%	0.2%	83	1,638,341	1,637,988	1,637,988	0.2%	0.2%
Salem River, NJ	72	220	59	59	0.1%	0.2%	160	128,863	49,744	49,744	0.0%	0.0%
San Diego Harbor, CA	70	233	27	27	0.1%	0.1%	88	1,377,588	99,119	99,119	0.0%	0.0%
San Francisco Harbor, CA	67	295	87	87	0.2%	0.4%	76	2,182,459	1,752,587	1,752,587	0.2%	0.2%
San Juan Harbor, PR	13	4,894	62	62	0.1%	0.3%	47	6,703,063	1,649,660	1,649,660	0.2%	0.2%
Sandusky Harbor, OH	93	127	118	118	0.3%	0.5%	61	4,174,578	4,138,507	4,138,507	0.6%	0.4%
Sault Ste. Marie, MI	141	29	25	25	0.1%	0.1%	200	8,100	7,343	7,343	0.0%	0.0%
Savannah Harbor, GA	10	6,142	2	2,019	4.6%	0.0%	22	22,203,825	11,412	8,480,589	0.0%	0.9%
Searsport Harbor, ME	104	104	47	47	0.1%	0.2%	103	937,320	638,094	638,094	0.1%	0.1%
Seattle Harbor, WA	12	5,033	1,604	3,665	8.4%	6.7%	26	17,963,068	10,879,701	16,709,075	1.5%	1.7%
Seward Harbor, AK	126	47	17	17	0.0%	0.1%	128	416,218	384,194	384,194	0.1%	0.0%
Shelter Is & Shelter Is Sd LI, NY	204	4	0	0	0.0%	0.0%	195	16,543	0	0	0.0%	0.0%
Sitka Harbor, AK	176	12	6	6	0.0%	0.0%	201	4,925	1,812	1,812	0.0%	0.0%
Skagway Harbor, AK	138	33	31	31	0.1%	0.1%	126	422,856	419,429	419,429	0.1%	0.0%
Caribbean Islands	196	6	0	0	0.0%	0.0%	206	1,797	0	0	0.0%	0.0%
Caribbean Islands	68	265	22	22	0.1%	0.1%	157	155,355	23,430	23,430	0.0%	0.0%

TABLE G-2

ANALYSIS OF PORT LEVE CONSTRAINTS, YEAR 2010

Port Name/Location Name	Calls						Tons					
	Relative Rank	Number of Call	Constrained Calls with Projects	Constrained Calls without Projects	Percent of Total Constrained Calls with Projects	Percent of Total Constrained Calls without Projects	Relative Rank	Number of Tons	Constrained Tons with Projects	Constrained Tons without Projects	Percent of Total Constrained Calls with Projects	Percent of Total Constrained Calls without Projects
Stephens Passage, AK	188	9	0	0	0.0%	0.0%	173	70,375	0	0	0.0%	0.0%
Stockton, CA	102	111	48	48	0.1%	0.2%	92	1,258,428	747,226	747,226	0.1%	0.1%
Stoneport, MI	134	36	36	36	0.1%	0.2%	115	625,558	625,558	625,558	0.1%	0.1%
Stony Point, NY	132	38	9	9	0.0%	0.0%	117	588,729	155,424	155,424	0.0%	0.0%
Suisun Bay Channel, CA	166	16	13	13	0.0%	0.1%	138	296,598	275,360	275,360	0.0%	0.0%
Tacoma Harbor, WA	18	2,528	278	1,200	2.7%	1.2%	27	14,953,982	3,336,924	8,170,926	0.5%	0.8%
Tampa Harbor, FL	25	1,479	59	59	0.1%	0.2%	29	14,701,230	1,869,363	1,869,363	0.3%	0.2%
Texas City, TX	24	1,582	1,043	1,043	2.4%	4.4%	6	59,889,920	56,733,357	56,733,357	8.1%	5.7%
Thompson Point NJ and Vicinity	206	3	0	0	0.0%	0.0%	190	24,114	0	0	0.0%	0.0%
Toledo Harbor, OH	58	340	266	266	0.6%	1.1%	46	7,211,845	6,971,372	6,971,372	1.0%	0.7%
Unalaska Bay and Island, AK	78	169	88	88	0.2%	0.4%	121	481,675	329,835	329,835	0.0%	0.0%
Valdez Harbor, AK	184	10	0	0	0.0%	0.0%	141	257,916	0	0	0.0%	0.0%
Whittier Harbor, AK	213	3	0	0	0.0%	0.0%	204	2,497	0	0	0.0%	0.0%
Wilmington Harbor, DE	33	1,068	74	74	0.2%	0.3%	57	4,284,209	1,371,779	1,371,779	0.2%	0.1%
Wrangell Harbor, AK	214	3	0	0	0.0%	0.0%	213	270	0	0	0.0%	0.0%
Yabucoa Harbor, PR	87	145	9	9	0.0%	0.0%	54	5,179,785	531,185	531,185	0.1%	0.1%
Yaquina Bay & Harbor, OR	186	10	10	10	0.0%	0.0%	185	39,522	39,522	39,522	0.0%	0.0%
York River, VA	112	81	65	65	0.1%	0.3%	62	4,165,228	4,103,026	4,103,026	0.6%	0.4%
TOTAL		178,870	23,878	43,665				1,695,759,705	704,103,253	990,381,796		

TABLE G-3

ANALYSIS OF PORT LEVEL CONSTRAINTS, YEAR 2020

Port Name/Location Name	Calls						Tons					
	Relative Rank	Number of Call	Constrained Calls with Projects	Constrained Calls without Projects	Percent of Total Constrained Calls with Projects	Percent of Total Constrained Calls without Projects	Relative Rank	Number of Tons	Constrained Tons with Projects	Constrained Tons without Projects	Percent of Total Constrained Calls with Projects	Percent of Total Constrained Calls without Projects
Afognak Bay, AK	146	28	0	0	0.0%	0.0%	135	393,671	0	0	0.0%	0.0%
Akutan Island, AK	198	7	0	0	0.0%	0.0%	208	1,293	0	0	0.0%	0.0%
Albany, NY	209	4	4	4	0.0%	0.0%	215	11	11	11	0.0%	0.0%
Alexandria Bay, NY	154	23	22	22	0.1%	0.0%	212	566	534	534	0.0%	0.0%
Alpena Harbor, MI	160	21	21	21	0.1%	0.0%	154	185,804	185,804	185,804	0.0%	0.0%
Anacortes Harbor, WA	104	137	108	108	0.3%	0.2%	71	3,770,701	3,512,445	3,512,445	0.4%	0.3%
Anchorage, AK	85	192	11	91	0.0%	0.1%	88	2,097,056	93,296	1,491,663	0.0%	0.1%
Antioch, CA	195	8	4	4	0.0%	0.0%	163	139,327	67,296	67,296	0.0%	0.0%
Ashtabula Harbor, OH	72	292	262	262	0.8%	0.4%	48	8,800,405	8,672,965	8,672,965	1.0%	0.6%
Atchafalaya River Morgan City To Gulf	83	206	134	134	0.4%	0.2%	104	1,165,709	1,053,012	1,053,012	0.1%	0.1%
Baltimore Harbor and Channels, MD	11	8,607	92	92	0.3%	0.1%	15	53,863,363	6,156,460	6,156,460	0.7%	0.4%
Barataria Bay, LA	208	4	4	4	0.0%	0.0%	186	36,054	36,054	36,054	0.0%	0.0%
Barbers Point, HI	77	219	98	150	0.3%	0.2%	41	12,491,333	7,558,684	10,932,865	0.8%	0.8%
Bayou Dupre, LA	125	53	53	53	0.2%	0.1%	102	1,231,416	1,231,416	1,231,416	0.1%	0.1%
Bayou La Batre, AL	163	20	20	20	0.1%	0.0%	198	16,148	16,148	16,148	0.0%	0.0%
Bayou Lafourche, LA	148	28	14	28	0.0%	0.0%	178	68,177	65,631	68,177	0.0%	0.0%
Beaumont, TX	35	1,281	624	624	1.9%	1.0%	16	49,342,181	43,360,144	43,360,144	4.8%	3.1%
Bellingham Bay and Harbor, WA	86	188	144	144	0.4%	0.2%	87	2,154,607	2,039,010	2,039,010	0.2%	0.1%
Bridgeport Harbor, CT	96	155	55	55	0.2%	0.1%	101	1,266,216	759,143	759,143	0.1%	0.1%
Brownsville, TX	52	597	135	135	0.4%	0.2%	72	3,556,793	1,605,016	1,605,016	0.2%	0.1%
Brunswick Harbor, GA	42	940	403	629	1.2%	1.0%	68	4,336,261	3,123,505	3,940,072	0.3%	0.3%
Bucksport Harbor, ME	138	33	33	33	0.1%	0.1%	124	500,155	500,155	500,155	0.1%	0.0%
Burlington-Florence-Roebling, NJ	196	7	2	2	0.0%	0.0%	158	167,164	9,321	9,321	0.0%	0.0%
Burns Waterway Harbor, IN	76	230	217	217	0.7%	0.3%	57	5,780,688	5,738,772	5,738,772	0.6%	0.4%
Calcite, MI	126	50	50	50	0.2%	0.1%	113	868,365	868,365	868,365	0.1%	0.1%
Canaveral Harbor, FL	65	409	27	27	0.1%	0.0%	84	2,430,162	283,212	283,212	0.0%	0.0%
Cape Cod Canal, MA	175	16	16	16	0.0%	0.0%	149	249,520	249,520	249,520	0.0%	0.0%
Carquinez Strait, CA	46	783	80	80	0.2%	0.1%	34	14,511,203	3,447,679	3,447,679	0.4%	0.2%
Charleston Harbor, SC	5	13,219	1,207	4,512	3.6%	6.9%	23	31,606,704	5,735,244	17,177,232	0.6%	1.2%
Charlevoix Harbor, MI	205	5	5	5	0.0%	0.0%	199	11,135	11,135	11,135	0.0%	0.0%
Chester Area, PA	51	682	107	125	0.3%	0.2%	58	5,775,801	4,336,597	4,447,913	0.5%	0.3%

TABLE G-3

ANALYSIS OF PORT LEVEL CONSTRAINTS, YEAR 2020

Port Name/Location Name	Calls						Tons					
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Caribbean Islands	106	122	35	35	0.1%	0.1%	161	150,298	64,411	64,411	0.0%	0.0%
Clarence Strait, AK	210	4	0	0	0.0%	0.0%	216	0	0	0	0.0%	0.0%
Cleveland Harbor, OH	59	426	385	385	1.2%	0.6%	49	8,717,228	8,555,481	8,555,481	0.9%	0.6%
Coeymans, NY	190	9	5	5	0.0%	0.0%	165	127,485	67,844	67,844	0.0%	0.0%
Conneaut Harbor, OH	103	143	124	124	0.4%	0.2%	66	4,617,364	4,534,421	4,534,421	0.5%	0.3%
Coos Bay, OR	56	459	350	350	1.1%	0.5%	65	4,882,090	4,330,026	4,330,026	0.5%	0.3%
Cordova Harbor, AK	201	6	6	6	0.0%	0.0%	188	33,437	33,437	33,437	0.0%	0.0%
Corpus Christi, TX	22	2,823	256	901	0.8%	1.4%	3	150,389,452	27,634,697	84,438,640	3.1%	6.1%
Del Rvr Betwn Phila Tren	75	233	233	233	0.7%	0.4%	97	1,448,196	1,448,196	1,448,196	0.2%	0.1%
Delaware River At Camden, NJ	28	1,841	60	95	0.2%	0.1%	53	7,127,048	1,076,931	1,594,998	0.1%	0.1%
Drummond Island, MI	186	10	10	10	0.0%	0.0%	166	112,624	112,624	112,624	0.0%	0.0%
Duluth-Superior Harbor, MN and WI	58	430	423	423	1.3%	0.6%	47	8,884,686	8,860,691	8,860,691	1.0%	0.6%
East Pearl River MS	63	412	412	412	1.2%	0.6%	140	317,507	317,507	317,507	0.0%	0.0%
Eastport Harbor, ME	110	111	25	25	0.1%	0.0%	115	831,046	253,448	253,448	0.0%	0.0%
El Segundo, CA	92	173	7	7	0.0%	0.0%	44	10,687,746	519,205	519,205	0.1%	0.0%
Erie Harbor, PA	135	38	35	35	0.1%	0.1%	119	589,918	582,258	582,258	0.1%	0.0%
Escanaba, MI	211	4	2	2	0.0%	0.0%	194	21,127	1,386	1,386	0.0%	0.0%
Everett Harbor, WA	115	104	83	83	0.2%	0.1%	91	1,711,301	1,668,459	1,668,459	0.2%	0.1%
Fairport Harbor, OH	161	20	20	20	0.1%	0.0%	127	464,786	464,786	464,786	0.1%	0.0%
Fajardo Harbor, PR	197	7	0	0	0.0%	0.0%	205	2,878	0	0	0.0%	0.0%
Fall River Harbor, MA	95	157	100	100	0.3%	0.2%	74	3,320,114	2,795,059	2,795,059	0.3%	0.2%
Fernandina Harbor, FL	39	1,080	136	136	0.4%	0.2%	83	2,600,932	938,026	938,026	0.1%	0.1%
Fort Pierce Harbor, FL	168	19	15	15	0.0%	0.0%	184	41,785	35,851	35,851	0.0%	0.0%
Caribbean Islands	192	8	4	4	0.0%	0.0%	214	288	224	224	0.0%	0.0%
Freeport Harbor, TX	31	1,623	392	392	1.2%	0.6%	18	47,898,023	29,570,044	29,570,044	3.3%	2.1%
Galveston Channel, TX	43	938	110	162	0.3%	0.2%	36	14,195,028	7,105,906	9,096,232	0.8%	0.7%
Gary Harbor, IN	188	9	8	8	0.0%	0.0%	181	54,931	54,261	54,261	0.0%	0.0%
Georgetown Harbor, SC	74	251	0	205	0.0%	0.3%	80	2,683,033	0	2,583,415	0.0%	0.2%
GIWW Mile 87	182	13	0	0	0.0%	0.0%	210	1,030	0	0	0.0%	0.0%
Gloucester Harbor, MA	108	119	64	64	0.2%	0.1%	175	75,939	44,885	44,885	0.0%	0.0%
Grays Harbor and Chehalis River, WA	79	212	212	212	0.6%	0.3%	79	2,825,174	2,825,174	2,825,174	0.3%	0.2%
Guanica Harbor, PR	170	19	6	6	0.0%	0.0%	174	77,322	31,795	31,795	0.0%	0.0%
Guayanilla Harbor, PR	93	163	115	115	0.3%	0.2%	51	7,415,600	6,572,533	6,572,533	0.7%	0.5%

TABLE G-3

ANALYSIS OF PORT LEVEL CONSTRAINTS, YEAR 2020

Port Name/Location Name	Calls						Tons					
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Gulfport Harbor, MS	38	1,132	111	111	0.3%	0.2%	62	5,239,364	1,361,004	1,361,004	0.2%	0.1%
Haines, AK	215	3	1	1	0.0%	0.0%	197	16,265	16,108	16,108	0.0%	0.0%
Hilo Harbor, HI	153	24	15	15	0.0%	0.0%	155	181,218	173,792	173,792	0.0%	0.0%
Holland Harbor, MI	199	6	6	6	0.0%	0.0%	180	62,350	62,350	62,350	0.0%	0.0%
Homer, AK	120	67	64	64	0.2%	0.1%	126	477,380	465,348	465,348	0.1%	0.0%
Honolulu Harbor, Oahu, HI	54	488	34	34	0.1%	0.1%	77	2,943,285	1,144,918	1,144,918	0.1%	0.1%
Hoonah Harbor, AK	140	32	32	32	0.1%	0.0%	131	416,236	416,236	416,236	0.0%	0.0%
Houma Navigation Canal LA	164	20	20	20	0.1%	0.0%	200	8,684	8,684	8,684	0.0%	0.0%
Houston, TX	1	23,999	1,226	4,301	3.7%	6.6%	1	207,876,436	65,161,136	136,699,633	7.2%	9.9%
Humboldt Harbor and Bay, CA	73	267	228	228	0.7%	0.4%	93	1,678,268	1,526,476	1,526,476	0.2%	0.1%
Huron Harbor, OH	184	13	13	13	0.0%	0.0%	192	26,491	26,491	26,491	0.0%	0.0%
Hydaburg, AK	144	30	0	0	0.0%	0.0%	138	318,698	0	0	0.0%	0.0%
Icy Bay, AK	141	32	1	1	0.0%	0.0%	156	179,748	70	70	0.0%	0.0%
Indiana Harbor, IN	111	111	111	111	0.3%	0.2%	78	2,833,073	2,833,073	2,833,073	0.3%	0.2%
Jacksonville Harbor, FL	15	4,996	397	760	1.2%	1.2%	43	11,720,803	3,677,252	5,376,302	0.4%	0.4%
Jobos Harbor, PR	64	412	172	172	0.5%	0.3%	76	3,095,244	2,750,851	2,750,851	0.3%	0.2%
Juneau Harbor, AK	155	23	0	0	0.0%	0.0%	145	283,747	0	0	0.0%	0.0%
Kahului Harbor, Maui, HI	157	22	14	14	0.0%	0.0%	162	142,134	106,156	106,156	0.0%	0.0%
Kake Harbor, AK	180	14	0	0	0.0%	0.0%	170	88,036	0	0	0.0%	0.0%
Kenai River, AK	119	76	6	6	0.0%	0.0%	96	1,553,470	20,804	20,804	0.0%	0.0%
Ketchikan Harbor, AK	98	149	137	137	0.4%	0.2%	132	404,708	389,808	389,808	0.0%	0.0%
Key West Harbor, FL	149	28	4	4	0.0%	0.0%	206	2,397	61	61	0.0%	0.0%
Klawock, AK	129	47	2	2	0.0%	0.0%	128	454,252	2,990	2,990	0.0%	0.0%
Kodiak Harbor, AK	156	22	17	17	0.1%	0.0%	196	16,617	10,471	10,471	0.0%	0.0%
Lake Charles, LA	29	1,708	834	834	2.5%	1.3%	10	73,236,644	66,271,680	66,271,680	7.3%	4.8%
Lake Huron	118	81	81	81	0.2%	0.1%	95	1,563,630	1,563,630	1,563,630	0.2%	0.1%
Lake Michigan	116	91	88	88	0.3%	0.1%	111	940,257	925,121	925,121	0.1%	0.1%
Long Beach Harbor, CA	4	16,302	0	59	0.0%	0.1%	6	88,725,279	0	1,201,891	0.0%	0.1%
Lorain Harbor, OH	165	20	20	20	0.1%	0.0%	134	395,217	395,217	395,217	0.0%	0.0%
Los Angeles Harbor, CA	6	12,746	0	0	0.0%	0.0%	11	72,577,880	0	0	0.0%	0.0%
Lower Delaware Bay Del	158	22	18	22	0.1%	0.0%	122	513,802	474,271	513,802	0.1%	0.0%
Ludington Harbor, MI	173	17	17	17	0.1%	0.0%	157	177,933	177,933	177,933	0.0%	0.0%
Manistee Harbor, MI	200	6	6	6	0.0%	0.0%	172	83,613	83,613	83,613	0.0%	0.0%
Marblehead, OH	203	6	6	6	0.0%	0.0%	190	32,939	32,939	32,939	0.0%	0.0%

TABLE G-3

ANALYSIS OF PORT LEVEL CONSTRAINTS, YEAR 2020

Port Name/Location Name	Calls						Tons					
	Relative Rank	Number of Call	Constrained Calls with Projects	Constrained Calls without Projects	Percent of Total Constrained Calls with Projects	Percent of Total Constrained Calls without Projects	Relative Rank	Number of Tons	Constrained Tons with Projects	Constrained Tons without Projects	Percent of Total Constrained Calls with Projects	Percent of Total Constrained Calls without Projects
Marcus Hook, PA	78	216	149	161	0.4%	0.2%	33	14,768,823	13,788,010	14,039,742	1.5%	1.0%
Mare Island Strait, CA	117	82	13	13	0.0%	0.0%	99	1,350,036	95,811	95,811	0.0%	0.0%
Marysville, MI	151	25	25	25	0.1%	0.0%	129	430,405	430,405	430,405	0.0%	0.0%
Matagorda Ship Channel, TX	55	482	336	336	1.0%	0.5%	38	13,448,270	12,766,146	12,766,146	1.4%	0.9%
Mayaguez Harbor, PR	49	731	39	39	0.1%	0.1%	117	628,615	166,070	166,070	0.0%	0.0%
Menominee Harbor and River, MI and WI	128	49	28	28	0.1%	0.0%	144	284,601	208,876	208,876	0.0%	0.0%
Metlakatla Harbor, AK	177	15	15	15	0.0%	0.0%	171	84,908	84,908	84,908	0.0%	0.0%
Miami Harbor, FL	2	19,713	3,799	4,619	11.4%	7.1%	39	13,336,469	1,446,042	4,132,494	0.2%	0.3%
Milwaukee Harbor, WI	87	185	148	148	0.4%	0.2%	82	2,609,570	2,523,010	2,523,010	0.3%	0.2%
Mobile Harbor, AL	16	4,973	93	693	0.3%	1.1%	12	68,754,464	5,115,319	27,924,674	0.6%	2.0%
Morehead City Harbor, NC	57	456	48	48	0.1%	0.1%	54	6,729,632	1,889,359	1,889,359	0.2%	0.1%
Muskegon Harbor, MI	134	40	40	40	0.1%	0.1%	112	878,002	878,002	878,002	0.1%	0.1%
Naknek River, AK	191	8	8	8	0.0%	0.0%	193	22,334	22,334	22,334	0.0%	0.0%
Narragansett Bay, RI	127	50	25	25	0.1%	0.0%	146	275,396	255,454	255,454	0.0%	0.0%
Nawiliwili Harbor, Kauai, HI	212	4	3	3	0.0%	0.0%	203	3,501	1,439	1,439	0.0%	0.0%
New Bedford and Fairhaven Harbor, MA	162	20	12	12	0.0%	0.0%	189	33,128	24,353	24,353	0.0%	0.0%
New Castle Area, DE	100	146	73	114	0.2%	0.2%	56	6,365,584	4,431,667	5,960,861	0.5%	0.4%
New Haven Harbor, CT	69	338	156	156	0.5%	0.2%	73	3,378,250	2,475,512	2,475,512	0.3%	0.2%
New London Harbor, CT	181	14	7	7	0.0%	0.0%	185	38,667	304	304	0.0%	0.0%
Nikishka, AK	97	150	54	54	0.2%	0.1%	59	5,684,886	2,367,841	2,367,841	0.3%	0.2%
Nome, AK	216	1	0	0	0.0%	0.0%	209	1,241	0	0	0.0%	0.0%
Norfolk Harbor, VA	14	6,332	154	414	0.5%	0.6%	17	48,766,550	13,157,785	14,178,174	1.5%	1.0%
Northville, L.I., NY	133	42	2	2	0.0%	0.0%	107	1,023,757	8,762	8,762	0.0%	0.0%
Oakland Harbor, CA	9	9,401	9	6,236	0.0%	9.6%	27	21,860,458	14,483	17,741,463	0.0%	1.3%
Ogdensburg Harbor, NY	152	24	21	21	0.1%	0.0%	160	151,740	151,109	151,109	0.0%	0.0%
Olympia Harbor, WA	150	28	28	28	0.1%	0.0%	150	244,694	244,694	244,694	0.0%	0.0%
Ontonagon Harbor, MI	189	9	9	9	0.0%	0.0%	168	103,937	103,937	103,937	0.0%	0.0%
Oswego Harbor, NY	132	42	24	24	0.1%	0.0%	143	291,486	222,457	222,457	0.0%	0.0%
Other Puget Sound Area Ports, WA	88	184	2	2	0.0%	0.0%	69	4,111,024	11,926	11,926	0.0%	0.0%
Other San Francisco Bay Area Ports, CA	121	66	66	66	0.2%	0.1%	109	992,281	992,281	992,281	0.1%	0.1%
Palm Beach Harbor, FL	23	2,317	67	67	0.2%	0.1%	98	1,440,622	299,847	299,847	0.0%	0.0%
Panama City Harbor, FL	40	1,013	221	221	0.7%	0.3%	89	1,932,495	945,483	945,483	0.1%	0.1%

TABLE G-3

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Port Name/Location Name	Calls						Tons					
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Pascagoula Harbor, MS	37	1,166	574	594	1.7%	0.9%	19	34,758,279	32,668,152	32,803,185	3.6%	2.4%
Paulsboro, NJ	62	412	236	300	0.7%	0.5%	25	25,829,023	21,294,263	24,854,646	2.4%	1.8%
Pearl Harbor, Oahu, HI	171	18	0	0	0.0%	0.0%	148	268,385	0	0	0.0%	0.0%
Penobscot River, ME	172	17	17	17	0.1%	0.0%	182	46,140	46,140	46,140	0.0%	0.0%
Pensacola Harbor, FL	113	109	25	25	0.1%	0.0%	152	193,751	75,258	75,258	0.0%	0.0%
Philadelphia Harbor, PA	18	3,347	585	655	1.8%	1.0%	13	67,164,594	55,440,641	57,288,435	6.1%	4.1%
Piscataqua River, ME and NH	80	212	137	137	0.4%	0.2%	70	3,916,960	3,331,219	3,331,219	0.4%	0.2%
Pittsburg, CA	143	31	30	30	0.1%	0.0%	116	659,735	642,393	642,393	0.1%	0.0%
Ponce Harbor, PR	45	856	42	42	0.1%	0.1%	100	1,318,635	320,592	320,592	0.0%	0.0%
Port Angeles Harbor, WA	112	110	7	7	0.0%	0.0%	105	1,134,777	62,140	62,140	0.0%	0.0%
Port Arthur, TX	27	1,860	1,078	1,078	3.2%	1.7%	9	80,962,572	73,818,133	73,818,133	8.2%	5.3%
Port Dolomite, MI	204	5	5	5	0.0%	0.0%	169	99,247	99,247	99,247	0.0%	0.0%
Port Everglades Harbor, FL	7	11,951	217	217	0.7%	0.3%	31	15,454,019	2,520,843	2,520,843	0.3%	0.2%
Port in Caribbean	48	736	225	225	0.7%	0.3%	14	62,587,983	37,445,930	37,445,930	4.1%	2.7%
Port Hueneme, CA	61	420	113	113	0.3%	0.2%	90	1,751,087	757,352	757,352	0.1%	0.1%
Port Huron, MI	84	192	76	76	0.2%	0.1%	177	69,723	36,159	36,159	0.0%	0.0%
Port Inland, MI	174	17	17	17	0.1%	0.0%	139	318,369	318,369	318,369	0.0%	0.0%
Port Jefferson Harbor, NY	169	19	19	19	0.1%	0.0%	110	966,481	966,481	966,481	0.1%	0.1%
Port Manatee, FL	89	183	12	12	0.0%	0.0%	114	841,825	27,745	27,745	0.0%	0.0%
Port Of Albany, NY	102	145	98	98	0.3%	0.2%	86	2,157,477	2,015,559	2,015,559	0.2%	0.1%
Port Of Astoria, OR	159	21	6	9	0.0%	0.0%	164	131,022	19,301	25,031	0.0%	0.0%
Port Of Baton Rouge, LA	20	3,030	101	573	0.3%	0.9%	7	81,999,617	5,905,113	32,945,471	0.7%	2.4%
Port Of Boston, MA	30	1,638	220	619	0.7%	0.9%	42	12,076,295	3,430,383	7,631,423	0.4%	0.6%
Port Of Buffalo, NY	90	175	116	116	0.3%	0.2%	106	1,132,845	932,903	932,903	0.1%	0.1%
Port Of Chicago, IL	34	1,398	1,147	1,147	3.4%	1.8%	40	12,810,838	12,417,771	12,417,771	1.4%	0.9%
Port Of Detroit, MI	36	1,251	1,071	1,071	3.2%	1.6%	30	15,830,346	15,625,897	15,625,897	1.7%	1.1%
Port Of Hopewell, VA	107	122	82	82	0.2%	0.1%	118	604,544	501,299	501,299	0.1%	0.0%
Port Of Kalama, WA	105	124	34	44	0.1%	0.1%	67	4,444,762	1,738,649	2,121,075	0.2%	0.2%
Port Of Longview, WA	68	373	20	49	0.1%	0.1%	55	6,602,385	309,410	960,878	0.0%	0.1%
Port Of New Orleans, LA	8	11,325	502	1,051	1.5%	1.6%	5	108,805,125	8,086,381	37,331,118	0.9%	2.7%
Port Of New York/New Jersey	3	18,342	1,976	5,240	5.9%	8.0%	4	117,741,010	42,891,372	69,125,541	4.7%	5.0%
Port Of Newport News, VA	33	1,496	78	101	0.2%	0.2%	37	14,113,711	5,472,486	6,383,594	0.6%	0.5%
Port Of Plaquemine, LA	41	961	162	467	0.5%	0.7%	21	33,912,809	9,355,835	25,939,726	1.0%	1.9%
Port Of Portland, OR	21	2,875	810	810	2.4%	1.2%	24	29,719,733	13,826,711	13,826,711	1.5%	1.0%

TABLE G-3

ANALYSIS OF PORT LEVEL CONSTRAINTS, YEAR 2020

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Port Of Richmond, VA	53	582	468	468	1.4%	0.7%	108	1,010,946	856,666	856,666	0.1%	0.1%
Port Of South Louisiana, LA	17	4,137	232	1,186	0.7%	1.8%	2	151,824,859	13,473,637	74,040,974	1.5%	5.4%
Port Of Vancouver, WA	47	775	207	207	0.6%	0.3%	50	8,314,073	3,339,271	3,339,271	0.4%	0.2%
Port Of Wilmington, NC	24	2,298	427	783	1.3%	1.2%	35	14,325,357	2,999,146	6,906,418	0.3%	0.5%
Port Royal Harbor, SC	183	13	10	10	0.0%	0.0%	167	106,268	95,202	95,202	0.0%	0.0%
Port Townsend Harbor, WA	193	8	6	6	0.0%	0.0%	204	2,928	2,163	2,163	0.0%	0.0%
Portland Harbor, ME	50	704	473	473	1.4%	0.7%	20	34,698,969	34,464,078	34,464,078	3.8%	2.5%
Potomac River At Alexandria, VA	137	35	13	13	0.0%	0.0%	179	67,324	33,699	33,699	0.0%	0.0%
Potomac River At Lower Cedar Point, MD	213	4	4	4	0.0%	0.0%	201	7,825	7,825	7,825	0.0%	0.0%
Presque Isle Harbor, MI	145	30	30	30	0.1%	0.0%	123	513,544	513,544	513,544	0.1%	0.0%
Prince Wales Is. West Side, AK	122	66	1	1	0.0%	0.0%	120	532,131	170	170	0.0%	0.0%
Prince William Sound, AK	139	33	-	-	0.0%	0.0%	147	270,606	0	0	0.0%	0.0%
Providence River And Harbor, RI	82	207	78	78	0.2%	0.1%	63	5,232,536	2,880,712	2,880,712	0.3%	0.2%
Redwood City Harbor, CA	178	15	15	15	0.0%	0.0%	142	298,123	298,123	298,123	0.0%	0.0%
Revillagigedo Channel	166	20	1	1	0.0%	0.0%	159	153,017	65	65	0.0%	0.0%
Richmond Harbor, CA	44	928	15	111	0.0%	0.2%	32	15,157,327	510,629	5,478,138	0.1%	0.4%
Rochester (Charlotte) Harbor, NY	123	63	50	50	0.2%	0.1%	176	74,389	30,624	30,624	0.0%	0.0%
Sacramento, CA	109	113	78	78	0.2%	0.1%	94	1,676,150	1,315,131	1,315,131	0.1%	0.1%
Salem Harbor, MA	124	63	60	60	0.2%	0.1%	81	2,630,533	2,629,791	2,629,791	0.3%	0.2%
Salem River, NJ	67	376	129	129	0.4%	0.2%	151	225,908	109,835	109,835	0.0%	0.0%
San Diego Harbor, CA	70	319	42	42	0.1%	0.1%	85	2,255,633	158,995	158,995	0.0%	0.0%
San Francisco Harbor, CA	66	389	120	120	0.4%	0.2%	75	3,196,401	2,657,086	2,657,086	0.3%	0.2%
San Juan Harbor, PR	12	7,012	79	79	0.2%	0.1%	45	9,601,320	2,128,147	2,128,147	0.2%	0.2%
Sandusky Harbor, OH	101	146	138	138	0.4%	0.2%	64	5,035,305	5,000,395	5,000,395	0.6%	0.4%
Sault Ste. Marie, MI	130	47	39	39	0.1%	0.1%	195	17,678	16,206	16,206	0.0%	0.0%
Savannah Harbor, GA	10	9,239	19	3,552	0.1%	5.5%	22	32,044,360	81,328	14,579,788	0.0%	1.1%
Searsport Harbor, ME	99	147	65	65	0.2%	0.1%	103	1,225,482	919,371	919,371	0.1%	0.1%
Seattle Harbor, WA	13	6,961	2,234	5,284	6.7%	8.1%	26	25,514,562	14,978,934	23,951,745	1.7%	1.7%
Seward Harbor, AK	131	46	17	17	0.1%	0.0%	137	369,881	339,990	339,990	0.0%	0.0%
Shelter Is & Shelter Is Sd LI, NY	202	6	1	1	0.0%	0.0%	191	28,644	92	92	0.0%	0.0%
Sitka Harbor, AK	176	16	8	8	0.0%	0.0%	202	6,617	1,426	1,426	0.0%	0.0%
Skagway Harbor, AK	142	31	30	30	0.1%	0.0%	141	311,757	308,943	308,943	0.0%	0.0%
Caribbean Islands	194	8	1	1	0.0%	0.0%	211	928	3	3	0.0%	0.0%
Caribbean Islands	71	317	34	34	0.1%	0.1%	153	191,953	32,458	32,458	0.0%	0.0%

TABLE G-3

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Stephens Passage, AK	187	10	0	0	0.0%	0.0%	173	78,506	0	0	0.0%	0.0%
Stockton, CA	94	161	74	74	0.2%	0.1%	92	1,708,015	1,102,283	1,102,283	0.1%	0.1%
Stoneport, MI	136	37	37	37	0.1%	0.1%	125	493,202	493,202	493,202	0.1%	0.0%
Stony Point, NY	147	28	11	11	0.0%	0.0%	130	430,017	176,823	176,823	0.0%	0.0%
Suisun Bay Channel, CA	167	19	17	17	0.1%	0.0%	133	396,200	369,262	369,262	0.0%	0.0%
Tacoma Harbor, WA	19	3,324	442	1,703	1.3%	2.6%	28	18,542,818	4,832,970	11,206,157	0.5%	0.8%
Tampa Harbor, FL	26	1,880	64	64	0.2%	0.1%	29	17,723,740	2,131,837	2,131,837	0.2%	0.2%
Texas City, TX	25	2,117	134	1,411	0.4%	2.2%	8	81,630,483	9,196,363	77,531,999	1.0%	5.6%
Thompson Point NJ and Vicinity	206	4	0	1	0.0%	0.0%	187	35,322	0	113	0.0%	0.0%
Toledo Harbor, OH	60	422	338	338	1.0%	0.5%	46	9,382,705	9,107,286	9,107,286	1.0%	0.7%
Unalaska Bay and Island, AK	91	174	98	98	0.3%	0.2%	121	517,414	381,512	381,512	0.0%	0.0%
Valdez Harbor, AK	179	15	0	0	0.0%	0.0%	136	381,985	0	0	0.0%	0.0%
Whittier Harbor, AK	214	4	0	0	0.0%	0.0%	207	2,179	0	0	0.0%	0.0%
Wilmington Harbor, DE	32	1,603	119	119	0.4%	0.2%	60	5,551,061	1,725,898	1,725,898	0.2%	0.1%
Wrangell Harbor, AK	207	4	0	0	0.0%	0.0%	213	469	0	0	0.0%	0.0%
Yabucoa Harbor, PR	81	208	15	15	0.0%	0.0%	52	7,270,224	945,727	945,727	0.1%	0.1%
Yaquina Bay & Harbor, OR	185	12	12	12	0.0%	0.0%	183	44,089	44,089	44,089	0.0%	0.0%
York River, VA	114	107	82	82	0.2%	0.1%	61	5,361,550	5,264,784	5,264,784	0.6%	0.4%
TOTAL		260,822	33,348	65,176				2,394,312,748	904,774,093	1,382,738,337		

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APPENDIX H

ANALYSIS OF VESSEL TYPE CONSTRAINTS

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TABLE H-1A

ANALYSIS OF VESSEL TYPE CONSTRAINTS, BULK CARRIER 2000

Coast Name	Port Name/Location Name	Number of Calls	With Projects			Without Projects		
			Constrained Calls With Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls	Constrained Calls Without Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls
Pacific	Afognak Bay, AK	16	0	0.0	0.0	0	0.0	0.0
Atlantic	Albany, NY	2	2	100.0	0.0	2	100.0	0.0
Great Lakes	Alexandria Bay, NY	2	2	100.0	0.0	2	100.0	0.0
Great Lakes	Alpena Harbor, MI	26	26	100.0	0.3	26	100.0	0.3
Pacific	Anacortes Harbor, WA	18	2	11.0	0.0	2	11.0	0.0
Pacific	Anchorage, AK	44	0	0.0	0.0	9	20.0	0.1
Pacific	Antioch, CA	10	4	38.6	0.1	4	38.6	0.1
Great Lakes	Ashtabula Harbor, OH	150	123	82.2	1.7	123	82.2	1.7
Gulf	Atchafalaya Rvr Morgan City To Gulf	3	1	30.8	0.0	1	30.8	0.0
Atlantic	Baltimore Harbor and Channels, MD	674	76	11.2	1.0	76	11.2	1.0
Gulf	Barataria Bay, LA	2	2	100.0	0.0	2	100.0	0.0
Pacific	Barbers Point, HI	26	12	46.9	0.2	12	46.9	0.2
Gulf	Bayou Dupre, LA	18	18	100.0	0.2	18	100.0	0.2
Gulf	Bayou La Batre, AL	4	4	100.0	0.1	4	100.0	0.1
Gulf	Beaumont, TX	91	28	30.6	0.4	28	30.6	0.4
Pacific	Bellingham Bay and Harbor, WA	40	40	100.0	0.5	40	100.0	0.5
Atlantic	Bridgeport Harbor, CT	2	2	100.0	0.0	2	100.0	0.0
Gulf	Brownsville, TX	64	21	33.0	0.3	21	33.0	0.3
Atlantic	Brunswick Harbor, GA	128	87	68.0	1.2	87	68.0	1.2
Atlantic	Burlington-Florence-Roebling, NJ	8	0	0.0	0.0	0	0.0	0.0
Great Lakes	Burns Waterway Harbor, IN	105	101	95.6	1.4	101	95.6	1.4
Great Lakes	Calcite, MI	67	67	100.0	0.9	67	100.0	0.9
Atlantic	Canaveral Harbor, FL	62	2	3.2	0.0	2	3.2	0.0
Atlantic	Cape Cod Canal, MA	1	1	100.0	0.0	1	100.0	0.0
Pacific	Carquinez Strait, CA	26	2	7.8	0.0	2	7.8	0.0
Atlantic	Charleston Harbor, SC	354	27	7.6	0.4	27	7.6	0.4
Great Lakes	Charlevoix Harbor, MI	4	4	100.0	0.1	4	100.0	0.1
Atlantic	Chester Area, PA	32	5	14.8	0.1	5	14.8	0.1
Atlantic	Caribbean Islands	14	2	13.9	0.0	2	13.9	0.0
Pacific	Clarence Strait, AK	2	0	0.0	0.0	0	0.0	0.0
Great Lakes	Cleveland Harbor, OH	188	169	90.1	2.3	169	90.1	2.3
Atlantic	Coeymans, NY	10	2	23.4	0.0	2	23.4	0.0
Great Lakes	Conneaut Harbor, OH	89	67	75.4	0.9	67	75.4	0.9
Pacific	Coos Bay, OR	224	177	78.9	2.4	177	78.9	2.4
Pacific	Cordova Harbor, AK	3	3	100.0	0.0	3	100.0	0.0
Gulf	Corpus Christi, TX	258	45	17.3	0.6	45	17.3	0.6
Atlantic	Del River Between Phila Tren	37	37	100.0	0.5	37	100.0	0.5
Atlantic	Delaware River At Camden, NJ	181	12	6.8	0.2	12	6.8	0.2
Great Lakes	Drummond Island, MI	12	12	100.0	0.2	12	100.0	0.2
Great Lakes	Duluth-Superior Harbor, MN and WI	369	362	98.1	4.9	362	98.1	4.9
Atlantic	Eastport Harbor, ME	32	2	6.5	0.0	2	6.5	0.0
Great Lakes	Erie Harbor, PA	21	20	92.7	0.3	20	92.7	0.3
Great Lakes	Escanaba, MI	2	0	0.0	0.0	0	0.0	0.0
Pacific	Everett Harbor, WA	44	42	93.8	0.6	42	93.8	0.6
Great Lakes	Fairport Harbor, OH	14	14	100.0	0.2	14	100.0	0.2
Atlantic	Fall River Harbor, MA	44	29	65.1	0.4	29	65.1	0.4
Atlantic	Fernandina Harbor, FL	46	21	44.4	0.3	21	44.4	0.3
Atlantic	Fort Pierce Harbor, FL	6	4	72.4	0.1	4	72.4	0.1
Gulf	Freeport Harbor, TX	41	2	5.8	0.0	2	5.8	0.0
Gulf	Galveston Channel, TX	168	32	19.1	0.4	32	19.1	0.4
Great Lakes	Gary Harbor, IN	2	2	100.0	0.0	2	100.0	0.0
Atlantic	Georgetown Harbor, SC	74	68	91.7	0.9	68	91.7	0.9

TABLE H-1A

ANALYSIS OF VESSEL TYPE CONSTRAINTS, BULK CARRIER 2000

Coast Name	Port Name/Location Name	Number of Calls	With Projects			Without Projects		
			Constrained Calls With Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls	Constrained Calls Without Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls
Gulf	GIWW Mile 87	4	0	0.0	0.0	0	0.0	0.0
Atlantic	Gloucester Harbor, MA	3	1	35.7	0.0	1	35.7	0.0
Pacific	Grays Harbor and Chehalis River, WA	119	119	100.0	1.6	119	100.0	1.6
Atlantic	Guanica Harbor, PR	6	1	17.6	0.0	1	17.6	0.0
Atlantic	Guayanilla Harbor, PR	4	4	100.0	0.1	4	100.0	0.1
Gulf	Gulfport Harbor, MS	58	14	24.2	0.2	14	24.2	0.2
Pacific	Hilo Harbor, HI	4	4	100.0	0.1	4	100.0	0.1
Great Lakes	Holland Harbor, MI	4	4	100.0	0.1	4	100.0	0.1
Pacific	Homer, AK	29	29	100.0	0.4	29	100.0	0.4
Pacific	Honolulu Harbor, Oahu, HI	10	3	30.5	0.0	3	30.5	0.0
Pacific	Hoonah Harbor, AK	16	16	100.0	0.2	16	100.0	0.2
Gulf	Houma Navigation Canal LA	2	2	100.0	0.0	2	100.0	0.0
Gulf	Houston, TX	978	164	16.8	2.2	164	16.8	2.2
Pacific	Humboldt Harbor and Bay, CA	69	53	76.9	0.7	53	76.9	0.7
Great Lakes	Huron Harbor, OH	4	4	100.0	0.1	4	100.0	0.1
Pacific	Hydaburg, AK	17	0	0.0	0.0	0	0.0	0.0
Pacific	Icy Bay, AK	16	0	0.0	0.0	0	0.0	0.0
Great Lakes	Indiana Harbor, IN	36	36	100.0	0.5	36	100.0	0.5
Atlantic	Jacksonville Harbor, FL	183	51	28.0	0.7	51	28.0	0.7
Atlantic	Jobos Harbor, PR	4	4	100.0	0.1	4	100.0	0.1
Pacific	Juneau Harbor, AK	12	0	0.0	0.0	0	0.0	0.0
Pacific	Kahului Harbor, Maui, HI	8	5	57.6	0.1	5	57.6	0.1
Pacific	Kake Harbor, AK	7	0	0.0	0.0	0	0.0	0.0
Pacific	Kenai River, AK	34	0	0.0	0.0	0	0.0	0.0
Pacific	Ketchikan Harbor, AK	23	23	100.0	0.3	23	100.0	0.3
Pacific	Klawock, AK	26	0	0.0	0.0	0	0.0	0.0
Pacific	Kodiak Harbor, AK	2	2	100.0	0.0	2	100.0	0.0
Gulf	Lake Charles, LA	176	40	22.6	0.5	40	22.6	0.5
Great Lakes	Lake Huron	58	58	100.0	0.8	58	100.0	0.8
Great Lakes	Lake Michigan	35	32	90.8	0.4	32	90.8	0.4
Pacific	Long Beach Harbor, CA	594	11	1.9	0.1	11	1.9	0.1
Great Lakes	Lorain Harbor, OH	8	8	100.0	0.1	8	100.0	0.1
Pacific	Los Angeles Harbor, CA	396	0	0.0	0.0	0	0.0	0.0
Atlantic	Lower Delaware Bay, DE	1	1	100.0	0.0	1	100.0	0.0
Great Lakes	Ludington Harbor, MI	14	14	100.0	0.2	14	100.0	0.2
Great Lakes	Manistee Harbor, MI	4	4	100.0	0.1	4	100.0	0.1
Great Lakes	Marblehead, OH	4	4	100.0	0.1	4	100.0	0.1
Atlantic	Marcus Hook, PA	18	3	16.4	0.0	3	16.4	0.0
Pacific	Mare Island Strait, CA	1	0	0.0	0.0	0	0.0	0.0
Great Lakes	Marysville, MI	17	17	100.0	0.2	17	100.0	0.2
Gulf	Matagorda Ship Channel, TX	131	80	61.6	1.1	80	61.6	1.1
Atlantic	Mayaguez Harbor, PR	16	2	12.8	0.0	2	12.8	0.0
Great Lakes	Menominee Harbor and River, MI and WI	20	8	38.9	0.1	8	38.9	0.1
Pacific	Metlakatla Harbor, AK	9	9	100.0	0.1	9	100.0	0.1
Atlantic	Miami Harbor, FL	706	600	85.0	8.1	600	85.0	8.1
Great Lakes	Milwaukee Harbor, WI	106	81	76.5	1.1	81	76.5	1.1
Gulf	Mobile Harbor, AL	718	256	35.6	3.4	256	35.6	3.4
Atlantic	Morehead City Harbor, NC	71	15	20.5	0.2	15	20.5	0.2
Great Lakes	Muskegon Harbor, MI	29	29	100.0	0.4	29	100.0	0.4
Pacific	Naknek River, AK	2	2	100.0	0.0	2	100.0	0.0
Pacific	Nawiliwili Harbor, Kauai, HI	2	1	49.3	0.0	1	49.3	0.0

TABLE H-1A

ANALYSIS OF VESSEL TYPE CONSTRAINTS, BULK CARRIER 2000

Coast Name	Port Name/Location Name	Number of Calls	With Projects			Without Projects		
			Constrained Calls With Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls	Constrained Calls Without Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls
Atlantic	New Bedford and Fairhaven Harbor, MA	2	2	100.0	0.0	2	100.0	0.0
Atlantic	New Haven Harbor, CT	95	47	49.1	0.6	47	49.1	0.6
Atlantic	New London Harbor, CT	5	0	0.0	0.0	0	0.0	0.0
Pacific	Nikishka, AK	2	0	0.0	0.0	0	0.0	0.0
Atlantic	Norfolk Harbor, VA	483	117	24.3	1.6	117	24.3	1.6
Atlantic	Northville, L.I., NY	1	0	0.0	0.0	0	0.0	0.0
Pacific	Oakland Harbor, CA	130	6	4.6	0.1	6	4.6	0.1
Great Lakes	Ogdensburg Harbor, NY	8	8	100.0	0.1	8	100.0	0.1
Pacific	Olympia Harbor, WA	16	16	100.0	0.2	16	100.0	0.2
Great Lakes	Ontonagon Harbor, MI	6	6	100.0	0.1	6	100.0	0.1
Great Lakes	Oswego Harbor, NY	6	6	100.0	0.1	6	100.0	0.1
Pacific	Other Puget Sound Area Ports, WA	23	0	0.0	0.0	0	0.0	0.0
Pacific	Other San Francisco Bay Area Ports, CA	10	10	100.0	0.1	10	100.0	0.1
Atlantic	Palm Beach Harbor, FL	25	7	29.0	0.1	7	29.0	0.1
Gulf	Panama City Harbor, FL	85	27	31.3	0.4	27	31.3	0.4
Gulf	Pascagoula Harbor, MS	106	61	57.0	0.8	61	57.0	0.8
Atlantic	Paulsboro, NJ	6	4	66.7	0.1	4	66.7	0.1
Gulf	Pensacola Harbor, FL	9	3	36.1	0.0	3	36.1	0.0
Atlantic	Philadelphia Harbor, PA	145	55	37.6	0.7	55	37.6	0.7
Atlantic	Piscataqua River, ME and NH	64	48	74.1	0.6	48	74.1	0.6
Pacific	Pittsburg, CA	35	34	96.9	0.5	34	96.9	0.5
Atlantic	Ponce Harbor, PR	47	10	21.6	0.1	10	21.6	0.1
Pacific	Port Angeles Harbor, WA	46	2	4.4	0.0	2	4.4	0.0
Gulf	Port Arthur, TX	177	20	11.1	0.3	20	11.1	0.3
Great Lakes	Port Dolomite, MI	5	5	100.0	0.1	5	100.0	0.1
Atlantic	Port Everglades Harbor, FL	196	10	5.3	0.1	10	5.3	0.1
Atlantic	Port in Caribbean	9	1	11.0	0.0	1	11.0	0.0
Pacific	Port Hueneme, CA	18	9	48.2	0.1	9	48.2	0.1
Great Lakes	Port Huron, MI	8	8	100.0	0.1	8	100.0	0.1
Great Lakes	Port Inland, MI	20	20	100.0	0.3	20	100.0	0.3
Gulf	Port Manatee, FL	22	2	9.1	0.0	2	9.1	0.0
Atlantic	Port Of Albany, NY	59	49	84.3	0.7	49	84.3	0.7
Pacific	Port Of Astoria, OR	9	3	32.6	0.0	3	32.6	0.0
Gulf	Port Of Baton Rouge, LA	768	148	19.2	2.0	148	19.2	2.0
Atlantic	Port Of Boston, MA	80	22	28.1	0.3	22	28.1	0.3
Great Lakes	Port Of Buffalo, NY	48	19	39.5	0.3	19	39.5	0.3
Great Lakes	Port Of Chicago, IL	340	329	96.8	4.4	329	96.8	4.4
Great Lakes	Port Of Detroit, MI	343	339	98.8	4.6	339	98.8	4.6
Atlantic	Port Of Hopewell, VA	60	20	32.9	0.3	20	32.9	0.3
Pacific	Port Of Kalama, WA	110	34	30.7	0.5	34	30.7	0.5
Pacific	Port Of Longview, WA	203	8	3.7	0.1	8	3.7	0.1
Gulf	Port Of New Orleans, LA	1,252	239	19.1	3.2	239	19.1	3.2
Atlantic	Port Of New York/New Jersey	405	98	24.1	1.3	98	24.1	1.3
Atlantic	Port Of Newport News, VA	312	88	28.2	1.2	88	28.2	1.2
Gulf	Port Of Plaquemine, LA	340	194	57.0	2.6	194	57.0	2.6
Pacific	Port Of Portland, OR	583	94	16.0	1.3	94	16.0	1.3
Atlantic	Port Of Richmond, VA	12	9	77.1	0.1	9	77.1	0.1
Gulf	Port Of South Louisiana, LA	1,446	456	31.5	6.1	456	31.5	6.1
Pacific	Port Of Vancouver, WA	262	22	8.5	0.3	22	8.5	0.3
Atlantic	Port Of Wilmington, NC	132	53	40.3	0.7	53	40.3	0.7
Atlantic	Portland Harbor, ME	16	15	88.5	0.2	15	88.5	0.2

TABLE H-1A

ANALYSIS OF VESSEL TYPE CONSTRAINTS, BULK CARRIER 2000

Coast Name	Port Name/Location Name	Number of Calls	With Projects			Without Projects		
			Constrained Calls With Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls	Constrained Calls Without Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls
Atlantic	Potomac River At Alexandria, VA	4	4	100.0	0.1	4	100.0	0.1
Great Lakes	Presque Isle Harbor, MI	35	35	100.0	0.5	35	100.0	0.5
Pacific	Prince Wales Is. West Side, AK	34	0	0.0	0.0	0	0.0	0.0
Pacific	Prince William Sound, AK	16	0	0.0	0.0	0	0.0	0.0
Atlantic	Providence River and Harbor, RI	39	3	7.6	0.0	3	7.6	0.0
Pacific	Redwood City Harbor, CA	14	14	100.0	0.2	14	100.0	0.2
Pacific	Revillagigedo Channel	12	0	0.0	0.0	0	0.0	0.0
Pacific	Richmond Harbor, CA	52	19	35.5	0.3	19	35.5	0.2
Great Lakes	Rochester (Charlotte) Harbor, NY	2	1	50.0	0.0	1	50.0	0.0
Pacific	Sacramento, CA	57	37	64.7	0.5	37	64.7	0.5
Atlantic	Salem Harbor, MA	20	20	100.0	0.3	20	100.0	0.3
Atlantic	Salem River, NJ	3	3	100.0	0.0	3	100.0	0.0
Pacific	San Diego Harbor, CA	77	2	2.6	0.0	2	2.6	0.0
Pacific	San Francisco Harbor, CA	43	7	16.9	0.1	7	16.9	0.1
Atlantic	San Juan Harbor, PR	151	3	2.0	0.0	3	2.0	0.0
Great Lakes	Sandusky Harbor, OH	86	79	92.1	1.1	79	92.1	1.1
Great Lakes	Sault Ste. Marie, MI	4	4	100.0	0.1	4	100.0	0.1
Atlantic	Savannah Harbor, GA	485	13	2.7	0.2	13	2.7	0.2
Atlantic	Searsport Harbor, ME	31	9	29.3	0.1	9	29.3	0.1
Pacific	Seattle Harbor, WA	305	266	87.3	3.6	266	87.3	3.6
Pacific	Seward Harbor, AK	10	10	100.0	0.1	10	100.0	0.1
Pacific	Skagway Harbor, AK	24	24	100.0	0.3	24	100.0	0.3
Atlantic	Caribbean Islands	21	3	14.9	0.0	3	14.9	0.0
Pacific	Stephens Passage, AK	6	0	0.0	0.0	0	0.0	0.0
Pacific	Stockton, CA	29	18	61.0	0.2	18	61.0	0.2
Great Lakes	Stoneport, MI	37	37	100.0	0.5	37	100.0	0.5
Atlantic	Stony Point, NY	35	3	7.5	0.0	3	7.5	0.0
Pacific	Tacoma Harbor, WA	309	147	47.6	2.0	147	47.6	2.0
Gulf	Tampa Harbor, FL	459	48	10.5	0.6	48	10.5	0.6
Gulf	Texas City, TX	66	24	36.7	0.3	24	36.7	0.3
Great Lakes	Toledo Harbor, OH	216	167	77.2	2.2	167	77.2	2.2
Pacific	Unalaska Bay and Island, AK	5	3	64.2	0.0	3	64.2	0.0
Atlantic	Wilmington Harbor, DE	71	39	54.7	0.5	39	54.7	0.5
Pacific	Wrangell Harbor, AK	2	0	0.0	0.0	0	0.0	0.0
Atlantic	Yabucoa Harbor, PR	2	1	50.0	0.0	1	50.0	0.0
Pacific	Yaquina Bay & Harbor, OR	5	5	100.0	0.1	5	100.0	0.1
	TOTAL		**7,424**			**7,433**		

TABLE H-1B

ANALYSIS OF VESSEL TYPE CONSTRAINTS, BULK CARRIER 2010

Coast Name	Port Name	Number of Calls	With Projects			Without Projects		
			Constrained Calls With Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls	Constrained Calls Without Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls
Pacific	Afognak Bay, AK	24	0	0.0	0.0	0	0.0	0.0
Atlantic	Albany, NY	3	3	100.0	0.0	3	100.0	0.0
Great Lakes	Alexandria Bay, NY	3	3	100.0	0.0	3	100.0	0.0
Great Lakes	Alpena Harbor, MI	24	24	100.0	0.3	24	100.0	0.2
Pacific	Anacortes Harbor, WA	21	4	21.5	0.1	4	21.5	0.0
Pacific	Anchorage, AK	71	0	0.0	0.0	21	29.0	0.2
Pacific	Antioch, CA	8	4	49.8	0.1	4	49.8	0.0
Great Lakes	Ashtabula Harbor, OH	229	197	86.1	2.3	197	86.1	1.8
Gulf	Atchafalaya Rvr Morgan City To Gulf	5	2	38.4	0.0	2	38.4	0.0
Atlantic	Baltimore Harbor and Channels, MD	953	77	8.0	0.9	77	8.0	0.7
Gulf	Barataria Bay LA	3	3	100.0	0.0	3	100.0	0.0
Pacific	Barbers Point, HI	35	15	44.3	0.2	17	50.0	0.2
Gulf	Bayou Dupre, LA	29	29	100.0	0.3	29	100.0	0.3
Gulf	Bayou La Batre, AL	6	6	100.0	0.1	6	100.0	0.1
Gulf	Beaumont, TX	131	37	28.3	0.4	37	28.3	0.3
Pacific	Bellingham Bay And Harbor, WA	70	70	100.0	0.8	70	100.0	0.6
Atlantic	Bridgeport Harbor, CT	4	4	100.0	0.0	4	100.0	0.0
Gulf	Brownsville, TX	105	37	35.1	0.4	37	35.1	0.3
Atlantic	Brunswick Harbor, GA	177	94	53.3	1.1	138	77.9	1.3
Atlantic	Burlington-Florence-Roebling, NJ	8	1	12.0	0.0	1	12.0	0.0
Great Lakes	Burns Waterway Harbor, IN	154	149	96.6	1.8	149	96.6	1.4
Great Lakes	Calcite, MI	56	56	100.0	0.7	56	100.0	0.5
Atlantic	Canaveral Harbor, FL	60	5	8.3	0.1	5	8.3	0.0
Atlantic	Cape Cod Canal, MA	2	2	100.0	0.0	2	100.0	0.0
Pacific	Carquinez Strait, CA	37	7	18.7	0.1	7	18.7	0.1
Atlantic	Charleston Harbor, SC	565	25	4.4	0.3	70	12.3	0.6
Great Lakes	Charlevoix Harbor, MI	5	5	100.0	0.1	5	100.0	0.0
Atlantic	Chester Area, PA	65	25	38.2	0.3	28	42.9	0.3
Atlantic	Caribbean Islands	16	4	24.9	0.0	4	24.9	0.0
Pacific	Clarence Strait, AK	3	0	0.0	0.0	0	0.0	0.0
Great Lakes	Cleveland Harbor, OH	275	246	89.6	2.9	246	89.6	2.3
Atlantic	Coeymans, NY	11	4	37.8	0.0	4	37.8	0.0
Great Lakes	Conneaut Harbor, OH	126	103	81.9	1.2	103	81.9	1.0
Pacific	Coos Bay, OR	343	284	82.7	3.4	284	82.7	2.6
Pacific	Cordova Harbor, AK	4	4	100.0	0.1	4	100.0	0.0
Gulf	Corpus Christi, TX	329	15	4.5	0.2	74	22.5	0.7
Atlantic	Del River Between Phila Tren	48	48	100.0	0.6	48	100.0	0.4
Atlantic	Delaware River At Camden, NJ	262	18	7.0	0.2	27	10.2	0.2
Great Lakes	Drummond Island, MI	10	10	100.0	0.1	10	100.0	0.1
Great Lakes	Duluth-Superior Harbor, MN and WI	386	381	98.5	4.5	381	98.5	3.5
Atlantic	Eastport Harbor, ME	65	11	16.4	0.1	11	16.4	0.1
Great Lakes	Erie Harbor, PA	33	31	93.4	0.4	31	93.4	0.3
Great Lakes	Escanaba, MI	3	1	33.3	0.0	1	33.3	0.0
Pacific	Everett Harbor, WA	66	62	94.2	0.7	62	94.2	0.6
Great Lakes	Fairport Harbor, OH	17	17	100.0	0.2	17	100.0	0.2
Atlantic	Fall River Harbor, MA	69	48	69.5	0.6	48	69.5	0.4
Atlantic	Fernandina Harbor, FL	88	41	46.2	0.5	41	46.2	0.4
Atlantic	Fort Pierce Harbor, FL	6	5	78.6	0.1	5	78.6	0.0
Gulf	Freeport Harbor, TX	61	8	13.6	0.1	8	13.6	0.1
Gulf	Galveston Channel, TX	239	38	16.0	0.5	47	19.8	0.4
Great Lakes	Gary Harbor, IN	4	4	100.0	0.0	4	100.0	0.0

TABLE H-1B

ANALYSIS OF VESSEL TYPE CONSTRAINTS, BULK CARRIER 2010

Coast Name	Port Name	Number of Calls	With Projects			Without Projects		
			Constrained Calls With Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls	Constrained Calls Without Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls
Atlantic	Georgetown Harbor, SC	104	0	0.0	0.0	91	87.4	0.8
Gulf	GIWW Mile 87	6	0	0.0	0.0	0	0.0	0.0
Atlantic	Gloucester Harbor, MA	4	2	45.7	0.0	2	45.7	0.0
Pacific	Grays Harbor and Chehalis River, WA	181	181	100.0	2.2	181	100.0	1.7
Atlantic	Guanica Harbor, PR	8	2	26.4	0.0	2	26.4	0.0
Atlantic	Guayanilla Harbor, PR	7	7	100.0	0.1	7	100.0	0.1
Gulf	Gulfport Harbor, MS	100	22	21.9	0.3	22	21.9	0.2
Pacific	Hilo Harbor, HI	6	6	100.0	0.1	6	100.0	0.1
Great Lakes	Holland Harbor, MI	6	6	100.0	0.1	6	100.0	0.1
Pacific	Homer, AK	42	42	100.0	0.5	42	100.0	0.4
Pacific	Honolulu Harbor, Oahu, HI	16	3	21.6	0.0	3	21.6	0.0
Pacific	Hoonah Harbor, AK	25	25	100.0	0.3	25	100.0	0.2
Gulf	Houma Navigation Canal LA	4	4	100.0	0.0	4	100.0	0.0
Gulf	Houston, TX	1,414	162	11.5	1.9	235	16.6	2.2
Pacific	Humboldt Harbor and Bay, CA	125	100	80.2	1.2	100	80.2	0.9
Great Lakes	Huron Harbor, OH	7	7	100.0	0.1	7	100.0	0.1
Pacific	Hydaburg, AK	27	0	0.0	0.0	0	0.0	0.0
Pacific	Icy Bay, AK	25	0	0.0	0.0	0	0.0	0.0
Great Lakes	Indiana Harbor, IN	63	63	100.0	0.7	63	100.0	0.6
Atlantic	Jacksonville Harbor, FL	213	29	13.8	0.3	61	28.7	0.6
Atlantic	Jobos Harbor, PR	6	6	100.0	0.1	6	100.0	0.1
Pacific	Juneau Harbor, AK	18	0	0.0	0.0	0	0.0	0.0
Pacific	Kahului Harbor, Maui, HI	10	7	64.9	0.1	7	64.9	0.1
Pacific	Kake Harbor, AK	11	0	0.0	0.0	0	0.0	0.0
Pacific	Kenai River, AK	36	2	5.5	0.0	2	5.5	0.0
Pacific	Ketchikan Harbor, AK	37	37	100.0	0.4	37	100.0	0.3
Pacific	Klawock, AK	40	1	2.5	0.0	1	2.5	0.0
Pacific	Kodiak Harbor, AK	3	3	100.0	0.0	3	100.0	0.0
Gulf	Lake Charles, LA	231	49	21.2	0.6	49	21.2	0.5
Great Lakes	Lake Huron	78	78	100.0	0.9	78	100.0	0.7
Great Lakes	Lake Michigan	53	49	92.0	0.6	49	92.0	0.5
Pacific	Long Beach Harbor, CA	755	0	0.0	0.0	17	2.3	0.2
Great Lakes	Lorain Harbor, OH	12	12	100.0	0.1	12	100.0	0.1
Pacific	Los Angeles Harbor, CA	480	0	0.0	0.0	0	0.0	0.0
Atlantic	Lower Delaware Bay Del	2	2	100.0	0.0	2	100.0	0.0
Great Lakes	Ludington Harbor, MI	17	17	100.0	0.2	17	100.0	0.2
Great Lakes	Manistee Harbor, MI	6	6	100.0	0.1	6	100.0	0.1
Great Lakes	Marblehead, OH	5	5	100.0	0.1	5	100.0	0.0
Atlantic	Marcus Hook, PA	24	4	16.5	0.0	6	24.8	0.1
Pacific	Mare Island Strait, CA	2	1	50.0	0.0	1	50.0	0.0
Great Lakes	Marysville, MI	24	24	100.0	0.3	24	100.0	0.2
Gulf	Matagorda Ship Channel, TX	176	102	57.6	1.2	102	57.6	0.9
Atlantic	Mayaguez Harbor, PR	24	5	19.5	0.1	5	19.5	0.0
Great Lakes	Menominee Harbor and River, MI and WI	30	12	42.1	0.1	12	42.1	0.1
Pacific	Metlakatla Harbor, AK	13	13	100.0	0.2	13	100.0	0.1
Atlantic	Miami Harbor, FL	1,166	1,021	87.5	12.2	1,045	89.6	9.6
Great Lakes	Milwaukee Harbor, WI	157	125	80.0	1.5	125	80.0	1.2
Gulf	Mobile Harbor, AL	1,251	39	3.1	0.5	406	32.5	3.8
Atlantic	Morehead City Harbor, NC	112	26	23.0	0.3	26	23.0	0.2
Great Lakes	Muskegon Harbor, MI	39	39	100.0	0.5	39	100.0	0.4
Pacific	Naknek River, AK	3	3	100.0	0.0	3	100.0	0.0
Pacific	Nawiliwili Harbor, Kauai, HI	3	2	66.7	0.0	2	66.7	0.0

TABLE H-1B

ANALYSIS OF VESSEL TYPE CONSTRAINTS, BULK CARRIER 2010

Coast Name	Port Name	Number of Calls	With Projects			Without Projects		
			Constrained Calls With Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls	Constrained Calls Without Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls
Atlantic	New Bedford and Fairhaven Harbor, MA	3	3	100.0	0.0	3	100.0	0.0
Atlantic	New Haven Harbor, CT	140	71	50.6	0.8	71	50.6	0.7
Atlantic	New London Harbor, CT	5	1	19.5	0.0	1	19.5	0.0
Pacific	Nikishka, AK	3	0	0.0	0.0	0	0.0	0.0
Atlantic	Norfolk Harbor, VA	559	118	21.0	1.4	122	21.7	1.1
Atlantic	Northville, L.I., NY	2	0	0.0	0.0	0	0.0	0.0
Pacific	Oakland Harbor, CA	131	4	3.1	0.0	13	10.1	0.1
Great Lakes	Ogdensburg Harbor, NY	11	11	100.0	0.1	11	100.0	0.1
Pacific	Olympia Harbor, WA	25	25	100.0	0.3	25	100.0	0.2
Great Lakes	Ontonagon Harbor, MI	8	8	100.0	0.1	8	100.0	0.1
Great Lakes	Oswego Harbor, NY	8	8	100.0	0.1	8	100.0	0.1
Pacific	Other Puget Sound Area Ports, WA	30	0	0.0	0.0	0	0.0	0.0
Pacific	Other San Francisco Bay Area Ports, CA	13	13	100.0	0.2	13	100.0	0.1
Atlantic	Palm Beach Harbor, FL	25	10	40.0	0.1	10	40.0	0.1
Gulf	Panama City Harbor, FL	140	49	35.1	0.6	49	35.1	0.5
Gulf	Pascagoula Harbor, MS	141	63	44.7	0.8	66	46.4	0.6
Atlantic	Paulsboro, NJ	11	8	73.1	0.1	8	73.1	0.1
Gulf	Pensacola Harbor, FL	12	5	44.6	0.1	5	44.6	0.0
Atlantic	Philadelphia Harbor, PA	217	86	39.8	1.0	95	43.7	0.9
Atlantic	Piscataqua River, ME and NH	83	64	76.3	0.8	64	76.3	0.6
Pacific	Pittsburg, CA	26	25	96.2	0.3	25	96.2	0.2
Atlantic	Ponce Harbor, PR	52	10	18.8	0.1	10	18.8	0.1
Pacific	Port Angeles Harbor, WA	68	4	5.9	0.0	4	5.9	0.0
Gulf	Port Arthur, TX	257	34	13.1	0.4	34	13.1	0.3
Great Lakes	Port Dolomite, MI	5	5	100.0	0.1	5	100.0	0.0
Atlantic	Port Everglades Harbor, FL	262	25	9.4	0.3	25	9.4	0.2
Atlantic	Port in Caribbean	16	3	19.1	0.0	3	19.1	0.0
Pacific	Port Hueneme, CA	51	28	55.4	0.3	28	55.4	0.3
Great Lakes	Port Huron, MI	11	11	100.0	0.1	11	100.0	0.1
Great Lakes	Port Inland, MI	18	18	100.0	0.2	18	100.0	0.2
Gulf	Port Manatee, FL	29	4	13.8	0.0	4	13.8	0.0
Atlantic	Port Of Albany, NY	76	64	83.9	0.8	64	83.9	0.6
Pacific	Port Of Astoria, OR	14	3	21.7	0.0	6	43.3	0.1
Gulf	Port Of Baton Rouge, LA	1,079	35	3.2	0.4	233	21.6	2.2
Atlantic	Port Of Boston, MA	98	29	29.8	0.3	34	34.9	0.3
Great Lakes	Port Of Buffalo, NY	61	28	46.2	0.3	28	46.2	0.3
Great Lakes	Port Of Chicago, IL	567	550	97.0	6.6	550	97.0	5.1
Great Lakes	Port Of Detroit, MI	560	554	99.0	6.6	554	99.0	5.1
Atlantic	Port Of Hopewell, VA	63	24	38.6	0.3	24	38.6	0.2
Pacific	Port Of Kalama, WA	108	29	26.9	0.3	33	30.5	0.3
Pacific	Port Of Longview, WA	274	5	1.8	0.1	19	7.0	0.2
Gulf	Port Of New Orleans, LA	1,855	73	3.9	0.9	321	17.3	3.0
Atlantic	Port Of New York/New Jersey	564	93	16.6	1.1	158	28.0	1.5
Atlantic	Port Of Newport News, VA	334	76	22.8	0.9	80	24.0	0.7
Gulf	Port Of Plaquemine, LA	481	51	10.7	0.6	256	53.2	2.4
Pacific	Port Of Portland, OR	859	153	17.8	1.8	153	17.8	1.4
Atlantic	Port Of Richmond, VA	12	7	56.7	0.1	7	56.7	0.1
Gulf	Port Of South Louisiana, LA	1,977	86	4.3	1.0	580	29.4	5.4
Pacific	Port Of Vancouver, WA	332	59	17.7	0.7	59	17.7	0.5
Atlantic	Port Of Wilmington, NC	213	16	7.5	0.2	97	45.6	0.9
Atlantic	Portland Harbor, ME	22	21	92.5	0.2	21	92.5	0.2
Atlantic	Potomac River At Alexandria, VA	6	6	100.0	0.1	6	100.0	0.1

TABLE H-1B

ANALYSIS OF VESSEL TYPE CONSTRAINTS, BULK CARRIER 2010

Coast Name	Port Name	Number of Calls	With Projects			Without Projects		
			Constrained Calls With Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls	Constrained Calls Without Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls
Great Lakes	Presque Isle Harbor, MI	27	27	100.0	0.3	27	100.0	0.2
Pacific	Prince Wales Is. West Side, AK	53	0	0.0	0.0	0	0.0	0.0
Pacific	Prince William Sound, AK	25	0	0.0	0.0	0	0.0	0.0
Atlantic	Providence River and Harbor, RI	41	8	18.8	0.1	8	18.8	0.1
Pacific	Redwood City Harbor, CA	13	13	100.0	0.2	13	100.0	0.1
Pacific	Revillagigedo Channel	16	0	0.0	0.0	0	0.0	0.0
Pacific	Richmond Harbor, CA	73	0	0.0	0.0	39	53.3	0.4
Great Lakes	Rochester (Charlotte) Harbor, NY	3	2	66.7	0.0	2	66.7	0.0
Pacific	Sacramento, CA	76	54	71.0	0.6	54	71.0	0.5
Atlantic	Salem Harbor, MA	31	31	100.0	0.4	31	100.0	0.3
Atlantic	Salem River, NJ	4	4	100.0	0.1	4	100.0	0.0
Pacific	San Diego Harbor, CA	107	4	3.7	0.0	4	3.7	0.0
Pacific	San Francisco Harbor, CA	42	11	26.0	0.1	11	26.0	0.1
Atlantic	San Juan Harbor, PR	231	6	2.7	0.1	6	2.7	0.1
Great Lakes	Sandusky Harbor, OH	127	118	93.2	1.4	118	93.2	1.1
Great Lakes	Sault Ste. Marie, MI	6	6	100.0	0.1	6	100.0	0.1
Atlantic	Savannah Harbor, GA	585	0	0.0	0.0	30	5.1	0.3
Atlantic	Searsport Harbor, ME	38	14	37.2	0.2	14	37.2	0.1
Pacific	Seattle Harbor, WA	372	208	56.0	2.5	326	87.8	3.0
Pacific	Seward Harbor, AK	11	11	100.0	0.1	11	100.0	0.1
Pacific	Skagway Harbor, AK	22	22	100.0	0.3	22	100.0	0.2
Atlantic	Caribbean Islands	20	5	23.8	0.1	5	23.8	0.0
Pacific	Stephens Passage, AK	9	0	0.0	0.0	0	0.0	0.0
Pacific	Stockton, CA	36	23	64.6	0.3	23	64.6	0.2
Great Lakes	Stoneport, MI	36	36	100.0	0.4	36	100.0	0.3
Atlantic	Stony Point, NY	38	9	23.0	0.1	9	23.0	0.1
Pacific	Tacoma Harbor, WA	391	92	23.4	1.1	203	51.9	1.9
Gulf	Tampa Harbor, FL	582	54	9.2	0.6	54	9.2	0.5
Gulf	Texas City, TX	89	36	40.6	0.4	36	40.6	0.3
Great Lakes	Toledo Harbor, OH	309	244	78.9	2.9	244	78.9	2.3
Pacific	Unalaska Bay and Island, AK	6	5	80.3	0.1	5	80.3	0.0
Atlantic	Wilmington Harbor, DE	87	49	56.1	0.6	49	56.1	0.4
Pacific	Wrangell Harbor, AK	3	0	0.0	0.0	0	0.0	0.0
Atlantic	Yabucoa Harbor, PR	4	2	53.1	0.0	2	53.1	0.0
Pacific	Yaquina Bay & Harbor, OR	7	7	100.0	0.1	7	100.0	0.1
	TOTAL		**8,392**			**10,833**		

TABLE H-1C

ANALYSIS OF VESSEL TYPE CONSTRAINTS, BULK CARRIER 2020

Coast Name	Port Name	Number of Calls	With Projects			Without Projects		
			Constrained Calls With Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls	Constrained Calls Without Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls
Pacific	Afognak Bay, AK	28	0	0.0	0.0	0	0.0	0.0
Atlantic	Albany, NY	4	4	100.0	0.0	4	100.0	0.0
Great Lakes	Alexandria Bay, NY	4	4	100.0	0.0	4	100.0	0.0
Great Lakes	Alpena Harbor, MI	21	21	100.0	0.2	21	100.0	0.1
Pacific	Anacortes Harbor, WA	24	10	40.4	0.1	10	40.4	0.1
Pacific	Anchorage, AK	94	1	1.1	0.0	36	38.4	0.2
Pacific	Antioch, CA	8	4	55.6	0.0	4	55.6	0.0
Great Lakes	Ashtabula Harbor, OH	292	262	89.6	2.3	262	89.6	1.8
Gulf	Atchafalaya Rvr Morgan City To Gulf	8	3	39.6	0.0	3	39.6	0.0
Atlantic	Baltimore Harbor and Channels, MD	1,251	72	5.8	0.6	72	5.8	0.5
Gulf	Barataria Bay LA	4	4	100.0	0.0	4	100.0	0.0
Pacific	Barbers Point, HI	47	25	53.2	0.2	27	57.5	0.2
Gulf	Bayou Dupre, LA	42	42	100.0	0.4	42	100.0	0.3
Gulf	Bayou La Batre, AL	8	8	100.0	0.1	8	100.0	0.1
Gulf	Beaumont, TX	174	51	29.2	0.5	51	29.2	0.3
Pacific	Bellingham Bay and Harbor, WA	101	101	100.0	0.9	101	100.0	0.7
Atlantic	Bridgeport Harbor, CT	5	5	100.0	0.0	5	100.0	0.0
Gulf	Brownsville, TX	153	60	39.0	0.5	60	39.0	0.4
Atlantic	Brunswick Harbor, GA	247	156	63.0	1.4	210	84.8	1.4
Atlantic	Burlington-Florence-Roebling, NJ	7	2	28.0	0.0	2	28.0	0.0
Great Lakes	Burns Waterway Harbor, IN	220	214	97.3	1.9	214	97.3	1.5
Great Lakes	Calcite, MI	50	50	100.0	0.4	50	100.0	0.3
Atlantic	Canaveral Harbor, FL	57	7	12.3	0.1	7	12.3	0.0
Atlantic	Cape Cod Canal, MA	3	3	100.0	0.0	3	100.0	0.0
Pacific	Carquinez Strait, CA	52	13	25.0	0.1	13	25.0	0.1
Atlantic	Charleston Harbor, SC	868	44	5.1	0.4	154	17.7	1.1
Great Lakes	Charlevoix Harbor, MI	5	5	100.0	0.0	5	100.0	0.0
Atlantic	Chester Area, PA	118	62	52.9	0.6	65	55.4	0.4
Atlantic	Caribbean Islands	16	6	37.9	0.1	6	37.9	0.0
Pacific	Clarence Strait, AK	4	0	0.0	0.0	0	0.0	0.0
Great Lakes	Cleveland Harbor, OH	342	308	89.9	2.7	308	89.9	2.1
Atlantic	Coeymans, NY	9	5	56.2	0.0	5	56.2	0.0
Great Lakes	Conneaut Harbor, OH	143	124	86.3	1.1	124	86.3	0.8
Pacific	Coos Bay, OR	390	336	86.1	3.0	336	86.1	2.3
Pacific	Cordova Harbor, AK	6	6	100.0	0.1	6	100.0	0.0
Gulf	Corpus Christi, TX	435	25	5.8	0.2	115	26.5	0.8
Atlantic	Del River Between Phila Tren	59	59	100.0	0.5	59	100.0	0.4
Atlantic	Delaware River At Camden, NJ	363	33	9.1	0.3	50	13.7	0.3
Great Lakes	Drummond Island, MI	10	10	100.0	0.1	10	100.0	0.1
Great Lakes	Duluth-Superior Harbor, MN and WI	414	410	98.9	3.6	410	98.9	2.8
Atlantic	Eastport Harbor, ME	106	25	24.0	0.2	25	24.0	0.2
Great Lakes	Erie Harbor, PA	34	31	92.2	0.3	31	92.2	0.2
Great Lakes	Escanaba, MI	4	2	50.0	0.0	2	50.0	0.0
Pacific	Everett Harbor, WA	79	75	94.6	0.7	75	94.6	0.5
Great Lakes	Fairport Harbor, OH	20	20	100.0	0.2	20	100.0	0.1
Atlantic	Fall River Harbor, MA	106	79	74.9	0.7	79	74.9	0.5
Atlantic	Fernandina Harbor, FL	166	78	46.9	0.7	78	46.9	0.5
Atlantic	Fort Pierce Harbor, FL	6	5	84.2	0.0	5	84.2	0.0
Gulf	Freeport Harbor, TX	82	14	17.1	0.1	14	17.1	0.1
Gulf	Galveston Channel, TX	305	53	17.2	0.5	67	22.0	0.5
Great Lakes	Gary Harbor, IN	5	5	100.0	0.0	5	100.0	0.0

TABLE H-1C

ANALYSIS OF VESSEL TYPE CONSTRAINTS, BULK CARRIER 2020

Coast Name	Port Name	Number of Calls	With Projects			Without Projects		
			Constrained Calls With Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls	Constrained Calls Without Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls
Atlantic	Georgetown Harbor, SC	144	0	0.0	0.0	126	87.5	0.9
Gulf	GIWW Mile 87	8	0	0.0	0.0	0	0.0	0.0
Atlantic	Gloucester Harbor, MA	5	3	54.9	0.0	3	54.9	0.0
Pacific	Grays Harbor and Chehalis River, WA	208	208	100.0	1.8	208	100.0	1.4
Atlantic	Guanica Harbor, PR	8	3	35.3	0.0	3	35.3	0.0
Atlantic	Guayanilla Harbor, PR	11	11	100.0	0.1	11	100.0	0.1
Gulf	Gulfport Harbor, MS	146	35	24.1	0.3	35	24.1	0.2
Pacific	Hilo Harbor, HI	10	10	100.0	0.1	10	100.0	0.1
Great Lakes	Holland Harbor, MI	6	6	100.0	0.1	6	100.0	0.0
Pacific	Homer, AK	45	45	100.0	0.4	45	100.0	0.3
Pacific	Honolulu Harbor, Oahu, HI	27	8	28.1	0.1	8	28.1	0.1
Pacific	Hoonah Harbor, AK	32	32	100.0	0.3	32	100.0	0.2
Gulf	Houma Navigation Canal LA	6	6	100.0	0.1	6	100.0	0.0
Gulf	Houston, TX	1,913	190	9.9	1.7	313	16.4	2.1
Pacific	Humboldt Harbor and Bay, CA	164	136	83.0	1.2	136	83.0	0.9
Great Lakes	Huron Harbor, OH	9	9	100.0	0.1	9	100.0	0.1
Pacific	Hydaburg, AK	30	0	0.0	0.0	0	0.0	0.0
Pacific	Icy Bay, AK	32	1	3.1	0.0	1	3.1	0.0
Great Lakes	Indiana Harbor, IN	103	103	100.0	0.9	103	100.0	0.7
Atlantic	Jacksonville Harbor, FL	208	34	16.5	0.3	67	32.1	0.5
Atlantic	Jobos Harbor, PR	8	8	100.0	0.1	8	100.0	0.1
Pacific	Juneau Harbor, AK	21	0	0.0	0.0	0	0.0	0.0
Pacific	Kahului Harbor, Maui, HI	17	12	71.7	0.1	12	71.7	0.1
Pacific	Kake Harbor, AK	14	0	0.0	0.0	0	0.0	0.0
Pacific	Kenai River, AK	34	4	11.7	0.0	4	11.7	0.0
Pacific	Ketchikan Harbor, AK	47	47	100.0	0.4	47	100.0	0.3
Pacific	Klawock, AK	47	2	4.3	0.0	2	4.3	0.0
Pacific	Kodiak Harbor, AK	4	4	100.0	0.0	4	100.0	0.0
Gulf	Lake Charles, LA	307	67	22.0	0.6	67	22.0	0.5
Great Lakes	Lake Huron	81	81	100.0	0.7	81	100.0	0.6
Great Lakes	Lake Michigan	58	54	93.8	0.5	54	93.8	0.4
Pacific	Long Beach Harbor, CA	970	0	0.0	0.0	23	2.3	0.2
Great Lakes	Lorain Harbor, OH	20	20	100.0	0.2	20	100.0	0.1
Pacific	Los Angeles Harbor, CA	593	0	0.0	0.0	0	0.0	0.0
Atlantic	Lower Delaware Bay Del	5	5	100.0	0.0	5	100.0	0.0
Great Lakes	Ludington Harbor, MI	17	17	100.0	0.2	17	100.0	0.1
Great Lakes	Manistee Harbor, MI	6	6	100.0	0.1	6	100.0	0.0
Great Lakes	Marblehead, OH	6	6	100.0	0.1	6	100.0	0.0
Atlantic	Marcus Hook, PA	30	7	24.1	0.1	9	30.7	0.1
Pacific	Mare Island Strait, CA	3	2	66.7	0.0	2	66.7	0.0
Great Lakes	Marysville, MI	25	25	100.0	0.2	25	100.0	0.2
Gulf	Matagorda Ship Channel, TX	259	147	56.8	1.3	147	56.8	1.0
Atlantic	Mayaguez Harbor, PR	33	9	25.9	0.1	9	25.9	0.1
Great Lakes	Menominee Harbor And River, MI and WI	38	17	45.2	0.2	17	45.2	0.1
Pacific	Metlakatla Harbor, AK	15	15	100.0	0.1	15	100.0	0.1
Atlantic	Miami Harbor, FL	1,699	1,505	88.6	13.3	1,548	91.1	10.6
Great Lakes	Milwaukee Harbor, WI	175	139	79.1	1.2	139	79.1	0.9
Gulf	Mobile Harbor, AL	1,888	50	2.7	0.4	604	32.0	4.1
Atlantic	Morehead City Harbor, NC	142	34	24.2	0.3	34	24.2	0.2
Great Lakes	Muskegon Harbor, MI	40	40	100.0	0.4	40	100.0	0.3
Pacific	Naknek River, AK	4	4	100.0	0.0	4	100.0	0.0
Pacific	Nawiliwili Harbor, Kauai, HI	4	3	75.0	0.0	3	75.0	0.0

TABLE H-1C

ANALYSIS OF VESSEL TYPE CONSTRAINTS, BULK CARRIER 2020

Coast Name	Port Name	Number of Calls	With Projects			Without Projects		
			Constrained Calls With Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls	Constrained Calls Without Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls
Atlantic	New Bedford and Fairhaven Harbor, MA	4	4	100.0	0.0	4	100.0	0.0
Atlantic	New Haven Harbor, CT	205	107	52.1	0.9	107	52.1	0.7
Atlantic	New London Harbor, CT	6	2	33.3	0.0	2	33.3	0.0
Pacific	Nikishka, AK	4	1	25.0	0.0	1	25.0	0.0
Atlantic	Norfolk Harbor, VA	607	115	19.0	1.0	121	20.0	0.8
Atlantic	Northville, L.I., NY	3	0	0.0	0.0	0	0.0	0.0
Pacific	Oakland Harbor, CA	138	5	3.6	0.0	21	15.4	0.1
Great Lakes	Ogdensburg Harbor, NY	13	13	100.0	0.1	13	100.0	0.1
Pacific	Olympia Harbor, WA	28	28	100.0	0.2	28	100.0	0.2
Great Lakes	Ontonagon Harbor, MI	9	9	100.0	0.1	9	100.0	0.1
Great Lakes	Oswego Harbor, NY	9	9	100.0	0.1	9	100.0	0.1
Pacific	Other Puget Sound Area Ports, WA	37	0	0.0	0.0	0	0.0	0.0
Pacific	Other San Francisco Bay Area Ports, CA	15	15	100.0	0.1	15	100.0	0.1
Atlantic	Palm Beach Harbor, FL	21	11	52.6	0.1	11	52.6	0.1
Gulf	Panama City Harbor, FL	232	76	32.8	0.7	76	32.8	0.5
Gulf	Pascagoula Harbor, MS	194	68	35.0	0.6	71	36.6	0.5
Atlantic	Paulsboro, NJ	17	13	76.3	0.1	13	76.3	0.1
Gulf	Pensacola Harbor, FL	16	8	49.5	0.1	8	49.5	0.1
Atlantic	Philadelphia Harbor, PA	311	138	44.5	1.2	158	50.8	1.1
Atlantic	Piscataqua River, ME and NH	97	73	75.5	0.7	73	75.5	0.5
Pacific	Pittsburg, CA	21	19	94.2	0.2	19	94.2	0.1
Atlantic	Ponce Harbor, PR	58	10	17.7	0.1	10	17.7	0.1
Pacific	Port Angeles Harbor, WA	79	7	8.4	0.1	7	8.4	0.0
Gulf	Port Arthur, TX	368	58	15.8	0.5	58	15.8	0.4
Great Lakes	Port Dolomite, MI	5	5	100.0	0.0	5	100.0	0.0
Atlantic	Port Everglades Harbor, FL	342	52	15.2	0.5	52	15.2	0.4
Atlantic	Port in Caribbean	23	5	21.7	0.0	5	21.7	0.0
Pacific	Port Hueneme, CA	100	62	62.2	0.6	62	62.2	0.4
Great Lakes	Port Huron, MI	13	13	100.0	0.1	13	100.0	0.1
Great Lakes	Port Inland, MI	17	17	100.0	0.2	17	100.0	0.1
Gulf	Port Manatee, FL	34	5	14.5	0.0	5	14.5	0.0
Atlantic	Port Of Albany, NY	94	78	83.4	0.7	78	83.4	0.5
Pacific	Port Of Astoria, OR	17	6	34.6	0.1	9	52.0	0.1
Gulf	Port Of Baton Rouge, LA	1,482	49	3.3	0.4	345	23.3	2.4
Atlantic	Port Of Boston, MA	107	39	36.5	0.3	46	43.3	0.3
Great Lakes	Port Of Buffalo, NY	67	35	51.3	0.3	35	51.3	0.2
Great Lakes	Port Of Chicago, IL	891	867	97.3	7.7	867	97.3	5.9
Great Lakes	Port Of Detroit, MI	867	859	99.1	7.6	859	99.1	5.9
Atlantic	Port Of Hopewell, VA	60	30	49.9	0.3	30	49.9	0.2
Pacific	Port Of Kalama, WA	109	25	23.1	0.2	35	31.6	0.2
Pacific	Port Of Longview, WA	308	9	3.0	0.1	34	10.9	0.2
Gulf	Port Of New Orleans, LA	2,523	89	3.5	0.8	396	15.7	2.7
Atlantic	Port Of New York/New Jersey	714	135	18.9	1.2	227	31.8	1.6
Atlantic	Port Of Newport News, VA	337	65	19.4	0.6	72	21.3	0.5
Gulf	Port Of Plaquemine, LA	610	65	10.6	0.6	316	51.7	2.2
Pacific	Port Of Portland, OR	1,292	264	20.5	2.3	264	20.5	1.8
Atlantic	Port Of Richmond, VA	16	8	49.2	0.1	8	49.2	0.1
Gulf	Port Of South Louisiana, LA	2,526	113	4.5	1.0	702	27.8	4.8
Pacific	Port Of Vancouver, WA	439	117	26.8	1.0	117	26.8	0.8
Atlantic	Port Of Wilmington, NC	310	34	11.1	0.3	146	47.0	1.0
Atlantic	Portland Harbor, ME	29	28	96.5	0.2	28	96.5	0.2
Atlantic	Potomac River At Alexandria, VA	8	8	100.0	0.1	8	100.0	0.1

TABLE H-1C

ANALYSIS OF VESSEL TYPE CONSTRAINTS, BULK CARRIER 2020

Coast Name	Port Name	Number of Calls	With Projects			Without Projects		
			Constrained Calls With Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls	Constrained Calls Without Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls
Great Lakes	Presque Isle Harbor, MI	26	26	100.0	0.2	26	100.0	0.2
Pacific	Prince Wales Is. West Side, AK	62	1	1.6	0.0	1	1.6	0.0
Pacific	Prince William Sound, AK	33	0	0.0	0.0	0	0.0	0.0
Atlantic	Providence River And Harbor, RI	43	14	32.5	0.1	14	32.5	0.1
Pacific	Redwood City Harbor, CA	15	15	100.0	0.1	15	100.0	0.1
Pacific	Revillagigedo Channel	20	1	5.1	0.0	1	5.1	0.0
Pacific	Richmond Harbor, CA	80	2	2.5	0.0	43	53.3	0.3
Great Lakes	Rochester (Charlotte) Harbor, NY	4	3	75.0	0.0	3	75.0	0.0
Pacific	Sacramento, CA	87	66	75.8	0.6	66	75.8	0.4
Atlantic	Salem Harbor, MA	48	48	100.0	0.4	48	100.0	0.3
Atlantic	Salem River, NJ	5	5	100.0	0.0	5	100.0	0.0
Pacific	San Diego Harbor, CA	167	7	4.0	0.1	7	4.0	0.0
Pacific	San Francisco Harbor, CA	44	15	33.3	0.1	15	33.3	0.1
Atlantic	San Juan Harbor, PR	324	10	2.9	0.1	10	2.9	0.1
Great Lakes	Sandusky Harbor, OH	146	138	94.3	1.2	138	94.3	0.9
Great Lakes	Sault Ste. Marie, MI	8	8	100.0	0.1	8	100.0	0.1
Atlantic	Savannah Harbor, GA	654	1	0.2	0.0	61	9.3	0.4
Atlantic	Searsport Harbor, ME	46	20	44.2	0.2	20	44.2	0.1
Pacific	Seattle Harbor, WA	408	238	58.4	2.1	361	88.5	2.5
Pacific	Seward Harbor, AK	12	12	100.0	0.1	12	100.0	0.1
Pacific	Skagway Harbor, AK	19	19	100.0	0.2	19	100.0	0.1
Atlantic	Caribbean Islands	16	6	36.0	0.1	6	36.0	0.0
Pacific	Stephens Passage, AK	10	0	0.0	0.0	0	0.0	0.0
Pacific	Stockton, CA	45	33	71.9	0.3	33	71.9	0.2
Great Lakes	Stoneport, MI	37	37	100.0	0.3	37	100.0	0.3
Atlantic	Stony Point, NY	28	11	38.3	0.1	11	38.3	0.1
Pacific	Tacoma Harbor, WA	412	100	24.3	0.9	230	55.8	1.6
Gulf	Tampa Harbor, FL	696	55	7.9	0.5	55	7.9	0.4
Gulf	Texas City, TX	111	13	12.0	0.1	50	45.2	0.3
Great Lakes	Toledo Harbor, OH	388	311	80.0	2.8	311	80.0	2.1
Pacific	Unalaska Bay and Island, AK	7	6	85.7	0.1	6	85.7	0.0
Atlantic	Wilmington Harbor, DE	101	58	57.9	0.5	58	57.9	0.4
Pacific	Wrangell Harbor, AK	4	0	0.0	0.0	0	0.0	0.0
Atlantic	Yabucoa Harbor, PR	8	5	58.5	0.0	5	58.5	0.0
Pacific	Yaquina Bay & Harbor, OR	8	8	100.0	0.1	8	100.0	0.1
	TOTAL		**11,279**			**14,640**		

TABLE H-2A

ANALYSIS OF VESSEL TYPE CONSTRAINTS, CONTAINER 2000

Coast Name	Port Name	Number of Calls	With Projects			Without Projects		
			Constrained Calls With Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls	Constrained Calls Without Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls
Great Lakes	Alexandria Bay, NY	6	6	100.0	0.1	6	100.0	0.1
Pacific	Anchorage, AK	7	3	45.8	0.0	5	76.4	0.0
Gulf	Atchafalaya Rvr Morgan City To Gulf	16	16	100.0	0.1	16	100.0	0.1
Atlantic	Baltimore Harbor and Channels, MD	1,491	0	0.0	0.0	0	0.0	0.0
Gulf	Bayou Dupre, LA	2	2	100.0	0.0	2	100.0	0.0
Gulf	Bayou Lafourche, LA	1	1	100.0	0.0	1	100.0	0.0
Gulf	Beaumont, TX	7	1	14.2	0.0	1	14.2	0.0
Pacific	Bellingham Bay and Harbor, WA	5	4	80.0	0.0	4	80.0	0.0
Gulf	Brownsville, TX	15	4	25.9	0.0	4	25.9	0.0
Atlantic	Brunswick Harbor, GA	24	21	86.9	0.2	21	86.9	0.2
Great Lakes	Burns Waterway Harbor, IN	1	1	100.0	0.0	1	100.0	0.0
Atlantic	Canaveral Harbor, FL	7	4	57.1	0.0	4	57.1	0.0
Pacific	Carquinez Strait, CA	8	0	0.0	0.0	0	0.0	0.0
Atlantic	Charleston Harbor, SC	3,197	1,465	45.8	12.9	1,465	45.8	12.9
Atlantic	Chester Area, PA	162	0	0.0	0.0	0	0.0	0.0
Atlantic	Caribbean Islands	14	5	32.4	0.0	5	32.4	0.0
Great Lakes	Cleveland Harbor, OH	14	14	100.0	0.1	14	100.0	0.1
Pacific	Coos Bay, OR	6	3	46.7	0.0	3	46.7	0.0
Gulf	Corpus Christi, TX	12	1	8.2	0.0	1	8.2	0.0
Atlantic	Del River Between Phila Tren	11	11	100.0	0.1	11	100.0	0.1
Atlantic	Delaware River At Camden, NJ	204	7	3.4	0.1	7	3.4	0.1
Great Lakes	Duluth-Superior Harbor, MN and WI	4	4	100.0	0.0	4	100.0	0.0
Gulf	East Pearl River MS	7	7	100.0	0.1	7	100.0	0.1
Atlantic	Eastport Harbor, ME	1	0	0.0	0.0	0	0.0	0.0
Pacific	El Segundo, CA	2	0	0.0	0.0	0	0.0	0.0
Great Lakes	Erie Harbor, PA	2	2	100.0	0.0	2	100.0	0.0
Atlantic	Fall River Harbor, MA	5	4	80.0	0.0	4	80.0	0.0
Atlantic	Fernandina Harbor, FL	124	2	1.6	0.0	2	1.6	0.0
Atlantic	Fort Pierce Harbor, FL	2	2	100.0	0.0	2	100.0	0.0
Atlantic	Caribbean Islands	2	2	100.0	0.0	2	100.0	0.0
Gulf	Freeport Harbor, TX	168	0	0.0	0.0	0	0.0	0.0
Gulf	Galveston Channel, TX	9	2	22.9	0.0	2	22.9	0.0
Great Lakes	Gary Harbor, IN	1	1	100.0	0.0	1	100.0	0.0
Atlantic	Georgetown Harbor, SC	8	8	100.0	0.1	8	100.0	0.1
Atlantic	Gloucester Harbor, MA	5	5	100.0	0.0	5	100.0	0.0
Pacific	Grays Harbor and Chehalis River, WA	2	2	100.0	0.0	2	100.0	0.0
Atlantic	Guanica Harbor, PR	1	1	100.0	0.0	1	100.0	0.0
Gulf	Gulfport Harbor, MS	255	5	2.0	0.0	5	2.0	0.0
Pacific	Hilo Harbor, HI	1	1	100.0	0.0	1	100.0	0.0
Pacific	Homer, AK	1	1	100.0	0.0	1	100.0	0.0
Pacific	Honolulu Harbor, Oahu, HI	67	0	0.0	0.0	0	0.0	0.0
Gulf	Houma Navigation Canal, LA	1	1	100.0	0.0	1	100.0	0.0
Gulf	Houston, TX	2,101	428	20.4	3.8	428	20.4	3.8
Pacific	Humboldt Harbor and Bay, CA	5	4	75.2	0.0	4	75.2	0.0
Great Lakes	Huron Harbor, OH	2	2	100.0	0.0	2	100.0	0.0
Great Lakes	Indiana Harbor, IN	4	4	100.0	0.0	4	100.0	0.0
Atlantic	Jacksonville Harbor, FL	751	92	12.2	0.8	92	12.2	0.8
Atlantic	Jobos Harbor, PR	1	1	100.0	0.0	1	100.0	0.0
Pacific	Ketchikan Harbor, AK	6	6	100.0	0.1	6	100.0	0.1
Atlantic	Key West Harbor, FL	3	2	66.7	0.0	2	66.7	0.0
Pacific	Kodiak Harbor, AK	5	5	100.0	0.0	5	100.0	0.0
Gulf	Lake Charles, LA	36	4	11.2	0.0	4	11.2	0.0

TABLE H-2A

ANALYSIS OF VESSEL TYPE CONSTRAINTS, CONTAINER 2000

Coast Name	Port Name	Number of Calls	With Projects			Without Projects		
			Constrained Calls With Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls	Constrained Calls Without Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls
Great Lakes	Lake Michigan	4	4	100.0	0.0	4	100.0	0.0
Pacific	Long Beach Harbor, CA	4,670	0	0.0	0.0	0	0.0	0.0
Pacific	Los Angeles Harbor, CA	3,713	0	0.0	0.0	0	0.0	0.0
Atlantic	Marcus Hook, PA	2	0	0.0	0.0	0	0.0	0.0
Pacific	Mare Island Strait, CA	11	4	36.4	0.0	4	36.4	0.0
Gulf	Matagorda Ship Channel, TX	4	2	47.9	0.0	2	47.9	0.0
Atlantic	Mayaguez Harbor, PR	6	0	0.0	0.0	0	0.0	0.0
Great Lakes	Menominee Harbor And River, MI and WI	2	2	100.0	0.0	2	100.0	0.0
Atlantic	Miami Harbor, FL	1,950	439	22.5	3.9	439	22.5	3.9
Great Lakes	Milwaukee Harbor, WI	4	4	100.0	0.0	4	100.0	0.0
Gulf	Mobile Harbor, AL	111	1	0.9	0.0	1	0.9	0.0
Atlantic	Morehead City Harbor, NC	15	0	0.0	0.0	0	0.0	0.0
Atlantic	New Bedford and Fairhaven Harbor, MA	2	1	50.0	0.0	1	50.0	0.0
Atlantic	New Haven Harbor, CT	4	1	25.0	0.0	1	25.0	0.0
Atlantic	New London Harbor, CT	1	0	0.0	0.0	0	0.0	0.0
Atlantic	Norfolk Harbor, VA	1,670	75	4.5	0.7	75	4.5	0.7
Pacific	Oakland Harbor, CA	3,639	2,335	64.2	20.6	2,335	64.2	20.6
Great Lakes	Ogdensburg Harbor, NY	4	4	100.0	0.0	4	100.0	0.0
Great Lakes	Oswego Harbor, NY	2	2	100.0	0.0	2	100.0	0.0
Pacific	Other Puget Sound Area Ports, WA	5	0	0.0	0.0	0	0.0	0.0
Pacific	Other San Francisco Bay Area Ports, CA	8	8	100.0	0.1	8	100.0	0.1
Atlantic	Palm Beach Harbor, FL	155	2	1.3	0.0	2	1.3	0.0
Gulf	Panama City Harbor, FL	32	8	26.5	0.1	8	26.5	0.1
Gulf	Pascagoula Harbor, MS	15	4	27.4	0.0	4	27.4	0.0
Atlantic	Paulsboro, NJ	10	2	20.0	0.0	2	20.0	0.0
Atlantic	Penobscot River ME	2	2	100.0	0.0	2	100.0	0.0
Gulf	Pensacola Harbor, FL	5	3	58.7	0.0	3	58.7	0.0
Atlantic	Philadelphia Harbor, PA	604	11	1.8	0.1	11	1.8	0.1
Atlantic	Piscataqua River, ME and NH	3	1	33.3	0.0	1	33.3	0.0
Pacific	Pittsburg, CA	2	2	100.0	0.0	2	100.0	0.0
Atlantic	Ponce Harbor, PR	262	4	1.5	0.0	4	1.5	0.0
Pacific	Port Angeles Harbor, WA	1	0	0.0	0.0	0	0.0	0.0
Gulf	Port Arthur, TX	17	2	12.0	0.0	2	12.0	0.0
Atlantic	Port Everglades Harbor, FL	1,875	45	2.4	0.4	45	2.4	0.4
Atlantic	Port in Caribbean	3	0	0.0	0.0	0	0.0	0.0
Pacific	Port Hueneme, CA	3	2	66.7	0.0	2	66.7	0.0
Great Lakes	Port Huron, MI	15	15	100.0	0.1	15	100.0	0.1
Gulf	Port Manatee, FL	4	0	0.0	0.0	0	0.0	0.0
Atlantic	Port Of Albany, NY	4	2	47.6	0.0	2	47.6	0.0
Pacific	Port Of Astoria, OR	1	0	0.0	0.0	0	0.0	0.0
Gulf	Port Of Baton Rouge, LA	26	0	0.0	0.0	0	0.0	0.0
Atlantic	Port Of Boston, MA	306	184	60.2	1.6	184	60.2	1.6
Great Lakes	Port Of Buffalo, NY	20	19	94.9	0.2	19	94.9	0.2
Great Lakes	Port Of Chicago, IL	27	25	92.5	0.2	25	92.5	0.2
Great Lakes	Port Of Detroit, MI	59	58	98.3	0.5	58	98.3	0.5
Atlantic	Port Of Hopewell, VA	10	9	89.6	0.1	9	89.6	0.1
Pacific	Port Of Kalama, WA	2	2	100.0	0.0	2	100.0	0.0
Pacific	Port Of Longview, WA	3	3	100.0	0.0	3	100.0	0.0
Gulf	Port Of New Orleans, LA	978	138	14.2	1.2	138	14.2	1.2
Atlantic	Port Of New York/New Jersey	4,662	1,444	31.0	12.7	1,444	31.0	12.7
Atlantic	Port Of Newport News, VA	309	0	0.0	0.0	0	0.0	0.0

TABLE H-2A

ANALYSIS OF VESSEL TYPE CONSTRAINTS, CONTAINER 2000

Coast Name	Port Name	Number of Calls	With Projects			Without Projects		
			Constrained Calls With Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls	Constrained Calls Without Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls
Gulf	Port Of Plaquemine, LA	3	0	0.0	0.0	0	0.0	0.0
Pacific	Port Of Portland, OR	469	186	39.7	1.6	186	39.7	1.6
Atlantic	Port Of Richmond, VA	235	235	100.0	2.1	235	100.0	2.1
Gulf	Port Of South Louisiana, LA	27	2	7.4	0.0	2	7.4	0.0
Pacific	Port Of Vancouver, WA	24	11	47.0	0.1	11	47.0	0.1
Atlantic	Port Of Wilmington, NC	277	126	45.4	1.1	126	45.4	1.1
Atlantic	Port Royal Harbor, SC	1	1	100.0	0.0	1	100.0	0.0
Pacific	Port Townsend Harbor, WA	1	1	100.0	0.0	1	100.0	0.0
Atlantic	Portland Harbor, ME	18	6	33.3	0.1	6	33.3	0.1
Atlantic	Potomac River At Alexandria, VA	1	1	100.0	0.0	1	100.0	0.0
Atlantic	Providence River and Harbor, RI	4	0	0.0	0.0	0	0.0	0.0
Pacific	Richmond Harbor, CA	40	0	0.0	0.0	0	0.0	0.0
Great Lakes	Rochester (Charlotte) Harbor, NY	14	14	100.0	0.1	14	100.0	0.1
Pacific	Sacramento, CA	3	1	33.3	0.0	1	33.3	0.0
Atlantic	Salem Harbor, MA	2	0	0.0	0.0	0	0.0	0.0
Atlantic	Salem River, NJ	16	16	100.0	0.1	16	100.0	0.1
Pacific	San Diego Harbor, CR	14	8	57.1	0.1	8	57.1	0.1
Pacific	San Francisco Harbor, CA	54	9	16.2	0.1	9	16.2	0.1
Atlantic	San Juan Harbor, PR	630	4	0.6	0.0	4	0.6	0.0
Great Lakes	Sault Ste. Marie, MI	9	9	100.0	0.1	9	100.0	0.1
Atlantic	Savannah Harbor, GA	1,975	971	49.2	8.6	971	49.2	8.6
Atlantic	Searsport Harbor, ME	7	3	45.0	0.0	3	45.0	0.0
Pacific	Seattle Harbor, WA	2,567	2,079	81.0	18.3	2,079	81.0	18.3
Atlantic	Shelter Is & Shelter Is Sd LI, NY	2	0	0.0	0.0	0	0.0	0.0
Pacific	Sitka Harbor, AK	2	2	100.0	0.0	2	100.0	0.0
Pacific	Skagway Harbor, AK	3	3	100.0	0.0	3	100.0	0.0
Atlantic	Caribbean Islands	1	0	0.0	0.0	0	0.0	0.0
Atlantic	Caribbean Islands	47	8	17.0	0.1	8	17.0	0.1
Pacific	Stockton, CA	5	2	40.0	0.0	2	40.0	0.0
Pacific	Tacoma Harbor, WA	913	549	60.1	4.8	549	60.1	4.8
Gulf	Tampa Harbor, FL	44	0	0.0	0.0	0	0.0	0.0
Gulf	Texas City, TX	10	1	9.6	0.0	1	9.6	0.0
Great Lakes	Toledo Harbor, OH	4	4	100.0	0.0	4	100.0	0.0
Pacific	Unalaska Bay and Island, AK	59	59	100.0	0.5	59	100.0	0.5
Atlantic	Wilmington Harbor, DE	363	5	1.4	0.0	5	1.4	0.0
Atlantic	York River, VA	1	1	100.0	0.0	1	100.0	0.0
	TOTAL		**11,351**			**11,353**		

TABLE H-2B

ANALYSIS OF VESSEL TYPE CONSTRAINTS, CONTAINER 2010

Coast Name	Port Name	Number of Calls	With Projects			Without Projects		
			Constrained Calls With Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls	Constrained Calls Without Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls
Great Lakes	Alexandria Bay, NY	8	8	100.0	0.1	8	100.0	0.0
Pacific	Anchorage, AK	8	4	48.8	0.1	6	73.2	0.0
Gulf	Atchafalaya Rvr Morgan City To Gulf	60	60	100.0	1.0	60	100.0	0.3
Atlantic	Baltimore Harbor and Channels, MD	2,727	0	0.0	0.0	0	0.0	0.0
Gulf	Bayou Dupre, LA	4	4	100.0	0.1	4	100.0	0.0
Gulf	Bayou Lafourche, LA	2	2	100.0	0.0	2	100.0	0.0
Gulf	Beaumont, TX	23	2	8.7	0.0	2	8.7	0.0
Pacific	Bellingham Bay and Harbor, WA	10	9	90.4	0.2	9	90.4	0.0
Gulf	Brownsville, TX	80	15	18.7	0.3	15	18.7	0.1
Atlantic	Brunswick Harbor, GA	128	70	54.9	1.2	113	88.4	0.6
Great Lakes	Burns Waterway Harbor, IN	2	2	100.0	0.0	2	100.0	0.0
Atlantic	Canaveral Harbor, FL	14	7	49.9	0.1	7	49.9	0.0
Pacific	Carquinez Strait, CA	14	2	14.3	0.0	2	14.3	0.0
Atlantic	Charleston Harbor, SC	5,455	547	10.0	9.5	2,577	47.2	13.0
Atlantic	Chester Area, PA	224	0	0.0	0.0	2	0.9	0.0
Atlantic	Caribbean Islands	21	10	47.2	0.2	10	47.2	0.1
Great Lakes	Cleveland Harbor, OH	29	29	100.0	0.5	29	100.0	0.1
Pacific	Coos Bay, OR	12	6	46.7	0.1	6	46.7	0.0
Gulf	Corpus Christi, TX	23	0	0.0	0.0	3	12.8	0.0
Atlantic	Del River Between Phila Tren	41	41	100.0	0.7	41	100.0	0.2
Atlantic	Delaware River At Camden, NJ	457	6	1.3	0.1	11	2.4	0.1
Great Lakes	Duluth-Superior Harbor, MN and WI	6	6	100.0	0.1	6	100.0	0.0
Gulf	East Pearl River, MS	34	34	100.0	0.6	34	100.0	0.2
Atlantic	Eastport Harbor, ME	2	0	0.0	0.0	0	0.0	0.0
Pacific	El Segundo, CA	3	0	0.0	0.0	0	0.0	0.0
Great Lakes	Erie Harbor, PA	3	3	100.0	0.1	3	100.0	0.0
Atlantic	Fall River Harbor, MA	8	6	75.0	0.1	6	75.0	0.0
Atlantic	Fernandina Harbor, FL	242	8	3.1	0.1	8	3.1	0.0
Atlantic	Fort Pierce Harbor, FL	3	3	100.0	0.1	3	100.0	0.0
Atlantic	Caribbean Islands	3	3	100.0	0.1	3	100.0	0.0
Gulf	Freeport Harbor, TX	319	2	0.6	0.0	2	0.6	0.0
Gulf	Galveston Channel, TX	33	1	3.0	0.0	4	12.2	0.0
Great Lakes	Gary Harbor, IN	2	2	100.0	0.0	2	100.0	0.0
Atlantic	Georgetown Harbor, SC	25	0	0.0	0.0	25	100.0	0.1
Atlantic	Gloucester Harbor, MA	12	12	100.0	0.2	12	100.0	0.1
Pacific	Grays Harbor and Chehalis River, WA	3	3	100.0	0.1	3	100.0	0.0
Atlantic	Guanica Harbor, PR	2	2	100.0	0.0	2	100.0	0.0
Gulf	Gulfport Harbor, MS	443	8	1.8	0.1	8	1.8	0.0
Pacific	Hilo Harbor, HI	2	2	100.0	0.0	2	100.0	0.0
Pacific	Homer, AK	2	2	100.0	0.0	2	100.0	0.0
Pacific	Honolulu Harbor, Oahu, HI	122	2	1.6	0.0	2	1.6	0.0
Gulf	Houma Navigation Canal, LA	2	2	100.0	0.0	2	100.0	0.0
Gulf	Houston, TX	4,456	108	2.4	1.9	782	17.5	3.9
Pacific	Humboldt Harbor And Bay, CA	15	13	86.0	0.2	13	86.0	0.1
Great Lakes	Huron Harbor, OH	3	3	100.0	0.1	3	100.0	0.0
Great Lakes	Indiana Harbor, IN	6	6	100.0	0.1	6	100.0	0.0
Atlantic	Jacksonville Harbor, FL	1,475	150	10.2	2.6	281	19.1	1.4
Atlantic	Jobos Harbor, PR	2	2	100.0	0.0	2	100.0	0.0
Pacific	Ketchikan Harbor, AK	11	11	100.0	0.2	11	100.0	0.1
Atlantic	Key West Harbor, FL	4	3	75.0	0.1	3	75.0	0.0
Pacific	Kodiak Harbor, AK	7	7	100.0	0.1	7	100.0	0.0

TABLE H-2B

ANALYSIS OF VESSEL TYPE CONSTRAINTS, CONTAINER 2010

Coast Name	Port Name	Number of Calls	With Projects			Without Projects		
			Constrained Calls With Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls	Constrained Calls Without Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls
Gulf	Lake Charles, LA	159	7	4.3	0.1	7	4.3	0.0
Great Lakes	Lake Michigan	6	6	100.0	0.1	6	100.0	0.0
Pacific	Long Beach Harbor, CA	8,119	0	0.0	0.0	0	0.0	0.0
Pacific	Los Angeles Harbor, CA	6,206	0	0.0	0.0	0	0.0	0.0
Atlantic	Marcus Hook, PA	4	0	0.0	0.0	0	0.0	0.0
Pacific	Mare Island Strait, CA	14	6	43.0	0.1	6	43.0	0.0
Gulf	Matagorda Ship Channel, TX	6	4	61.8	0.1	4	61.8	0.0
Atlantic	Mayaguez Harbor, PR	41	2	5.6	0.0	2	5.6	0.0
Great Lakes	Menominee Harbor and River, MI and WI	4	4	100.0	0.1	4	100.0	0.0
Atlantic	Miami Harbor, FL	3,986	433	10.9	7.5	874	21.9	4.4
Great Lakes	Milwaukee Harbor, WI	5	5	100.0	0.1	5	100.0	0.0
Gulf	Mobile Harbor, AL	622	0	0.0	0.0	3	0.5	0.0
Atlantic	Morehead City Harbor, NC	51	2	3.9	0.0	2	3.9	0.0
Atlantic	New Bedford and Fairhaven Harbor, MA	3	2	66.7	0.0	2	66.7	0.0
Atlantic	New Haven Harbor, CT	8	2	24.1	0.0	2	24.1	0.0
Atlantic	New London Harbor, CT	2	0	0.0	0.0	0	0.0	0.0
Atlantic	Norfolk Harbor, VA	2,405	0	0.0	0.0	148	6.2	0.7
Pacific	Oakland Harbor, CA	5,798	0	0.0	0.0	3,947	68.1	19.8
Great Lakes	Ogdensburg Harbor, NY	6	6	100.0	0.1	6	100.0	0.0
Great Lakes	Oswego Harbor, NY	5	5	100.0	0.1	5	100.0	0.0
Pacific	Other Puget Sound Area Ports, WA	7	0	0.0	0.0	0	0.0	0.0
Pacific	Other San Francisco Bay Area Ports, CA	12	12	100.0	0.2	12	100.0	0.1
Atlantic	Palm Beach Harbor, FL	331	8	2.5	0.1	8	2.5	0.0
Gulf	Panama City Harbor, FL	186	41	22.1	0.7	41	22.1	0.2
Gulf	Pascagoula Harbor, MS	67	15	23.1	0.3	17	26.1	0.1
Atlantic	Paulsboro, NJ	13	3	22.7	0.1	4	30.3	0.0
Atlantic	Penobscot River, ME	3	3	100.0	0.1	3	100.0	0.0
Gulf	Pensacola Harbor, FL	14	5	35.7	0.1	5	35.7	0.0
Atlantic	Philadelphia Harbor, PA	1,022	22	2.1	0.4	29	2.9	0.1
Atlantic	Piscataqua River, ME and NH	6	2	33.4	0.0	2	33.4	0.0
Pacific	Pittsburg, CA	3	3	100.0	0.1	3	100.0	0.0
Atlantic	Ponce Harbor, PR	433	10	2.3	0.2	10	2.3	0.1
Pacific	Port Angeles Harbor, WA	2	0	0.0	0.0	0	0.0	0.0
Gulf	Port Arthur, TX	73	4	5.5	0.1	4	5.5	0.0
Atlantic	Port Everglades Harbor, FL	3,661	68	1.9	1.2	68	1.9	0.3
Atlantic	Port in Caribbean	6	0	0.0	0.0	0	0.0	0.0
Pacific	Port Hueneme, CA	9	7	77.7	0.1	7	77.7	0.0
Great Lakes	Port Huron, MI	17	17	100.0	0.3	17	100.0	0.1
Gulf	Port Manatee, FL	7	1	15.4	0.0	1	15.4	0.0
Atlantic	Port Of Albany, NY	10	4	38.5	0.1	4	38.5	0.0
Pacific	Port Of Astoria, OR	2	0	0.0	0.0	0	0.0	0.0
Gulf	Port Of Baton Rouge, LA	65	0	0.0	0.0	2	3.1	0.0
Atlantic	Port Of Boston, MA	489	40	8.3	0.7	288	59.0	1.5
Great Lakes	Port Of Buffalo, NY	46	45	97.8	0.8	45	97.8	0.2
Great Lakes	Port Of Chicago, IL	73	71	97.2	1.2	71	97.2	0.4
Great Lakes	Port Of Detroit, MI	97	96	99.0	1.7	96	99.0	0.5
Atlantic	Port Of Hopewell, VA	23	22	95.7	0.4	22	95.7	0.1
Pacific	Port Of Kalama, WA	3	3	100.0	0.1	3	100.0	0.0
Pacific	Port Of Longview, WA	4	4	100.0	0.1	4	100.0	0.0
Gulf	Port Of New Orleans, LA	2,461	220	8.9	3.8	234	9.5	1.2
Atlantic	Port Of New York/New Jersey	7,392	660	8.9	11.4	2,466	33.4	12.4

TABLE H-2B

ANALYSIS OF VESSEL TYPE CONSTRAINTS, CONTAINER 2010

Coast Name	Port Name	Number of Calls	With Projects			Without Projects		
			Constrained Calls With Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls	Constrained Calls Without Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls
Atlantic	Port Of Newport News, VA	537	0	0.0	0.0	1	0.2	0.0
Gulf	Port Of Plaquemine, LA	6	0	0.0	0.0	0	0.0	0.0
Pacific	Port Of Portland, OR	744	327	44.0	5.7	327	44.0	1.6
Atlantic	Port Of Richmond, VA	321	321	100.0	5.6	321	100.0	1.6
Gulf	Port Of South Louisiana, LA	54	0	0.0	0.0	3	5.6	0.0
Pacific	Port Of Vancouver, WA	54	25	46.5	0.4	25	46.5	0.1
Atlantic	Port Of Wilmington, NC	531	197	37.2	3.4	270	50.8	1.4
Atlantic	Port Royal Harbor, SC	2	2	100.0	0.0	2	100.0	0.0
Pacific	Port Townsend Harbor, WA	2	2	100.0	0.0	2	100.0	0.0
Atlantic	Portland Harbor, ME	62	10	16.1	0.2	10	16.1	0.1
Atlantic	Potomac River At Alexandria, VA	3	3	100.0	0.0	3	100.0	0.0
Atlantic	Providence River and Harbor, RI	6	0	0.0	0.0	0	0.0	0.0
Pacific	Richmond Harbor, CA	71	0	0.0	0.0	1	1.4	0.0
Great Lakes	Rochester (Charlotte) Harbor, NY	37	37	100.0	0.6	37	100.0	0.2
Pacific	Sacramento, CA	6	3	49.9	0.1	3	49.9	0.0
Atlantic	Salem Harbor, MA	3	1	33.3	0.0	1	33.3	0.0
Atlantic	Salem River, NJ	55	55	100.0	0.9	55	100.0	0.3
Pacific	San Diego Harbor, CA	21	13	61.2	0.2	13	61.2	0.1
Pacific	San Francisco Harbor, CA	100	10	10.3	0.2	10	10.3	0.1
Atlantic	San Juan Harbor, PR	1,253	6	0.5	0.1	6	0.5	0.0
Great Lakes	Sault Ste. Marie, MI	14	14	100.0	0.2	14	100.0	0.1
Atlantic	Savannah Harbor, GA	3,671	2	0.1	0.0	1,853	50.5	9.3
Atlantic	Searsport Harbor, ME	18	5	28.0	0.1	5	28.0	0.0
Pacific	Seattle Harbor, WA	3,856	1,356	35.2	23.5	3,265	84.7	16.4
Atlantic	Shelter Is & Shelter Is Sd LI, NY	4	0	0.0	0.0	0	0.0	0.0
Pacific	Sitka Harbor, AK	3	3	100.0	0.1	3	100.0	0.0
Pacific	Skagway Harbor, AK	6	6	100.0	0.1	6	100.0	0.0
Atlantic	Caribbean Islands	2	0	0.0	0.0	0	0.0	0.0
Atlantic	Caribbean Islands	75	11	14.1	0.2	11	14.1	0.1
Pacific	Stockton, CA	13	5	37.6	0.1	5	37.6	0.0
Pacific	Tacoma Harbor, WA	1,395	163	11.7	2.8	910	65.2	4.6
Gulf	Tampa Harbor, FL	198	2	1.0	0.0	2	1.0	0.0
Gulf	Texas City, TX	28	3	10.6	0.1	3	10.6	0.0
Great Lakes	Toledo Harbor, OH	10	10	100.0	0.2	10	100.0	0.0
Pacific	Unalaska Bay and Island, AK	70	70	100.0	1.2	70	100.0	0.4
Atlantic	Wilmington Harbor, DE	674	10	1.5	0.2	10	1.5	0.1
Atlantic	York River, VA	2	2	100.0	0.0	2	100.0	0.0
	TOTAL		**5,772**			**19,891**		

TABLE H-2C

ANALYSIS OF VESSEL TYPE CONSTRAINTS, CONTAINER 2020

Coast Name	Port Name	Number of Calls	With Projects			Without Projects		
			Constrained Calls With Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls	Constrained Calls Without Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls
Great Lakes	Alexandria Bay, NY	10	10	100.0	0.1	10	100.0	0.0
Pacific	Anchorage, AK	11	5	46.1	0.0	7	65.0	0.0
Gulf	Atchafalaya Rvr Morgan City To Gulf	109	109	100.0	1.1	109	100.0	0.3
Atlantic	Baltimore Harbor and Channels, MD	4,396	0	0.0	0.0	0	0.0	0.0
Gulf	Bayou Dupre, LA	6	6	100.0	0.1	6	100.0	0.0
Gulf	Bayou Lafourche, LA	4	4	100.0	0.0	4	100.0	0.0
Gulf	Beaumont, TX	54	5	9.0	0.0	5	9.0	0.0
Pacific	Bellingham Bay and Harbor, WA	15	14	89.2	0.1	14	89.2	0.0
Gulf	Brownsville, TX	200	50	25.0	0.5	50	25.0	0.2
Atlantic	Brunswick Harbor, GA	324	182	56.1	1.8	289	89.2	0.9
Great Lakes	Burns Waterway Harbor, IN	3	3	100.0	0.0	3	100.0	0.0
Atlantic	Canaveral Harbor, FL	21	9	42.8	0.1	9	42.8	0.0
Pacific	Carquinez Strait, CA	20	5	24.8	0.0	5	24.8	0.0
Atlantic	Charleston Harbor, SC	8,649	1,150	13.3	11.4	4,275	49.4	13.1
Atlantic	Chester Area, PA	307	0	0.0	0.0	6	2.0	0.0
Atlantic	Caribbean Islands	27	14	53.5	0.1	14	53.5	0.0
Great Lakes	Cleveland Harbor, OH	60	60	100.0	0.6	60	100.0	0.2
Pacific	Coos Bay, OR	23	11	48.8	0.1	11	48.8	0.0
Gulf	Corpus Christi, TX	35	0	0.0	0.0	5	14.3	0.0
Atlantic	Del River Between Phila Tren	87	87	100.0	0.9	87	100.0	0.3
Atlantic	Delaware River At Camden, NJ	870	8	0.9	0.1	16	1.8	0.0
Great Lakes	Duluth-Superior Harbor, MN and WI	7	7	100.0	0.1	7	100.0	0.0
Gulf	East Pearl River MS	76	76	100.0	0.8	76	100.0	0.2
Atlantic	Eastport Harbor, ME	3	0	0.0	0.0	0	0.0	0.0
Pacific	El Segundo, CA	4	0	0.0	0.0	0	0.0	0.0
Great Lakes	Erie Harbor, PA	4	4	100.0	0.0	4	100.0	0.0
Atlantic	Fall River Harbor, MA	13	9	71.0	0.1	9	71.0	0.0
Atlantic	Fernandina Harbor, FL	403	22	5.4	0.2	22	5.4	0.1
Atlantic	Fort Pierce Harbor, FL	4	4	100.0	0.0	4	100.0	0.0
Atlantic	Caribbean Islands	4	4	100.0	0.0	4	100.0	0.0
Gulf	Freeport Harbor, TX	555	4	0.8	0.0	4	0.8	0.0
Gulf	Galveston Channel, TX	66	2	3.0	0.0	6	9.8	0.0
Great Lakes	Gary Harbor, IN	3	3	100.0	0.0	3	100.0	0.0
Atlantic	Georgetown Harbor, SC	61	-	0.0	0.0	61	100.0	0.2
Atlantic	Gloucester Harbor, MA	24	24	100.0	0.2	24	100.0	0.1
Pacific	Grays Harbor and Chehalis River, WA	4	4	100.0	0.0	4	100.0	0.0
Atlantic	Guanica Harbor, PR	3	3	100.0	0.0	3	100.0	0.0
Gulf	Gulfport Harbor, MS	676	19	2.7	0.2	19	2.7	0.1
Pacific	Hilo Harbor, HI	3	3	100.0	0.0	3	100.0	0.0
Pacific	Homer, AK	3	3	100.0	0.0	3	100.0	0.0
Pacific	Honolulu Harbor, Oahu, HI	196	4	2.0	0.0	4	2.0	0.0
Gulf	Houma Navigation Canal, LA	3	3	100.0	0.0	3	100.0	0.0
Gulf	Houston, TX	8,351	256	3.1	2.5	1,401	16.8	4.3
Pacific	Humboldt Harbor and Bay, CA	41	38	92.2	0.4	38	92.2	0.1
Great Lakes	Huron Harbor, OH	4	4	100.0	0.0	4	100.0	0.0
Great Lakes	Indiana Harbor, IN	8	8	100.0	0.1	8	100.0	0.0
Atlantic	Jacksonville Harbor, FL	2,512	309	12.3	3.1	633	25.2	1.9
Atlantic	Jobos Harbor, PR	3	3	100.0	0.0	3	100.0	0.0
Pacific	Ketchikan Harbor, AK	19	19	100.0	0.2	19	100.0	0.1
Atlantic	Key West Harbor, FL	5	4	80.0	0.0	4	80.0	0.0
Pacific	Kodiak Harbor, AK	8	8	100.0	0.1	8	100.0	0.0

TABLE H-2C

ANALYSIS OF VESSEL TYPE CONSTRAINTS, CONTAINER 2020

Coast Name	Port Name	Number of Calls	With Projects			Without Projects		
			Constrained Calls With Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls	Constrained Calls Without Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls
Gulf	Lake Charles, LA	331	15	4.7	0.2	15	4.7	0.0
Great Lakes	Lake Michigan	8	8	100.0	0.1	8	100.0	0.0
Pacific	Long Beach Harbor, CA	12,997	0	0.0	0.0	0	0.0	0.0
Pacific	Los Angeles Harbor, CA	9,605	0	0.0	0.0	0	0.0	0.0
Atlantic	Marcus Hook, PA	6	0	0.0	0.0	1	17.5	0.0
Pacific	Mare Island Strait, CA	17	8	48.0	0.1	8	48.0	0.0
Gulf	Matagorda Ship Channel, TX	9	6	69.9	0.1	6	69.9	0.0
Atlantic	Mayaguez Harbor, PR	111	13	11.4	0.1	13	11.4	0.0
Great Lakes	Menominee Harbor and River, MI and WI	6	6	100.0	0.1	6	100.0	0.0
Atlantic	Miami Harbor, FL	7,068	808	11.4	8.0	1,550	21.9	4.7
Great Lakes	Milwaukee Harbor, WI	6	6	100.0	0.1	6	100.0	0.0
Gulf	Mobile Harbor, AL	1,499	0	0.0	0.0	10	0.6	0.0
Atlantic	Morehead City Harbor, NC	99	10	10.0	0.1	10	10.0	0.0
Atlantic	New Bedford and Fairhaven Harbor, MA	4	3	75.0	0.0	3	75.0	0.0
Atlantic	New Haven Harbor, CT	16	4	25.8	0.0	4	25.8	0.0
Atlantic	New London Harbor, CT	3	1	33.3	0.0	1	33.3	0.0
Atlantic	Norfolk Harbor, VA	3,323	0	0.0	0.0	249	7.5	0.8
Pacific	Oakland Harbor, CA	8,631	0	0.0	0.0	6,186	71.7	18.9
Great Lakes	Ogdensburg Harbor, NY	7	7	100.0	0.1	7	100.0	0.0
Great Lakes	Oswego Harbor, NY	5	5	100.0	0.0	5	100.0	0.0
Pacific	Other Puget Sound Area Ports, WA	9	0	0.0	0.0	0	0.0	0.0
Pacific	Other San Francisco Bay Area Ports, CA	16	16	100.0	0.2	16	100.0	0.0
Atlantic	Palm Beach Harbor, FL	576	41	7.1	0.4	41	7.1	0.1
Gulf	Panama City Harbor, FL	481	113	23.4	1.1	113	23.4	0.3
Gulf	Pascagoula Harbor, MS	179	40	22.4	0.4	43	23.9	0.1
Atlantic	Paulsboro, NJ	17	4	23.1	0.0	8	46.2	0.0
Atlantic	Penobscot River ME	4	4	100.0	0.0	4	100.0	0.0
Gulf	Pensacola Harbor, FL	27	9	34.1	0.1	9	34.1	0.0
Atlantic	Philadelphia Harbor, PA	1,568	46	2.9	0.5	80	5.1	0.2
Atlantic	Piscataqua River, ME and NH	12	3	24.3	0.0	3	24.3	0.0
Pacific	Pittsburg, CA	4	4	100.0	0.0	4	100.0	0.0
Atlantic	Ponce Harbor, PR	636	19	3.0	0.2	19	3.0	0.1
Pacific	Port Angeles Harbor, WA	3	0	0.0	0.0	0	0.0	0.0
Gulf	Port Arthur, TX	163	6	3.7	0.1	6	3.7	0.0
Atlantic	Port Everglades Harbor, FL	6,168	105	1.7	1.0	105	1.7	0.3
Atlantic	Port in Caribbean	8	0	0.0	0.0	0	0.0	0.0
Pacific	Port Hueneme, CA	18	16	89.0	0.2	16	89.0	0.0
Great Lakes	Port Huron, MI	19	19	100.0	0.2	19	100.0	0.1
Gulf	Port Manatee, FL	9	3	33.2	0.0	3	33.2	0.0
Atlantic	Port Of Albany, NY	22	7	32.4	0.1	7	32.4	0.0
Pacific	Port Of Astoria, OR	3	0	0.0	0.0	0	0.0	0.0
Gulf	Port Of Baton Rouge, LA	129	0	0.0	0.0	8	5.8	0.0
Atlantic	Port Of Boston, MA	704	84	11.9	0.8	413	58.6	1.3
Great Lakes	Port Of Buffalo, NY	61	60	98.4	0.6	60	98.4	0.2
Great Lakes	Port Of Chicago, IL	145	143	98.6	1.4	143	98.6	0.4
Great Lakes	Port Of Detroit, MI	151	150	99.3	1.5	150	99.3	0.5
Atlantic	Port Of Hopewell, VA	34	33	97.1	0.3	33	97.1	0.1
Pacific	Port Of Kalama, WA	4	4	100.0	0.0	4	100.0	0.0
Pacific	Port Of Longview, WA	6	6	100.0	0.1	6	100.0	0.0
Gulf	Port Of New Orleans, LA	4,971	356	7.2	3.5	417	8.4	1.3
Atlantic	Port Of New York/New Jersey	11,000	1,211	11.0	12.0	3,999	36.4	12.2

TABLE H-2C

ANALYSIS OF VESSEL TYPE CONSTRAINTS, CONTAINER 2020

Coast Name	Port Name	Number of Calls	With Projects			Without Projects		
			Constrained Calls With Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls	Constrained Calls Without Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls
Atlantic	Port Of Newport News, VA	842	0	0.0	0.0	2	0.2	0.0
Gulf	Port Of Plaquemine, LA	10	0	0.0	0.0	0	0.0	0.0
Pacific	Port Of Portland, OR	1,112	523	47.0	5.2	523	47.0	1.6
Atlantic	Port Of Richmond, VA	435	435	100.0	4.3	435	100.0	1.3
Gulf	Port Of South Louisiana, LA	92	0	0.0	0.0	4	4.4	0.0
Pacific	Port Of Vancouver, WA	129	59	45.8	0.6	59	45.8	0.2
Atlantic	Port Of Wilmington, NC	933	357	38.2	3.5	512	54.9	1.6
Atlantic	Port Royal Harbor, SC	3	3	100.0	0.0	3	100.0	0.0
Pacific	Port Townsend Harbor, WA	3	3	100.0	0.0	3	100.0	0.0
Atlantic	Portland Harbor, ME	125	22	18.0	0.2	22	18.0	0.1
Atlantic	Potomac River At Alexandria, VA	5	5	100.0	0.0	5	100.0	0.0
Atlantic	Providence River and Harbor, RI	9	2	22.5	0.0	2	22.5	0.0
Pacific	Richmond Harbor, CA	114	0	0.0	0.0	2	1.8	0.0
Great Lakes	Rochester (Charlotte) Harbor, NY	47	47	100.0	0.5	47	100.0	0.1
Pacific	Sacramento, CA	9	5	58.2	0.0	5	58.2	0.0
Atlantic	Salem Harbor, MA	4	2	45.0	0.0	2	45.0	0.0
Atlantic	Salem River, NJ	124	124	100.0	1.2	124	100.0	0.4
Pacific	San Diego Harbor, CA	33	21	62.8	0.2	21	62.8	0.1
Pacific	San Francisco Harbor, CA	151	13	8.3	0.1	13	8.3	0.0
Atlantic	San Juan Harbor, PR	2,120	10	0.5	0.1	10	0.5	0.0
Great Lakes	Sault Ste. Marie, MI	24	24	100.0	0.2	24	100.0	0.1
Atlantic	Savannah Harbor, GA	6,226	17	0.3	0.2	3,318	53.3	10.2
Atlantic	Searsport Harbor, ME	35	8	21.2	0.1	8	21.2	0.0
Pacific	Seattle Harbor, WA	5,470	1,940	35.5	19.2	4,819	88.1	14.7
Atlantic	Shelter Is & Shelter Is Sd LI, NY	6	1	15.8	0.0	1	15.8	0.0
Pacific	Sitka Harbor, AK	4	4	100.0	0.0	4	100.0	0.0
Pacific	Skagway Harbor, AK	8	8	100.0	0.1	8	100.0	0.0
Atlantic	Caribbean Islands	3	1	33.3	0.0	1	33.3	0.0
Atlantic	Caribbean Islands	115	20	16.9	0.2	20	16.9	0.1
Pacific	Stockton, CA	29	12	42.1	0.1	12	42.1	0.0
Pacific	Tacoma Harbor, WA	1,954	304	15.5	3.0	1,345	68.8	4.1
Gulf	Tampa Harbor, FL	414	4	1.0	0.0	4	1.0	0.0
Gulf	Texas City, TX	49	0	0.0	0.0	5	10.3	0.0
Great Lakes	Toledo Harbor, OH	13	13	100.0	0.1	13	100.0	0.0
Pacific	Unalaska Bay and Island, AK	71	71	100.0	0.7	71	100.0	0.2
Atlantic	Wilmington Harbor, DE	1,120	42	3.8	0.4	42	3.8	0.1
Atlantic	York River, VA	6	6	100.0	0.1	6	100.0	0.0
	TOTAL		**10,089**			**32,681**		

TABLE H-3A

ANALYSIS OF VESSEL TYPE CONSTRAINTS, GENERAL 2000

Coast Name	Port Name	Number of Calls	With Projects			Without Projects		
			Constrained Calls With Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls	Constrained Calls Without Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls
Pacific	Akutan Island, AK	2	0	0.0	0.0	0	0.0	0.0
Great Lakes	Alexandria Bay, NY	1	1	100.0	0.1	1	100.0	0.1
Pacific	Anchorage, AK	9	0	0.0	0.0	0	0.0	0.0
Gulf	Atchafalaya Rvr Morgan City To Gulf	37	0	0.0	0.0	0	0.0	0.0
Atlantic	Baltimore Harbor and Channels, MD	1,118	0	0.0	0.0	0	0.0	0.0
Gulf	Bayou Dupre, LA	2	2	100.0	0.1	2	100.0	0.1
Gulf	Bayou Lafourche, LA	5	5	100.0	0.3	5	100.0	0.3
Gulf	Beaumont, TX	60	1	1.7	0.1	1	1.7	0.1
Pacific	Bellingham Bay and Harbor, WA	33	14	41.0	0.9	14	41.0	0.9
Atlantic	Bridgeport Harbor, CT	63	2	3.5	0.1	2	3.5	0.1
Gulf	Brownsville, TX	62	2	3.3	0.1	2	3.3	0.1
Atlantic	Brunswick Harbor, GA	240	62	26.1	3.9	62	26.1	3.9
Atlantic	Bucksport Harbor, ME	4	4	100.0	0.3	4	100.0	0.3
Great Lakes	Burns Waterway Harbor, IN	7	0	0.0	0.0	0	0.0	0.0
Atlantic	Canaveral Harbor, FL	199	2	1.0	0.1	2	1.0	0.1
Pacific	Carquinez Strait, CA	149	0	0.0	0.0	0	0.0	0.0
Atlantic	Charleston Harbor, SC	1,181	6	0.5	0.4	6	0.5	0.4
Atlantic	Chester Area, PA	96	0	0.0	0.0	0	0.0	0.0
Atlantic	Caribbean Islands	75	3	4.0	0.2	3	4.0	0.2
Great Lakes	Cleveland Harbor, OH	8	4	53.3	0.3	4	53.3	0.3
Pacific	Coos Bay, OR	28	1	4.4	0.1	1	4.4	0.1
Gulf	Corpus Christi, TX	37	0	0.0	0.0	0	0.0	0.0
Atlantic	Del River Between Phila Tren	50	50	100.0	3.1	50	100.0	3.1
Atlantic	Delaware River At Camden, NJ	282	0	0.0	0.0	0	0.0	0.0
Gulf	East Pearl River, MS	176	176	100.0	10.9	176	100.0	10.9
Atlantic	Eastport Harbor, ME	1	0	0.0	0.0	0	0.0	0.0
Pacific	El Segundo, CA	2	0	0.0	0.0	0	0.0	0.0
Pacific	Everett Harbor, WA	10	3	30.8	0.2	3	30.8	0.2
Atlantic	Fall River Harbor, MA	3	0	0.0	0.0	0	0.0	0.0
Atlantic	Fernandina Harbor, FL	170	2	1.2	0.1	2	1.2	0.1
Atlantic	Fort Pierce Harbor, FL	8	2	24.8	0.1	2	24.8	0.1
Atlantic	Caribbean Islands	2	0	0.0	0.0	0	0.0	0.0
Gulf	Freeport Harbor, TX	56	0	0.0	0.0	0	0.0	0.0
Gulf	Galveston Channel, TX	199	0	0.0	0.0	0	0.0	0.0
Great Lakes	Gary Harbor, IN	1	0	0.0	0.0	0	0.0	0.0
Atlantic	Georgetown Harbor, SC	19	9	49.9	0.6	9	49.9	0.6
Atlantic	Gloucester Harbor, MA	53	18	35.1	1.1	18	35.1	1.1
Atlantic	Guanica Harbor, PR	6	0	0.0	0.0	0	0.0	0.0
Gulf	Gulfport Harbor, MS	166	20	12.1	1.3	20	12.1	1.3
Pacific	Hilo Harbor, HI	1	0	0.0	0.0	0	0.0	0.0
Pacific	Homer, AK	5	3	50.8	0.2	3	50.8	0.2
Pacific	Honolulu Harbor, Oahu, HI	120	0	0.0	0.0	0	0.0	0.0
Gulf	Houma Navigation Canal, LA	2	2	100.0	0.1	2	100.0	0.1
Gulf	Houston, TX	3,329	38	1.2	2.4	38	1.2	2.4
Pacific	Humboldt Harbor And Bay, CA	18	15	80.7	0.9	15	80.7	0.9
Atlantic	Jacksonville Harbor, FL	921	2	0.3	0.1	2	0.3	0.1
Atlantic	Jobos Harbor, PR	1	1	100.0	0.1	1	100.0	0.1
Pacific	Ketchikan Harbor, AK	29	29	100.0	1.8	29	100.0	1.8
Atlantic	Key West Harbor, FL	2	0	0.0	0.0	0	0.0	0.0
Pacific	Kodiak Harbor, AK	3	3	100.0	0.2	3	100.0	0.2
Gulf	Lake Charles, LA	96	0	0.0	0.0	0	0.0	0.0
Pacific	Long Beach Harbor, CA	657	0	0.0	0.0	0	0.0	0.0

TABLE H-3A

ANALYSIS OF VESSEL TYPE CONSTRAINTS, GENERAL 2000

Coast Name	Port Name	Number of Calls	With Projects			Without Projects		
			Constrained Calls With Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls	Constrained Calls Without Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls
Pacific	Los Angeles Harbor, CA	707	0	0.0	0.0	0	0.0	0.0
Pacific	Mare Island Strait, CA	1	0	0.0	0.0	0	0.0	0.0
Gulf	Matagorda Ship Channel, TX	5	0	0.0	0.0	0	0.0	0.0
Atlantic	Mayaguez Harbor, PR	241	2	0.9	0.1	2	0.9	0.1
Great Lakes	Menominee Harbor and River, MI and WI	3	3	100.0	0.2	3	100.0	0.2
Atlantic	Miami Harbor, FL	4,718	679	14.4	42.3	679	14.4	42.3
Gulf	Mobile Harbor, AL	542	0	0.0	0.0	0	0.0	0.0
Atlantic	Morehead City Harbor, NC	79	0	0.0	0.0	0	0.0	0.0
Atlantic	Narragansett Bay, RI	27	2	8.2	0.1	2	8.2	0.1
Atlantic	New Bedford and Fairhaven Harbor, MA	8	2	24.1	0.1	2	24.1	0.1
Atlantic	New Castle Area, DE	2	0	0.0	0.0	0	0.0	0.0
Atlantic	New Haven Harbor, CT	47	0	0.0	0.0	0	0.0	0.0
Atlantic	New London Harbor, CT	2	0	0.0	0.0	0	0.0	0.0
Atlantic	Norfolk Harbor, VA	868	0	0.0	0.0	0	0.0	0.0
Pacific	Oakland Harbor, CA	251	9	3.6	0.6	9	3.6	0.6
Great Lakes	Ogdensburg Harbor, NY	1	1	100.0	0.1	1	100.0	0.1
Great Lakes	Oswego Harbor, NY	43	0	0.0	0.0	0	0.0	0.0
Pacific	Other Puget Sound Area Ports, WA	22	0	0.0	0.0	0	0.0	0.0
Pacific	Other San Francisco Bay Area Ports, CA	4	4	100.0	0.2	4	100.0	0.2
Atlantic	Palm Beach Harbor, FL	861	0	0.0	0.0	0	0.0	0.0
Gulf	Panama City Harbor, FL	123	17	13.8	1.1	17	13.8	1.1
Gulf	Pascagoula Harbor, MS	160	9	5.4	0.5	9	5.4	0.5
Atlantic	Paulsboro, NJ	5	0	0.0	0.0	0	0.0	0.0
Atlantic	Penobscot River ME	3	3	100.0	0.2	3	100.0	0.2
Gulf	Pensacola Harbor, FL	30	1	4.0	0.1	1	4.0	0.1
Atlantic	Philadelphia Harbor, PA	361	2	0.5	0.1	2	0.5	0.1
Atlantic	Piscataqua River, ME and NH	4	0	0.0	0.0	0	0.0	0.0
Atlantic	Ponce Harbor, PR	81	0	0.0	0.0	0	0.0	0.0
Pacific	Port Angeles Harbor, WA	9	0	0.0	0.0	0	0.0	0.0
Gulf	Port Arthur, TX	57	0	0.0	0.0	0	0.0	0.0
Atlantic	Port Everglades Harbor, FL	2,496	4	0.2	0.2	4	0.2	0.2
Atlantic	Port in Caribbean	7	0	0.0	0.0	0	0.0	0.0
Pacific	Port Hueneme, CA	234	4	1.8	0.3	4	1.8	0.3
Great Lakes	Port Huron, MI	110	5	4.7	0.3	5	4.7	0.3
Gulf	Port Manatee, FL	52	0	0.0	0.0	0	0.0	0.0
Atlantic	Port Of Albany, NY	18	6	33.1	0.4	6	33.1	0.4
Pacific	Port Of Astoria, OR	1	0	0.0	0.0	0	0.0	0.0
Gulf	Port Of Baton Rouge, LA	125	0	0.0	0.0	0	0.0	0.0
Atlantic	Port Of Boston, MA	243	0	0.0	0.0	0	0.0	0.0
Great Lakes	Port Of Buffalo, NY	26	2	7.7	0.1	2	7.7	0.1
Great Lakes	Port Of Chicago, IL	63	11	17.8	0.7	11	17.8	0.7
Great Lakes	Port Of Detroit, MI	48	9	17.8	0.5	9	17.8	0.5
Atlantic	Port Of Hopewell, VA	10	2	19.2	0.1	2	19.2	0.1
Pacific	Port Of Longview, WA	5	1	23.0	0.1	1	23.0	0.1
Gulf	Port Of New Orleans, LA	1,320	0	0.0	0.0	0	0.0	0.0
Atlantic	Port Of New York/New Jersey	2,016	176	8.7	10.9	176	8.7	10.9
Atlantic	Port Of Newport News, VA	152	0	0.0	0.0	0	0.0	0.0
Gulf	Port Of Plaquemine, LA	6	0	0.0	0.0	0	0.0	0.0
Pacific	Port Of Portland, OR	201	2	0.8	0.1	2	0.8	0.1
Atlantic	Port Of Richmond, VA	62	9	13.8	0.5	9	13.8	0.5
Gulf	Port Of South Louisiana, LA	89	0	0.0	0.0	0	0.0	0.0

TABLE H-3A

ANALYSIS OF VESSEL TYPE CONSTRAINTS, GENERAL 2000

Coast Name	Port Name	Number of Calls	With Projects			Without Projects		
			Constrained Calls With Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls	Constrained Calls Without Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls
Pacific	Port Of Vancouver, WA	46	5	11.9	0.3	5	11.9	0.3
Atlantic	Port Of Wilmington, NC	142	6	4.2	0.4	6	4.2	0.4
Atlantic	Port Royal Harbor, SC	1	1	100.0	0.1	1	100.0	0.1
Pacific	Port Townsend Harbor, WA	1	1	100.0	0.1	1	100.0	0.1
Atlantic	Portland Harbor, ME	69	4	6.1	0.3	4	6.1	0.3
Atlantic	Potomac River At Alexandria, VA	16	0	0.0	0.0	0	0.0	0.0
Pacific	Prince Wales Is. West Side, AK	2	0	0.0	0.0	0	0.0	0.0
Atlantic	Providence River And Harbor, RI	34	0	0.0	0.0	0	0.0	0.0
Pacific	Richmond Harbor, CA	53	0	0.0	0.0	0	0.0	0.0
Great Lakes	Rochester (Charlotte) Harbor, NY	21	0	0.0	0.0	0	0.0	0.0
Pacific	Sacramento, CA	9	0	0.0	0.0	0	0.0	0.0
Atlantic	Salem Harbor, MA	1	0	0.0	0.0	0	0.0	0.0
Atlantic	Salem River, NJ	89	0	0.0	0.0	0	0.0	0.0
Pacific	San Diego Harbor, CA	78	5	6.1	0.3	5	6.1	0.3
Pacific	San Francisco Harbor, CA	62	0	0.0	0.0	0	0.0	0.0
Atlantic	San Juan Harbor, PR	2,035	0	0.0	0.0	0	0.0	0.0
Atlantic	Savannah Harbor, GA	1,200	63	5.2	3.9	63	5.2	3.9
Atlantic	Searsport Harbor, ME	14	0	0.0	0.0	0	0.0	0.0
Pacific	Seattle Harbor, WA	373	27	7.3	1.7	27	7.3	1.7
Pacific	Seward Harbor, AK	5	5	100.0	0.3	5	100.0	0.3
Pacific	Sitka Harbor, AK	3	3	100.0	0.2	3	100.0	0.2
Pacific	Skagway Harbor, AK	4	4	100.0	0.3	4	100.0	0.3
Atlantic	Caribbean Islands	3	0	0.0	0.0	0	0.0	0.0
Atlantic	Caribbean Islands	141	2	1.4	0.1	2	1.4	0.1
Pacific	Stockton, CA	13	0	0.0	0.0	0	0.0	0.0
Pacific	Tacoma Harbor, WA		21	5.2	1.3	21	5.2	1.3
Gulf	Tampa Harbor, FL	437	0	0.0	0.0	0	0.0	0.0
Gulf	Texas City, TX		0	0.0	0.0	0	0.0	0.0
Great Lakes	Toledo Harbor, OH	4	4	100.0	0.2	4	100.0	0.2
Pacific	Unalaska Bay and Island, AK		5	5.7	0.3	5	5.7	0.3
Pacific	Whittier Harbor, AK	2	0	0.0	0.0	0	0.0	0.0
Atlantic	Wilmington Harbor, DE		1	0.7	0.1	1	0.7	0.1
Atlantic	York River, VA	9	0	0.0	0.0	0	0.0	0.0
	TOTAL		**1,606**			**1,606**		

TABLE H-3B

ANALYSIS OF VESSEL TYPE CONSTRAINTS, GENERAL 2010

Coast Name	Port Name	Number of Calls	With Projects			Without Projects		
			Constrained Calls With Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls	Constrained Calls Without Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls
Pacific	Akutan Island, AK	5	0	0.0	0.0	0	0.0	0.0
Great Lakes	Alexandria Bay, NY	1	1	100.0	0.1	1	100.0	0.0
Pacific	Anchorage, AK	13	0	0.0	0.0	2	15.7	0.1
Gulf	Atchafalaya Rvr Morgan City To Gulf	47	0	0.0	0.0	0	0.0	0.0
Atlantic	Baltimore Harbor and Channels, MD	1,559	0	0.0	0.0	0	0.0	0.0
Gulf	Bayou Dupre, LA	3	3	100.0	0.2	3	100.0	0.1
Gulf	Bayou Lafourche, LA	8	0	0.0	0.0	8	100.0	0.3
Gulf	Beaumont, TX	112	1	1.1	0.1	1	1.1	0.1
Pacific	Bellingham Bay and Harbor, WA	42	18	43.4	0.9	18	43.4	0.8
Atlantic	Bridgeport Harbor, CT	97	13	13.6	0.7	13	13.6	0.5
Gulf	Brownsville, TX	96	4	4.0	0.2	4	4.0	0.2
Atlantic	Brunswick Harbor, GA	299	50	16.8	2.6	96	32.0	4.0
Atlantic	Bucksport Harbor, ME	5	5	100.0	0.2	5	100.0	0.2
Great Lakes	Burns Waterway Harbor, IN	6	0	0.0	0.0	0	0.0	0.0
Atlantic	Canaveral Harbor, FL	241	2	0.8	0.1	2	0.8	0.1
Pacific	Carquinez Strait, CA	225	0	0.0	0.0	0	0.0	0.0
Atlantic	Charleston Harbor, SC	1,729	0	0.0	0.0	11	0.7	0.5
Atlantic	Chester Area, PA	146	0	0.0	0.0	0	0.0	0.0
Atlantic	Caribbean Islands	60	4	6.6	0.2	4	6.6	0.2
Great Lakes	Cleveland Harbor, OH	10	6	64.6	0.3	6	64.6	0.3
Pacific	Coos Bay, OR	38	2	5.1	0.1	2	5.1	0.1
Gulf	Corpus Christi, TX	41	0	0.0	0.0	0	0.0	0.0
Atlantic	Del Rvr Betwn Phila Tren	64	64	100.0	3.3	64	100.0	2.7
Atlantic	Delaware River At Camden, NJ	412	0	0.0	0.0	0	0.0	0.0
Gulf	East Pearl River, MS	269	269	100.0	13.6	269	100.0	11.1
Atlantic	Eastport Harbor, ME	2	0	0.0	0.0	0	0.0	0.0
Pacific	El Segundo, CA	3	0	0.0	0.0	0	0.0	0.0
Pacific	Everett Harbor, WA	14	6	40.4	0.3	6	40.4	0.2
Atlantic	Fall River Harbor, MA	8	0	0.0	0.0	0	0.0	0.0
Atlantic	Fernandina Harbor, FL	296	11	3.7	0.5	11	3.7	0.4
Atlantic	Fort Pierce Harbor, FL	8	4	49.1	0.2	4	49.1	0.2
Atlantic	Caribbean Islands	3	0	0.0	0.0	0	0.0	0.0
Gulf	Freeport Harbor, TX	89	0	0.0	0.0	0	0.0	0.0
Gulf	Galveston Channel, TX	303	0	0.0	0.0	0	0.0	0.0
Great Lakes	Gary Harbor, IN	1	0	0.0	0.0	0	0.0	0.0
Atlantic	Georgetown Harbor, SC	31	0	0.0	0.0	14	44.5	0.6
Atlantic	Gloucester Harbor, MA	67	23	34.9	1.2	23	34.9	1.0
Atlantic	Guanica Harbor, PR	7	0	0.0	0.0	0	0.0	0.0
Gulf	Gulfport Harbor, MS	235	35	14.9	1.8	35	14.9	1.4
Pacific	Hilo Harbor, HI	1	0	0.0	0.0	0	0.0	0.0
Pacific	Homer, AK	7	3	50.6	0.2	3	50.6	0.1
Pacific	Honolulu Harbor, Oahu, HI	154	0	0.0	0.0	0	0.0	0.0
Gulf	Houma Navigation Canal, LA	3	3	100.0	0.2	3	100.0	0.1
Gulf	Houston, TX	4,930	0	0.0	0.0	64	1.3	2.7
Pacific	Humboldt Harbor and Bay, CA	35	29	84.0	1.5	29	84.0	1.2
Atlantic	Jacksonville Harbor, FL	1,415	3	0.2	0.1	3	0.2	0.1
Atlantic	Jobos Harbor, PR	2	2	100.0	0.1	2	100.0	0.1
Pacific	Ketchikan Harbor, AK	42	42	100.0	2.1	42	100.0	1.7
Atlantic	Key West Harbor, FL	2	0	0.0	0.0	0	0.0	0.0
Pacific	Kodiak Harbor, AK	4	4	100.0	0.2	4	100.0	0.2
Gulf	Lake Charles, LA	118	0	0.0	0.0	0	0.0	0.0

TABLE H-3B

ANALYSIS OF VESSEL TYPE CONSTRAINTS, GENERAL 2010

Coast Name	Port Name	Number of Calls	With Projects			Without Projects		
			Constrained Calls With Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls	Constrained Calls Without Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls
Pacific	Long Beach Harbor, CA	965	0	0.0	0.0	0	0.0	0.0
Pacific	Los Angeles Harbor, CA	945	0	0.0	0.0	0	0.0	0.0
Pacific	Mare Island Strait, CA	1	0	0.0	0.0	0	0.0	0.0
Gulf	Matagorda Ship Channel, TX	5	0	0.0	0.0	0	0.0	0.0
Atlantic	Mayaguez Harbor, PR	401	8	2.0	0.4	8	2.0	0.3
Great Lakes	Menominee Harbor and River, MI and WI	4	4	100.0	0.2	4	100.0	0.2
Atlantic	Miami Harbor, FL	7,248	1,049	14.5	53.1	1,051	14.5	43.4
Gulf	Mobile Harbor, AL	860	0	0.0	0.0	0	0.0	0.0
Atlantic	Morehead City Harbor, NC	109	0	0.0	0.0	0	0.0	0.0
Atlantic	Narragansett Bay, RI	28	4	15.9	0.2	4	15.9	0.2
Atlantic	New Bedford and Fairhaven Harbor, MA	11	3	28.1	0.2	3	28.1	0.1
Atlantic	New Castle Area, DE	4	0	0.0	0.0	0	0.0	0.0
Atlantic	New Haven Harbor, CT	63	1	1.6	0.1	1	1.6	0.0
Atlantic	New London Harbor, CT	2	0	0.0	0.0	0	0.0	0.0
Atlantic	Norfolk Harbor, VA	1,168	0	0.0	0.0	0	0.0	0.0
Pacific	Oakland Harbor, CA	316	0	0.0	0.0	13	4.0	0.5
Great Lakes	Ogdensburg Harbor, NY	1	1	100.0	0.1	1	100.0	0.0
Great Lakes	Oswego Harbor, NY	24	0	0.0	0.0	0	0.0	0.0
Pacific	Other Puget Sound Area Ports, WA	26	0	0.0	0.0	0	0.0	0.0
Pacific	Other San Francisco Bay Area Ports, CA	4	4	100.0	0.2	4	100.0	0.2
Atlantic	Palm Beach Harbor, FL	1,242	2	0.2	0.1	2	0.2	0.1
Gulf	Panama City Harbor, FL	197	21	10.5	1.0	21	10.5	0.9
Gulf	Pascagoula Harbor, MS	239	10	4.1	0.5	17	7.3	0.7
Atlantic	Paulsboro, NJ	5	0	0.0	0.0	0	0.0	0.0
Atlantic	Penobscot River ME	3	3	100.0	0.2	3	100.0	0.1
Gulf	Pensacola Harbor, FL	42	3	6.3	0.1	3	6.3	0.1
Atlantic	Philadelphia Harbor, PA	488	3	0.5	0.1	3	0.5	0.1
Atlantic	Piscataqua River, ME and NH	6	0	0.0	0.0	0	0.0	0.0
Atlantic	Ponce Harbor, PR	101	2	2.0	0.1	2	2.0	0.1
Pacific	Port Angeles Harbor, WA	11	0	0.0	0.0	0	0.0	0.0
Gulf	Port Arthur, TX	76	0	0.0	0.0	0	0.0	0.0
Atlantic	Port Everglades Harbor, FL	3,732	5	0.1	0.3	5	0.1	0.2
Atlantic	Port in Caribbean	9	0	0.0	0.0	0	0.0	0.0
Pacific	Port Hueneme, CA	265	17	6.3	0.8	17	6.3	0.7
Great Lakes	Port Huron, MI	150	18	12.2	0.9	18	12.2	0.8
Gulf	Port Manatee, FL	82	0	0.0	0.0	0	0.0	0.0
Atlantic	Port Of Albany, NY	20	6	30.6	0.3	6	30.6	0.3
Pacific	Port Of Astoria, OR	1	0	0.0	0.0	0	0.0	0.0
Gulf	Port Of Baton Rouge, LA	160	0	0.0	0.0	0	0.0	0.0
Atlantic	Port Of Boston, MA	256	0	0.0	0.0	0	0.0	0.0
Great Lakes	Port Of Buffalo, NY	27	3	10.9	0.2	3	10.9	0.1
Great Lakes	Port Of Chicago, IL	69	16	23.3	0.8	16	23.3	0.7
Great Lakes	Port Of Detroit, MI	53	11	20.4	0.6	11	20.4	0.4
Atlantic	Port Of Hopewell, VA	12	3	27.9	0.2	3	27.9	0.1
Pacific	Port Of Longview, WA	7	1	20.9	0.1	1	20.9	0.1
Gulf	Port Of New Orleans, LA	1,895	2	0.1	0.1	2	0.1	0.1
Atlantic	Port Of New York/New Jersey	2,902	50	1.7	2.5	203	7.0	8.4
Atlantic	Port Of Newport News, VA	187	0	0.0	0.0	0	0.0	0.0
Gulf	Port Of Plaquemine, LA	7	0	0.0	0.0	0	0.0	0.0
Pacific	Port Of Portland, OR	228	1	0.6	0.1	1	0.6	0.1
Atlantic	Port Of Richmond, VA	84	9	10.9	0.5	9	10.9	0.4

TABLE H-3B

ANALYSIS OF VESSEL TYPE CONSTRAINTS, GENERAL 2010

Coast Name	Port Name	Number of Calls	With Projects			Without Projects		
			Constrained Calls With Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls	Constrained Calls Without Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls
Gulf	Port Of South Louisiana, LA	17	0	0.0	0.0	0	0.0	0.0
Pacific	Port Of Vancouver, WA	88	11	12.0	0.5	11	12.0	0.4
Atlantic	Port Of Wilmington, NC	224	8	3.7	0.4	8	3.7	0.3
Atlantic	Port Royal Harbor, SC	2	2	100.0	0.1	2	100.0	0.1
Pacific	Port Townsend Harbor, WA	1	1	100.0	0.1	1	100.0	0.0
Atlantic	Portland Harbor, ME	94	6	6.4	0.3	6	6.4	0.3
Atlantic	Potomac River At Alexandria, VA	17	0	0.0	0.0	0	0.0	0.0
Pacific	Prince Wales Is. West Side, AK	3	0	0.0	0.0	0	0.0	0.0
Atlantic	Providence River and Harbor, RI	30	0	0.0	0.0	0	0.0	0.0
Pacific	Richmond Harbor, CA	66	0	0.0	0.0	0	0.0	0.0
Great Lakes	Rochester (Charlotte) Harbor, NY	17	0	0.0	0.0	0	0.0	0.0
Pacific	Sacramento, CA	9	0	0.0	0.0	0	0.0	0.0
Atlantic	Salem Harbor, MA	1	0	0.0	0.0	0	0.0	0.0
Atlantic	Salem River, NJ	161	0	0.0	0.0	0	0.0	0.0
Pacific	San Diego Harbor, CA	90	5	5.8	0.3	5	5.8	0.2
Pacific	San Francisco Harbor, CA	61	0	0.0	0.0	0	0.0	0.0
Atlantic	San Juan Harbor, PR	3,078	0	0.0	0.0	0	0.0	0.0
Atlantic	Savannah Harbor, GA	1,600	0	0.0	0.0	92	5.8	3.8
Atlantic	Searsport Harbor, ME	19	0	0.0	0.0	0	0.0	0.0
Pacific	Seattle Harbor, WA	473	29	6.1	1.5	40	8.5	1.7
Pacific	Seward Harbor, AK	5	5	100.0	0.3	5	100.0	0.2
Pacific	Sitka Harbor, AK	3	3	100.0	0.2	3	100.0	0.1
Pacific	Skagway Harbor, AK	3	3	100.0	0.2	3	100.0	0.1
Atlantic	Caribbean Islands	4	0	0.0	0.0	0	0.0	0.0
Atlantic	Caribbean Islands	157	2	1.3	0.1	2	1.3	0.1
Pacific	Stockton, CA	24	0	0.0	0.0	0	0.0	0.0
Pacific	Tacoma Harbor, WA	533	13	2.4	0.6	34	6.3	1.4
Gulf	Tampa Harbor, FL	539	0	0.0	0.0	0	0.0	0.0
Gulf	Texas City, TX	58	0	0.0	0.0	0	0.0	0.0
Great Lakes	Toledo Harbor, OH	4	4	100.0	0.2	4	100.0	0.2
Pacific	Unalaska Bay and Island, AK	92	13	14.0	0.7	13	14.0	0.5
Pacific	Whittier Harbor, AK	3	0	0.0	0.0	0	0.0	0.0
Atlantic	Wilmington Harbor, DE	288	1	0.4	0.1	1	0.4	0.1
Atlantic	York River, VA	16	0	0.0	0.0	0	0.0	0.0
	TOTAL		**1,975**			**2,421**		

TABLE H-3C

ANALYSIS OF VESSEL TYPE CONSTRAINTS, GENERAL 2020

Coast Name	Port Name	Number of Calls	With Projects			Without Projects		
			Constrained Calls With Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls	Constrained Calls Without Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls
Pacific	Akutan Island, AK	7	0	0.0	0.0	0	0.0	0.0
Great Lakes	Alexandria Bay, NY	1	1	100.0	0.0	1	100.0	0.0
Pacific	Anchorage, AK	17	0	0.0	0.0	4	22.9	0.1
Gulf	Atchafalaya Rvr Morgan City To Gulf	56	0	0.0	0.0	0	0.0	0.0
Atlantic	Baltimore Harbor and Channels, MD	2,047	0	0.0	0.0	0	0.0	0.0
Gulf	Bayou Dupre, LA	4	4	100.0	0.2	4	100.0	0.1
Gulf	Bayou Lafourche, LA	11	0	0.0	0.0	11	100.0	0.3
Gulf	Beaumont, TX	157	2	1.2	0.1	2	1.2	0.1
Pacific	Bellingham Bay and Harbor, WA	49	23	46.3	0.8	23	46.3	0.7
Atlantic	Bridgeport Harbor, CT	129	30	22.9	1.1	30	22.9	0.9
Gulf	Brownsville, TX	126	6	4.8	0.2	6	4.8	0.2
Atlantic	Brunswick Harbor, GA	366	65	17.8	2.4	131	35.7	4.0
Atlantic	Bucksport Harbor, ME	6	6	100.0	0.2	6	100.0	0.2
Great Lakes	Burns Waterway Harbor, IN	5	0	0.0	0.0	0	0.0	0.0
Atlantic	Canaveral Harbor, FL	280	2	0.7	0.1	2	0.7	0.1
Pacific	Carquinez Strait, CA	320	0	0.0	0.0	0	0.0	0.0
Atlantic	Charleston Harbor, SC	2,377	0	0.0	0.0	21	0.9	0.6
Atlantic	Chester Area, PA	192	0	0.0	0.0	0	0.0	0.0
Atlantic	Caribbean Islands	49	5	10.2	0.2	5	10.2	0.2
Great Lakes	Cleveland Harbor, OH	13	10	79.7	0.4	10	79.7	0.3
Pacific	Coos Bay, OR	46	3	6.4	0.1	3	6.4	0.1
Gulf	Corpus Christi, TX	40	0	0.0	0.0	0	0.0	0.0
Atlantic	Del River Between Phila Tren	82	82	100.0	3.1	82	100.0	2.5
Atlantic	Delaware River At Camden, NJ	547	0	0.0	0.0	0	0.0	0.0
Gulf	East Pearl River, MS	334	334	100.0	12.5	334	100.0	10.2
Atlantic	Eastport Harbor, ME	2	0	0.0	0.0	0	0.0	0.0
Pacific	El Segundo, CA	4	0	0.0	0.0	0	0.0	0.0
Pacific	Everett Harbor, WA	16	8	50.6	0.3	8	50.6	0.3
Atlantic	Fall River Harbor, MA	17	0	0.0	0.0	0	0.0	0.0
Atlantic	Fernandina Harbor, FL	508	35	6.9	1.3	35	6.9	1.1
Atlantic	Fort Pierce Harbor, FL	9	6	67.5	0.2	6	67.5	0.2
Atlantic	Caribbean Islands	4	0	0.0	0.0	0	0.0	0.0
Gulf	Freeport Harbor, TX	134	0	0.0	0.0	0	0.0	0.0
Gulf	Galveston Channel, TX	446	0	0.0	0.0	0	0.0	0.0
Great Lakes	Gary Harbor, IN	2	0	0.0	0.0	0	0.0	0.0
Atlantic	Georgetown Harbor, SC	46	0	0.0	0.0	18	38.2	0.5
Atlantic	Gloucester Harbor, MA	86	32	37.9	1.2	32	37.9	1.0
Atlantic	Guanica Harbor, PR	7	0	0.0	0.0	0	0.0	0.0
Gulf	Gulfport Harbor, MS	295	49	16.7	1.8	49	16.7	1.5
Pacific	Hilo Harbor, HI	1	0	0.0	0.0	0	0.0	0.0
Pacific	Homer, AK	7	4	58.5	0.1	4	58.5	0.1
Pacific	Honolulu Harbor, Oahu, HI	177	0	0.0	0.0	0	0.0	0.0
Gulf	Houma Navigation Canal LA	5	5	100.0	0.2	5	100.0	0.2
Gulf	Houston, TX	6,686	0	0.0	0.0	93	1.4	2.8
Pacific	Humboldt Harbor and Bay, CA	58	50	87.1	1.9	50	87.1	1.5
Atlantic	Jacksonville Harbor, FL	1,905	4	0.2	0.1	4	0.2	0.1
Atlantic	Jobos Harbor, PR	3	3	100.0	0.1	3	100.0	0.1
Pacific	Ketchikan Harbor, AK	54	54	100.0	2.0	54	100.0	1.6
Atlantic	Key West Harbor, FL	2	0	0.0	0.0	0	0.0	0.0
Pacific	Kodiak Harbor, AK	5	5	100.0	0.2	5	100.0	0.2
Gulf	Lake Charles, LA	131	0	0.0	0.0	0	0.0	0.0

TABLE H-3C

ANALYSIS OF VESSEL TYPE CONSTRAINTS, GENERAL 2020

Coast Name	Port Name	Number of Calls	With Projects			Without Projects		
			Constrained Calls With Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls	Constrained Calls Without Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls
Pacific	Long Beach Harbor, CA	1,280	0	0.0	0.0	0	0.0	0.0
Pacific	Los Angeles Harbor, CA	1,215	0	0.0	0.0	0	0.0	0.0
Pacific	Mare Island Strait, CA	1	0	0.0	0.0	0	0.0	0.0
Gulf	Matagorda Ship Channel, TX	6	0	0.0	0.0	0	0.0	0.0
Atlantic	Mayaguez Harbor, PR	587	18	3.0	0.7	18	3.0	0.5
Great Lakes	Menominee Harbor and River, MI and WI	5	5	100.0	0.2	5	100.0	0.1
Atlantic	Miami Harbor, FL	9,740	1,402	14.4	52.3	1,405	14.4	43.1
Gulf	Mobile Harbor, AL	1,166	0	0.0	0.0	0	0.0	0.0
Atlantic	Morehead City Harbor, NC	147	0	0.0	0.0	0	0.0	0.0
Atlantic	Narragansett Bay, RI	32	8	24.0	0.3	8	24.0	0.2
Atlantic	New Bedford and Fairhaven Harbor, MA	12	5	37.5	0.2	5	37.5	0.1
Atlantic	New Castle Area, DE	5	0	0.0	0.0	0	0.0	0.0
Atlantic	New Haven Harbor, CT	74	2	2.7	0.1	2	2.7	0.1
Atlantic	New London Harbor, CT	1	0	0.0	0.0	0	0.0	0.0
Atlantic	Norfolk Harbor, VA	1,488	0	0.0	0.0	0	0.0	0.0
Pacific	Oakland Harbor, CA	401	0	0.0	0.0	15	3.9	0.5
Great Lakes	Ogdensburg Harbor, NY	1	1	100.0	0.0	1	100.0	0.0
Great Lakes	Oswego Harbor, NY	11	0	0.0	0.0	0	0.0	0.0
Pacific	Other Puget Sound Area Ports, WA	29	0	0.0	0.0	0	0.0	0.0
Pacific	Other San Francisco Bay Area Ports, CA	4	4	100.0	0.1	4	100.0	0.1
Atlantic	Palm Beach Harbor, FL	1,582	4	0.3	0.1	4	0.3	0.1
Gulf	Panama City Harbor, FL	278	23	8.2	0.9	23	8.2	0.7
Gulf	Pascagoula Harbor, MS	312	15	4.7	0.5	27	8.6	0.8
Atlantic	Paulsboro, NJ	6	0	0.0	0.0	0	0.0	0.0
Atlantic	Penobscot River ME	4	4	100.0	0.1	4	100.0	0.1
Gulf	Pensacola Harbor, FL	60	4	7.5	0.2	4	7.5	0.1
Atlantic	Philadelphia Harbor, PA	594	4	0.6	0.1	4	0.6	0.1
Atlantic	Piscataqua River, ME and NH	7	0	0.0	0.0	0	0.0	0.0
Atlantic	Ponce Harbor, PR	122	4	3.3	0.1	4	3.3	0.1
Pacific	Port Angeles Harbor, WA	13	0	0.0	0.0	0	0.0	0.0
Gulf	Port Arthur, TX	89	0	0.0	0.0	0	0.0	0.0
Atlantic	Port Everglades Harbor, FL	4,966	6	0.1	0.2	6	0.1	0.2
Atlantic	Port in Caribbean	10	0	0.0	0.0	0	0.0	0.0
Pacific	Port Hueneme, CA	302	34	11.4	1.3	34	11.4	1.1
Great Lakes	Port Huron, MI	139	28	19.9	1.0	28	19.9	0.8
Gulf	Port Manatee, FL	127	0	0.0	0.0	0	0.0	0.0
Atlantic	Port Of Albany, NY	23	6	27.5	0.2	6	27.5	0.2
Pacific	Port Of Astoria, OR	1	0	0.0	0.0	0	0.0	0.0
Gulf	Port Of Baton Rouge, LA	187	0	0.0	0.0	0	0.0	0.0
Atlantic	Port Of Boston, MA	299	0	0.0	0.0	0	0.0	0.0
Great Lakes	Port Of Buffalo, NY	24	4	16.5	0.1	4	16.5	0.1
Great Lakes	Port Of Chicago, IL	81	21	25.6	0.8	21	25.6	0.6
Great Lakes	Port Of Detroit, MI	65	13	19.8	0.5	13	19.8	0.4
Atlantic	Port Of Hopewell, VA	11	4	37.1	0.2	4	37.1	0.1
Pacific	Port Of Longview, WA	8	2	22.6	0.1	2	22.6	0.1
Gulf	Port Of New Orleans, LA	2,461	4	0.2	0.1	4	0.2	0.1
Atlantic	Port Of New York/New Jersey	3,857	62	1.6	2.3	228	5.9	7.0
Atlantic	Port Of Newport News, VA	218	0	0.0	0.0	0	0.0	0.0
Gulf	Port Of Plaquemine, LA	8	0	0.0	0.0	0	0.0	0.0
Pacific	Port Of Portland, OR	243	1	0.4	0.0	1	0.4	0.0
Atlantic	Port Of Richmond, VA	114	12	10.8	0.5	12	10.8	0.4

TABLE H-3C

ANALYSIS OF VESSEL TYPE CONSTRAINTS, GENERAL 2020

Coast Name	Port Name	Number of Calls	With Projects			Without Projects		
			Constrained Calls With Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls	Constrained Calls Without Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls
Gulf	Port Of South Louisiana, LA	144	0	0.0	0.0	0	0.0	0.0
Pacific	Port Of Vancouver, WA	146	23	15.7	0.9	23	15.7	0.7
Atlantic	Port Of Wilmington, NC	321	12	3.6	0.4	12	3.6	0.4
Atlantic	Port Royal Harbor, SC	4	4	100.0	0.1	4	100.0	0.1
Pacific	Port Townsend Harbor, WA	1	1	100.0	0.0	1	100.0	0.0
Atlantic	Portland Harbor, ME	125	8	6.3	0.3	8	6.3	0.2
Atlantic	Potomac River At Alexandria, VA	18	0	0.0	0.0	0	0.0	0.0
Pacific	Prince Wales Is. West Side, AK	4	0	0.0	0.0	0	0.0	0.0
Atlantic	Providence River and Harbor, RI	28	0	0.0	0.0	0	0.0	0.0
Pacific	Richmond Harbor, CA	79	0	0.0	0.0	0	0.0	0.0
Great Lakes	Rochester (Charlotte) Harbor, NY	12	0	0.0	0.0	0	0.0	0.0
Pacific	Sacramento, CA	8	0	0.0	0.0	0	0.0	0.0
Atlantic	Salem Harbor, MA	1	0	0.0	0.0	0	0.0	0.0
Atlantic	Salem River, NJ	246	0	0.0	0.0	0	0.0	0.0
Pacific	San Diego Harbor, CA	96	6	5.9	0.2	6	5.9	0.2
Pacific	San Francisco Harbor, CA	64	0	0.0	0.0	0	0.0	0.0
Atlantic	San Juan Harbor, PR	4,079	0	0.0	0.0	0	0.0	0.0
Atlantic	Savannah Harbor, GA	1,999	0	0.0	0.0	130	6.5	4.0
Atlantic	Searsport Harbor, ME	27	0	0.0	0.0	0	0.0	0.0
Pacific	Seattle Harbor, WA	568	40	7.0	1.5	55	9.7	1.7
Pacific	Seward Harbor, AK	5	5	100.0	0.2	5	100.0	0.2
Pacific	Sitka Harbor, AK	4	4	100.0	0.1	4	100.0	0.1
Pacific	Skagway Harbor, AK	3	3	100.0	0.1	3	100.0	0.1
Atlantic	Caribbean Islands	5	0	0.0	0.0	0	0.0	0.0
Atlantic	Caribbean Islands	169	2	1.2	0.1	2	1.2	0.1
Pacific	Stockton, CA	37	0	0.0	0.0	0	0.0	0.0
Pacific	Tacoma Harbor, WA	660	20	3.0	0.7	49	7.4	1.5
Gulf	Tampa Harbor, FL	600	0	0.0	0.0	0	0.0	0.0
Gulf	Texas City, TX	67	0	0.0	0.0	0	0.0	0.0
Great Lakes	Toledo Harbor, OH	3	3	100.0	0.1	3	100.0	0.1
Pacific	Unalaska Bay and Island, AK	94	21	22.0	0.8	21	22.0	0.6
Pacific	Whittier Harbor, AK	4	0	0.0	0.0	0	0.0	0.0
Atlantic	Wilmington Harbor, DE	358	1	0.3	0.0	1	0.3	0.0
Atlantic	York River, VA	25	1	0.0	0.0	1	0.0	0.0
	TOTAL		**2,679**			**3,262**		

TABLE H-4A

ANALYSIS OF VESSEL TYPE CONSTRAINTS, OTHER 2000

Coast Name	Port Name	Number of Calls	With Projects			Without Projects		
			Constrained Calls With Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls	Constrained Calls Without Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls
Pacific	Anchorage, AK	24	0	0.0	0.0	0	0.0	0.0
Gulf	Atchafalaya Rvr Morgan City To Gulf	5	0	0.0	0.0	0	0.0	0.0
Atlantic	Baltimore Harbor and Channels, MD	198	0	0.0	0.0	0	0.0	0.0
Gulf	Bayou La Batre, AL	4	4	100.0	7.8	4	100.0	7.8
Gulf	Bayou Lafourche, LA	1	1	100.0	2.7	1	100.0	2.7
Gulf	Beaumont, TX	1	0	0.0	0.0	0	0.0	0.0
Atlantic	Brunswick Harbor, GA	1	0	0.0	0.0	0	0.0	0.0
Great Lakes	Burns Waterway Harbor, IN	1	0	0.0	0.0	0	0.0	0.0
Atlantic	Canaveral Harbor, FL	16	0	0.0	0.0	0	0.0	0.0
Atlantic	Charleston Harbor, SC	265	1	0.4	1.9	1	0.4	1.9
Atlantic	Chester Area, PA	2	1	50.0	1.9	1	50.0	1.9
Gulf	Corpus Christi, TX	8	2	30.6	4.7	2	30.6	4.7
Atlantic	Delaware River At Camden, NJ	1	0	0.0	0.0	0	0.0	0.0
Gulf	East Pearl River MS	1	1	100.0	2.1	1	100.0	2.1
Pacific	Everett Harbor, WA	5	0	0.0	0.0	0	0.0	0.0
Atlantic	Fajardo Harbor, PR	2	0	0.0	0.0	0	0.0	0.0
Atlantic	Fernandina Harbor, FL	1	0	0.0	0.0	0	0.0	0.0
Gulf	Freeport Harbor, TX	2	0	0.0	0.0	0	0.0	0.0
Gulf	Galveston Channel, TX	2	0	0.0	0.0	0	0.0	0.0
Gulf	GIWW Mile 87	1	0	0.0	0.0	0	0.0	0.0
Gulf	Gulfport Harbor, MS	2	0	0.0	0.0	0	0.0	0.0
Pacific	Haines, AK	2	1	42.7	1.9	1	42.7	1.9
Pacific	Hilo Harbor, HI	1	0	0.0	0.0	0	0.0	0.0
Pacific	Homer, AK	1	0	0.0	0.0	0	0.0	0.0
Pacific	Honolulu Harbor, Oahu, HI	2	0	0.0	0.0	0	0.0	0.0
Gulf	Houston, TX	232	0	0.0	0.0	0	0.0	0.0
Atlantic	Jacksonville Harbor, FL	70	0	0.0	0.0	0	0.0	0.0
Pacific	Juneau Harbor, AK	2	0	0.0	0.0	0	0.0	0.0
Pacific	Ketchikan Harbor, AK	6	0	0.0	0.0	0	0.0	0.0
Atlantic	Key West Harbor, FL	8	0	0.0	0.0	0	0.0	0.0
Pacific	Kodiak Harbor, AK	4	0	0.0	0.0	0	0.0	0.0
Gulf	Lake Charles, LA	2	0	0.0	0.0	0	0.0	0.0
Pacific	Long Beach Harbor, CA	90	2	2.2	3.8	2	2.2	3.8
Pacific	Los Angeles Harbor, CA	185	0	0.0	0.0	0	0.0	0.0
Atlantic	Marcus Hook, PA	3	3	100.0	4.9	3	100.0	4.9
Gulf	Matagorda Ship Channel, TX	1	0	0.0	0.0	0	0.0	0.0
Atlantic	Miami Harbor, FL	383	2	0.6	4.6	2	0.6	4.6
Gulf	Mobile Harbor, AL	11	0	0.0	0.0	0	0.0	0.0
Atlantic	Narragansett Bay, RI	1	0	0.0	0.0	0	0.0	0.0
Pacific	Nome, AK	1	0	0.0	0.0	0	0.0	0.0
Atlantic	Norfolk Harbor, VA	212	1	0.5	1.9	1	0.5	1.9
Pacific	Oakland Harbor, CA	66	2	3.0	3.8	2	3.0	3.8
Great Lakes	Ogdensburg Harbor, NY	1	0	0.0	0.0	0	0.0	0.0
Atlantic	Palm Beach Harbor, FL	37	0	0.0	0.0	0	0.0	0.0
Gulf	Pascagoula Harbor, MS	1	0	0.0	0.0	0	0.0	0.0
Atlantic	Paulsboro, NJ	1	0	0.0	0.0	0	0.0	0.0
Atlantic	Philadelphia Harbor, PA	117	9	7.8	17.3	9	7.8	17.3
Atlantic	Piscataqua River, ME and NH	7	0	0.0	0.0	0	0.0	0.0
Atlantic	Ponce Harbor, PR	4	0	0.0	0.0	0	0.0	0.0
Atlantic	Port Everglades Harbor, FL	109	0	0.0	0.0	0	0.0	0.0
Atlantic	Port in Caribbean	17	6	33.2	11.0	6	33.2	11.0
Great Lakes	Port Huron, MI	2	0	0.0	0.0	0	0.0	0.0

TABLE H-4A

ANALYSIS OF VESSEL TYPE CONSTRAINTS, OTHER 2000

Coast Name	Port Name	Number of Calls	With Projects			Without Projects		
			Constrained Calls With Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls	Constrained Calls Without Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls
Gulf	Port Manatee, FL	9	0	0.0	0.0	0	0.0	0.0
Gulf	Port Of Baton Rouge, LA	48	0	0.0	0.0	0	0.0	0.0
Atlantic	Port Of Boston, MA	130	1	0.8	1.9	1	0.8	1.9
Great Lakes	Port Of Buffalo, NY	1	0	0.0	0.0	0	0.0	0.0
Great Lakes	Port Of Chicago, IL	44	0	0.0	0.0	0	0.0	0.0
Great Lakes	Port Of Detroit, MI	54	0	0.0	0.0	0	0.0	0.0
Atlantic	Port Of Hopewell, VA	2	1	50.0	1.9	1	50.0	1.9
Pacific	Port Of Kalama, WA	1	0	0.0	0.0	0	0.0	0.0
Pacific	Port Of Longview, WA	10	1	10.1	1.9	1	10.1	1.9
Gulf	Port Of New Orleans, LA	157	0	0.0	0.0	0	0.0	0.0
Atlantic	Port Of New York/New Jersey	315	2	0.6	3.8	2	0.6	3.8
Atlantic	Port Of Newport News, VA	25	0	0.0	0.0	0	0.0	0.0
Gulf	Port Of Plaquemine, LA	1	0	0.0	0.0	0	0.0	0.0
Pacific	Port Of Portland, OR	56	1	1.8	1.9	1	1.8	1.9
Atlantic	Port Of Richmond, VA	4	1	25.0	1.9	1	25.0	1.9
Gulf	Port Of South Louisiana, LA	14	0	0.0	0.0	0	0.0	0.0
Pacific	Port Of Vancouver, WA	5	0	0.0	0.0	0	0.0	0.0
Atlantic	Port Of Wilmington, NC	3	0	0.0	0.0	0	0.0	0.0
Atlantic	Portland Harbor, ME	3	0	0.0	0.0	0	0.0	0.0
Atlantic	Potomac River At Alexandria, VA	3	0	0.0	0.0	0	0.0	0.0
Atlantic	Providence River and Harbor, RI	1	1	100.0	2.8	1	100.0	2.8
Pacific	Richmond Harbor, CA	1	0	0.0	0.0	0	0.0	0.0
Pacific	San Diego Harbor, CA	2	0	0.0	0.0	0	0.0	0.0
Pacific	San Francisco Harbor, CA	6	1	15.8	1.9	1	15.8	1.9
Atlantic	San Juan Harbor, PR	99	2	2.0	3.8	2	2.0	3.8
Atlantic	Savannah Harbor, GA	53	0	0.0	0.0	0	0.0	0.0
Atlantic	Searsport Harbor, ME	1	0	0.0	0.0	0	0.0	0.0
Pacific	Seattle Harbor, WA	106	2	1.9	3.8	2	1.9	3.8
Pacific	Seward Harbor, AK	30	0	0.0	0.0	0	0.0	0.0
Pacific	Sitka Harbor, AK	4	0	0.0	0.0	0	0.0	0.0
Pacific	Skagway Harbor, AK	2	0	0.0	0.0	0	0.0	0.0
Atlantic	Caribbean Islands	4	0	0.0	0.0	0	0.0	0.0
Pacific	Tacoma Harbor, WA	75	2	2.7	3.8	2	2.7	3.8
Gulf	Tampa Harbor, FL	34	0	0.0	0.0	0	0.0	0.0
Gulf	Texas City, TX	52	0	0.0	0.0	0	0.0	0.0
Great Lakes	Toledo Harbor, OH	2	0	0.0	0.0	0	0.0	0.0
Atlantic	Yabucoa Harbor, PR	2	0	0.0	0.0	0	0.0	0.0
	TOTAL		**52**			**52**		

TABLE H-4B

ANALYSIS OF VESSEL TYPE CONSTAINTS, OTHER 2010

Coast Name	Port Name	Number of Calls	With Projects			Without Projects		
			Constrained Calls With Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls	Constrained Calls Without Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls
Pacific	Anchorage, AK	25	0	0.0	0.0	0	0.0	0.0
Gulf	Atchafalaya Rvr Morgan City To Gulf	7	0	0.0	0.0	0	0.0	0.0
Atlantic	Baltimore Harbor and Channels, Md	357	0	0.0	0.0	0	0.0	0.0
Gulf	Bayou La Batre, AL	7	7	100.0	10.7	7	100.0	10.1
Gulf	Bayou Lafourche, LA	2	0	0.0	0.0	2	100.0	3.2
Gulf	Beaumont, TX	2	0	0.0	0.0	0	0.0	0.0
Atlantic	Brunswick Harbor, GA	2	0	0.0	0.0	0	0.0	0.0
Great Lakes	Burns Waterway Harbor, IN	1	0	0.0	0.0	0	0.0	0.0
Atlantic	Canaveral Harbor, FL	26	0	0.0	0.0	0	0.0	0.0
Atlantic	Charleston Harbor, SC	462	1	0.2	1.5	1	0.2	1.4
Atlantic	Chester Area, PA	2	1	50.0	1.5	1	50.0	1.4
Gulf	Corpus Christi, TX	7	3	40.4	4.5	3	40.4	4.3
Atlantic	Delaware River At Camden, NJ	1	0	0.0	0.0	0	0.0	0.0
Gulf	East Pearl River MS	2	2	100.0	2.3	2	100.0	2.2
Pacific	Everett Harbor, WA	7	0	0.0	0.0	0	0.0	0.0
Atlantic	Fajardo Harbor, PR	4	0	0.0	0.0	0	0.0	0.0
Atlantic	Fernandina Harbor, FL	1	0	0.0	0.0	0	0.0	0.0
Gulf	Freeport Harbor, TX	4	0	0.0	0.0	0	0.0	0.0
Gulf	Galveston Channel, TX	4	0	0.0	0.0	0	0.0	0.0
Gulf	GIWW Mile 87	1	0	0.0	0.0	0	0.0	0.0
Gulf	Gulfport Harbor, MS	2	0	0.0	0.0	0	0.0	0.0
Pacific	Haines, AK	3	1	36.1	1.5	1	36.1	1.4
Pacific	Hilo Harbor, HI	3	0	0.0	0.0	0	0.0	0.0
Pacific	Homer, AK	1	0	0.0	0.0	0	0.0	0.0
Pacific	Honolulu Harbor, Oahu, HI	5	0	0.0	0.0	0	0.0	0.0
Gulf	Houston, TX	332	0	0.0	0.0	0	0.0	0.0
Atlantic	Jacksonville Harbor, FL	126	0	0.0	0.0	0	0.0	0.0
Pacific	Juneau Harbor, AK	2	0	0.0	0.0	0	0.0	0.0
Pacific	Ketchikan Harbor, AK	9	0	0.0	0.0	0	0.0	0.0
Atlantic	Key West Harbor, FL	14	0	0.0	0.0	0	0.0	0.0
Pacific	Kodiak Harbor, AK	4	0	0.0	0.0	0	0.0	0.0
Gulf	Lake Charles, LA	3	0	0.0	0.0	0	0.0	0.0
Pacific	Long Beach Harbor, CA	158	0	0.0	0.0	2	1.3	2.9
Pacific	Los Angeles Harbor, CA	239	0	0.0	0.0	0	0.0	0.0
Atlantic	Marcus Hook, PA	4	4	100.0	5.6	4	100.0	5.2
Gulf	Matagorda Ship Channel, TX	3	0	0.0	0.0	0	0.0	0.0
Atlantic	Miami Harbor, FL	643	4	0.6	6.3	4	0.6	5.9
Gulf	Mobile Harbor, AL	24	0	0.0	0.0	0	0.0	0.0
Atlantic	Narragansett Bay, RI	1	0	0.0	0.0	0	0.0	0.0
Pacific	Nome, AK	1	0	0.0	0.0	0	0.0	0.0
Atlantic	Norfolk Harbor, VA	322	1	0.3	1.5	1	0.3	1.4
Pacific	Oakland Harbor, CA	118	2	1.7	3.0	2	1.7	2.9
Great Lakes	Ogdensburg Harbor, NY	2	0	0.0	0.0	0	0.0	0.0
Atlantic	Palm Beach Harbor, FL	72	0	0.0	0.0	0	0.0	0.0
Gulf	Pascagoula Harbor, MS	1	0	0.0	0.0	0	0.0	0.0
Atlantic	Paulsboro, NJ	1	0	0.0	0.0	0	0.0	0.0
Atlantic	Philadelphia Harbor, PA	207	13	6.4	20.0	13	6.4	18.8
Atlantic	Piscataqua River, ME And NH	9	0	0.0	0.0	0	0.0	0.0
Atlantic	Ponce Harbor, PR	5	0	0.0	0.0	0	0.0	0.0
Atlantic	Port Everglades Harbor, FL	174	0	0.0	0.0	0	0.0	0.0
Atlantic	Port in Caribbean	41	10	25.4	15.8	10	25.4	14.8
Great Lakes	Port Huron, MI	2	0	0.0	0.0	0	0.0	0.0

TABLE H-4B

ANALYSIS OF VESSEL TYPE CONSTAINTS, OTHER 2010

Coast Name	Port Name	Number of Calls	With Projects			Without Projects		
			Constrained Calls With Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls	Constrained Calls Without Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls
Gulf	Port Manatee, FL	6	0	0.0	0.0	0	0.0	0.0
Gulf	Port Of Baton Rouge, LA	112	0	0.0	0.0	0	0.0	0.0
Atlantic	Port Of Boston, MA	189	1	0.5	1.5	1	0.5	1.4
Great Lakes	Port Of Buffalo, NY	1	0	0.0	0.0	0	0.0	0.0
Great Lakes	Port Of Chicago, IL	86	0	0.0	0.0	0	0.0	0.0
Great Lakes	Port Of Detroit, MI	65	0	0.0	0.0	0	0.0	0.0
Atlantic	Port Of Hopewell, VA	2	1	50.0	1.5	1	50.0	1.4
Pacific	Port Of Kalama, WA	1	0	0.0	0.0	0	0.0	0.0
Pacific	Port Of Longview, WA	15	1	6.6	1.5	1	6.6	1.4
Gulf	Port Of New Orleans, LA	263	0	0.0	0.0	0	0.0	0.0
Atlantic	Port Of New York/New Jersey	599	2	0.3	3.0	2	0.3	2.9
Atlantic	Port Of Newport News, VA	37	0	0.0	0.0	0	0.0	0.0
Gulf	Port Of Plaquemine, LA	2	0	0.0	0.0	0	0.0	0.0
Pacific	Port Of Portland, OR	62	1	1.6	1.5	1	1.6	1.4
Atlantic	Port Of Richmond, VA	4	1	23.5	1.5	1	23.5	1.4
Gulf	Port Of South Louisiana, LA	24	0	0.0	0.0	0	0.0	0.0
Pacific	Port Of Vancouver, WA	7	0	0.0	0.0	0	0.0	0.0
Atlantic	Port Of Wilmington, NC	3	0	0.0	0.0	0	0.0	0.0
Atlantic	Portland Harbor, ME	4	0	0.0	0.0	0	0.0	0.0
Atlantic	Potomac River At Alexandria, VA	4	0	0.0	0.0	0	0.0	0.0
Atlantic	Providence River and Harbor, RI	3	3	100.0	4.5	3	100.0	4.2
Pacific	Richmond Harbor, CA	2	0	0.0	0.0	0	0.0	0.0
Pacific	San Diego Harbor, CA	2	0	0.0	0.0	0	0.0	0.0
Pacific	San Francisco Harbor, CA	9	1	11.5	1.5	1	11.5	1.4
Atlantic	San Juan Harbor, PR	168	2	1.2	3.0	2	1.2	2.9
Atlantic	Savannah Harbor, GA	77	0	0.0	0.0	0	0.0	0.0
Atlantic	Searsport Harbor, ME	1	0	0.0	0.0	0	0.0	0.0
Pacific	Seattle Harbor, WA	176	2	1.1	3.0	2	1.1	2.9
Pacific	Seward Harbor, AK	30	0	0.0	0.0	0	0.0	0.0
Pacific	Sitka Harbor, AK	6	0	0.0	0.0	0	0.0	0.0
Pacific	Skagway Harbor, AK	2	0	0.0	0.0	0	0.0	0.0
Atlantic	Caribbean Islands	4	0	0.0	0.0	0	0.0	0.0
Pacific	Tacoma Harbor, WA	108	2	1.9	3.0	2	1.9	2.9
Gulf	Tampa Harbor, FL	42	0	0.0	0.0	0	0.0	0.0
Gulf	Texas City, TX	78	0	0.0	0.0	0	0.0	0.0
Great Lakes	Toledo Harbor, OH	2	0	0.0	0.0	0	0.0	0.0
Pacific	Unalaska Bay and Island, AK	1	0	0.0	0.0	0	0.0	0.0
Atlantic	Yabucoa Harbor, PR	4	0	0.0	0.0	0	0.0	0.0
	Total		**66**			**70**		

TABLE H4-C

ANALYSIS OF VESSEL TYPE CONSTRAINTS, OTHER 2020

Coast Name	Port Name	Number of Calls	With Projects			Without Projects		
			Constrained Calls With Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls	Constrained Calls Without Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls
Pacific	Anchorage, AK	22	0	0.0	0.0	0	0.0	0.0
Gulf	Atchafalaya Rvr Morgan City To Gulf	11	0	0.0	0.0	0	0.0	0.0
Atlantic	Baltimore Harbor and Channels, MD	562	0	0.0	0.0	0	0.0	0.0
Gulf	Bayou La Batre, AL	12	12	100.0	13.1	12	100.0	12.3
Gulf	Bayou Lafourche, LA	3	0	0.0	0.0	3	100.0	3.5
Gulf	Beaumont, TX	3	0	0.0	0.0	0	0.0	0.0
Atlantic	Brunswick Harbor, GA	3	0	0.0	0.0	0	0.0	0.0
Great Lakes	Burns Waterway Harbor, IN	1	0	0.0	0.0	0	0.0	0.0
Atlantic	Canaveral Harbor, FL	39	0	0.0	0.0	0	0.0	0.0
Atlantic	Charleston Harbor, SC	762	1	0.1	1.1	1	0.1	1.0
Atlantic	Chester Area, PA	2	1	50.0	1.1	1	50.0	1.0
Gulf	Corpus Christi, TX	8	3	37.2	3.3	3	37.2	3.1
Atlantic	Delaware River At Camden, NJ	2	0	0.0	0.0	0	0.0	0.0
Gulf	East Pearl River, MS	2	2	100.0	2.2	2	100.0	2.1
Pacific	Everett Harbor, WA	8	0	0.0	0.0	0	0.0	0.0
Atlantic	Fajardo Harbor, PR	7	0	0.0	0.0	0	0.0	0.0
Atlantic	Fernandina Harbor, FL	1	0	0.0	0.0	0	0.0	0.0
Gulf	Freeport Harbor, TX	6	0	0.0	0.0	0	0.0	0.0
Gulf	Galveston Channel, TX	7	0	0.0	0.0	0	0.0	0.0
Gulf	GIWW Mile 87	1	0	0.0	0.0	0	0.0	0.0
Gulf	Gulfport Harbor, MS	3	0	0.0	0.0	0	0.0	0.0
Pacific	Haines, AK	3	1	36.6	1.1	1	36.6	1.0
Pacific	Hilo Harbor, HI	5	0	0.0	0.0	0	0.0	0.0
Pacific	Homer, AK	1	0	0.0	0.0	0	0.0	0.0
Pacific	Honolulu Harbor, Oahu, HI	9	0	0.0	0.0	0	0.0	0.0
Gulf	Houston, TX	485	0	0.0	0.0	0	0.0	0.0
Atlantic	Jacksonville Harbor, FL	226	0	0.0	0.0	0	0.0	0.0
Pacific	Juneau Harbor, AK	2	0	0.0	0.0	0	0.0	0.0
Pacific	Ketchikan Harbor, AK	2	0	0.0	0.0	0	0.0	0.0
Atlantic	Key West Harbor, FL	21	0	0.0	0.0	0	0.0	0.0
Pacific	Kodiak Harbor, AK	5	0	0.0	0.0	0	0.0	0.0
Gulf	Lake Charles, LA	4	0	0.0	0.0	0	0.0	0.0
Pacific	Long Beach Harbor, CA	275	0	0.0	0.0	2	0.7	2.1
Pacific	Los Angeles Harbor, CA	344	0	0.0	0.0	0	0.0	0.0
Atlantic	Marcus Hook, PA	6	6	100.0	6.2	6	100.0	5.9
Gulf	Matagorda Ship Channel, TX	7	0	0.0	0.0	0	0.0	0.0
Atlantic	Miami Harbor, FL	1,009	6	0.6	7.1	6	0.6	6.7
Gulf	Mobile Harbor, AL	50	0	0.0	0.0	0	0.0	0.0
Atlantic	Narragansett Bay, RI	1	0	0.0	0.0	0	0.0	0.0
Pacific	Nome, AK	1	0	0.0	0.0	0	0.0	0.0
Atlantic	Norfolk Harbor, VA	477	1	0.2	1.1	1	0.2	1.0
Pacific	Oakland Harbor, CA	191	2	1.0	2.2	2	1.0	2.1
Great Lakes	Ogdensburg Harbor, NY	3	0	0.0	0.0	0	0.0	0.0
Atlantic	Palm Beach Harbor, FL	122	0	0.0	0.0	0	0.0	0.0
Gulf	Pascagoula Harbor, MS	1	0	0.0	0.0	0	0.0	0.0
Atlantic	Paulsboro, NJ	1	0	0.0	0.0	0	0.0	0.0
Atlantic	Philadelphia Harbor, PA	309	19	6.3	21.5	19	6.3	20.3
Atlantic	Piscataqua River, ME And NH	12	0	0.0	0.0	0	0.0	0.0
Atlantic	Ponce Harbor, PR	6	0	0.0	0.0	0	0.0	0.0
Atlantic	Port Everglades Harbor, FL	263	0	0.0	0.0	0	0.0	0.0
Atlantic	Port in Caribbean	82	18	21.5	19.6	18	21.5	18.5

TABLE H4-C

ANALYSIS OF VESSEL TYPE CONSTRAINTS, OTHER 2020

Coast Name	Port Name	Number of Calls	With Projects			Without Projects		
			Constrained Calls With Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls	Constrained Calls Without Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls
Great Lakes	Port Huron, MI	2	0	0.0	0.0	0	0.0	0.0
Gulf	Port Manatee, FL	4	0	0.0	0.0	0	0.0	0.0
Gulf	Port Of Baton Rouge, LA	117	0	0.0	0.0	0	0.0	0.0
Atlantic	Port Of Boston, MA	254	1	0.4	1.1	1	0.4	1.0
Great Lakes	Port Of Buffalo, NY	1	0	0.0	0.0	0	0.0	0.0
Great Lakes	Port Of Chicago, IL	147	0	0.0	0.0	0	0.0	0.0
Great Lakes	Port Of Detroit, MI	80	0	0.0	0.0	0	0.0	0.0
Atlantic	Port Of Hopewell, VA	2	1	50.0	1.1	1	50.0	1.0
Pacific	Port Of Kalama, WA	2	0	0.0	0.0	0	0.0	0.0
Pacific	Port Of Longview, WA	17	1	5.9	1.1	1	5.9	1.0
Gulf	Port Of New Orleans, LA	409	0	0.0	0.0	0	0.0	0.0
Atlantic	Port Of New York/New Jersey	1,091	2	0.2	2.2	2	0.2	2.1
Atlantic	Port Of Newport News, VA	49	0	0.0	0.0	0	0.0	0.0
Gulf	Port Of Plaquemine, LA	4	0	0.0	0.0	0	0.0	0.0
Pacific	Port Of Portland, OR	70	1	1.4	1.1	1	1.4	1.0
Atlantic	Port Of Richmond, VA	5	1	21.7	1.1	1	21.7	1.0
Gulf	Port Of South Louisiana, LA	38	0	0.0	0.0	0	0.0	0.0
Pacific	Port Of Vancouver, WA	9	0	0.0	0.0	0	0.0	0.0
Atlantic	Port Of Wilmington, NC	4	0	0.0	0.0	0	0.0	0.0
Atlantic	Portland Harbor, ME	8	0	0.0	0.0	0	0.0	0.0
Atlantic	Potomac River At Alexandria, VA	4	0	0.0	0.0	0	0.0	0.0
Atlantic	Providence River and Harbor, RI	4	4	100.0	4.5	4	100.0	4.2
Pacific	Richmond Harbor, CA	2	0	0.0	0.0	0	0.0	0.0
Pacific	San Diego Harbor, CA	4	0	0.0	0.0	0	0.0	0.0
Pacific	San Francisco Harbor, CA	12	1	8.5	1.1	1	8.5	1.0
Atlantic	San Juan Harbor, PR	264	2	0.8	2.2	2	0.8	2.1
Atlantic	Savannah Harbor, GA	122	0	0.0	0.0	0	0.0	0.0
Atlantic	Searsport Harbor, ME	1	0	0.0	0.0	0	0.0	0.0
Pacific	Seattle Harbor, WA	280	2	0.7	2.2	2	0.7	2.1
Pacific	Seward Harbor, AK	28	0	0.0	0.0	0	0.0	0.0
Pacific	Sitka Harbor, AK	8	0	0.0	0.0	0	0.0	0.0
Pacific	Skagway Harbor, AK	2	0	0.0	0.0	0	0.0	0.0
Atlantic	Caribbean Islands	4	0	0.0	0.0	0	0.0	0.0
Pacific	Tacoma Harbor, WA	158	2	1.4	2.4	2	1.4	2.3
Gulf	Tampa Harbor, FL	56	0	0.0	0.0	0	0.0	0.0
Gulf	Texas City, TX	91	0	0.0	0.0	0	0.0	0.0
Great Lakes	Toledo Harbor, OH	1	0	0.0	0.0	0	0.0	0.0
Pacific	Unalaska Bay and Island, AK	1	0	0.0	0.0	0	0.0	0.0
Atlantic	Yabucoa Harbor, PR	5	0	0.0	0.0	0	0.0	0.0
	TOTAL		**90**			**95**		

TABLE H-5A

ANALYSIS OF VESSEL TYPE CONSTRAINTS, TANKER 2000

Coast Name	Port Name/Location Name	Number of Calls	With Projects			Without Projects		
			Constrained Calls With Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls	Constrained Calls Without Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls
Great Lakes	Alexandria Bay, NY	4	3	75.0	0.0	3	75.0	0.0
Pacific	Anacortes Harbor, WA	50	43	86.2	0.6	43	86.2	0.6
Pacific	Anchorage, AK	30	1	3.4	0.0	28	93.7	0.4
Gulf	Atchafalaya Rvr Morgan City To Gulf	13	13	100.0	0.2	13	100.0	0.2
Atlantic	Baltimore Harbor and Channels, MD	263	21	7.8	0.3	21	7.8	0.3
Pacific	Barbers Point, HI	94	59	62.6	0.8	59	62.6	0.8
Gulf	Bayou Lafourche, LA	5	5	100.0	0.1	5	100.0	0.1
Gulf	Beaumont, TX	426	234	54.9	3.3	234	54.9	3.3
Pacific	Bellingham Bay and Harbor, WA	13	3	22.7	0.0	3	22.7	0.0
Atlantic	Bridgeport Harbor, CT	15	15	100.0	0.2	15	100.0	0.2
Gulf	Brownsville, TX	80	9	11.7	0.1	9	11.7	0.1
Atlantic	Bucksport Harbor, ME	23	23	100.0	0.3	23	100.0	0.3
Atlantic	Canaveral Harbor, FL	9	6	63.7	0.1	6	63.7	0.1
Atlantic	Cape Cod Canal, MA	7	7	100.0	0.1	7	100.0	0.1
Pacific	Carquinez Strait, CA	140	18	12.7	0.3	18	12.7	0.2
Atlantic	Charleston Harbor, SC	182	40	22.3	0.6	40	22.3	0.6
Atlantic	Chester Area, PA	32	23	72.6	0.3	23	72.6	0.3
Atlantic	Caribbean Islands	18	5	27.5	0.1	5	27.5	0.1
Great Lakes	Cleveland Harbor, OH	9	3	32.8	0.0	3	32.8	0.0
Gulf	Corpus Christi, TX	1,084	375	34.6	5.3	375	34.6	5.3
Atlantic	Del River Between Phila Tren	2	2	100.0	0.0	2	100.0	0.0
Atlantic	Delaware River At Camden, NJ	31	20	66.4	0.3	20	66.4	0.3
Great Lakes	Duluth-Superior Harbor, MN and WI	7	2	30.3	0.0	2	30.3	0.0
Pacific	El Segundo, CA	59	0	0.0	0.0	0	0.0	0.0
Atlantic	Fall River Harbor, MA	14	5	37.8	0.1	5	37.8	0.1
Atlantic	Fernandina Harbor, FL	1	1	100.0	0.0	1	100.0	0.0
Gulf	Freeport Harbor, TX	419	204	48.7	2.9	204	48.7	2.9
Gulf	Galveston Channel, TX	61	44	72.1	0.6	44	72.1	0.6
Gulf	GIWW Mile 87	2	0	0.0	0.0	0	0.0	0.0
Atlantic	Gloucester Harbor, MA	2	2	100.0	0.0	2	100.0	0.0
Atlantic	Guayanilla Harbor, PR	91	70	77.4	1.0	70	77.4	1.0
Gulf	Gulfport Harbor, MS	7	4	60.9	0.1	4	60.9	0.1
Pacific	Hilo Harbor, HI	2	0	0.0	0.0	0	0.0	0.0
Pacific	Homer, AK	9	9	100.0	0.1	9	100.0	0.1
Pacific	Honolulu Harbor, Oahu, HI	45	10	21.6	0.1	10	21.6	0.1
Gulf	Houma Navigation Canal, LA	4	4	100.0	0.1	4	100.0	0.1
Gulf	Houston, TX	3,181	1,003	31.5	14.2	1,003	31.5	14.1
Pacific	Humboldt Harbor and Bay, CA	2	2	100.0	0.0	2	100.0	0.0
Atlantic	Jacksonville Harbor, FL	107	42	39.0	0.6	42	39.0	0.6
Atlantic	Jobos Harbor, PR	155	65	41.6	0.9	65	41.6	0.9
Pacific	Kahului Harbor, Maui, HI	2	0	0.0	0.0	0	0.0	0.0
Pacific	Kenai River, AK	21	0	0.0	0.0	0	0.0	0.0
Pacific	Ketchikan Harbor, AK	10	10	100.0	0.1	10	100.0	0.1
Gulf	Lake Charles, LA	448	337	75.2	4.8	337	75.2	4.7
Great Lakes	Lake Michigan	10	10	100.0	0.1	10	100.0	0.1
Pacific	Long Beach Harbor, CA	377	13	3.4	0.2	13	3.4	0.2
Pacific	Los Angeles Harbor, CA	362	0	0.0	0.0	0	0.0	0.0
Atlantic	Lower Delaware Bay DE	8	8	100.0	0.1	8	100.0	0.1
Atlantic	Marcus Hook, PA	83	63	75.9	0.9	63	75.9	0.9
Pacific	Mare Island Strait, CA	20	1	5.1	0.0	1	5.1	0.0
Gulf	Matagorda Ship Channel, TX	83	70	84.2	1.0	70	84.2	1.0

TABLE H-5A

ANALYSIS OF VESSEL TYPE CONSTRAINTS, TANKER 2000

Coast Name	Port Name/Location Name	Number of Calls	With Projects			Without Projects		
			Constrained Calls With Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls	Constrained Calls Without Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls
Atlantic	Miami Harbor, FL	96	62	64.2	0.9	62	64.2	0.9
Great Lakes	Milwaukee Harbor, WI	2	1	50.0	0.0	1	50.0	0.0
Gulf	Mobile Harbor, AL	166	48	29.0	0.7	48	29.0	0.7
Atlantic	Morehead City Harbor, NC	68	3	5.0	0.0	3	5.0	0.0
Pacific	Naknek River, AK	2	2	100.0	0.0	2	100.0	0.0
Atlantic	Narragansett Bay, RI	10	10	100.0	0.1	10	100.0	0.1
Atlantic	New Castle Area, DE	102	90	88.4	1.3	90	88.4	1.3
Atlantic	New Haven Harbor, CT	41	41	100.0	0.6	41	100.0	0.6
Atlantic	New London Harbor, CT	2	2	100.0	0.0	2	100.0	0.0
Pacific	Nikishka, AK	45	5	10.0	0.1	5	10.0	0.1
Atlantic	Norfolk Harbor, VA	250	51	20.3	0.7	51	20.3	0.7
Atlantic	Northville, L.I., NY	30	0	0.0	0.0	0	0.0	0.0
Pacific	Oakland Harbor, CA	26	8	31.3	0.1	8	31.3	0.1
Great Lakes	Oswego Harbor, NY	24	4	16.8	0.1	4	16.8	0.1
Pacific	Other Puget Sound Area Ports, WA	44	0	0.0	0.0	0	0.0	0.0
Pacific	Other San Francisco Bay Area Ports, CA	19	19	100.0	0.3	19	100.0	0.3
Atlantic	Palm Beach Harbor, FL	14	7	51.2	0.1	7	51.2	0.1
Gulf	Panama City Harbor, FL	5	2	40.1	0.0	2	40.1	0.0
Gulf	Pascagoula Harbor, MS	246	226	92.1	3.2	226	92.1	3.2
Atlantic	Paulsboro, NJ	246	189	76.9	2.7	189	76.9	2.7
Pacific	Pearl Harbor, Oahu, HI	9	0	0.0	0.0	0	0.0	0.0
Atlantic	Penobscot River ME	4	4	100.0	0.1	4	100.0	0.1
Gulf	Pensacola Harbor, FL	3	1	33.3	0.0	1	33.3	0.0
Atlantic	Philadelphia Harbor, PA	307	204	66.5	2.9	204	66.5	2.9
Atlantic	Piscataqua River, ME And NH	59	51	86.2	0.7	51	86.2	0.7
Pacific	Pittsburg, CA	2	2	100.0	0.0	2	100.0	0.0
Atlantic	Ponce Harbor, PR	25	4	16.3	0.1	4	16.3	0.1
Pacific	Port Angeles Harbor, WA	12	0	0.0	0.0	0	0.0	0.0
Gulf	Port Arthur, TX	574	461	80.3	6.5	461	80.3	6.5
Atlantic	Port Everglades Harbor, FL	156	21	13.8	0.3	21	13.8	0.3
Atlantic	Port in Caribbean	213	83	39.2	1.2	83	39.2	1.2
Great Lakes	Port Huron, MI	10	8	77.4	0.1	8	77.4	0.1
Atlantic	Port Jefferson Harbor, NY	6	6	100.0	0.1	6	100.0	0.1
Gulf	Port Manatee, FL	11	2	17.8	0.0	2	17.8	0.0
Atlantic	Port Of Albany, NY	4	4	100.0	0.1	4	100.0	0.1
Gulf	Port Of Baton Rouge, LA	589	123	21.0	1.7	123	21.0	1.7
Atlantic	Port Of Boston, MA	246	107	43.3	1.5	107	43.3	1.5
Great Lakes	Port Of Buffalo, NY	23	14	60.1	0.2	14	60.1	0.2
Great Lakes	Port Of Chicago, IL	65	44	67.6	0.6	44	67.6	0.6
Great Lakes	Port Of Detroit, MI	71	23	32.9	0.3	23	32.9	0.3
Atlantic	Port Of Hopewell, VA	6	5	84.3	0.1	5	84.3	0.1
Pacific	Port Of Kalama, WA	5	1	22.4	0.0	1	22.4	0.0
Pacific	Port Of Longview, WA	13	2	15.8	0.0	2	15.8	0.0
Gulf	Port Of New Orleans, LA	459	123	26.8	1.7	123	26.8	1.7
Atlantic	Port Of New York/New Jersey	1,044	439	42.0	6.2	439	42.0	6.2
Atlantic	Port Of Newport News, VA	38	25	65.0	0.4	25	65.0	0.4
Gulf	Port Of Plaquemine, LA	199	96	48.2	1.4	96	48.2	1.3
Pacific	Port Of Portland, OR	85	13	15.4	0.2	13	15.4	0.2
Atlantic	Port Of Richmond, VA	6	6	100.0	0.1	6	100.0	0.1
Gulf	Port Of South Louisiana, LA	661	243	36.7	3.4	243	36.7	3.4
Pacific	Port Of Vancouver, WA	35	2	5.8	0.0	2	5.8	0.0
Atlantic	Port Of Wilmington, NC	210	36	17.0	0.5	36	17.0	0.5
Atlantic	Port Royal Harbor, SC	13	1	7.4	0.0	1	7.4	0.0

TABLE H-5A

ANALYSIS OF VESSEL TYPE CONSTRAINTS, TANKER 2000

Coast Name	Port Name/Location Name	Number of Calls	With Projects			Without Projects		
			Constrained Calls With Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls	Constrained Calls Without Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls
Pacific	Port Townsend Harbor, WA	2	0	0.0	0.0	0	0.0	0.0
Atlantic	Portland Harbor, ME	209	206	98.7	2.9	206	98.7	2.9
Atlantic	Potomac River At Lower Cedar Point, MD	2	2	100.0	0.0	2	100.0	0.0
Great Lakes	Presque Isle Harbor, MI	2	2	100.0	0.0	2	100.0	0.0
Atlantic	Providence River and Harbor, RI	85	27	31.4	0.4	27	31.4	0.4
Pacific	Richmond Harbor, CA	244	33	13.5	0.5	33	13.5	0.5
Pacific	Sacramento, CA	5	3	58.7	0.0	3	58.7	0.0
Atlantic	Salem Harbor, MA	7	7	100.0	0.1	7	100.0	0.1
Pacific	San Diego Harbor, CA	8	3	31.0	0.0	3	31.0	0.0
Pacific	San Francisco Harbor, CA	56	41	73.9	0.6	41	73.9	0.6
Atlantic	San Juan Harbor, PR	119	41	34.7	0.6	41	34.7	0.6
Great Lakes	Sault Ste. Marie, MI	5	3	57.1	0.0	3	57.1	0.0
Atlantic	Savannah Harbor, GA	195	41	21.2	0.6	41	21.2	0.6
Atlantic	Searsport Harbor, ME	28	27	96.1	0.4	27	96.1	0.4
Pacific	Seattle Harbor, WA	98	20	20.4	0.3	20	20.4	0.3
Atlantic	Caribbean Islands	5	3	56.2	0.0	3	56.2	0.0
Pacific	Stockton, CA	29	13	43.6	0.2	13	43.6	0.2
Pacific	Suisun Bay Channel, CA	12	10	83.9	0.1	10	83.9	0.1
Pacific	Tacoma Harbor, WA	76	33	43.0	0.5	33	43.0	0.5
Gulf	Tampa Harbor, FL	143	2	1.4	0.0	2	1.4	0.0
Gulf	Texas City, TX	875	657	75.2	9.3	657	75.2	9.2
Atlantic	Thompson Point NJ and Vicinity	2	0	0.0	0.0	0	0.0	0.0
Great Lakes	Toledo Harbor, OH	16	7	44.3	0.1	7	44.3	0.1
Pacific	Valdez Harbor, AK	6	0	0.0	0.0	0	0.0	0.0
Atlantic	Wilmington Harbor, DE	19	13	67.8	0.2	13	67.8	0.2
Atlantic	Yabucoa Harbor, PR	96	4	4.0	0.1	4	4.0	0.1
Pacific	Yaquina Bay & Harbor, OR	2	2	100.0	0.0	2	100.0	0.0
Atlantic	York River, VA	49	49	100.0	0.7	49	100.0	0.7
	TOTAL		**7,083**			**7,110**		

TABLE H-5B

ANALYSIS OF VESSEL TYPE CONSTRAINTS, TANKER 2010

Coast Name	Port Name/Location Name	Number of Calls	With Projects			Without Projects		
			Constrained Calls With Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls	Constrained Calls Without Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls
Great Lakes	Alexandria Bay, NY	6	5	83.3	0.1	5	83.3	0.0
Pacific	Anacortes Harbor, WA	78	68	86.9	0.9	68	86.9	0.6
Pacific	Anchorage, AK	35	3	8.5	0.0	32	92.2	0.3
Gulf	Atchafalaya Rvr Morgan City To Gulf	17	17	100.0	0.2	17	100.0	0.2
Atlantic	Baltimore Harbor and Channels, MD	297	20	6.9	0.3	20	6.9	0.2
Pacific	Barbers Point, HI	138	53	38.3	0.7	95	69.1	0.9
Gulf	Bayou Lafourche, LA	7	7	100.0	0.1	7	100.0	0.1
Gulf	Beaumont, TX	656	388	59.2	5.1	388	59.2	3.7
Pacific	Bellingham Bay and Harbor, WA	16	5	29.5	0.1	5	29.5	0.0
Atlantic	Bridgeport Harbor, CT	17	17	100.0	0.2	17	100.0	0.2
Gulf	Brownsville, TX	99	13	13.0	0.2	13	13.0	0.1
Atlantic	Bucksport Harbor, ME	22	22	100.0	0.3	22	100.0	0.2
Atlantic	Canaveral Harbor, FL	10	7	67.9	0.1	7	67.9	0.1
Atlantic	Cape Cod Canal, MA	10	10	100.0	0.1	10	100.0	0.1
Pacific	Carquinez Strait, CA	249	35	14.0	0.5	35	14.0	0.3
Atlantic	Charleston Harbor, SC	328	9	2.7	0.1	47	14.4	0.4
Atlantic	Chester Area, PA	49	32	65.3	0.4	38	77.7	0.4
Atlantic	Caribbean Islands	25	7	28.5	0.1	7	28.5	0.1
Great Lakes	Cleveland Harbor, OR	9	5	53.7	0.1	5	53.7	0.0
Gulf	Corpus Christi, TX	1,652	140	8.5	1.8	551	33.4	5.3
Atlantic	Del River Between Phila Tren	3	3	100.0	0.0	3	100.0	0.0
Atlantic	Delaware River At Camden, NJ	43	17	40.4	0.2	23	54.3	0.2
Great Lakes	Duluth-Superior Harbor, MN and WI	7	4	55.4	0.1	4	55.4	0.0
Pacific	El Segundo, CA	111	2	1.8	0.0	2	1.8	0.0
Atlantic	Fall River Harbor, MA	17	8	45.8	0.1	8	45.8	0.1
Atlantic	Fernandina Harbor, FL	1	1	100.0	0.0	1	100.0	0.0
Gulf	Freeport Harbor, TX	621	290	46.7	3.8	290	46.7	2.8
Gulf	Galveston Channel, TX	87	41	46.9	0.5	64	74.2	0.6
Gulf	GIWW Mile 87	3	0	0.0	0.0	0	0.0	0.0
Atlantic	Gloucester Harbor, MA	3	3	100.0	0.0	3	100.0	0.0
Atlantic	Guayanilla Harbor, PR	115	83	72.0	1.1	83	72.0	0.8
Gulf	Gulfport Harbor, MS	9	6	64.1	0.1	6	64.1	0.1
Pacific	Hilo Harbor, HI	4	1	24.6	0.0	1	24.6	0.0
Pacific	Homer, AK	11	11	100.0	0.1	11	100.0	0.1
Pacific	Honolulu Harbor, Oahu, HI	64	16	24.7	0.2	16	24.7	0.2
Gulf	Houma Navigation Canal, LA	5	5	100.0	0.1	5	100.0	0.0
Gulf	Houston, TX	4,793	649	13.5	8.5	1,656	34.6	15.8
Pacific	Humboldt Harbor and Bay, CA	3	3	100.0	0.0	3	100.0	0.0
Atlantic	Jacksonville Harbor, FL	122	42	34.9	0.6	48	39.7	0.5
Atlantic	Jobos Harbor, PR	292	103	35.3	1.3	103	35.3	1.0
Pacific	Kahului Harbor, Maui, HI	4	1	24.6	0.0	1	24.6	0.0
Pacific	Kenai River, AK	29	1	3.5	0.0	1	3.5	0.0
Pacific	Ketchikan Harbor, AK	14	14	100.0	0.2	14	100.0	0.1
Gulf	Lake Charles, LA	677	529	78.1	6.9	529	78.1	5.1
Great Lakes	Lake Michigan	16	16	100.0	0.2	16	100.0	0.2
Pacific	Long Beach Harbor, CA	554	0	0.0	0.0	0	4.2	0.2
Pacific	Los Angeles Harbor, CA	641	0	0.0	0.0	0	0.0	0.0
Atlantic	Lower Delaware Bay, DE	12	8	67.7	0.1	12	100.0	0.1
Atlantic	Marcus Hook, PA	127	94	73.8	1.2	102	80.2	1.0
Pacific	Mare Island Strait, CA	36	2	5.5	0.0	2	5.5	0.0
Gulf	Matagorda Ship Channel, TX	140	124	88.3	1.6	124	88.3	1.2

TABLE H-5B

ANALYSIS OF VESSEL TYPE CONSTRAINTS, TANKER 2010

Coast Name	Port Name/Location Name	Number of Calls	With Projects			Without Projects		
			Constrained Calls With Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls	Constrained Calls Without Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls
Atlantic	Miami Harbor, FL	142	54	38.3	0.7	83	58.6	0.8
Great Lakes	Milwaukee Harbor, WI	3	2	66.7	0.0	2	66.7	0.0
Gulf	Mobile Harbor, AL	260	37	14.3	0.5	63	24.2	0.6
Atlantic	Morehead City Harbor, NC	67	4	6.4	0.1	4	6.4	0.0
Pacific	Naknek River, AK	3	3	100.0	0.0	3	100.0	0.0
Atlantic	Narragansett Bay, RI	13	13	100.0	0.2	13	100.0	0.1
Atlantic	New Castle Area, DE	123	70	56.9	0.9	104	84.1	1.0
Atlantic	New Haven Harbor, CT	38	38	100.0	0.5	38	100.0	0.4
Atlantic	New London Harbor, CT	3	3	100.0	0.0	3	100.0	0.0
Pacific	Nikishka, AK	91	21	23.2	0.3	21	23.2	0.2
Atlantic	Norfolk Harbor, VA	337	44	13.0	0.6	47	13.9	0.4
Atlantic	Northville, L.I., NY	33	1	3.1	0.0	1	3.1	0.0
Pacific	Oakland Harbor, CA	33	0	0.0	0.0	10	29.9	0.1
Great Lakes	Oswego Harbor, NY	17	7	40.3	0.1	7	40.3	0.1
Pacific	Other Puget Sound Area Ports, WA	72	1	1.4	0.0	1	1.4	0.0
Pacific	Other San Francisco Bay Area Ports, CA	26	26	100.0	0.3	26	100.0	0.2
Atlantic	Palm Beach Harbor, FL	14	9	61.2	0.1	9	61.2	0.1
Gulf	Panama City Harbor, FL	12	4	38.6	0.1	4	38.6	0.0
Gulf	Pascagoula Harbor, MS	377	350	92.7	4.6	353	93.5	3.4
Atlantic	Paulsboro, NJ	309	187	60.7	2.4	235	76.2	2.3
Pacific	Pearl Harbor, Oahu, HI	13	0	0.0	0.0	0	0.0	0.0
Atlantic	Penobscot River, ME	7	7	100.0	0.1	7	100.0	0.1
Gulf	Pensacola Harbor, FL	4	2	47.4	0.0	2	47.4	0.0
Atlantic	Philadelphia Harbor, PA	423	272	64.3	3.5	285	67.4	2.7
Atlantic	Piscataqua River, ME and NH	64	52	80.9	0.7	52	80.9	0.5
Pacific	Pittsburg, CA	4	4	100.0	0.1	4	100.0	0.0
Atlantic	Ponce Harbor, PR	30	6	20.4	0.1	6	20.4	0.1
Pacific	Port Angeles Harbor, WA	12	0	0.0	0.0	0	0.0	0.0
Gulf	Port Arthur, TX	919	743	80.9	9.7	743	80.9	7.1
Atlantic	Port Everglades Harbor, FL	174	36	20.8	0.5	36	20.8	0.3
Atlantic	Port in Caribbean	368	129	35.1	1.7	129	35.1	1.2
Great Lakes	Port Huron, MI	15	12	82.1	0.2	12	82.1	0.1
Atlantic	Port Jefferson Harbor, NY	11	11	100.0	0.1	11	100.0	0.1
Gulf	Port Manatee, FL	9	3	31.9	0.0	3	31.9	0.0
Atlantic	Port Of Albany, NY	6	6	100.0	0.1	6	100.0	0.1
Gulf	Port Of Baton Rouge, LA	833	28	3.4	0.4	166	19.9	1.6
Atlantic	Port Of Boston, MA	237	75	31.5	1.0	123	52.0	1.2
Great Lakes	Port Of Buffalo, NY	20	14	71.5	0.2	14	71.5	0.1
Great Lakes	Port Of Chicago, IL	88	70	79.2	0.9	70	79.2	0.7
Great Lakes	Port Of Detroit, MI	74	35	47.1	0.5	35	47.1	0.3
Atlantic	Port Of Hopewell, VA	10	9	90.4	0.1	9	90.4	0.1
Pacific	Port Of Kalama, WA	6	2	33.3	0.0	3	49.9	0.0
Pacific	Port Of Longview, WA	21	1	4.9	0.0	4	19.4	0.0
Gulf	Port Of New Orleans, LA	684	31	4.6	0.4	169	24.7	1.6
Atlantic	Port Of New York/New Jersey	1,299	415	32.0	5.4	574	44.2	5.5
Atlantic	Port Of Newport News, VA	44	12	27.7	0.2	26	58.8	0.2
Gulf	Port Of Plaquemine, LA	261	82	31.6	1.1	121	46.3	1.2
Pacific	Port Of Portland, OR	114	17	15.2	0.2	17	15.2	0.2
Atlantic	Port Of Richmond, VA	9	9	100.0	0.1	9	100.0	0.1
Gulf	Port Of South Louisiana, LA	961	74	7.7	1.0	350	36.4	3.3
Pacific	Port Of Vancouver, WA	44	4	9.1	0.1	4	9.1	0.0
Atlantic	Port Of Wilmington, NC	414	19	4.7	0.3	60	14.6	0.6
Atlantic	Port Royal Harbor, SC	8	2	26.1	0.0	2	26.1	0.0

TABLE H-5B

ANALYSIS OF VESSEL TYPE CONSTRAINTS, TANKER 2010

Coast Name	Port Name/Location Name	Number of Calls	With Projects			Without Projects		
			Constrained Calls With Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls	Constrained Calls Without Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls
Pacific	Port Townsend Harbor, WA	3	1	33.3	0.0	1	33.3	0.0
Atlantic	Portland Harbor, ME	296	293	99.2	3.8	293	99.2	2.8
Atlantic	Potomac River At Lower Cedar Point, ME	3	3	100.0	0.0	3	100.0	0.0
Great Lakes	Presque Isle Harbor, MI	3	3	100.0	0.0	3	100.0	0.0
Atlantic	Providence River and Harbor, RI	103	43	42.1	0.6	43	42.1	0.4
Pacific	Richmond Harbor, CA	446	9	2.0	0.1	52	11.7	0.5
Pacific	Sacramento, CA	7	5	69.7	0.1	5	69.7	0.0
Atlantic	Salem Harbor, MA	8	8	100.0	0.1	8	100.0	0.1
Pacific	San Diego Harbor, CA	13	5	38.9	0.1	5	38.9	0.0
Pacific	San Francisco Harbor, CA	83	65	77.8	0.8	65	77.8	0.6
Atlantic	San Juan Harbor, PR	164	47	28.8	0.6	47	28.8	0.5
Great Lakes	Sault Ste. Marie, MI	9	5	54.6	0.1	5	54.6	0.0
Atlantic	Savannah Harbor, GA	209	0	0.0	0.0	43	20.4	0.4
Atlantic	Searsport Harbor, ME	29	28	96.5	0.4	28	96.5	0.3
Pacific	Seattle Harbor, WA	155	9	5.8	0.1	31	20.1	0.3
Atlantic	Caribbean Islands	9	5	56.7	0.1	5	56.7	0.0
Pacific	Stockton, CA	37	20	52.3	0.3	20	52.3	0.2
Pacific	Suisun Bay Channel, CA	16	13	86.3	0.2	13	86.3	0.1
Pacific	Tacoma Harbor, WA	102	10	9.5	0.1	52	50.9	0.5
Gulf	Tampa Harbor, FL	117	4	3.2	0.0	4	3.2	0.0
Gulf	Texas City, TX	1,329	1,004	75.5	13.1	1,004	75.5	9.6
Atlantic	Thompson Point NJ and Vicinity	3	0	0.0	0.0	0	0.0	0.0
Great Lakes	Toledo Harbor, OH	16	9	56.5	0.1	9	56.5	0.1
Pacific	Valdez Harbor, AK	10	0	0.0	0.0	0	0.0	0.0
Atlantic	Wilmington Harbor, DE	20	14	70.1	0.2	14	70.1	0.1
Atlantic	Yabucoa Harbor, PR	137	6	4.6	0.1	6	4.6	0.1
Pacific	Yaquina Bay & Harbor, OR	3	3	100.0	0.0	3	100.0	0.0
Atlantic	York River, VA	62	62	100.0	0.8	62	100.0	0.6
	TOTAL		**7,673**			**10,450**		

TABLE H-5C

ANALYSIS OF VESSEL TYPE CONSTRAINTS, TANKER 2020

Coast Name	Port Name/Location Name	Number of Calls	With Projects			Without Projects		
			Constrained Calls With Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls	Constrained Calls Without Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls
Great Lakes	Alexandria Bay, NY	8	7	87.5	0.1	7	87.5	0.0
Pacific	Anacortes Harbor, WA	112	98	87.2	1.1	98	87.2	0.7
Pacific	Anchorage, AK	47	5	10.4	0.1	44	93.3	0.3
Gulf	Atchafalaya Rvr Morgan City To Gulf	22	22	100.0	0.2	22	100.0	0.2
Atlantic	Baltimore Harbor and Channels, MD	350	20	5.6	0.2	20	5.6	0.1
Pacific	Barbers Point, HI	172	73	42.4	0.8	123	71.3	0.8
Gulf	Bayou Lafourche, LA	10	10	100.0	0.1	10	100.0	0.1
Gulf	Beaumont, TX	893	567	63.5	6.2	567	63.5	3.9
Pacific	Bellingham Bay and Harbor, WA	24	7	31.0	0.1	7	31.0	0.1
Atlantic	Bridgeport Harbor, CT	21	21	100.0	0.2	21	100.0	0.1
Gulf	Brownsville, TX	118	19	16.3	0.2	19	16.3	0.1
Atlantic	Bucksport Harbor, ME	27	27	100.0	0.3	27	100.0	0.2
Atlantic	Canaveral Harbor, FL	12	9	70.9	0.1	9	70.9	0.1
Atlantic	Cape Cod Canal, MA	13	13	100.0	0.1	13	100.0	0.1
Pacific	Carquinez Strait, CA	391	62	15.9	0.7	62	15.9	0.4
Atlantic	Charleston Harbor, SC	563	12	2.1	0.1	61	10.9	0.4
Atlantic	Chester Area, PA	64	44	68.3	0.5	53	82.1	0.4
Atlantic	Caribbean Islands	30	10	32.8	0.1	10	32.8	0.1
Great Lakes	Cleveland Harbor, OH	11	7	65.1	0.1	7	65.1	0.0
Gulf	Corpus Christi, TX	2,305	227	9.9	2.5	778	33.7	5.4
Atlantic	Del River Between Phila Tren	4	4	100.0	0.0	4	100.0	0.0
Atlantic	Delaware River At Camden, NJ	58	20	33.6	0.2	29	50.4	0.2
Great Lakes	Duluth-Superior Harbor, MN And WI	9	6	69.2	0.1	6	69.2	0.0
Pacific	El Segundo, CA	165	7	4.3	0.1	7	4.3	0.0
Atlantic	Fall River Harbor, MA	22	12	53.8	0.1	12	53.8	0.1
Atlantic	Fernandina Harbor, FL	1	1	100.0	0.0	1	100.0	0.0
Gulf	Freeport Harbor, TX	846	374	44.2	4.1	374	44.2	2.6
Gulf	Galveston Channel, TX	113	55	48.4	0.6	88	77.7	0.6
Gulf	GIWW Mile 87	4	0	0.0	0.0	0	0.0	0.0
Atlantic	Gloucester Harbor, MA	4	4	100.0	0.0	4	100.0	0.0
Atlantic	Guayanilla Harbor, PR	152	103	68.1	1.1	103	68.1	0.7
Gulf	Gulfport Harbor, MS	12	8	67.2	0.1	8	67.2	0.1
Pacific	Hilo Harbor, HI	5	2	37.1	0.0	2	37.1	0.0
Pacific	Homer, AK	12	12	100.0	0.1	12	100.0	0.1
Pacific	Honolulu Harbor, Oahu, HI	80	22	27.8	0.2	22	27.8	0.2
Gulf	Houma Navigation Canal LA	6	6	100.0	0.1	6	100.0	0.0
Gulf	Houston, TX	6,563	780	11.9	8.5	2,494	38.0	17.2
Pacific	Humboldt Harbor and Bay, CA	4	4	100.0	0.0	4	100.0	0.0
Atlantic	Jacksonville Harbor, FL	145	51	34.9	0.6	58	39.7	0.4
Atlantic	Jobos Harbor, PR	397	157	39.7	1.7	157	39.7	1.1
Pacific	Kahului Harbor, Maui, HI	5	2	37.1	0.0	2	37.1	0.0
Pacific	Kenai River, AK	42	2	4.8	0.0	2	4.8	0.0
Pacific	Ketchikan Harbor, AK	17	17	100.0	0.2	17	100.0	0.1
Gulf	Lake Charles, LA	934	751	80.4	8.2	751	80.4	5.2
Great Lakes	Lake Michigan	26	26	100.0	0.3	26	100.0	0.2
Pacific	Long Beach Harbor, CA	781	0	0.0	0.0	35	4.4	0.2
Pacific	Los Angeles Harbor, CA	989	0	0.0	0.0	0	0.0	0.0
Atlantic	Lower Delaware Bay, DE	17	13	76.9	0.1	17	100.0	0.1
Atlantic	Marcus Hook, PA	174	136	78.2	1.5	146	83.6	1.0
Pacific	Mare Island Strait, CA	60	3	5.0	0.0	3	5.0	0.0
Gulf	Matagorda Ship Channel, TX	201	183	90.7	2.0	183	90.7	1.3
Atlantic	Miami Harbor, FL	197	78	39.7	0.8	109	55.3	0.8

TABLE H-5C

ANALYSIS OF VESSEL TYPE CONSTRAINTS, TANKER 2020

Coast Name	Port Name/Location Name	Number of Calls	With Projects			Without Projects		
			Constrained Calls With Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls	Constrained Calls Without Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls
Great Lakes	Milwaukee Harbor, WI	4	3	75.0	0.0	3	75.0	0.0
Gulf	Mobile Harbor, AL	370	43	11.6	0.5	79	21.3	0.5
Atlantic	Morehead City Harbor, NC	69	4	5.9	0.0	4	5.9	0.0
Pacific	Naknek River, AK	4	4	100.0	0.0	4	100.0	0.0
Atlantic	Narragansett Bay, RI	17	17	100.0	0.2	17	100.0	0.1
Atlantic	New Castle Area, DE	141	73	51.8	0.8	114	80.7	0.8
Atlantic	New Haven Harbor, CT	43	43	100.0	0.5	43	100.0	0.3
Atlantic	New London Harbor, CT	4	4	100.0	0.0	4	100.0	0.0
Pacific	Nikishka, AK	146	53	36.7	0.6	53	36.7	0.4
Atlantic	Norfolk Harbor, VA	437	38	8.6	0.4	42	9.6	0.3
Atlantic	Northville, L.I., NY	39	2	5.2	0.0	2	5.2	0.0
Pacific	Oakland Harbor, CA	40	2	5.0	0.0	12	30.0	0.1
Great Lakes	Oswego Harbor, NY	17	10	58.6	0.1	10	58.6	0.1
Pacific	Other Puget Sound Area Ports, WA	108	2	1.8	0.0	2	1.8	0.0
Pacific	Other San Francisco Bay Area Ports, CA	32	32	100.0	0.3	32	100.0	0.2
Atlantic	Palm Beach Harbor, FL	15	11	71.9	0.1	11	71.9	0.1
Gulf	Panama City Harbor, FL	22	10	43.2	0.1	10	43.2	0.1
Gulf	Pascagoula Harbor, MS	479	451	94.1	4.9	454	94.7	3.1
Atlantic	Paulsboro, NJ	371	219	59.0	2.4	279	75.2	1.9
Pacific	Pearl Harbor, Oahu, HI	18	0	0.0	0.0	0	0.0	0.0
Atlantic	Penobscot River ME	9	9	100.0	0.1	9	100.0	0.1
Gulf	Pensacola Harbor, FL	6	3	54.1	0.0	3	54.1	0.0
Atlantic	Philadelphia Harbor, PA	565	378	66.9	4.1	395	69.9	2.7
Atlantic	Piscataqua River, ME and NH	84	61	72.4	0.7	61	72.4	0.4
Pacific	Pittsburg, CA	6	6	100.0	0.1	6	100.0	0.0
Atlantic	Ponce Harbor, PR	34	9	26.6	0.1	9	26.6	0.1
Pacific	Port Angeles Harbor, WA	15	0	0.0	0.0	0	0.0	0.0
Gulf	Port Arthur, TX	1,239	1,013	81.8	11.0	1,013	81.8	7.0
Atlantic	Port Everglades Harbor, FL	213	54	25.5	0.6	54	25.5	0.4
Atlantic	Port in Caribbean	613	202	32.9	2.2	202	32.9	1.4
Great Lakes	Port Huron, MI	19	16	85.2	0.2	16	85.2	0.1
Atlantic	Port Jefferson Harbor, NY	19	19	100.0	0.2	19	100.0	0.1
Gulf	Port Manatee, FL	9	4	44.5	0.0	4	44.5	0.0
Atlantic	Port Of Albany, NY	7	7	100.0	0.1	7	100.0	0.0
Gulf	Port Of Baton Rouge, LA	1,116	52	4.7	0.6	220	19.7	1.5
Atlantic	Port Of Boston, MA	274	96	35.1	1.0	158	57.9	1.1
Great Lakes	Port Of Buffalo, NY	21	17	80.0	0.2	17	80.0	0.1
Great Lakes	Port Of Chicago, IL	134	116	86.6	1.3	116	86.6	0.8
Great Lakes	Port Of Detroit, MI	88	48	54.8	0.5	48	54.8	0.3
Atlantic	Port Of Hopewell, VA	14	13	92.9	0.1	13	92.9	0.1
Pacific	Port Of Kalama, WA	9	5	54.7	0.1	6	66.0	0.0
Pacific	Port Of Longview, WA	33	2	6.0	0.0	6	17.9	0.0
Gulf	Port Of New Orleans, LA	961	53	5.5	0.6	234	24.4	1.6
Atlantic	Port Of New York/New Jersey	1,680	566	33.7	6.1	784	46.7	5.4
Atlantic	Port Of Newport News, VA	50	13	25.5	0.1	27	54.3	0.2
Gulf	Port Of Plaquemine, LA	330	97	29.4	1.1	151	45.9	1.0
Pacific	Port Of Portland, OR	158	21	13.0	0.2	21	13.0	0.1
Atlantic	Port Of Richmond, VA	12	12	100.0	0.1	12	100.0	0.1
Gulf	Port Of South Louisiana, LA	1,338	120	8.9	1.3	480	35.9	3.3
Pacific	Port Of Vancouver, WA	53	7	13.6	0.1	7	13.6	0.0
Atlantic	Port Of Wilmington, NC	730	25	3.4	0.3	113	15.5	0.8
Atlantic	Port Royal Harbor, SC	6	3	49.7	0.0	3	49.7	0.0
Pacific	Port Townsend Harbor, WA	4	2	50.0	0.0	2	50.0	0.0

TABLE H-5C

ANALYSIS OF VESSEL TYPE CONSTRAINTS, TANKER 2020

Coast Name	Port Name/Location Name	Number of Calls	With Projects			Without Projects		
			Constrained Calls With Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls	Constrained Calls Without Projects	Percent Of Calls Constrained	Percent of Total Constrained Calls
Atlantic	Portland Harbor, ME	418	415	99.4	4.5	415	99.4	2.9
Atlantic	Potomac River At Lower Cedar Point, MD	4	4	100.0	0.0	4	100.0	0.0
Great Lakes	Presque Isle Harbor, MI	4	4	100.0	0.0	4	100.0	0.0
Atlantic	Providence River and Harbor, RI	123	58	47.6	0.6	58	47.6	0.4
Pacific	Richmond Harbor, CA	654	13	2.0	0.1	67	10.2	0.5
Pacific	Sacramento, CA	9	7	74.1	0.1	7	74.1	0.0
Atlantic	Salem Harbor, MA	10	10	100.0	0.1	10	100.0	0.1
Pacific	San Diego Harbor, CA	19	9	47.9	0.1	9	47.9	0.1
Pacific	San Francisco Harbor, CA	118	92	77.7	1.0	92	77.7	0.6
Atlantic	San Juan Harbor, PR	225	58	25.6	0.6	58	25.6	0.4
Great Lakes	Sault Ste. Marie, MI	15	7	46.9	0.1	7	46.9	0.0
Atlantic	Savannah Harbor, GA	239	1	0.4	0.0	43	17.8	0.3
Atlantic	Searsport Harbor, ME	38	37	97.3	0.4	37	97.3	0.3
Pacific	Seattle Harbor, WA	235	14	6.0	0.2	47	19.9	0.3
Atlantic	Caribbean Islands	13	7	55.0	0.1	7	55.0	0.0
Pacific	Stockton, CA	49	29	59.0	0.3	29	59.0	0.2
Pacific	Suisun Bay Channel, CA	19	17	88.6	0.2	17	88.6	0.1
Pacific	Tacoma Harbor, WA	140	16	11.3	0.2	77	55.1	0.5
Gulf	Tampa Harbor, FL	114	5	4.8	0.1	5	4.8	0.0
Gulf	Texas City, TX	1,799	121	6.7	1.3	1,355	75.4	9.3
Atlantic	Thompson Point NJ and Vicinity	4	0	0.0	0.0	1	22.6	0.0
Great Lakes	Toledo Harbor, OH	17	11	64.6	0.1	11	64.6	0.1
Pacific	Valdez Harbor, AK	15	0	0.0	0.0	0	0.0	0.0
Atlantic	Wilmington Harbor, DE	24	18	74.5	0.2	18	74.5	0.1
Atlantic	Yabucoa Harbor, PR	195	10	5.1	0.1	10	5.1	0.1
Pacific	Yaquina Bay & Harbor, OR	4	4	100.0	0.0	4	100.0	0.0
Atlantic	York River, VA	76	76	100.0	0.8	76	100.0	0.5
	TOTAL		**9,210**			**14,498**		

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